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REPORT OF THE SUPERINTENDENT

OF THE

U. S. COAST AND GEODETIC SURVEY

SHOWING

THE PROGRESS OF THE WORK

DURING THE

FISCAL YEAR ENDING WITH

JUNE, 1896.

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LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

The Report of the Superintendent of the United States Coast and Geodetic Survey, stating progress made in that work during the fiscal year ending June 30, 1896.

TREASURY DEPARTMENT, OFFICE OF THE SECRETARY,
Washington, D. C., December 8, 1896.

SIR: In compliance with the requirements of section 4690, Revised Statutes, I have the honor to transmit herewith, for the information of Congress, a report addressed to this Department by W. W. Duffield, Superintendent of the United States Coast and Geodetic Survey, showing the progress made in that work during the fiscal year ended June 30, 1896, and accompanied by maps illustrating the general advance in the operations of the Survey up to that date.

Respectfully, yours,

J. G. CARLISLE,
Secretary.

The VICE-PRESIDENT OF THE UNITED STATES
AND PRESIDENT OF THE SENATE.

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LETTER OF TRANSMISSION.

UNITED STATES COAST AND GEODETIC SURVEY,
Washington, D. C., December 8, 1896.

SIR: In conformity with law and the regulations of the Treasury Department I have the honor to submit herewith, for transmission to Congress, the Annual Report on the progress of the Coast and Geodetic Survey for the fiscal year ending June 30, 1896. It is accompanied by maps illustrating the general advance in the field work of the Survey up to that date.

Very respectfully, yours,

W. W. DUFFIELD,
Superintendent.

Hon. J. G. CARLISLE,
Secretary of the Treasury.

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REPORT OF THE SUPERINTENDENT

OF THE

U. S. COAST AND GEODETIC SURVEY

FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

IN TWO PARTS.

PARTS I AND II.

PREFATORY NOTE.

In this report of the fiscal year 1896 the division into two parts has been retained, but both parts are published in one volume.

Part I contains the historical portion. It presents abstracts of progress in field and office work, gives estimates for future work, and a statement of expenditures during the fiscal year.

The usual maps and progress sketches, showing in detail the localities and scope of the field operations, accompany the report.

Part II contains the Appendices which relate to the methods, discussions, and results of the Survey, with such illustrations as are required.

The illustrations accompany the Appendices to which they respectively belong.

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REPORT.

PART I.

INTRODUCTORY STATEMENT.

This report presents a full account of the varied operations carried on during the fiscal year by this important branch of the public service, and also gives in concise tabular form complete statistics relating to the distribution of field parties and the results accomplished both in field and office.

The usual maps and sketches, showing graphically the progress of the Survey and the present condition of the work, accompany the report and will be found at the end of the volume.

Field operations.—The field operations during the year have included the measurement of base lines; reconnaissance; triangulation; astronomical determinations of time, latitude, and azimuth; telegraphic and chronometric determinations of longitude; topographical and hydrographical surveys and resurveys; tidal and current observations; determinations of magnetic declination, dip, and intensity; pendulum observations for determination of the force of gravity; geodetic leveling; Coast Pilot examinations; boundary-line surveys; special topographic and hydrographic examinations, including the investigation of reported dangers to navigation; and laying out and marking of naval speed trial courses.

Upward of fifty field parties were engaged on these various branches of the work, and these were distributed along the Atlantic, Gulf, Pacific, and Alaskan coasts, and in the interior of the country. Surveys or observations were conducted within the limits or on the coasts of twenty States and Territories along the seaboards, and in fifteen interior States and Territories.

The special operations of importance begun, continued, or completed during the year may be enumerated as follows:

Completion of the topographic and hydrographic resurvey of New Bedford Harbor and its approaches; continuation of the topographic and hydrographic resurvey of Buzzards Bay; continuation of hydrographic surveys and examinations on the coast of Massachusetts; continuation of hydrographic resurveys in Nantucket Sound, Block Island Sound, and off Montauk Point; continuation of the topographic resurvey of the southern shores of Long Island; continuation of the Hudson River survey; extension of the main triangulation eastward across the States of Maryland and Delaware to Capes Henry and Henlopen; hydrographic resurvey of the harbor and entrance of Port Royal, S. C.; magnetic determinations in various Eastern, Middle, Southern, and Western States; special hydrographic examinations along the Atlantic, Gulf, and Pacific coasts; completion of the hydrographic resurvey of Pensacola Bay and Entrance; continuation of the primary triangulation of the oblique arc in Alabama; continuation of the determination of points for State surveys; progress made in the triangulation of Lake Ponchartrain; continuation of the transcontinental triangulation in Kansas, Colorado, and Utah, including base-line measurements; continuation of the transcontinental line of precise levels in Kansas; continuation of the topographic and hydrographic resurvey of San Francisco Bay and Harbor; continuation of the survey of Washington Sound; continuation of general and hydrographic surveys in southeast

Alaska; continuation of the survey of the California and Nevada oblique boundary line; continuation of surveys in connection with the Southeast Alaska-British Columbia boundary line; magnetic determinations at sixty-one stations in various parts of the country; telegraphic and chronometric longitude determinations at twenty-two stations; gravity determinations at six stations; tidal observations at various points on the Atlantic, Gulf, and Pacific coasts, including Alaska.

In accordance with the uniform practice of the Department, requests from national or State authorities for special surveys, or for the detail of officers for special service, have been complied with whenever practicable, and the following operations have in this way been undertaken and completed:

A special hydrographic survey of the Dry Tortugas deep-water anchorage and its approaches, at the request of the Navy Department; the erection of beacons on the north shore of Long Island for the Long Island Sound speed trial course, at the request of the honorable Secretary of the Navy; cooperation with the Navy Department in the erection of beacons on the coasts of Maine and Massachusetts for the speed-trial course of the *Indiana* and *Katahdin;* cooperation with the Navy Department in the laying out and marking of a speed-trial course in Santa Barbara Channel for the new battle ship *Oregon;* a special topographical survey on a large scale of the grounds of the Naval Academy at Annapolis, for the Navy Department; cooperation with the United States Geological Survey in the determination of the telegraphic difference of longitude between San Francisco, Cal., and Ellensburg, Wash. At the request of the commissioners appointed by the United States Supreme Court, two officers of the Survey were detailed to examine and retrace a portion of the boundary line between the States of Missouri and Iowa.

Special assignments.—The assignments of two of the assistants of the Survey to special duty by appointment of the President have been continued, one as a member of the Mississippi River Commission and the other as a member of the International Boundary Commission organized for the survey and marking of that part of the United States and Mexican boundary line extending westward from El Paso. The latter officer, however, performed regular coast-survey service from the beginning of the fiscal year until October 1, the date fixed for the reassembling of the Boundary Commission.

Office work.—In the office the usual progress has been made in the reduction and computation of the field results, in the drawing, engraving, and preparing for publication the charts of the Survey, the Coast Pilot, and the annual tide tables, and there has been no abatement of the efforts to give the public the earliest notice of important changes or discoveries. The monthly issue of Notices to Mariners has been continued, and during the year 121 000 copies were distributed gratis. The issue, during the same time, of charts, Coast Pilots, and Tide Tables has been as follows: Charts, 64 541; Coast Pilots, 848; Tide Tables, 6 580.

Office of Standard Weights and Measures.—This important office, also under the charge of the Superintendent of the Coast and Geodetic Survey, has been conducted as heretofore, and notwithstanding its small force, prompt response has been made to all requests for information, and the usual amount of work in testing, verifying, and standardizing weights and measures for other departments of the Government, for States, and for private parties has been accomplished.

Some progress has also been made in the acquiring of electrical standards and in the preparation for undertaking the determination and verification of electrical units. This work is necessarily slow on account of limited means, the whole annual appropriation for the purchase of material and apparatus and for incidental expenses being only $500.

Among the operations carried on during the year the following may be specially mentioned as of the greatest importance:

First. The construction of the 50-metre comparator, by means of which a higher degree of precision in the determination of linear values is possible, and with a much less expenditure of time and labor.

Second. The standardization, by means of this 50-metre comparator and a standard in ice, of the new duplex base apparatus. This base apparatus was designed by one of the Assistants of the Survey, and was entirely constructed in the Survey instrument shop, and it is believed that it will yield results far superior to any other base apparatus yet devised for rapid and economical

field work. One prominent feature of the apparatus is its yielding two simultaneous measures of a base by rods of two different metals with widely different coefficients of expansion, so that the temperatures can be deduced more accurately than by indications of thermometers. The difficulty of obtaining the true temperature of the bars during a measure has heretofore been the greatest source of uncertainty in primary bases.

International Geodetic Conference.—As official notification had been received that at the General Conference of the International Geodetic Association to be held at Berlin, Germany, in October, 1895, propositions to modify the terms of the International Geodetic Convention of 1886 would be considered, it was deemed of the utmost importance that the Coast and Geodetic Survey should be represented by a delegate and participate in the deliberations. Accordingly Assistant O. H. Tittmann was appointed as delegate by the President of the United States, and in accordance with instructions sailed for Europe on the 17th of September, arriving in Berlin in time to attend the opening meeting on the 30th. The meetings of the Conference lasted until October 12.

Essential modifications of the terms of the existing treaty were agreed upon for submission to the several Governments concerned, the principal ones being as follows: First, a more equitable distribution of votes; second, the abolition of the permanent Commission, and the substitution therefor of an executive board, with a consultative commission on which every participating country shall be represented; and third, an increase of the annual budget, with a view to establishing stations for observing the variation of latitude.

Mr. Tittmann returned soon after the close of the meetings, and on November 4 resumed his duties as Assistant in Charge of the Office.

Arrangement of this Report.—The contents of Part I are arranged in the following order: Introductory statement, including notice of field and office work, special assignments, Office of Standard Weights and Measures, arrangement of this Report, and geographical order and classification of localities of field work; General statement of progress in field and office work, including subdivisions of the former and notices of publications of the Survey during the year; Explanations of estimates for the fiscal year 1898, and the estimates themselves in detail; Abstracts of reports from field parties, including Eastern, Middle, Western, and Alaska divisions, and special operations; Abstracts of office and suboffice annual reports; Supplementary tables, viz, No. 1, Showing the distribution and personnel of field parties, No. 2, Giving statistics of field and office work, No. 3, Giving list of information furnished during the year in reply to official and personal calls; Office annual reports, viz, No. 1, Report of the Assistant in Charge of the Office, accompanied by reports of the various chiefs of divisions, No. 2, Report of the hydrographic inspector, No. 3, Report of the disbursing agent, No. 4, Report of the Assistant in Charge of the Office of Standard Weights and Measures; List of maps and progress sketches to illustrate the work, and the maps and sketches themselves.

Part II contains the Appendices and their illustrations, the Appendices being professional and scientific papers relating to methods, discussions, and results.

Geographical classification of localities of field work.—The same geographical classification of localities in use since 1891 has been retained in this Report, viz:

I. The Eastern Division, including all States east of the Mississippi River.

II. The Middle Division, comprising the States and Territories between the Mississippi River and the Rocky Mountains.

III. The Western Division, embracing the States and Territories between the Rocky Mountains and the Pacific Ocean.

IV. The Division of Alaska, including Alaska and the Aleutian and Pribiloff Islands.

Special operations are grouped together under one heading without regard to the above classification, but the geographical order has nevertheless been preserved as far as possible.

GENERAL STATEMENT OF PROGRESS.

FIELD WORK.

EASTERN DIVISION.—*States east of the Mississippi River.*—Within the limits or off the coasts of the States constituting the Eastern Division the following-named operations were begun, continued, or completed during the fiscal year 1896: Telegraphic determination of the difference of longitude between Cambridge, Mass., and Calais, Me., with incidental magnetic and gravity determinations, completed; hydrographic surveys and examinations on the coast of Massachusetts, continued; hydrographic resurveys in Nantucket Sound and its eastern approaches, and special examinations in the vicinity, continued; topographic and hydrographic resurvey of Buzzards Bay, Massachusetts, continued; examination of reported danger to navigation in the harbor of Bristol, R. I., completed; hydrographic surveys to the southward of Block Island Sound and off Montauk Point, continued; special examinations in Long Island Sound, completed; topographical resurvey of the south shores of Long Island, continued; tidal observations at Fort Hamilton, New York Harbor, continued; tidal observations at Willets Point, N. Y., completed; topographic survey of the Hudson River, continued; extension of the transcontinental arc eastward to Capes May and Henlopen, reconnaissance and triangulation, commenced; erection and establishment of a tidal indicator on the Delaware River at Reedy Island, completed; tidal observations at the Washington, D. C., Navy-Yard, continued; magnetic determinations in various Eastern, Middle, and Southern States, completed; special hydrographic examinations at various points on the Atlantic and Gulf coasts, completed; tidal observations at Charleston, S. C., by the United States engineers, continued; hydrographic resurvey of Port Royal Entrance, South Carolina, commenced; establishment of a tidal station at Port Royal, S. C.; telegraphic determinations and incidental latitude, magnetic, and gravity observations in various Eastern and Southern States, completed; hydrographic resurvey of Pensacola Bay and Entrance, completed; triangulation of the oblique arc in Alabama, continued; hydrographic examinations along the Gulf coasts of Florida, Alabama, Mississippi, and Louisiana, for the Coast Pilot, completed; magnetic observations at various points in the Central and Northern States, completed; primary triangulation in northeastern Tennessee and southeastern Kentucky, and along the Kentucky, Virginia, and Tennessee State lines, continued.

MIDDLE DIVISION.—*States and Territories between the Mississippi River and the Rocky Mountains.*—Within the limits of the Middle Division, as above defined, the following operations were in progress or completed during the fiscal year:

Triangulation of Lake Pontchartrain, Louisiana, in progress; determination of telegraphic difference of longitude between New Orleans, La., and Austin, Tex., completed; establishment of a tidal station at Point Isabel, Tex., completed; telegraphic determination of longitude of Little Rock, Ark., completed; examination of base line in Missouri completed; transcontinental arc in Kansas, reconnaissance, triangulation, and base measure continued; transcontinental line of precise levels in Kansas continued; magnetic observations in Missouri, Nebraska, South Dakota, and North Dakota completed.

WESTERN DIVISION.—*States and Territories west of the Rocky Mountains.*—Within the limits or off the coasts of the States comprising the Western Division the following operations were in progress or completed during the fiscal year:

Topographic and hydrographic resurvey of San Francisco Bay and Harbor, continued; topographic and hydrographic examination of Cuylers Harbor, San Miguel Island, California, completed; tidal observations at Sausalito tidal station continued; magnetic observations at San Francisco and Monterey, Cal., completed; topographical survey of Washington Sound, Washington, continued; transcontinental triangulation in Colorado continued; transcontinental triangulation and base measure in Utah continued; magnetic observations at various points in Montana completed.

DIVISION OF ALASKA.—In this division, which includes the coasts of Alaska bordering upon the Pacific Ocean, Bering Sea, and the Arctic Ocean, the following field operations were in progress or completed during the fiscal year:

and also by the branch hydrographic offices of the Navy Department, the United States custom-houses, and the United States consulates in foreign ports.

Bulletins.—But one bulletin was issued during the year, viz, No. 35, containing general information in regard to certain parts of Alaska. It is, in fact, a compilation of the most recent information relative to the harbors, anchorages, and dangers to navigation in the vicinity of Chatham and Peril straits and Cooks Inlet. The data in relation to the latter locality are derived from the notes of Prof. W. H. Dall, of the United States Geological Survey, and those relating to Chatham and Peril straits from actual surveys by the United States Coast and Geodetic Survey. As considerable time necessarily elapses before the results of a survey can be given to the navigator in chart form, and no complete or reliable Coast Pilot of the Alaskan coast exists, the early publication of valuable information in bulletin form is deemed of the utmost importance. Other bulletins of a similar nature, for other Alaskan localities, will be issued from time to time as material for them is obtained.

EXPLANATION OF ESTIMATES.

The estimates submitted to the Secretary of the Treasury for the fiscal year 1898 were accompanied by the following explanations:

U. S. COAST AND GEODETIC SURVEY,
OFFICE OF THE SUPERINTENDENT,
Washington, D. C., October 2, 1896.

SIR: I have the honor to transmit herewith estimates for the work of the United States Coast and Geodetic Survey and Office of Construction of Standard Weights and Measures for the fiscal year ending June 30, 1898.

An increased amount has been asked for "field expenses" to provide for urgently needed surveys and resurveys, including, among other important objects, the resurvey of Galveston Bay, for which an appropriation of $10 000 is asked, to be available until expended, and a reconnaissance along the Pacific coast from Cape Mendocino to the Straits of Juan de Fuca.

The item for "contribution to the International Geodetic Association" has been omitted, as it is thought that this object should be estimated for by the Department of State, and arrangements have been suggested to effect the change.

The estimate for "repairs and maintenance of vessels" has been increased by the amount of $10 000, to be immediately available, to provide for the construction of new boilers for the steamer *Blake*. The present boilers are worn out beyond repair.

An appropriation of $75 000 is asked for commencing the construction of a new steamer for service in Alaska and the Aleutian Islands. Such a vessel is absolutely necessary for the exploration and survey of the Aleutian Islands and northwestern Alaska. The Survey has no vessel of either sufficient power or strength to safely engage upon that work.

Under the head of "Salaries" an addition of $1 000 is asked in the item for salary of Superintendent, making it $6 000, as provided by statute. This was the amount appropriated until the year 1895–96, when $5 000 was appropriated.

The following changes in the office force are recommended: The designations "clerk to the Superintendent" and "clerk to the Assistant in Charge of the Office and Topography" to be abolished, and these positions to be included under the general head of "Clerical force," at the same rates of pay. These positions are now in the classified service, from which they were formerly excepted.

Under the head of "Chart correctors, buoy colorists, etc.," it is proposed to promote one from $1 200 to $1 350 per annum—a well-merited advancement—and to transfer to this designation one plate printer at $1 000, whose present duties relate more especially to chart corrections.

Under the head of "Topographic and hydrographic draftsmen," it is proposed to promote one from $900 to $1 200 per annum. Of those classified as "astronomical, geodetic, tidal, and miscellaneous computers," the promotion of two from $1 400 to $1 600 and of one from $1 200 to $1 400 per annum is recommended. The estimates have been so modified as to provide for these proposed changes.

Of the "electrotypers and photographers, plate printers and their helpers, instrument makers, etc.," it is proposed to advance four from $1 000 to $1 100 per annum each, and one from $700 to $900 per annum, and to drop one at $700. These changes are intended in order to make the rates of compensation correspond more nearly with the rates paid for similar services elsewhere.

A reduction of $600 is made in the estimate for "office expenses."

In the estimate for "Office of Construction of Standard Weights and Measures," it is recommended to increase the force by one expert, to be called a verifier, for the purpose of taking in hand the verification of electrical standards. Congress has taken a first step toward establishing electrical standards by legalizing units of electrical measure, but no provision has been made to enable the office to make verifications in conformity with the law for the benefit of the public concerned.

The increase in the salary of the present adjuster has been recommended time and again on account of his efficient services, and the recommendation of an increase from $1 500 to $1 800 is here repeated as more commensurate with the service rendered.

The pay of an assistant messenger, whose duties are better designated by the word "helper" than by the old title, is recommended for increase from $720 to $900 per annum.

These changes would put the Office of Weights and Measures on approximately the same footing on which it was prior to 1887, in which year the office of verifier was abolished.

Very respectfully,

W. W. DUFFIELD, *Superintendent.*

The SECRETARY OF THE TREASURY,
Washington, D. C.

ESTIMATES FOR THE FISCAL YEAR ENDING JUNE 30, 1898.

For every expenditure requisite for and incident to the survey of the Atlantic, Gulf, and Pacific coasts of the United States and the coast of the Territory of Alaska, including the survey of rivers to the head of tide water or ship navigation; deep-sea soundings, temperature, and current observations along the coast and throughout the Gulf Stream and Japan Stream flowing off the said coasts; tidal observations; the necessary resurveys; the preparation of the Coast Pilot; continuing researches, and other work relating to terrestrial magnetism and magnetic maps of the United States and adjacent waters, and the tables of magnetic declination, dip, and intensity usually accompanying them; and including compensation not otherwise appropriated for of persons employed in the field work, in conformity with the regulations of the Government of the Coast and Geodetic Survey adopted by the Secretary of the Treasury; for special examinations that may be required by the Light-House Board or other proper authority, and including traveling expenses of officers and men of the Navy on duty; for commutation to officers of the field force while on field duty, at a rate to be fixed by the Secretary of the Treasury, not exceeding $2·50 per day each; outfit, equipment, and care of vessels used in the Survey, and also the repairs and maintenance of the complement of vessels; to be expended in accordance with the regulations relating to the Coast and Geodetic Survey from time to time prescribed by the Secretary of the Treasury and under the following heads: *Provided*, That no advance of money to chiefs of field parties under this appropriation shall be made unless to a commissioned officer or to a civilian officer, who shall give bond in such sum as the Secretary of the Treasury may direct:

FOR FIELD EXPENSES:

For survey of unfinished portions of the Atlantic Coast from Maine to Florida, including Portsmouth Harbor and Piscataqua River, Hudson River to Troy, and for the necessary resurveys, including the coast from Lynn to Cape Ann, the shores of Marthas Vineyard, and Nantucket Sound, approaches to New Bedford, Buzzards Bay, Chesapeake Bay and tributaries, and Savannah River Bar $35 000

To continue the primary triangulation from the vicinity of Montgomery toward Mobile, and for triangulation, topography, and hydrography of unfinished portions of the Gulf Coast, including Lake Pontchartrain and Sabine Lake, and for the necessary resurveys, including $10 000 to be available until expended for the resurvey of Galveston Bay 18 000

For offshore soundings along the Atlantic and Gulf coasts, and current and temperature observations in the Gulf Stream 5 000

For triangulation, topography, and hydrography of the coasts of California, Oregon, and Washington, and for reconnaissance along the Pacific Coast from Cape Mendocino to the Straits of San Juan de Fuca, and for necessary resurveys, San Francisco Harbor, triangulation, topography, and hydrography 30 000

For continuing explorations in the waters of Alaska and making hydrographic surveys in the same, including survey of the Aleutian Islands and examination of the mouth of Yukon River, and for the establishment of latitude, longitude, and magnetic stations 15 000

FOR FIELD EXPENSES—Continued.

For continuing the researches in physical hydrography relating to harbors and bars, including computations and plattings, and for tidal and current observations on the Atlantic, Gulf, and Pacific coasts	$5 000
For examination of reported dangers on the Atlantic, Gulf, and Pacific coasts, and to continue the compilation of the Coast Pilot and to make special hydrographic examinations, and including the employment of such pilots and nautical experts in the field and office as may be necessary for the same	5 100
To continue magnetic observations in all parts of the United States	2 000
For continuing the line of exact levels between the Atlantic, Pacific, and Gulf coasts	4 000
For furnishing points to State surveys, to be applied as far as practicable in States where points have not been furnished, and for surveying and distinctly marking with permanent monuments that portion of the eastern boundary of the State of California commencing at and running southeastward from the intersection of the thirty-ninth degree of north latitude with the one hundred and twentieth degree of longitude west from Greenwich, and for the primary triangulation along the Rio Grande	15 000
For determinations of geographical positions and to continue gravity observations	2 500
For traveling expenses of officers and men of the Navy on duty, and for any special surveys that may be required by the Light-House Board or other proper authority, and contingent expenses incident thereto	3 500
For objects not hereinbefore named that may be deemed urgent, including the actual necessary expenses of officers of the field force temporarily ordered to the office at Washington for consultation with the Superintendent, to be paid as directed by the Superintendent, in accordance with the Treasury regulations	6 000
[For expenses of the attendance of the American delegate at the meetings of the International Geodetic Association, $550, or so much thereof as may be necessary: *Provided*, That such expenses of attendance shall be payable out of the item "for objects not named;" and 20 per cent of the foregoing amounts shall be available interchangeably for expenditure on the objects named.]	
In all, for field expenses	146 100

FOR REPAIRS AND MAINTENANCE OF VESSELS:

For repairs and maintenance of the complement of vessels used in the Coast and Geodetic Survey, including $10 000 to be immediately available for boilers for the steamer *Blake*	35 000

FOR A NEW STEAMER FOR USE IN ALASKA:

For constructing a steamer under the direction of the Secretary of the Treasury for service in Alaska and the Aleutian Islands	75 000
[And the Secretary of the Treasury is hereby authorized to contract for building said vessel at a cost not to exceed $125 000.]	

SALARIES, COAST AND GEODETIC SURVEY:

For Superintendent	6 000
For pay of assistants, to be employed either in the field or office, as the Superintendent may direct:	
For two assistants, at $4 000 each	8 000
For one assistant	3 200
For four assistants, at $3 000 each	12 000
For four assistants, at $2 500 each	10 000
For seven assistants, at $2 200 each	15 400
For seven assistants, at $2 000 each	14 000
For three assistants, at $1 800 each	5 400
For three assistants, at $1 600 each	4 800
For three assistants, at $1 400 each	4 200
For four assistants, at $1 200 each	4 800
For aids temporarily employed at a salary not greater than $900 per annum each	3 600
In all	91 400

PAY OF OFFICE FORCE:

For one disbursing agent	2 200
For one general office assistant	1 800
For one chief of division of library and archives	1 800
For clerical force, namely:	
For two, at $1 650 each	3 300
For three, at $1 400 each	4 200
For six, at $1 200 each	7 200
For four, at $1 000 each	4 000

PAY OF OFFICE FORCE—Continued.

For chart correctors, buoy colorists, stenographers, writers, typewriters, and copyists, namely:	
For one	$1 350
For one	1 200
For one	1 000
For three, at $900 each	2 700
For one	800
For seven, at $720 each	5 040
For one	600
For topographic and hydrographic draftsmen, namely:	
For one	2 400
For one	2 200
For two, at $2 000 each	4 000
For three, at $1 800 each	5 400
For two, at $1 400 each	2 800
For two, at $1 200 each	2 400
For two, at $1 000 each	2 000
For one	900
For astronomical, geodetic, tidal, and miscellaneous computers, namely:	
For two, at $2 000 each	4 000
For five, at $1 600 each	8 000
For one	1 400
For one	1 200
For two, at $1 000 each	2 000
For copperplate engravers, namely:	
For two, at $2 000 each	4 000
For two, at $1 800 each	3 600
For two, at $1 600 each	3 200
For one	1 400
For two, at $1 200 each	2 400
For two, at $1 000 each	2 000
For additional engravers, at not to exceed $900 per annum each	4 100
For electrotypers and photographers, plate printers and their helpers, instrument makers, carpenters, engineer, and other skilled laborers, namely:	
For two, at $1 800 each	3 600
For one	1 600
For two, at $1 200 each	2 400
For four, at $1 100 each	4 400
For five, at $1 000 each	5 000
For three, at $900 each	2 700
For five, at $700 each	3 500
For watchmen, firemen, messengers and laborers, packers and folders, and miscellaneous work, namely:	
For three, at $880 each	2 640
For six, at $820 each	4 920
For two, at $700 each	1 400
For three, at $640 each	1 920
For four, at $630 each	2 520
For four, at $550 each	2 200
For two, at $365 each	730
In all	136 120

OFFICE EXPENSES:

For the purchase of new instruments, for materials and supplies required in the instrument shop, carpenter shop, and drawing division, and for books, maps, charts, and subscriptions	7 700
For copperplates, chart paper, printer's ink, copper, zinc, and chemicals for electrotyping and photographing; engraving, printing, photographing, and electrotyping supplies; for extra engraving and drawing, and for photolithographing charts and printing from stone and copper for immediate use	15 500
For stationery for the office and field parties, transportation of instruments and supplies, when not charged to party expenses, office wagon and horses, fuel, gas, telegrams, ice, and washing	6 000
For miscellaneous expenses, contingencies of all kinds, office furniture, repairs, and extra labor, and for traveling expenses of assistants and others employed in the office sent on special duty in the service of the office	4 200

PUBLISHING OBSERVATIONS:

For the discussion and publication of observations $1 000

[That no part of the money herein appropriated for the Coast and Geodetic Survey shall be available for allowance to civilians or other officers for subsistence while on duty at Washington (except as hereinbefore provided for officers of the field force ordered to Washington for short periods for consultation with the Superintendent), or to officers of the Navy attached to the Survey, except as now provided by law.]

PRINTING AND BINDING, COAST AND GEODETIC SURVEY:

For printing and lithographing, photolithographing, photoengraving, and all forms of illustration done by the Public Printer, on requisition by the Treasury Department, for the Coast and Geodetic Survey, namely:

Tide tables, coast pilots, appendixes to the Superintendent's annual reports, published separately; notices to mariners, circulars, blank books, blank forms, and miscellaneous printing, including the cost of all binding and covering; the necessary stock and materials and binding for the library and archives 20 935

NOTE.—No engraving is done by the Public Printer for the Coast and Geodetic Survey.

Total Coast and Geodetic Survey, exclusive of printing and binding 518 020

OFFICE OF CONSTRUCTION OF STANDARD WEIGHTS AND MEASURES:

Salaries, Office of Standard Weights and Measures—

For construction and verification of standard weights and measures, including metric standards, for the custom-houses, other offices of the United States and for the several States, and mural standards of length in Washington, D. C.—

For 1 adjuster	1 800
For 1 verifier	1 500
For 1 mechanician	1 250
For 1 assistant messenger and 1 watchman	1 620
In all	6 170

Contingent expenses, Office of Standard Weights and Measures—

For purchase of materials and apparatus, and incidental expenses	500
For expenses of the attendance of the American member of the International Committee on Weights and Measures at the general conference provided for in the convention signed May 20, 1875, the sum of $475, or so much thereof as may be necessary	475
Total, contingent expenses, Office of Standard Weights and Measures	975

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1896.

EASTERN DIVISION.

STATES EAST OF THE MISSISSIPPI RIVER.

1. Maine.
2. New Hampshire.
3. Vermont.
4. Massachusetts.
5. Rhode Island.
6. Connecticut.
7. New York.
8. New Jersey.
9. Pennsylvania.
10. Delaware.
11. Maryland.
12. District of Columbia.
13. Virginia.
14. North Carolina.
15. South Carolina.
16. Georgia.
17. Florida.
18. Alabama.
19. Mississippi.
20. Michigan.
21. Wisconsin.
22. Ohio.
23. Indiana.
24. Illinois.
25. West Virginia.
26. Kentucky.
27. Tennessee.

Progress sketches showing the localities of field work in the Eastern Division will be found at the close of Part I.

Telegraphic determination of the difference of longitude between Cambridge, Mass., and Calais, Me.; also incidental magnetic and gravity determinations.—In August, 1895, Assistants A. T. Mosman and G. R. Putnam, in accordance with instructions, proceeded to Cambridge, Mass., and Calais, Me., respectively, for the purpose of determining the difference of longitude between the two points. Assistant Mosman, accompanied by Assistant Homer P. Ritter, reached Cambridge on the 16th, and Assistant Putnam arrived at Calais on the 17th. The two observatories were at once erected and connected with the Western Union lines, and observations began on the 21st. Exchanges of time signals took place on the nights of August 21, 25, 27, and 30, and September 1, and again, after the usual interchange of observers, on September 5, 8, 10, 13, and 14.

Assistant Putnam also made at Calais three days' observations for the determination of the magnetic declination, dip, and intensity, and two days' pendulum observations for the determination of the force of gravity. The magnetic observations were obtained on August 22, 23, and 24, and the pendulum observations on August 22 and 23, the observations for both being so arranged as not to interfere with or delay the longitude work. The parties returned to Washington on September 18, and were engaged until October 10 in computing the results of this and previous work, after which Messrs. Putnam and Ritter were assigned to duty in the Weights and Measures Office and computing division, respectively, and Assistant Mosman resumed his duties as member of the United States and Mexico International Boundary Commission.

Hydrographic surveys and examinations on the coast of Massachusetts.—The steamer *Bache*, Lieut. Robert G. Peck, U. S. N., commanding, after erecting beacons on the north shore of Long Island, as described under the head of "Special operations," and carrying the Superintendent of the Coast and Geodetic Survey and the Hydrographic Inspector on a tour of inspection to New Bedford, Hyannis, and Boston to visit the topographic and hydrographic parties at work in those localities, finally reached Boston on the evening of July 30, 1895. A few days were spent in preparing the steam launch stored at the Boston Navy-Yard for service and in obtaining water and other needed supplies for the ship, after which the *Bache* proceeded to Cohasset and began the season's work. A special examination was first made of the vicinity of Minot's Ledge, then of the depths off Boston Light-House, Broad Sound, and along the coast from Nahant to the entrance of Salem Harbor, the results in each case save one being a verification of the conditions already charted. At one spot in Broad Sound a depth of 18 feet was found where the chart shows 4½

fathoms. This lies directly in the fairway of vessels bound for Lynn, and its discovery was therefore one of great importance. Its location was carefully determined and reported, and a special Notice to Mariners was promptly issued. The unfinished sheet of the previous year, Nahant to Cat Island, was then taken up and completed and special examinations were made in Salem Harbor and its approaches, after which the sheet Marblehead to Manchester was begun. From the 18th to the 27th of September the *Bache* was absent from her working ground, building beacons on the coasts of Maine and Massachusetts for the use of the Navy Department in laying out the speed-trial course of the *Indiana* and *Katahdin*.

The sheet was completed November 1, and the season's work closed. The *Bache* proceeded to Boston to store her boats and equipments and to procure a supply of coal for the run to New York, and arrived at the latter point November 12, after having stopped en route at Provincetown, Hyannis, Woods Hole, New Bedford, and Bridgeport.

A special report on new rocks and shoals developed during the season has been made by Lieutenant Peck, and the positions of such of them as are of sufficient importance will be given in Notices to Mariners.

The statistics of the season's work are as follows:

Area sounded, in square geographical miles	38·5
Number of miles run while sounding	493
Number of angles measured	9 560
Number of soundings taken	29 958
Number of tidal stations established	7

The officers attached to the party during the season were as follows: Commanding officer, Lieut. Robert G. Peck; Lieut. E. H. Tillman; Ensigns H. K. Hines, A. H. Davis, and F. M. Russell; P. A. Surg. G. H. Barber; P. A. Engineer A. McAllister; Pay Yeoman J. L. Dunn, draftsman; Master-at-Arms Thomas S. Martin, observer and recorder. Seamen John Craig and A. Andersen also served as recorders.

The further services of the *Bache's* party will appear under the proper geographic headings.

Continuation of hydrographic resurveys in Nantucket Sound and its eastern approaches, and special examinations and developments on Nantucket Shoals and in the approaches of Hyannis Harbor.—At the close of the last fiscal year the steamer *Blake* was undergoing repairs at Jersey City, and on their completion in July, 1895, Lieut. Commander H. G. O. Colby assumed charge of the vessel and proceeded to Hyannisport, Mass., arriving there on the 22d. The work assigned to the *Blake* consisted of the resurvey of the eastern entrance and approaches of Nantucket Sound, and special examinations and developments of part of Nantucket Shoals and the approaches to Hyannis Harbor; also, a close development of the greater part of Handkerchief Shoal and the passage between it and Monomoy Point, and a general survey of Butlers Hole and the area between these localities and Nantucket.

Work was at once commenced and was prosecuted with vigor until the boisterous and inclement weather incident to the season of the year compelled a cessation of operations in November.

The survey near the entrance of Nantucket Sound was one of great difficulty on account of conflicting tidal currents, the scarcity of available signals, the prevailing southwest winds and accompanying heavy seas, and the large traffic of coastwise vessels of every description; the fishing boats and small craft and the numerous fishing nets and lobster pots also seriously hampered the movements of the vessels. Notwithstanding the difficulties encountered, the results of the season's work were very satisfactory, and a large amount of useful and necessary data for the correction of the charts of the locality was obtained.

Lieutenant-Commander Colby reports that the heavy northeast gales cause a frequent shifting of the shoals and channels in this vicinity, and strongly recommends that, in view of the great commercial importance of these waterways, annual reexaminations be made.

The season closed on the 7th of November, and the *Blake* proceeded to Baltimore, arriving there on the 21st, after stopping en route at Newport, New York, and the Patuxent River. After underergoing necessary repairs she was, in January, 1896, assigned to further duty on the coast of South Carolina, which will be noticed further on in proper geographical order.

The statistics of the Nantucket Sound work, including the special examinations above mentioned, are as follows:

Area surveyed, in square geographical miles	37
Number of miles (geographical) run while sounding	512
Number of angles measured	6 830
Number of soundings taken	27 312
Number of tidal stations established	2
Number of specimens of bottom preserved	1

The list of naval officers attached to the party was as follows: Lieut. Commander H. G. O. Colby in command, Lieut. J. A. Shearman, Lieut. W. S. Benson, Ensign A. T. Long, Asst. Surg. B. R. Ward, and Pay Yeoman W. S. Crosby.

Resurvey of Buzzards Bay, Massachusetts.—A resurvey of Buzzards Bay being urgently needed on account of the numerous changes reported since the previous survey of fifty years ago, four topographical parties and one hydrographic party were assigned to duty in this region just before the close of the last fiscal year. The four topographical parties were under the charge of Assistants D. B. Wainwright, J. A. Flemer, Stehman Forney, and W. I. Vinal, respectively, and the hydrographic party under the charge of Lieut. G. C. Hanus, U. S. N., commanding the schooner *Eagre*. To the latter was assigned the hydrographic survey of New Bedford Harbor and its approaches, while to the four shore parties were assigned eight topographic sheets, laid out in sequence to embrace the shores of the bay and a strip of topography varying in width from 1 to 3 miles, from the western part of the entrance to Swifts Hill and Falmouth Village; the topography and shore line on the peninsula between the latter points and Woods Hole and the outlying islands of Naushon, Pasque, Nashawena, and Cuttyhunk were not included in this season's scheme.

It was hoped that the whole of the topographical work above outlined could be completed during the summer and autumn, but owing to the scantiness of the appropriation, and the necessity of reserving a portion for urgent work on the Southern coast during the winter, the parties were obliged to disband by the end of October, leaving considerable areas to be completed during the following year.

The reports of the several chiefs of parties are noticed separately in the paragraphs immediately following, and the results and tabulated statistics of each are there given.

Topographical resurvey of Buzzards Bay, Massachusetts.—New Bedford and Mattapoiset sheets.—To Assistant D. B. Wainwright were assigned the New Bedford and Mattapoiset sheets, the former extending from Moshers Point, at the southwest point of the entrance of Clarks Cove, to Sconticut Neck, and including the city of New Bedford and the villages of Fairhaven and Acushnet, and the latter extending from Sconticut Neck to Angelica Point. As many of the old trigonometric points were, from various causes, not recoverable, it was necessary to execute a supplemental plane-table triangulation to determine a sufficient number of new points to properly control the topography, and this work first received attention. The wharf lines of New Bedford and Fairhaven and the shore line of Acushnet River were next delineated, as these were required for the use of the hydrographic party operating in the same locality, and afterwards the principal streets of New Bedford were run out with the plane table so as to furnish the draftsmen of the party with the proper data for reducing and platting the city map. The regular detailed topography was then taken up and carried from Moshers Point to Sconticut Neck, thus completing the first sheet. The second sheet was begun early in September, and on this also the interpolation of additional points was found necessary before the topography proper could be executed.

The work was carried on continuously until October 30, when, in accordance with instructions, field operations ceased, the party was disbanded, and Mr. Wainwright returned to Washington, D. C. The second sheet was by that date completed nearly up to Mattapoiset Neck, leaving the portion between that point and Angelica Point for another season.

The topographic features of this portion of the bay are described by Mr. Wainwright as consisting of a series of narrow and shallow valleys, running normal, or approximately so, to the coast line and separated by narrow and low ridges, the latter in some cases projecting outward

several miles into the bay, forming peninsulas which are locally termed "necks." Owing to the small drainage area of any one valley, the streams, with the single exception of the Acushnet River, are insignificant, and in a dry season like the past summer are very much shrunken and without perceptible current. In the vicinity of New Bedford the country is divided into small farms, and these are divided and subdivided by stone dikes and walls. From present indications, however, it seems probable that this characteristic form of fencing will soon disappear, as farmers in the vicinity of the new State highways now in process of construction have found it profitable to cart the stone to the crushers, and there dispose of it at so much per ton. Farther to the eastward the country is less open, and large, wooded areas exist, in which the maple and scrub oak predominate. Along the shores, at points exposed to current and wave action, there are found evidences of slow erosion, in the existence of shingle beaches and outlying rocks; the inward bends and coves are skirted by salt marshes, upon which are scattered boulders transported thither from neighboring beaches by the winter ice during high storm tides.

The valley near the mouth of which are located the city of New Bedford and the villages of Fairhaven and Acushnet, although the largest in the locality, has only a moderate drainage area and does not discharge an excessive amount of fresh water into the harbor, and as its streams all pass through one or more lakes or ponds very little sediment reaches tide water. The changes in the harbor from this source are therefore very slow and gradual.

The weather during the season was quite favorable for field work, the rainfall being much below the average and generally occurring either at night or on Sundays, but the prevailing southwest winds occasionally blew with such strength that a temporary suspension of field work was necessary. All members of the party performed their duties very satisfactorily, but Messrs. R. J. McAdory and George Taylor receive especial commendation in Mr. Wainwright's report; the former served as foreman and the latter as recorder and draftsman.

The statistics of the season's work have been tabulated, as follows:

Area surveyed, in square statute miles	22½
Length of general coast line surveyed, in statute miles	6
Length of river shore line surveyed, in statute miles	4
Length of creek shore line surveyed, in statute miles	4
Length of roads surveyed, in statute miles (exclusive of 4 square miles of streets in New Bedford and Fairhaven)	39
Number of topographic sheets finished	1½

During the winter and spring Assistant Wainwright was engaged in inking his sheets and in the performance of miscellaneous office duties, and at the close of the fiscal year was preparing for field duty on the resurvey of Chesapeake Bay.

Topographical resurvey of Buzzards Bay, Massachusetts.— Wareham and Sippican sheets.—To Assistant J. A. Flemer were assigned the two sheets embracing the upper part of the bay, and which for convenience may be designated as the Wareham and Sippican sheets, the former embracing the area from Monumet River on the east to Wareham River and vicinity on the west, and the latter from Wareham River to Angelica Point, the northern limit of Assistant Wainwright's upper sheet.

Assistant Flemer began work on July 1 at Cohasset Narrows, and first completed the eastern section, or the country lying between Cohasset Narrows and Monumet River. The paucity of recoverable trigonometric points for this work necessitated the measurement of a base and the execution of a plane-table triangulation to give a sufficient number of points of control for the topography. A convenient site for the base was furnished by the bridge over Cohasset Narrows. The western half of the sheet was then completed, and the Sippican sheet was begun. Work continued without interruption until October 31, when, in accordance with instructions, field operations ceased, the party disbanded, and Mr. Flemer, with his aid, A. F. Zust, returned to Washington. About half of the second sheet was completed.

The country in this vicinity is generally flat or rolling and well wooded, and the shores of the creeks and coves are marshy; the few prominent hills existing range from 90 to 120 feet in elevation, and are covered by a dense growth of timber

The statistics of the season's work are given by Mr. Flemer as follows:

Area surveyed, in square statute miles	21
Length of high-water shore line surveyed, in statute miles	94
Length of low-water shore line surveyed, in statute miles	76
Length of roads surveyed, in statute miles	115
Length of creek and pond shore lines surveyed, in statute miles	17
Length of railroads surveyed, in statute miles	10
Length of cranberry bog outline surveyed, in statute miles	7½
Number of topographic sheets finished	1½

Assistant J. A. Flemer and A. F. Zust were subsequently engaged in inking topographical sheets and on miscellaneous office duty until the close of the fiscal year.

Topographic resurvey of Buzzards Bay, Massachusetts.— Westport and Padanaram sheets.— To assistant Stehman Forney were assigned two lower projections, designated as the Westport and Padanaram sheets, the former embracing the topography from Quicksand Point, Rhode Island, at the southwestern part of Buzzards Bay Entrance and near the boundary line between the States of Massachusetts and Rhode Island, to Slocum Neck, and the latter extending from Slocum Neck to Moshers Point, the southern limit of the New Bedford sheet. The party was organized on July 1, and work was immediately begun on the upper or Padanaram sheet. Here also, on account of the disappearance of the old triangulation stations, a new plane-table triangulation had to be executed before attempting to delineate the topographical features. The upper sheet was finished and the lower or Westport sheet about half completed before the close of the season on October 31. The width of the surveyed topography on the upper sheet is about 2½ miles, on the lower 1½ miles. The shores of this part of Buzzards Bay are rocky with occasional sand beaches, which furnish excellent bathing facilities, and the slopes near the shore are thickly dotted with summer hotels and private residences. Padanaram, Bay View, Nonquitt, Horse Neck Beach, Westport Point, and Westport Harbor are pleasant and thriving summer resorts. Westport River and its Western Branch are quite large streams, with 6 feet of water on their beds at low tide, and are navigable for vessels of small size for a distance of 5 miles from the mouth.

Messrs. William Bowie and Edgar R. Strobel served as recorders in the party, the former throughout the season, and the latter to September 1.

At the close of the season Assistant Forney returned to Washington, and was engaged during the remainder of the fiscal year in inking his sheets and in the performance of miscellaneous office duty.

The statistics of the season's work has been tabulated as follows:

Area surveyed, in square statute miles	17½
Length of general coast line surveyed, in statute miles	33
Length of river shore line surveyed, in statute miles	3½
Length of pond shore line surveyed, in statute miles	47
Length of roads surveyed, in statute miles	40
Number of topographical sheets completed	1½

Topographical resurvey of Buzzards Bay, Massachusetts.— West Falmouth and Pocasset sheets.— To Assistant W. I. Vinal were assigned the West Falmouth and Pocasset sheets, which embrace the shores of the bay and the adjacent country from Great Sippowissett Creek, the northern boundary of the survey of 1890, to Monumet River, the southern boundary of the Monumet sheet of this resurvey. Mr. Vinal organized his party on July 1 at West Falmouth, and immediately began field operations. The same difficulties in recovering old stations of the former survey were experienced, and consequently the determination of new ones was necessary before the topographic delineation could be carried on. The regular topographic survey began July 10, and was carried on continuously until the latter part of October, when the party reached Pocasset River, thus completing the work to that limit, with the exception of a small area to the north and east of Cataumet Harbor. This portion and that from Pocasset River to Monumet River were necessarily left for another season. The topography of this section does not differ essentially from that of the adjoining one, already described, and the principal features are thus enumerated by Assistant Vinal: Sand and shingle beaches, alternating with strips of rocky shore; creeks; fresh and salt

water ponds; eroded gravel banks; bowlders; low sand dunes; tracts of marsh, some of which have been reclaimed for cranberry cultivation; open and village detail; summer resorts and residences; railroads; country roads, and roads not classified as public highways; wooded hills, etc.

The accurate delineation of elevation contours was in some places quite difficult on account of the underbrush and dense second growth of deciduous timber, and considerable cutting and trimming out was necessary. Along the shores are numerous detached and outlying rocks, and as many of these are visible only at low water, more than ordinary care was required in surveying the coast line. The small harbors along this part of the coast afford shelter from wind and sea for numerous pleasure yachts, but are seldom entered by trading vessels of any considerable size; the entrance to Hog Island (Chappaquoit) Harbor was buoyed for the first time in July of this year.

At the close of the Buzzards Bay work Mr. Vinal, in accordance with instructions, transferred his party to Cohasset, Mass., and made a resurvey of the shore line from White Rock to Brush Island; he then disbanded the party and returned to Washington. Mr. H. S. Williams acted as recorder, and Messrs. J. J. Carlisle and R. B. Crutchfield as rodmen throughout the season, their services being entirely satisfactory.

The following are the statistics of the season's work:

Area surveyed, in square statute miles	11
Length of coast line surveyed, in statute miles	25
Length of shore line of rivers, creeks, and ponds surveyed, in statute miles	25
Length of roads and railways surveyed, in statute miles	52

Assistant Vinal was engaged during the remainder of the fiscal year in inking his topographical sheets, and on miscellaneous office duty, and at its close was preparing for the resumption of field work on the Buzzards Bay resurvey.

Hydrographic resurvey of Buzzards Bay, Massachusetts.—The hydrographic party of the schooner *Eagre*, under the charge of Lieut. G. C. Hanus, U. S. N., as stated in my last report, began the hydrographic survey of New Bedford Harbor and its approaches in May, 1895, and by the end of that fiscal year had made good progress, a number of signals having been erected, and 341 miles of soundings run. Work was continued without intermission during the present fiscal year until the middle of October, and after that date whenever the weather conditions would permit. The party remained in the field throughout the winter, and some work was accomplished during each month, excepting January and February, the hydrography of New Bedford Harbor and its approaches being completed on the 16th of April. The party was then engaged for a time on current and tidal observations, after which the vessel was moved to Marion, where preparations were made for the resurvey of the head of Buzzards Bay. Five additional current stations, and nine comparative tidal stations, were occupied, and about 150 signals were erected and determined, after which the regular sounding work of the head of the bay began on May 14 and was continued until the close of the fiscal year.

During January and February, when no field work was possible, the vessel's boats were overhauled, the boilers of the steam launches were repaired, and such refitting as the vessel required was attended to.

Lieutenant Hanus's reports contain much valuable information relating especially to New Bedford Harbor, the various rocks, ledges, and other dangers to navigation being enumerated, and their exact positions given; he also gives the depth of water at each wharf along the water front, and furnishes statistics as to the tonnage and draft of vessels entering the harbor during the year. The aids to navigation, such as lights, buoys, ranges, and prominent landmarks, were also carefully determined, and are likewise mentioned in detail in his descriptive report.

For the New Bedford Harbor and approaches work a primary tide gauge was established on the sheltered side of the stone pier at Clark Point, and six secondary or staff gauges were located at convenient places as the work advanced, and frequently compared directly with the standard. The six secondaries were located as follows:

1. Upper Padanaram gauge near Sterns's Bathing Wharf (used for reducing soundings made at the upper harbor).
2. Lower Padanaram gauge near the coal wharf below the bridge (used only for comparison).
3. Nonquitt gauge near Ricketson's Wharf in the village of Nonquitt (used only for comparison).

4. Philadelphia and Reading Coal Wharf gauge in the southern slip of the coal company (used for reducing soundings taken between Palmer Island and Fairhaven Bridge).

5. Wamsutta Mills Wharf gauge (used for reducing soundings taken between Fairhaven and Coggeshall Street bridges).

6. Belleville gauge halfway between the Coggeshall Street Bridge and head of the river, west side (used for reducing soundings taken above the bridge).

The hydrographic work in the vicinity of New Bedford is platted on three sheets, numbered 1, 1½, and 2, respectively; No. 1 includes New Bedford Harbor, Clarke Cove, and Padanaram Harbor; No. 1½ the Acushnet River, and No. 2 the approaches to the harbor, this term being defined as embracing all the waters between Misnaum Point and West Island. The shore line and positions of determined points were furnished by the topographical party working in the vicinity.

The statistics of the New Bedford work are as follows:

Area sounded, in square geographical miles	74
Number of miles (geographical) run while sounding	2 076
Number of angles measured to locate soundings	26 202
Number of angles measured to determine signals and buoys	1 033
Number of soundings taken	150 468
Number of tidal stations established	7
Number of specimens of bottom preserved	64
Number of signals erected	15
Number of hydrographic sheets furnished	3

The work at the head of the bay is still in progress, but the partial statistics, to June 30, 1896, are given as follows:

Number of miles (geographical) run while sounding	652
Number of angles measured to locate soundings	7 727
Number of angles measured to determine signals and buoys	1 517
Number of soundings taken	58 004
Number of tidal stations established	8
Number of current stations established	5
Number of hydrographic sheets finished	1

The following-named naval officers were attached to the party: Lieut. C. S. Ripley, Ensign W. A. Edgar, Ensign J. F. Hubbard, and Pay Yeoman William B. Proctor.

Lieutenant Ripley was detached from the vessel and the Coast and Geodetic Survey service October 15, and was succeeded by Ensign J. F. Hubbard.

Town boundary line surveys of the State of Massachusetts, continued under the direction of the Topographical Survey Commission of the State.—Assistant Henry L. Whiting, during the fiscal year, continued to serve as chairman of the Topographical Survey Commission of the State of Massachusetts, and took personal charge of the general management of the field and office work relating to the Town Boundary Survey. Three field parties were engaged on the work—one under the charge of Mr. James B. Tolley in executing a secondary triangulation in the central and southern parts of the State; the second under the charge of Mr. Eugene E. Peirce in the southeastern part of the State, mainly in Bristol and Plymouth counties, determining new boundary lines formed by the subdivision of former townships; and the third under the charge of Mr. F. E. Bowman, on similar work in Barnstable County. The amount and detail of the work did not vary materially from those of former years, and about the same amount of office work was executed.

As heretofore, the original descriptions of the main triangulation stations, with sketches, their geographical positions, and other data necessary for the prosecution of the work, have been furnished to the State Commission by the Coast and Geodetic Survey Office.

Assistant Whiting also continued to serve as a member of the Mississippi River Commission, and attended the various meetings of that body during the year. The first meeting took place on November 5, 1895, at St. Louis, on board the U. S. S. *Mississippi*, and the semiannual inspection of the works of improvement immediately followed, the Commission adjourning on the 17th at New Orleans; the second meeting took place from January 9 to 11, inclusive, at New York; the third meeting occurred on April 16 at St. Louis, and the inspection of the high-water stage of the

river followed, the Commission adjourning at New Orleans on the 22d; the fourth and last meeting took place at New York from June 16 to 22, inclusive. After each of the inspection trips Assistant Whiting stopped over at Washington for conference with the Superintendent, and at various times during the year submitted such special reports as were required.

Examination of a reported danger to navigation in the harbor of Bristol, R. I.—In December, 1895, a notice was received at this office from Mr. Nathaniel G. Herreshoff, of Bristol, R. I., that a scow sloop, carrying a deck load of granite blocks, had capsized in the east channel of the harbor and dumped about 25 tons of the rock, thus creating a serious danger to navigation. Lieut. G. C. Hanus, who was engaged on the hydrographic resurvey of Buzzards Bay, was directed to investigate the matter and locate the obstruction on the chart. He proceeded at once to Bristol, taking with him one member of his crew, and after consultation with Mr. Herreshoff, who knew the approximate location of the accident, hired a boat, and, assisted by the keepers of the Bristol Ferry and Muscle light-houses, made a careful examination. The whole vicinity indicated was sounded with the lead, and subsequently it was dragged over with a grapnel, but no trace of the stones could be found. The bottom was found to be very soft, and Lieutenant Hanus concluded that the heavy rocks had deeply embedded themselves in the mud; he recommends, however, a further examination at a more favorable season of the year, as different persons with whom he afterwards conferred do not agree as to the location of the dumping.

On the completion of the examination Lieutenant Hanus returned to New Bedford and resumed his duties as commander of the *Eagre*.

Hydrographic surveys to the southward of Block Island Sound and off Montauk Point, and special examinations in Long Island Sound.—In July, 1895, the steamer *Endeavor*, Lieut. L. M. Garrett commanding, made special hydrographic examinations in Davids Island Harbor and along the north shore of Long Island Sound off Cornfield Point, Duck Island, and Kelsey Point, after which, early in August, the survey of the waters to the southward of Block Island Sound and the east end of Long Island was begun; the development of the outlying dangers in the vicinity of Montauk Point was also included in the plan of the season's operations. After the erection of the necessary signals at suitable points, and the establishment of tide gauges at Block Island Harbor and at Tuthills Wharf, Fort Pond Bay, the work was prosecuted as rapidly as weather conditions would permit until November 11, when the season closed. Much time was lost during the season on account of smoky or hazy atmosphere and wind, the former often interfering in otherwise good weather on account of the distance of some of the lines from the shore and the consequent difficulty of seeing the signals. The work was left unfinished, but was again resumed in the spring of 1896, as noted in the next paragraph.

The *Endeavor* returned to Baltimore, reaching that point November 19, and remained there throughout the winter, there being no appropriation remaining available for her employment on the Southern coast.

The statistics of the season's work in the vicinity of Block Island Sound and Montauk Point, including the special examinations in Davis Island Harbor, and off Cornfield Point, Duck Island, and Kelsey Point, are as follows:

Area surveyed, in square geographical miles	209
Number of miles (geographical) run while sounding	837
Number of angles measured	5 369
Number of soundings taken	15 353

The officers attached to the *Endeavor* during the season were the following: Lieut. L. M. Garrett, commanding officer; Lieut. John J. Blandin, Ensign C. M. McCormick, Machinist J. C. Richards, Pay Yeoman C. Lee Green, and Writer Eugene Veith.

Lieut. L. M. Garrett and Ensign C. M. McCormick were subsequently detached from the vessel, and the former was succeeded by Lieut. W. S. Benson. It may also be mentioned that Lieutenant Garrett served at the office as acting Hydrographic Inspector from November 4 to December 3, the command of the *Endeavor* meanwhile temporarily devolving upon Lieutenant Blandin.

Resumption of the hydrographic surveys to the southward of Block Island Sound and off Montauk Point, in the spring of 1896.—On May 6, 1896, Lieut. W. S. Benson, U. S. N., assumed charge of

the steamer *Endeavor*, and on the 13th proceeded with the vessel to the vicinity of Montauk Point, arriving there on the 18th. The hydrographic survey of the waters to the south of Block Island Sound and in the vicinity of Montauk Point was at once resumed, the most favorable weather being devoted to the outer lines, and the work nearer shore being executed when the atmosphere was not sufficiently clear for seeing signals at long distances. Excellent progress was made to the close of the fiscal year, at which date the party was still in the field. A full report of the results of the season's work will appear in the next annual report.

The statistics to June 30 are as follows:

Area surveyed, in square geographical miles	10
Number of miles (geographical) run while sounding	367
Number of angles measured	3 357
Number of soundings taken	9 019
Number of tidal stations occupied	4

The officers now attached to the *Endeavor* are: Lieut. W. S. Benson, in command; Lieut. John J. Blandin, Pay Yeoman C. Lee Green, Machinist J. C. Richards, and Writer Elijah H. Phinney.

Continuation of the topographical resurvey of the south shores of Long Island, New York.—At the close of the last fiscal year Assistant C. T. Iardella, under instructions dated June 10, had organized his party at Speonk, Long Island, and completed his arrangements for the continuation of the topographic resurvey of the south shore of Long Island, or more specifically, of that portion of the island lying to the north of Morisches, Quantuck, and Shinnecock bays. The actual shore line of these bays and of the outer beach, with a narrow fringe of topography, had been surveyed during the previous season. Field work began July 1, the portion lying between Speonk and Harts Cove, where the previous year's work terminated, being first executed. The work was then continued eastward to the Shinnecock Hills, or about 2 miles beyond Canoe Place, where the Shinnecock Canal connects the waters of Shinnecock and Peconic bays. A strip of topography varying from a quarter of a mile to about 2 statute miles in width, and including a number of small towns, villages, and summer resorts, was executed, covering a total area of about 24 square miles. Work closed October 30, and the party disbanded and returned to Washington. Aid Hugh C. Denson served in the party throughout the season and performed his duties in a very satisfactory manner, receiving therefor the commendation of his chief.

Mr. Iardella's report contains interesting geographical and historical information relative to the various localities embraced in the season's work, and is accompanied by a sketch showing the connection with previous surveys.

The following is a statistical statement of the work accomplished:

Area surveyed, in square statute miles	24
Length of creek shore line surveyed, in statute miles	3
Length of pond shore line surveyed, in statute miles	4½
Length of road surveyed, in statute miles	138
Number of topographical sheets completed	2¾

The limits of the three topographical sheets may be generally stated as follows: Sheet No. 1, from Harts Cove to Quantuck Bay; sheet No. 2, from Quantuck Bay to Tianna Bay; sheet No. 3, from Tianna Bay to Shinnecock Hills.

On his return to Washington, Assistant Iardella was engaged in inking his sheets and on other office work until again assigned to field duty. On June 16 he was directed to make preparations for the resumption of the Long Island work, but owing to the lack of funds was not able to take the field before the beginning of the new fiscal year.

Continuation of the tidal record and the automatic tidal indicator at Fort Hamilton, New York Harbor.—The self-registering tide gauge at the Fort Hamilton tidal station, established in December, 1892, has continued in successful operation throughout the entire fiscal year, and no break has occurred in the record. Observer J. G. Spaulding has continued in charge of the gauge, and made the monthly tabulations and forwarded them with the original maregrams to the office. He has also had charge of the tidal indicator, which has continued to work satisfactorily.

Continuation and completion of the series of tidal observations at the automatic tidal station at Willets Point, N. Y.—The self-registering tide gauge established in 1891 at Willets Point, N. Y.,

was, through the kind cooperation of the officers of the United States engineers stationed at the post, kept in successful operation throughout nearly the whole fiscal year; the record for March, 1896, however, was lost on account of ice, and early in June the series was discontinued. The thanks of the office are due to Lieuts. R. R. Raymond and William H. Brown for attending to the gauge and transmitting the monthly records.

Continuation of the topographic survey of the Hudson River (vicinity of Marlboro).—As stated in the Report for 1895, two topographical parties took the field at the close of that fiscal year for the continuation of the topographic survey of the Hudson River. The party of Assistant John W. Donn began work at Prospect Hill and first executed a subsidiary triangulation to determine a sufficient number of points of control for the topography. The topography was then executed, a strip averaging 1 mile in width being surveyed on both sides of the river to the line Milton—Camelot, the southern limit of the work of the other party. On the west side of the river the topography was somewhat intricate and the contouring difficult, as vineyards covered the hillsides, and orchards to a large extent the valleys and low areas; on the eastern side the work was simpler, the chief difficulties being met in the parked inclosures and ornamental grounds of wealthy proprietors.

The work continued without interruption until November 1, when in accordance with instructions the party was disbanded and Assistant Donn returned to Washington.

The statistics of the work from July 1 to November 1 are given as follows:

Area of topography surveyed, in square statute miles	20
Length of river shore line surveyed, in statute miles	13
Length of shore line of creeks and ponds surveyed, in statute miles	15
Length of roads surveyed, in statute miles	33
Length of railroads surveyed, in statute miles	12
Number of geographical positions determined	6
Number of finished topographic sheets	2

The limits of the topographic sheets may be stated as follows: No. 1, from Mud Hole to Marlboro; No. 2, from Marlboro to Milton.

Assistant Donn's subsequent services will be noticed elsewhere in this report.

Continuation of the topographic survey of the Hudson River (vicinity of Poughkeepsie).—The party of Assistant W. C. Hodgkins was organized at Poughkeepsie and began operations July 1. Many of the old trigonometric stations could not be recovered, and others had become useless on account of erection of buildings, growth of shade trees, etc., so that it was necessary to execute a subsidiary triangulation to furnish the requisite number of points for topographic use. The primary stations "Vervalin" and "Lloyd" furnished a base for this work, and from it thirty-five new positions were determined. The topographical work was then taken up and continued to the end of October, but the extreme heat of the summer and the illness of several members of the party seriously retarded progress. The sheet worked upon included about 8 miles of the river, from Milton and Camelot stations northward to the sharp bend known as Crum Elbow. Within these limits the shore line of both banks was run, together with the railways near each shore; the detailed topography on the east side between the shore and the "old post road" was completed from the southern edge of the sheet to the centre of Poughkeepsie. This margin is rather narrow in some places and will require widening hereafter, but Assistant Hodgkins reports that the additional topography required is of a simple character and can be rapidly delineated.

The most striking feature of this locality is the terrace-like plateau, the western edge of which is nearly straight for over a mile, with an almost uniform elevation of about 170 feet above high water; from this edge the ground slopes abruptly down from 40 to 100 feet and then extends in irregular undulations to the rocky and precipitous bluffs which border the river. This natural terrace affords delightful sites for numerous country seats.

On October 31, in accordance with instructions, field operations ceased and the party was disbanded, but Mr. Hodgkins was engaged at Poughkeepsie on office work incident to his field labors until November 19, when he proceeded to New York. He was then granted a short leave of absence, and on its expiration proceeded to Washington and reported at the office on December 6.

Until April following, when he was again assigned to field duty, he was engaged in inking his topographical sheet and on miscellaneous office duty. His further services on the Missouri

and Iowa boundary and on the transcontinental geodetic work in Kansas will be noticed under the appropriate headings.

The statistics of the season's work on the Hudson are as follows:

Area of triangulation, in square statute miles	60
Area of topography, in square statute miles	2½
Number of signals erected	25
Number of stations occupied by horizontal angles	17
Number of geographical positions determined	35
Length of river shore line surveyed, in statute miles	18
Length of creek and pond shore line surveyed, in statute miles	12
Length of roads surveyed, in statute miles	41
Number of topographic sheets worked upon	1

Establishment of a tidal indicator at Reedy Island, Delaware River.—The maritime interests of Philadelphia having secured an appropriation for the erection of a tidal indicator on the Delaware River at Reedy Island, Assistant J. F. Pratt was directed to draw up the plans and make all necessary arrangements for its construction. Mr. Pratt visited the locality and selected the site, arranged for the necessary piling and supports, and afterwards, as chief of the instrument division, superintended the construction of the indicator at this office. In December, 1895, it was erected, and has since been working satisfactorily. It is located at the northern end of the ice breaker at Reedy Island Quarantine Station, and appears as a large white semicircle with feet and half feet shown by heavy black lines, the foot divisions being numbered. A pointer, actuated by the rise and fall of the tide, indicates at any time the actual height of the tide above or below the plane of reference (mean low water), while an arrowhead in the center of the disk indicates whether the tide is rising or falling. The figures, lines, pointer, and arrowhead can be readily seen with the aid of an ordinary marine glass at a distance of a mile, and the navigator is thus furnished with all necessary tidal information.

Extension of the transcontinental arc eastward to Capes May and Henlopen.—Reconnaissance and triangulation.—On the 1st of April, 1896, Assistant F. W. Perkins, accompanied by Extra Observer George A. Fairfield, proceeded to the eastern extremity of the great transcontinental arc for the purpose of executing a reconnaissance and primary triangulation eastward across Chesapeake and Delaware bays and the intervening portions of the States of Maryland and Delaware to capes May and Henlopen. This triangulation will serve not only as an extension of the arc near the thirty-ninth parallel, but also as a connection of the Atlantic Coast triangulation with that starting westward and southward from Fire Island base, and will form the basis of future topographical surveys of the States of Maryland and Delaware.

Three stations of the 1834 work, "Osborne's Ruin," "Linsted" and "Webb," were found without difficulty, and subsequently two others, "Turkey Point" and "Finlay," were recovered. The reconnaissance, notwithstanding the difficulties incident to such work in a comparatively flat and wooded country, was completed by May 9, and resulted in the laying out of a very satisfactory scheme of figures with sides varying from 10 to 30 miles in length.

Assistant Perkins's report of the reconnaissance furnishes the following information concerning the nature of the country traversed.

> The western shore of Delaware Bay is low, generally a soft marsh of considerable width, and the land rises gradually to the dividing ridge near the Delaware and Maryland boundary, where it is from 70 to 80 feet above sea level. Spur ridges of about the same elevation branch out from this, running about west-southwest to the eastern shore of Maryland, which is again low, but rarely marshy. The western shore of Maryland is rolling country and much more heavily wooded than the peninsula, which is mostly in a high state of cultivation.

A construction party was then organized for the building of signals, heights of 120 feet being required at some points to overcome intervening obstructions. In the marshes of Delaware it was necessary to have pile foundations, the piles being driven to the harder strata some 25 feet or more below the surface. The signals on these foundations were subsequently found to be subject to troublesome vibrations, as were also the screw-pile light-houses occupied on the bay, and the measurements of the angles there were consequently slow and difficult. It is believed, however, that with the care taken the results will prove entirely satisfactory.

The signal building had advanced sufficiently by May 16 for the observations to begin, and at that date Mr. G. A. Fairfield commenced the occupation of Cape Henlopen Light-House. Assistants W. B. Fairfield and John Nelson were subsequently assigned to the party, and the former began observations at Brandywine Shoal Light-House on June 4, and the latter at "Stone" station on the 18th.

By the end of June the observations at "Cape Henlopen" and "Brandywine" stations were completed, and those at "Stone," "Cape May," and "Egg Island" were in progress.

The party is still in the field, and a full account of its operations must therefore be deferred, but Assistant Perkins has furnished the following partial statistics, showing the results to the close of the fiscal year:

Area of reconnaissance executed, in square statute miles	1 700
Number of primary points selected	16
Number of observing signals built (120 feet each)	5
Number of points occupied for horizontal directions	4
Number of directions determined	65
Number of pointings made for horizontal directions	2 955

Continuation of the tidal record at the automatic tide-gauge station at the United States Navy-Yard, Washington, D. C.—The self-registering tide gauge established at the Washington Navy-Yard tidal station in 1891 has been kept in operation throughout the entire fiscal year, under the supervision of the chief of the tidal division of the office, and a continuous record has been obtained.

Magnetic observations in the Eastern, Middle, and Southern States.—At the close of the last fiscal year Assistant J. B. Baylor, who had been instructed to determine the magnetic declination, dip, and intensity at various specified stations along the Atlantic seaboard had reached Nantucket, Mass. The work was continued in the present fiscal year until September 19, during which time complete magnetic observations, including the incidental astronomical observations for azimuth and time, were obtained at the following places: Nantucket (partially observed prior to July 1); Provincetown and Cambridge, Mass.; Portland, Bangor, and Eastport, Me.; Providence, R. I.; New Haven, Conn.; New Brunswick, N. J.; Philadelphia and Harrisburg, Pa.; and Baltimore, Md. Mr. Baylor then returned to Washington, and was engaged at the office in computing and reducing field observations until January, when he resumed field work.

Observations of the magnetic declination, dip, and intensity, and the incidental determination of time, latitude, and azimuth were made between January 8 and April 8 at the following places: Donaldsonville, Cheneyville, Baton Rouge, and Amite, La.; Poplarville, Shieldsboro, and Mississippi City, Miss.; Mobile, Citronelle, Greenville, Montgomery, Selma, Eufaula, and Opelika, Ala.; and Rome, Ga. Atlanta, Ga, was also in the list of stations to be observed, but was omitted by Mr. Baylor for the reason that the required observations there were obtained in March by the telegraphic longitude party under Assistant G. R. Putnam.

On the completion of the magnetic work, Assistant Baylor again returned to Washington, and during the remainder of the fiscal year was engaged on computations and reduction of field observations.

Special hydrographic examinations at various points on the Atlantic and Gulf coasts.—Charleston Harbor: In January, 1896, the steamer *Bache*, Lieut. Robert G. Peck, U. S. N., commanding, while en route to her field of work in Pensacola Bay, had occasion to stop at Charleston, S. C., and advantage was taken of the opportunity to make a special examination of insufficiently developed parts of the harbor and secure the necessary data for the completion of the chart. This work occupied the party for five days, and the statistics relating to it are as follows:

Number of miles (geographical) run while sounding	8.5
Number of angles measured	194
Number of soundings taken	885
Number of tidal stations occupied	1

Dry Tortugas, Florida: In February, 1896, Lieut. Robert G. Peck, in accordance with instructions issued at the request of the Navy Department, temporarily suspended the work in Pensacola

Bay and proceeded with the steamer *Bache* to the Dry Tortugas and made a special hydrographic examination of the Southeast Channel and the deep-water anchorage. This was required by the Navy Department in view of the proposed use of Dry Tortugas as a coaling station for the larger vessels of the North Atlantic fleet during the contemplated drill in the Bay of Florida. For a full account of this work and its results, see under the head of "Special operations."

Key West Fla: After completing the Tortugas work the *Bache* proceeded to Key West and made a successful search for the rock on which the U. S. S. *Raleigh* struck in going to sea from that harbor on February 6, 1896. The obstruction is outside of the harbor and was found without great difficulty, notwithstanding the fact that its position was not as reported to this office. It was apparently of coral formation and of small area; the least depth found over it, when reduced to mean low water, was 15·9 feet, and all around it the lead showed 5 fathoms or more.

The statistics of the Key West work, as given by Lieutenant Peck, are as follows:

Number of miles (geographical) run while sounding	6
Number of angles measured	116
Number of soundings taken	538
Number of tidal stations occupied	1

Blackfish Bank, off Assateague Island, Virginia: In May, 1896, Lieut. R. G. Peck, while en route from the Gulf Coast to New York, made a hydrographic examination of the Blackfish Bank off Assateague Island, Virginia, and found a shoal spot with only 3·2 feet at mean low water, where the chart showed nothing less than 3¼ fathoms. The shoal covers an area about 300 metres in diameter, and on all sides the depths increased gradually to 5 fathoms. The great distance of this shoal from shore makes it a very serious danger to navigation, and prompt notice of its existence was therefore given in our Notices to Mariners. The Light-House Board has since caused a can buoy to be placed to mark the locality.

The statistics of the Blackfish Bank work are as follows:

Area surveyed, in square geographical miles	4
Number of miles (geographical) run while sounding	52
Number of angles measured	306
Number of soundings taken	1 980
Number of tidal stations occupied	1

Fenwick Island and Isle of Wight Shoals, Maryland and Delaware: Lieutenant Peck also made special examinations of the Fenwick Island and Isle of Wight shoals and a smaller intermediate one, the results in each case being the finding of shoaler water than shown on the chart. The locations of the shoal spots were carefully determined, as was also the position of the Fenwick island Life-Saving Station.

The statistics of the work are as follows:

Area surveyed, in square geographical miles	4
Number of miles (geographical) run while sounding	48
Number of angles measured	302
Number of soundings taken	1 877

Ocean City, Md.: Lieutenant Peck, while engaged on the above work, was informed of the existence of a dangerous shoal spot, about 3 miles NE. ½ E. of Ocean City and 1¼ miles from shore, on which the keeper of the Ocean City Life-Saving Station had recently seen a passing schooner strike. An examination resulted in the confirmation of the report, and the finding of a depth of 11½ feet, where the chart showed 3¾ fathoms. Its position was carefully determined, and as promptly as possible the information was published in Notices to Mariners.

On the completion of the above examination the *Bache* proceeded on her way to New York, arriving there on May 30.

Automatic tidal record at Fort Sumter, Charleston Harbor, South Carolina.—The officers of the Corps of Engineers, U. S. A., have continued the tidal record at the Fort Sumter station during the year, by means of the self-registering gauge furnished them by the Coast and Geodetic Survey in 1894. The record is made primarily for the use of the engineers engaged on the work of harbor

improvement, but the originals are finally deposited in the archives of this Survey. During the fiscal year the continuous records from March 17, 1894, to March 1, 1896, have been received by this office.

Hydrographic resurvey of Port Royal Entrance, South Carolina.—After undergoing repairs and refitting at Baltimore, the steamer *Blake*, under the command of Lieut. Commander H. G. O. Colby, U. S. N., sailed on the 21st of January for Port Royal, S. C., for the purpose of executing a hydrographic resurvey of the entrance to that harbor, and arrived there on the 27th, a detention of three days at Hampton Roads having occurred on account of stress of weather. The preparations for the work were at once begun, but considerable delay occurred on account of the difficulty of finding a sufficient number of the old triangulation points or hydrographic stations, the great hurricane and tidal wave of 1893 having destroyed and obliterated most of them. Two triangulation points and two hydrographic stations were eventually found, and from these and the Martins Industry Light Vessel the requisite number of auxiliary points were determined. Subsequently, on account of the long distances and the consequent imperfect visibility of shore signals, it was found necessary to erect water signals on the bar, and this was a work of considerable difficulty on account of prevalent strong winds and rough seas. These conditions of wind and sea also interfered seriously with the hydrographic survey of the shoaler parts of the entrance, as boat work was rarely practicable and the *Blake's* draft precluded her use in the shallow water. The channels, however, were carefully surveyed, and the unfinished portions will be taken up another season. The sounding work was carried on whenever practicable from March 3 to June 29, at which latter date the season closed and the *Blake* returned to New York to prepare for her summer's work on the New England coast.

On the 20th of April Lieutenant-Commander Colby was detached from the *Blake* and proceeded to Washington for the purpose of assuming the duties of Hydrographic Inspector, the command of the vessel meanwhile devolving on Lieut. John A. Shearman until May 25, when Lieut. Commander A. Dunlap, who had been assigned to the command of the vessel, arrived. The season's report was made by the latter, and contains much valuable information, not only in regard to changes in the channels, shoals, etc., but also in relation to tides and tidal currents, anchorages, meteorological conditions, etc., and important statistics affecting commerce. It may be mentioned that at the naval station in this harbor is located the only dry dock on the Atlantic Coast of the United States that can accommodate our first-class battle ships, and this fact makes Port Royal Entrance a very important one from a military point of view, and emphasizes the necessity of having thorough surveys and keeping the published charts up to date.

The statistics of the season's work are given as follows:

Area surveyed, in square geographical miles	28
Number of miles (geographical) run while sounding	1 244
Number of angles measured	10 224
Number of soundings taken	58 412
Number of tidal stations established	2
Number of specimens of bottom preserved	30

The naval officers attached to the party during the season were as follows: Lieut. Commander H. G. O. Colby, in command until April 20; Lieut. Commander A. Dunlap, in command from May 25; Lieut. John A. Shearman; Ensign A. T. Long; Ensign J. H. Reid; Ensign H. A. Wiley; P. A. Surg. C. M. De Vallin; Pay Yeoman W. S. Crosby.

Establishment of a tidal station at Port Royal, S. C.—In March, 1896, Assistant E. B. Latham, in accordance with instructions, and on the completion of similar duties in Texas, proceeded to Port Royal, S. C., for the purpose of establishing a tidal station at that place. A Stierle self-registering gauge was set up in the boathouse of the naval station and a staff gauge was also conveniently placed. Three bench marks were also established for future reference and for verifying, from time to time, the constancy of position of the gauges in elevation. After installing an observer and instructing him in his duties, Mr. Latham, on April 11, returned to Washington and was assigned to office duty. Subsequently he was assigned to field duty on the Salina base measure, under the direction of Assistant F. D. Granger, as mentioned further on under the head of the "Transcontinental geodetic work in Kansas."

The tidal station, under the charge of the observer, B. W. Weeks, was still in operation at the close of the fiscal year.

Telegraphic longitude determinations and incidental latitude, magnetic and gravity determinations in various States.—In the early part of February, 1896, Assistants C. H. Sinclair and G. R. Putnam, in accordance with instructions, resumed the determination of telegraphic differences of longitude, the former having charge of the main party and the latter of the cooperating one.

The lines first required were: Charleston, S. C., to Key West, Fla.; Atlanta, Ga., to Key West, Fla.; Atlanta, Ga., to Little Rock, Ark.; Charleston, S. C., to Washington, D. C. Subsequently the following lines were added to the programme: Washington, D. C., to Cambridge, Mass.; Washington, D. C., to Ithaca, N. Y.; Cambridge, Mass., to Ithaca, N. Y.; old Naval Observatory, Washington, D. C., to Coast and Geodetic Survey Observatory, Washington, D. C.

The parties took up the lines in the order named, Assistant Sinclair proceeding to Charleston and Assistant Putnam to Key West. At Charleston the granite pier of 1880, near the east end of the citadel, was found undisturbed and a small wooden observatory was erected over it. At Key West the old pier of 1872 had disappeared, but by measurements to the reference marks its position was recovered; a new site was, however, selected in the grounds of the custom-house, and the pier and wooden observatory constructed. The new and old stations were then connected by a small triangulation. Time signals were exchanged between Charleston and Key West on the nights of February 11, 12, 18, 19, and 20, and again, after the usual interchange of observers, on February 25, 26, 27, 29, and March 1. Assistant Sinclair also determined the latitude at both stations; at Charleston by sixty-six observations on sixteen pairs of stars during five nights, using zenith telescope No. 6, mounted on a wooden stand; and at Key West by eighty-four observations on twenty-one pairs of stars during five nights, using the same instrument mounted on a pier built of brick laid in cement. Assistant Putnam determined the magnetic declination, dip and intensity at the Key West station by three days' observations, and also made pendulum observations at both stations for the determination of the force of gravity.

On the completion of the Charleston to Key West line Assistant Putnam moved the Charleston outfit to Atlanta, Ga., the other party remaining at Key West. The pier of 1880 in the capitol grounds at Atlanta was found still preserved, and the station was soon ready for occupation. Time signals were exchanged between the two stations on the nights of March 7, 8, 9, 13, and 14, and again, after interchange of observers, on March 20, 21, 25, 26, and 27. Magnetic and gravity determinations were also made at Atlanta by Assistant Putnam.

Mr. Putnam then moved the Key West outfit to Little Rock, Ark., the other party remaining at Atlanta. The Little Rock pier of 1893 in the custom-house grounds had disappeared, but its foundation was recovered without difficulty and a new pier was erected upon it. Time signals were exchanged between Little Rock and Atlanta on the nights of April 2, 4, 5, 7, and again, after the interchange of observers, on April 10, 11, 13, and 14. Meanwhile, as opportunity offered, magnetic and gravity determinations were made at Little Rock by Assistant Putnam. In all cases the latitude, magnetic and gravity observations were so arranged as not to interfere with or delay the longitude work. On the completion of the line, Atlanta to Little Rock, the instrumental outfits were moved to Charleston, S. C., and Washington, D. C., respectively, the station at the latter place being the one in the grounds of the old Naval Observatory. Observations were obtained and time signals exchanged on the nights of April 21, 22, 26, and 28, and again, after interchange of observers, on May 3, 4, 6, and 7. This completed the line, Charleston to Washington, and Assistant Sinclair then moved the Charleston instruments to Cambridge, Mass., where the old station was reoccupied. Time exchanges between Washington and Cambridge took place on the nights of May 14, 16, 17, 27, and 29, and again, after interchange of observers, on June 1, 2, 5, 10, 12, and 17. While this work was in progress signals were also exchanged with the Cornell Engineering School at Ithaca, N. Y., by the observers at both ends of the line, Prof. E. A. Fuertes having requested this cooperation of the Coast and Geodetic Survey for the determination of the longitude of the Cornell station, and furnishing the observer for the third point. As far as practicable, the same stars were observed at the three stations, and the telegraphic circuit was so arranged, with a side repeater in New York, that time signals sent from either station were simultaneously recorded at the other two. Time signals were exchanged between Cambridge and Ithaca

on the nights of May 16, 17, 19, 22, 23, and 27 with Mr. Sinclair at Cambridge, and on June 1, 2, and 3 with Mr. Putnam at Cambridge; also between Washington and Ithaca on May 15, 16, 17, and 27 with Mr. Putnam at Washington, and on June 1 and 2 with Mr. Sinclair at Washington. The observations at Ithaca throughout the series were made by Prof. John F. Hayford, of Cornell University, formerly an assistant of the Coast and Geodetic Survey. Subsequently he came to Washington for the purpose of observing with Messrs. Sinclair and Putnam for personal equation, as no interchange of observers took place between Ithaca and the other stations.

The line Cambridge to Washington being completed, the instruments at the former place were brought to the observatory in the grounds of the Coast and Geodetic Survey Office, and Messrs. Sinclair and Putnam then began the determination of the difference of longitude of that station and the one in the grounds of the old Naval Observatory. This work was incomplete at the close of the fiscal year, but observations and time signal exchanges were obtained on the nights of June 22, 26, 28, 29, 30, and July 1. On account of the proximity of the two stations the method of operation was considerably modified, it being sometimes practicable on the same night to secure observations and time exchanges, then an interchange of observers, and finally additional observations and time exchanges; on other occasions a large number of stars were observed and more frequent time exchanges made, but without interchanging observers. The general plan was to exchange signals during each time set of ten stars, as very nearly the middle time could be selected for this purpose, and thus the results would be rendered independent, or nearly so, of chronometer rate, but partially cloudy weather interrupted the observations to such an extent that a considerable modification of the plan was unavoidable. After July 1 the work had to be suspended, as Mr. Putnam was detached from the party for the purpose of accompanying the Greenland exploring expedition, and no other observer was then available to take his place. It was during the progress of this work at Washington that the personal equation observations above referred to with Professor Hayford were made. This was done by two methods: First, by noting transits of stars over half the lines in the diaphragm, the three observers leading in turn; and, second, by observing the same time sets, recording them on the same chronograph, with the same chronometer, but each observer using his own instrument. The time intervals were such that the records did not interfere, and very accordant results were obtained by both methods.

It should also be mentioned that during the progress of the longitude observations at Cambridge the magnetic declination, dip and intensity were determined at South Boston, Mass., and on their conclusion at Newport, R. I., by Assistant Putnam; three days' observations were made at each place. He also, while at Washington, made observations for the redetermination of the periods of the pendulums used at the Southern stations.

Completion of the hydrographic resurvey of Pensacola Bay and Entrance, Florida.—In December, 1895, Lieut. Robert G. Peck, commanding the steamer *Bache*, was directed to resume the hydrographic resurvey of Pensacola Bay and Entrance, and accordingly left New York on the 9th of January, 1896, and reached Pensacola on the 29th, having stopped en route at the following places: At Sandy Hook for twenty-four hours, in consequence of stormy weather; at Hampton Roads for two days for the purpose of receiving on board the members of the Coast Pilot party, also bound for Pensacola; at Charleston for five days to make a special hydrographic examination and obtain a whale boat stored there two years previously, and at Key West for three days on account of bad weather.

The work in Pensacola Bay and vicinity embraced the connection of the recent hydrography of the Coast and Geodetic Survey with that of the United States engineers covering the bar and entrance, and such sea connections as might be found necessary; in addition to this, Lieutenant Peck was also directed to make a comprehensive system of tidal comparisons over the whole field of work covered by the resurvey, in order to establish a uniform plane of reference for the reduction of all soundings and to relate our work to that of the United States engineers.

The field work was at once commenced and continued to February 26, when a temporary suspension was necessary in consequence of a request from the Navy Department for an immediate hydrographic examination of the Dry Tortugas Anchorage, together with its approaches, preliminary to its use as a coaling station for the larger vessels of the North Atlantic Squadron during the contemplated drill in the Bay of Florida. On the completion of this duty the *Bache* proceeded

to Key West and made a special examination near the entrance of that harbor, after which she returned to Pensacola Bay and resumed her regular work on March 30. The resurvey of Pensacola Bay and vicinity, including a special examination of shoals in East Bay, was finally successfully completed on the 18th of April and the *Bache* left for the north on the 27th, stopping en route at various places along the Atlantic Coast for special examinations, which have been noticed in a previous page of this report, and for a few hours at the sea spring off Matanzas Inlet, coast of Florida, for the purpose of collecting specimens of the water for the Rensselaer Polytechnic Institute, and finally arrived at New York on May 30.

The statistics of the Pensacola Bay work are as follows:

Area sounded, in square geographical miles	8
Number of miles run while sounding	203
Number of angles measured	2 871
Number of soundings taken	11 034

The following-named officers were attached to Lieutenant Peck's party: Lieut. E. H. Tillman; Ensigns H. K. Hines, A. H. Davis, and F. M. Russell; P. A. Surg. E. R. Stitt; Machinist A. J. Miskimon; Pay Yeoman J. L. Dunn, draftsman, and Master-at-Arms Thomas S. Martin, observer and recorder. Seaman John Craig also served as recorder.

Continuation of the triangulation of the oblique arc in Alabama.—The resumption of the oblique arc work in Alabama by Assistant F. Walley Perkins was noticed in the Report for 1895, and an account of the progress made to the close of the last fiscal year was there given.

Early in July, 1895, preparations for the occupation of the triangulation stations were completed, lights posted at the necessary points, and the light keepers engaged and instructed in their duties. Observations were begun at "Red Hill" on the 21st of July and the station was completed on the 24th. The camp was then moved to "Dean," and that station was also completed by the end of the month. Mr. G. A. Fairfield, extra observer, joined the party early in August, and was detailed to make observations at "Creagh" and "White," while Assistant Perkins was occupying "Coon" and "Pollard;" the parties were then transferred to "Fatama" and "Midway," respectively, and all these stations, together with "Lookout Hill," were finished by November. Owing to the exhaustion of the allotment, observations commenced at "Cold Creek" on December 1 were not completed.

In the early part of the season some time was necessarily lost in reopening lines, as the growth of trees is very rapid at that time of the year, and throughout the season the usual delays incident to observing through narrow lanes cut through timber were experienced.

Until the latter part of September the atmospheric conditions were very favorable, but about this time the rains ceased, fires started in various directions, and the atmosphere soon became hazy and smoky, so that during the remainder of the season the longer lines of the scheme could only be observed on rare occasions.

While the observations above noted were in progress a building party under the direction of Foreman Jasper S. Bilby was engaged in constructing and erecting additional signal towers, and by December 6 three—viz, "Daphne," "Spring Hill," and "St. Elmo"—were completed. They have each a height of 120 feet, and their construction and erection occupied only twenty-two working days, including the time spent in packing and moving the party from point to point; the six signals, varying in height from 80 to 120 feet, completed prior to the beginning of the fiscal year, have already been mentioned in the Report for 1895. These nine tripods and scaffolds are probably the best ever constructed for similar work, and as they have been built in less time and with a smaller force than heretofore considered necessary, the superiority of Mr. Perkins's system and method seems to be demonstrated.

On the completion of the signal building work, arrangements were made for the storage of the instruments and camp outfit, and the party disbanded December 15.

Assistant Perkins highly commends the service of Mr. George A. Fairfield, and refers to his exceptional powers as a skillful and accurate observer. He also reports that Mr. R. B. Derickson, who acted as recorder in the party from August 10 to the close of the season, rendered valuable and efficient service.

Assistant Perkins concludes, from this season's and former experience, that in this section of

the country favorable conditions for observing over long lines prevail from March until the middle of September. These limits may vary somewhat in different years, but generally speaking, the working season, so far as actual observing is concerned, should be confined within them. His report is accompanied by a sketch showing the progress made during the year and the work remaining to complete the oblique arc as originally projected, and furnishes the following tabulation of the results for the fiscal year:

Number of 120-foot towers erected	3
Number of signals erected	2
Number of primary stations occupied for horizontal angles	10
Number of primary stations occupied for vertical angles	8
Number of secondary points determined	12
Number of elevations determined trigonometrically	11
Number of pointings made for horizontal angles	6 071
Number of pointings made for vertical angles	1 062
Number of square miles surveyed	2 824

The further services of Assistant F. W. Perkins and Extra Observer George A. Fairfield are noticed elsewhere in this report.

Hydrographic examinations along the Gulf coasts of Florida, Alabama, Mississippi, and Louisiana, and collection of information for the Coast Pilot.—In the latter part of December, 1895, Ensign Glennie Tarbox, U. S. N., was directed to proceed to Milton, Fla., where the schooner *Transit* was laid up, and organize a party on that vessel for the purpose of examining the various parts of the Gulf Coast of the United States, collecting such information as was necessary for the publication of the Coast Pilot for that region, and verifying the miscellaneous information already in our possession received from various sources. Early in the following month, accompanied by Mr. John Ross, of the Coast Pilot division, Ensign Tarbox proceeded to Hampton Roads, and there took passage for Pensacola on the steamer *Bache*, which was bound for the same port. On arriving there a crew was enlisted and the *Transit* was soon prepared for service.

Leaving Pensacola on the 11th of February, the party proceeded eastward through Santa Rosa Sound and examined the whole south and west coasts of Florida as far as the mouth of the Caloosahatchee River, stopping en route for the collection of local information and the noting of landmarks, aids to navigation, sailing directions, ranges, etc., at the following places: Garniers Bayou, Choctawhatchee Bay, St. Andrews Bay, Apalachicola Bay and River, East Pass, Cedar Keys, Port Tampa, Palmetto (Manatee River), Gasparilla Island, Punta Gorda, Peace River, Pine Island Sound, and San Carlos Bay. Owing to adverse winds the Caloosa River could not be entered without risk of too much delay, and on April 12 the return trip was begun. The Anclote Keys were examined, and after touching again at Cedar Keys the *Transit* proceeded to Mobile Bay and then continued the cruise westward in the same manner through Mississippi Sound, Lake Borgne, the Rigolets, and Lake Pontchartrain to New Orleans, stopping en route at Pascagoula. Returning eastward again, Biloxi, Ship Island Anchorage, and Horn Island Anchorage were vsited, and the season's work finally closed at Pensacola on May 12. The *Transit* was again laid up at Milton in charge of a ship keeper, the crew was discharged, and Messrs. Tarbox and Ross returned to Washington and resumed their duties in the Coast Pilot division.

During this cruise the *Transit* ran about 2 000 miles, and visited every point of any commercial importance within the limits above given; the best local authorities were interviewed and much valuable information was collected. When running along shore or entering or leaving harbors special attention was paid to noting natural and artificial features which would assist the mariner, and wherever practicable the schooner was run in the principal channels upon the lines followed by the larger class of vessels.

Ensign Tarbox's report points out numerous changes in the topography and hydrography of some of the localities visited, and these will at once be indicated on the charts affected. In some cases, however, resurveys seem to be demanded.

Magnetic observations at various points in the Central and Northwestern States.—In March, 1896, Assistant R. L. Faris was instructed to make determinations of the magnetic elements at various points in the Central and Northwestern States, and took the field for this purpose on April 15, beginning operations at Williamsburg, Ky. The observations for magnetic declination, dip, and

intensity were made at each station on one or two days, according to the requirements, together with the necessary astronomical observations for time, latitude, and azimuth; the longitudes were determined chronometrically.

The following is a list of stations completed by the close of the fiscal year: Williamsburg, Lexington, and Louisville, Ky.; Vincennes, Ind.; Sandoval, Ill.; St. Louis, Mo.; Norfolk, Newport, and Chadron, Nebr.; Yankton, Mitchell, Pierre, and Aberdeen, S. Dak.; Jamestown and Dickinson, N. Dak.; Glendive, Miles City, Forsyth, Billings, Bozeman, Townsend, Helena, Cascade, and Fort Benton, Mont.—in all, twenty-four stations. As many of these belong properly to the Middle and Western divisions, they will be again referred to under those heads. All stations were so selected as to be free from local artificial disturbing causes, and were carefully marked, and their descriptions have been filed in the archives of the Survey for future reference.

The party was still in the field and the magnetic survey in progress at the close of the fiscal year, and the results for the remainder of the season will therefore appear in my next report.

Geodetic operations.—Continuation of the triangulation in northeastern Tennessee and southeastern Kentucky, and along the Kentucky, Virginia, and Tennessee State lines.—At the close of the last fiscal year the party under the charge of Prof. A. H. Buchanan was already in the field and had made some progress on the extension of the Tennessee triangulation. Early in July the vicinity of "Rogers" station was revisited, and some days were spent in making the necessary observations and measurements to connect the object observed upon from "Damascus" station with "Rogers," the signal at the latter place having been destroyed. Camp was next moved to "Benn" station, and on account of rain and fog the observations there were not completed until August 20. The party then moved to "Poore" station, and here also was delayed by rain and fog, but all the observations required were obtained by September 18. The next camping site was in the vicinity of "Buffalo" station, and the observations made at this station completed the work laid out and were finished by October 2. Professor Buchanan then disbanded party, in accordance with instructions, and returned to his home at Lebanon, Tenn.

The results of the season are as follows:

Number of primary stations occupied for horizontal angles or directions	3
Number of stations reoccupied	1
Number of horizontal directions determined	13

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1896.

MIDDLE DIVISION.

STATES AND TERRITORIES BETWEEN THE MISSISSIPPI RIVER AND THE ROCKY MOUNTAINS.

28. Minnesota.
29. North Dakota.
30. South Dakota.
31. Iowa.
32. Nebraska.
33. Missouri.
34. Kansas.
35. Arkansas.
36. Indian Territory.
37. Oklahoma Territory.
38. Louisiana.
39. Texas.

Progress Sketches, showing the localities of field work in the Middle Division, will be found at the close of Part I.

Triangulation of Lake Pontchartrain, Louisiana.—In December, 1895, Assistant P. A. Welker was directed to proceed to Pensacola, Fla., where the schooner *Quick* was laid up, and organize a party for the survey of Lake Pontchartrain. Mr. Welker reached Pensacola on the 6th of January, 1896, and by the 14th the vessel was ready for sea, and started for Lake Pontchartrain, reaching the working ground on January 20. The remainder of the month was spent in making a reconnaissance and in deciding upon a practicable scheme for executing the work. Owing to the flatness of the country and the great width of the lake the ordinary methods of triangulation would have been very expensive, as signals of great height would have been required and the opportunities for the accurate observing of such long lines would have been comparatively infrequent. Neither could a smaller scheme of triangles and quadrilaterals along the shores be resorted to on account of the immense amount of cutting required, the country in the vicinity of the lake being for the most part densely wooded and swampy, the cypress swamps in some sections extending to the water's edge. The cutting of innumerable lines through these heavily timbered swamps would probably have entailed even a greater expense than carrying the larger scheme of figures across the lake. It was decided, therefore, to build signals from 18 to 40 feet in height at suitable intervals along the shores and to erect temporary signals in the shallow waters, from 2 to 3 miles from shore. The shore signals were occupied and observed from in the usual manner, the angles at the water stations being all concluded. In this way triangulation, sufficiently accurate for the future topographic and hydrographic surveys, was obtained at a reasonable cost. The season's work began at the Pontchartrain Light-House, that being the only determined point of the old triangulation of the eastern end of the lake that could be found. A base line 733·28 metres in length was measured at West End, a suburb of New Orleans, about 4 miles west of the above-mentioned light-house, and the azimuth of the line was determined astronomically. This base line and azimuth and the determined latitude and longitude of the light-house constituted the data upon which the trigonometric survey is based. Satisfactory progress was made with the work, notwitstanding the difficulties arising from the unstable foundations on which the observing tripods and scaffolds were built, which necessitated the suspension of observations whenever the wind blew with any considerable strength. The scheme of triangulation was laid out all the way round the lake to Raggedy Point, the junction point with the old work, but the observations were only completed to Shanty Point, or a little more than half the distance reconnoitred. Observations were also made for magnetic declination whenever practicable without delaying the trigonometric work.

Assistant John Nelson, Aid Charles C. Yates, and Recorder G. W. Nelson were attached to the party during the season and rendered valuable and efficient service. Work closed on the 17th of April, and after disbanding party and making suitable provision for the care of the vessel, Assistant Welker and Messrs. Nelson, Yates, and Nelson returned to Washington.

Mr. Welker states in his report that the country surrounding Lake Pontchartrain is almost entirely of a marshy or swampy character; along the southern shore there is a belt from 1 to 3 miles wide of soft marsh covered with grass and weeds 10 to 12 feet high and with scattering willows from 10 to 40 feet high; back of this belt are immense cypress swamps. On the northwest and northern shores, as far as Chefuncte River, the cypress swamps extend nearly or quite to the shore line, and in this locality water navigation within 2 miles of shore is dangerous on account of the numerous snags and sunken trees. He also experienced some difficulty on account of the heavy seas produced by the prevailing easterly winds. These winds have a clear, uninterrupted sweep of 40 miles, and when fresh or strong render landings on the west shore impracticable.

The statistics of the season's work are given as follows:

Area of reconnaissance, in square statute miles	100
Area of triangulation completed, in square statute miles	75
Number of observing tripods and scaffolds erected	9
Number of signal poles erected	7
Number of stations occupied for horizontal angles	14
Number of geographic positions determined	20
Number of azimuth stations occupied	1
Number of magnetic declinations determined	3
Number of bases measured (three times)	1

Assistant Welker's services on the Alaskan Boundary Survey and on the transcontinental triangulation will be mentioned in their appropriate places elsewhere in this report.

Determination of the telegraphic difference of longitude between Austin, Tex., and New Orleans, La., and incidental magnetic and gravity determinations.—At the close of the last fiscal year the parties engaged in the telegraphic determinations of longitudes in various Southwestern States had reached Austin, Tex., and New Orleans, La., respectively, and had obtained three nights' observations and exchanges of time signals. Work was then temporarily suspended, pending the arrival of Assistant A. T. Mosman, who had been detailed to relieve Assistant Edwin Smith, whose connection with the Survey ceased on June 30. Assistant Mosman arrived at New Orleans on July 2, and was joined there by Assistant Putnam on the 4th. After readjusting the instruments observations were made for personal equation the same night, and Mr. Putnam returned on the following day to Austin. Exchanges of signals between New Orleans and Austin were obtained on the nights of July 8, 13, 14, and 15, and again after the usual interchange of observers on the nights of July 23, 24, 26, and 28. The weather at New Orleans was very unfavorable, seven consecutive nights being cloudy and preventing observations, while the sky at Austin was clear on all of them save one. Mr. G. A. Fairfield, extra observer, was assigned to Assistant Mosman's party, and arrived at New Orleans on July 14. He remained with Mr. Mosman to the close of the work, and was subsequently transferred to Assistant Perkin's party in Alabama.

Magnetic observations were made by Assistant Putnam at New Orleans on July 19, 23, and 24, and pendulum observations for the determination of gravity on the 24th and 25th, the observations being so arranged as not to interfere with or delay the longitude work. Messrs. Mosman and Putnam then returned to Washington, and soon after took the field again in the Northeast. Their work there belonging geographically to the Eastern Division, will be treated of under that head.

Tidal record at Port Eads, La.—Through the courtesy of the United States engineer officers stationed at Port Eads, La., we have been enabled to secure from the automatic tidal record of that station a tabulation of the hourly ordinates for the calendar year 1895.

Establishment of a tidal station at Point Isabel, Texas.—Early in March, 1896, Assistant E. B. Latham, in accordance with instructions, proceeded to Point Isabel, Texas, for the purpose of establishing there a tidal station. A Stierle self-registering gauge was set up in the Brazos Island Light-House, and a staff gauge was also located. These were referred to permanent bench marks, three of which were located on Padre Island and four on the mainland. A tidal observer was engaged, and after fully instructing him in his duties Mr. Latham proceeded, on March 19, to Port Royal, S. C. The establishment of a tidal station at the latter point has been mentioned in a previous part of this report, under the proper geographical heading.

The Brazos Island tide station was discontinued June 26, as the range of tide was found to be only about half a foot.

Telegraphic longitude determination of Little Rock, Ark., and incidental magnetic and gravity determinations.—In April, 1896, Assistants C. H. Sinclair and G. R. Putnam determined the telegraphic difference of longitude between Little Rock, Ark., and Atlanta, Ga., and incidentally determined also the magnetic declination, dip, and intensity and the relative force of gravity. For a full account of this work see under the head of "Telegraphic longitude determinations," Eastern section.

Transcontinental geodetic work.—Reconnaissance, triangulation, and base-line measurement in Kansas.—Early in October, 1895, Assistant F. D. Granger, having completed the primary triangulation assigned to him in Colorado, as fully described under the head of "Geodetic work in the Western Division," transferred his party and outfit to Salina, Kans., and began a careful reconnaissance for the selection of a suitable site for a base line in the vicinity of the line Wilmer-Taylor. This reconnaissance was completed November 1, and resulted in the selection of a base 6·5 kilometres in length in the valley of the Salina River, between the towns of Salina and New Cambria. Owing to the lateness of the season no further work could then be done, and in accordance with instructions the party was disbanded and Assistant Granger returned to Washington, where he was engaged in working up the results of his Colorado work and on miscellaneous office duty until April following, when he was directed to resume field operations in Kansas.

Assistant Granger reached Salina on the 17th of April, and immediately began preparations for the geodetic connection of the proposed base line with the existing triangulation. Signals were erected at Iron Mound, North Pole Mound, Vine Creek, West Base, and East Base, the latter two being the termini of the base, and on May 4 the regular observations began at West Base. That station was completed by May 12, three primary and several tertiary points having been observed upon from an elevation of the theodolite of 20 feet, and the party was then transferred to Iron Mound, where observations were finished on the 22d. At that point the theodolite had an elevation of only 5½ feet, and three primary and a number of tertiary objects were observed upon. East Base was next occupied, the elevation of the instrument being 35 feet, and the observations there were concluded on the 31st. The next point, North Pole Mound, the last one in the base figure requiring occupation, was originally selected as an interior station in the quadrilateral Vine Creek-Iron Mound-Heath-Thompson to provide for the contingency of the failure of one of the diagonals of that figure, and was observed upon from Vine Creek and Iron Mound in 1890, and from Heath and Thompson in 1891, but had never been occupied. Preparations for its occupation were finished by June 4, and all the necessary observations, on six primary stations and four tertiary objects, were obtained by the 10th. The elevation of the theodolite at this station was 24·5 feet. While the observations at North Pole Mound were in progress, Assistants A. L. Baldwin and E. B. Latham, who had been assigned to Assistant Graham's party early in June, were engaged in clearing and grading the base line and preparing it for measurement. Assistant W. C. Hodgkins also reported for duty in the party on June 16, but owing to a severe attack of rheumatism, was unable to take an active part in the field work until the 23d.

The preparation of the line was completed under Assistant Granger's direction on June 18, and on the following day the actual base measurement was begun, and was in progress at the close of the fiscal year. A full account of the preparation and measurement of the Salina base line and the special services performed by each member of the party, will appear in the next annual report.

The statistics of the Kansas work, exclusive of base measurement, to June 30 are as follows:

Area of reconnaissance for base site, in square statute miles	23
Area of triangulation, in square statute miles	95
Number of signals erected	7
Number of stations occupied for horizontal measures	4
Number of stations occupied for vertical measures	4
Number of geographical positions determined	3
Number of elevations determined trigonometrically	4

Mr. Granger's report is accompanied by a sketch showing the relative positions of the base line and the old and new stations and the mode of connection. The junction is strong and in every way satisfactory.

Transcontinental geodetic work.—Examination of a proposed base line in Missouri.—In May, 1896, Assistant A. L. Baldwin, in accordance with instructions, proceeded to Versailles, Mo., for the purpose of examining the base line previously selected in that vicinity, with a view to determining its practicability. This base line was one of those intended for verification of the transcontinental triangulation, and its ends had already been connected therewith, but the actual measurement had been postponed from time to time for various reasons, chiefly on account of insufficient appropriations. Mr. Baldwin found the terminal marks undisturbed, and ran over the base with a level, but found that three barns had been constructed directly on the line. Owing to this circumstance and the existence of other difficulties, which it was thought would make the measure of the base unduly expensive, it was decided to abandon the line, and Mr. Baldwin was notified to that effect by telegraph. He was then directed to proceed to Salina, Kans., and report to Assistant F. D. Granger for duty in the transcontinental geodetic party operating in that locality, and arrived there on the 3d of June. His services in this party have already been mentioned in the preceding paragraph.

Continuation of the transcontinental line of precise levels, Kansas.—Under the Superintendent's instructions of June 24, 1895, Assistant Isaac Winston proceeded to Lawrence, Kans., reaching that point July 9, and organized a party for the continuation of the transcontinental line of geodetic leveling. Messrs. F. Weld, J. R. Chase, and F. S. C. Hunter, who had been assigned to the party by the Office, reported the same day, and on the 10th two additional men were secured and the instruction of the various members in their respective duties began. Mr. Guy Rainey also reported for duty in the party July 20. The actual leveling commenced on the 11th, the starting point of the season being at Holliday, Kans., where two permanent bench marks had been previously established (in 1891). These bench marks were found undisturbed and in good condition. The route followed was along the roadbed of the Atchison, Topeka and Santa Fe Railroad to Topeka, at which point a crossing of the Kansas River was made, and thence along the Union Pacific Railroad to Salina. The season's work closed at the latter point October 26, 1895.

Two simultaneous lines were run over the whole distance, and the running was continuously in one direction; geodetic level No. 5 and the new parafined wooden rods P. & Q. were used throughout the season. Permanent bench marks were established at all towns and villages along the route where suitable stone or brick buildings could be found on which to place them, and on stone piers and abutments of railroad bridges, and temporary bench marks were placed at intervals of about 1 kilometre. The latter served the double purpose of furnishing frequent checks on the correctness of the work by means of the comparisons of the two lines, and of minimizing the amount of remeasurement required when discrepancies developed. As an indication of the care with which the work was executed, it may be here stated that but few remeasurements were found necessary during the season. Railway trains furnished the means of daily transportation of the party until Topeka was reached, but west of that point, the trains being infrequent and not suitably timed, the hire of a wagon and team of horses was found necessary. The velocipede cars, successfully used elsewhere by the leveling party, could have been advantageously employed in this section, and in future will be utilized wherever practicable, when the consent of the railway officials can be obtained.

No special difficulties were encountered during the season, except those arising from the prevailing strong winds. The winds in this region blow almost continuously during many months of the year, and on some days caused an entire cessation of work, while on many others the progress was seriously delayed. A resort to wire or rope guys to support the rods during observation was unavoidable, and the securing of the requisite stability of the leveling instruments was a matter of considerable difficulty.

Mr. Winston has since had constructed an observing tent, to the open base of which are attached paper wheels fitting the railway track. The canvas supported on a light detachable frame furnishes complete protection from both sun and wind, and can be opened in any desired direction for observing. One man can easily trundle this car tent along the track from station to station, and two men can readily remove it from the track on the approach of a train. This device will be used next season, and will doubtless much facilitate and expedite the work in windy weather.

The season's work closed at Salina October 26, and the party was then disbanded and Mr. Winston returned to Washington, reporting for duty at the Office October 31.

The distance leveled during the season was 277 kilometres, and the number of permanent bench marks established was 35.

After completing the records and computations of his season's work, Assistant Winston aided Assistant Eimbeck in the computation of the transcontinental triangulation, and subsequently assisted the Chief of the Office of Standard Weights and Measures in the examination and standardization of two sets of base bars, and performed miscellaneous office duty. On the 8th of June, 1896, he was directed to prepare for the resumption of field work on the Kansas leveling, and started for the field on the 28th, reaching Salina on the 30th, the last day of the fiscal year.

The results of the work will appear in the next Annual Report.

Magnetic observations at various points in the States of Missouri, Nebraska, South Dokota, and North Dakota.—During the progress of the magnetic survey undertaken by Assistant R. L. Faris in April, 1896, as mentioned under the head of Eastern Division, observations for magnetic declination, dip and intensity, together with the incidental determinations of time, azimuth, latitude, and chronometric longitude, were made at the following-named places in the States of Missouri, Nebraska, South Dakota, and North Dakota: St. Louis, Mo.; Norfolk, Newport, and Chadron, Nebr.; Yankton, Mitchell, Pierre, and Aberdeen, S. Dak.; Jamestown and Dickinson, N. Dak. For stations determined in States belonging to the Eastern and Western Divisions, see under the appropriate geographical headings.

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1896.

WESTERN DIVISION.

STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC.

40. California.
41. Oregon.
42. Washington.
43. Idaho.
44. Montana.
45. Wyoming.
46. Nevada.
47. Utah Territory.
48. Colorado.
49. Arizona Territory.
50. New Mexico Territory.

Progress Sketches, showing the localities of field work in the Western Division, are given at the close of Part I.

Continuation of the topographical resurvey of San Francisco Bay and Harbor.—The party under the charge of Assistant A. F. Rodgers engaged on the topographical resurvey of San Francisco Bay and Harbor was still in the field at the close of the last fiscal year. On July 1 Assistant Rodgers, in accordance with instructions, assumed charge of the San Francisco suboffice, but the topographical resurvey was continued under his general direction, Mr. Ferdinand Westdahl temporarily taking immediate charge of the party. During July Mr. Westdahl made a survey of the pier heads, wharves, and water front of the harbor, and furnished tracings of the shore line to the hydrographic parties. In August Assistant Fremont Morse was assigned to the charge of the party, and, after computing the triangulation previously executed and making a projection embracing the eastern shore of the bay and the water fronts of Alameda, Oakland, and Berkeley, took the field in the latter part of the month. Work was then continued without interruption until January 2, 1896, when on account of unfavorable weather conditions it was deemed expedient to suspend operations. The sheet above mentioned was completed, and also one embracing the water fronts of Sausalito and Belvedere and the shore line of Richardson Bay, Raccoon Strait, and Angel Island. Mr. Morse was then occupied for a few days in making magnetic observations at San Francisco and Monterey, after which he was engaged in inking his topographical sheets until March 25, when he was assigned to chronometric longitude work in Alaska. In February Assistant Rodgers detailed Mr. F. W. Edmonds to connect by leveling the bench marks established at the Union Iron Works with two new ones located respectively at the San Francisco Magdalen Asylum and the Golden Gate Woolen Mills warehouse. This work was satisfactorily performed and the relations of the bench marks to the Fort Point plane of reference determined.

In April field topographical work was resumed by Mr. Westdahl on the eastern shore of the bay, southward from Robert Landing, and continued until June, when a temporary suspension was necessary to enable the party to execute the triangulation to connect the Lafayette Park Astronomical Observatory with the new station selected in the Presidio Military Reservation. The site for the new observatory had been selected in March by Assistants A. F. Rodgers, J. J. Gilbert, and E. F. Dickins in consequence of municipal improvements rendering the old station no longer available, and the War Department had kindly granted permission to erect an observatory. The triangulation was executed by Assistant Gilbert, who also prepared the plans and specifications for the new building, the construction of which was begun before the close of the fiscal year.

The statistics of the topographical work of the year are as follows:

Area surveyed, in square statute miles	31
Number of miles of shore line surveyed	71
Number of miles of wharf line and water front surveyed	10
Number of miles of roads and railroads surveyed	78

During the year Mr. Ferdinand Westdahl was at various times detailed for special topographic or hydrographic duty, viz, in October to make an investigation of reported topographic changes

in Cuylers Harbor, San Miguel Island; in December to determine the position of a buoy placed to mark Mission Bay Rock; in the latter part of December to search for an alleged rock near Pescadero Point, San Mateo County, Cal., and in April to determine the position of the wreck of the British ship *Blairmore*.

The results of the Cuylers Harbor investigation are given elsewhere in this report.

Messrs. Westdahl and Edmonds also performed miscellaneous office duties.

Assistant Rodgers in his report acknowledges his obligations to all the members of his party for their zealous cooperation.

Continuation of the hydrographic resurvey of San Francisco Bay and Entrance.—At the close of the previous fiscal year the parties on the steamers *Gedney* and *McArthur*, under the command of Lieuts. Lucian Flynne and James H. Sears, respectively, were engaged on the hydrographic resurvey of San Francisco Bay and Entrance, and a statement of the progress made to June 30 appears in my last report. The work was continued by both parties during the current year until December 4 in the case of the *Gedney*, and November 25 in the case of the *McArthur*, when the unfavorable weather incident to the season of the year compelled a temporary cessation. Both parties resumed field work early in April, 1896, and, with the exception of short periods when they were taken off for special duty on the naval speed-trial course in Santa Barbara Channel, and the investigation of alleged seismic changes in Cuylers Harbor, San Miguel Island, were continuously employed on the resurvey of San Francisco Bay from that time to the close of the fiscal year. The work is still in progress, and will be further treated in my next report.

The steamer *Gedney* remained under the command of Lieut. Lucian Flynne only until July 22, however, when he was relieved by Lieut. A. P. Osborn. Three hydrographic sheets, designated as Nos. 2, 3, and 8, were worked upon by this party, and two of them, Nos. 2 and 3, were completed, while No. 8 was well advanced. The localities and limits of the sheets are as follows: No. 2, San Francisco Entrance, from Fort Point to the eastward of Blossom Rock; No. 3, San Francisco Bay, from Bluff Point to Alcatraz Island; No. 8, San Francisco Bay, from California City Point to Point Knox. Work was not carried on continuously on any one sheet until finished, as when tidal or weather conditions were unfavorable in one locality it was frequently practicable to prosecute the survey in another, and thus utilize time which would otherwise have been lost. Field operations were suspended for the winter December 4, and the vessel was anchored in smooth water in Oakland Creek. The office work then engaged the attention of the party until April 1, when the work of sounding was resumed. On April 20, Lieutenant Osborn, in accordance with special instructions, proceeded with his vessel to Santa Barbara Channel for the purpose of establishing a speed-trial course for the battle-ship *Oregon*, and rendering such assistance during the trial as might be required by the naval authorities, and subsequently was directed to make a hydrographic examination of Cuylers Harbor. These duties were completed by May 20, and the party then returned to San Francisco Bay, and, in accordance with a request of the Honorable Secretary of the Navy, first took up the survey of Mare Island Strait, on a scale of 1–10 000, and the development of the main channel from Point Penole to Mare Island, on a scale of 1–20 000. The channel lines were run not wider than 100 metres apart, and a close survey was made as far up as the brickyard wharf above Vallejo, special attention being given to the thorough development of all rocks and shoals. This was finished on June 18, and the unfinished sheet No. 8 was again taken up, and was still in progress at the close of the fiscal year. The Mare Island Strait work being considered a part of the San Francisco Bay resurvey, the statistics relating thereto will be combined with those of the main work in the table given below. The statistics of the Cuylers Harbor work will be given further on in a paragraph devoted to that subject, and a fuller account of the work on the Santa Barbara Channel speed-trial course will also appear under a special heading.

The statistics of the year's work of the *Gedney* party in San Francisco Bay and approaches are as follows:

Area sounded, in square geographical miles	30·5
Number of miles (geographical) run while sounding	989
Number of angles measured	15 224
Number of soundings taken	35 843
Number of tidal stations established	6
Number of hydrographic sheets finished	3

The naval officers of the party were as follows: Lieut. Lucian Flynne, in command until July 22, when he was detached; Lieut. A. P. Osborn, in command from July 22 to the close of the fiscal year; Lieut. A. C. Almy; Ensign C. M. Stone; Yeoman F. C. Schubert, draftsman; Apothecary A. F. Berryhill, observer (detached July 10, 1895); Apothecary C. W. Fitzgerald, observer; Writer A. E. Brisman, recorder; and Quartermaster Eric Swanberg, recorder.

The steamer *McArthur* continued throughout the year under the command of Lieut. James H. Sears, and to his party were assigned the three hydrographic sheets designated as Nos. 1, 4, and 5, two of which, Nos. 1 and 5, were completed. No. 1 includes the Bonita Channel and the Golden Gate to Fort Point, joining the *Gedney's* sheet No. 2 at the latter point; No. 5 covers the area between San Francisco, Yerba Buena Island, and Oakland, and extending southward nearly to Point Avisadero; and No. 4 covers the intervening area between sheet No. 5 and the *Gedney's* sheet No. 3. Some new dangers were developed and duly reported, and those previously known

upon the harbor, and that an upheaval from the bottom of the harbor, but near shore, had also occurred. The dimensions of the upheaved portion above high-water line were: Length, 170 metres; greatest width, 60 metres; and greatest elevation, 35 feet. The new shore line and the topographic changes were carefully delineated, but the hydrographic examination could not then be made on account of the heavy swell which continued throughout Mr. Westdahl's stay on the island.

Subsequently, in May, 1896, after the completion of the duty in connection with the speed trial of the battle-ship *Oregon*, Lieut. A. P. Osborn, U. S. N., commanding the Coast and Geodetic Survey steamer *Gedney*, made a thorough hydrographic examination of the harbor and found that no material changes of depth had occurred; the trivial changes found were moreover limited to a very small area in the immediate vicinity of the landslide and upheaval.

On the completion of the examination Lieutenant Osborn returned to San Francisco and resumed work on the hydrographic resurvey of that harbor and its approaches.

The statistics of the hydrographic examination of Cuylers Harbor are as follows:

Area sounded, in square geographical miles	1
Number of miles (geographical) run while sounding	15
Number of angles measured	152
Number of soundings taken	423
Number of tidal stations established	1

Continuation of the tidal record at the Sausalito (San Francisco Bay) tidal station.—The self-registering tide gauge at the Sausalito tidal station, under the supervision of Assistant A. F. Rodgers, continued in successful operation throughout the year, and an unbroken record has been received. Observer Emmet Gray had immediate charge of the station until April 1, 1896, when he was succeeded by Observer Harris S. Ballard. The usual precautions were taken to verify the permanency of the relation of the tide gauge to the bench marks in the locality, lines of spirit leveling having been run from time to time by Messrs. Ferdinand Westdahl and F. W. Edmonds.

Magnetic observations at San Francisco and Monterey, Cal.—In January, 1896, the annual observations for magnetic declination, dip and intensity were made at San Francisco, at the Presidio station, by Assistant Fremont Morse, and subsequently a complete series was also made by the same observer at Monterey, Cal.

Continuation of the topographical survey of Washington Sound, Washington.—At the close of the last fiscal year Assistant J. J. Gilbert was engaged at Olympia in computing his previous triangulation, and in supervising the repairs to the steam launch *Tarry Not*. On July 6, 1895, he was instructed to prepare for the immediate resumption of the topographic survey of Washington Sound, and accordingly left Olympia for the field, on the steam launch, July 15, stopping en route at Seattle and Port Townsend for stores, instruments, and party equipments. Port Stanley was reached on the 18th, and after selecting a camp site at Broken Point, Shaw Island, repairing the scow, stored at Port Stanley in 1889, securing the necessary lumber, and pitching camp, field operations were begun on the 25th at Yellow Island. The first topographical sheet was completed by August 31; a new projection was then made, and work began immediately on the second sheet, which was completed by October 5. A third sheet was worked upon at intervals, meanwhile, and completed by October 20. On the completion of sheet No. 3 the season was well advanced, and, as the allotment for the party was nearly expended, it was decided to close operations for the season. Breaking camp began on the 22d, and by the 24th the camp equipage and other property were safely stowed on the scow, and the latter towed to Port Stanley and placed in the charge of Mr. F. C. Troxwell for the winter. The party then proceeded to Seattle and Olympia, reaching the latter point on the 25th; the steam launch was then hauled out and housed over at a suitable place near the dry house of Mr. R. F. Whitham on the east side of Budds Inlet, about 3 miles from the city wharves. Assistant Gilbert proceeded to San Francisco November 7, and was engaged during the winter in inking sheets and completing the office work incident to his field labors of the present and past season.

Assistant F. A. Young was attached to the party during the season until October 22, when, by the direction of the Superintendent, he was detached, and proceeded to Washington, D. C., where he was engaged on miscellaneous office duty until again ordered to field duty in Alaska. Mr.

Young observed magnetic declination, dip and intensity at a station near the camp, and made the subsequent computations, and throughout the season rendered valuable assistance in the execution of the topographical work. The season was generally favorable for the prosecution of the work, only one rainy day occurring, but fogs and smoke prevailed to some extent in the latter part.

The statistics of the Washington Sound work may be briefly stated as follows:

Number of magnetic stations occupied	1
Area of topography surveyed, in square statute miles	42
Length of coast line surveyed, in statute miles	90
Length of lake-shore line surveyed, in statute miles	3
Length of roads surveyed, in statute miles	79
Number of topographical sheets completed	3

The topography surveyed embraces Orcas Island from Orcas Knob to Grindstone Harbor, including Deer Harbor and West Sound; San Juan Island from Limestone Point to Argyle, including Friday Harbor; and all of Shaws, Jones, Yellow, Brown, Reef, Fawn, Nob, Cliff, Crane, Bell, Blind, Canoe, Oneal, and Turn islands.

A sketch, showing the work executed and the laying out of the sheets, accompanies Assistant Gilbert's report.

During May and part of June, 1896, Mr. Gilbert assisted in the investigations connected with the proposed transfer of the Lafayette Park Astronomical Observatory to a more suitable location, prepared plans and specifications for the new building, and connected the new station trigonometrically with the old, and with the triangulation of San Francisco Bay. On June 16, in accordance with instructions, he proceeded to Utah and reported to Assistant William Eimbeck for duty under his direction on the transcontinental geodetic work.

Geodetic work.—Continuation of the transcontinental triangulation in Colorado.—At the close of the last fiscal year Assistant F. D. Granger was engaged on the occupation of Big Springs, a primary station of the great transcontinental scheme of triangulation, and had just completed a reconnaissance for the location of a secondary point between Big Springs and Plateau, resulting in the selection of Dry Camp. The observations at Big Springs were finished by July 13, and determined the horizontal directions and elevations of four primary, one secondary, and a number of tertiary points, the primary stations being Cramers Gulch, Plateau, Pikes Peak, and Divide, and the secondary station the newly selected point, Dry Camp. The instruments and camp were then transferred to Divide Station, located in El Paso County, about 3 miles east of Eastonville, a small town on the Gulf Railroad. The preparations for occupation were completed by July 24, and the observations were begun on the following day and finished on August 23. Three primary stations (Big Springs, Pikes Peak, and Bison Peak), two secondaries (Mounts Morrison and Table), and twenty-five tertiaries were thus determined, both as to horizontal direction and elevation. The line to Mount Morrison, which is represented on the published sketch of the Colorado reconnaissance as unobstructed, was found to be cut off by trees on intervening ridges, but fortunately, after an examination of the line by the recorder of the party, Mr. J. B. Boutelle, the cutting of an avenue through the timber was found to be practicable, and the visibility of the station was thus secured. Observations on this point were of great importance, inasmuch as the trigonometric connection with the Chamberlin Observatory at Denver was in a measure dependent thereon.

On the completion of the observations at Divide, Assistant Granger stored a portion of his camp equipage at Eastonville, and with a reduced party, consisting of Foreman E. E. Torrey, a driver, a cook, and two hands, and a limited outfit, proceeded to Cramers Gulch, arriving there on the evening of September 3. The preparations for occupation, including the erection of a 20-foot observing tripod and scaffold, were finished by September 6, and the observations, which were begun on the following day, were completed on the 17th. The party and outfit were then transferred to Station Plateau, where observations were begun on the 24th of September and concluded on the 6th of October. At Cramers Gulch and Plateau two primaries and five tertiaries and three primaries and two tertiaries, respectively, were observed, and the horizontal direction of the secondary station, Dry Camp, was determined.

This completed the portion of the Colorado work assigned to Assistant Granger, and, in accordance with instructions, the party was then transferred to Salina, Kans., for the purpose of making a reconnaissance for the selection of a base-line site in the vicinity of the line Wilmer to Taylor. This work, belonging properly to the Middle Division, has already been reported under that head, in its regular geographic order.

The statistics of the Colorado work are given in tabular form as follows:

Area of triangulation, in square statute miles	900
Number of signals erected	6
Number of stations occupied for horizontal measures	5
Number of stations occupied for vertical measures	3
Number of geographical positions determined	5
Number of elevations determined trigonometrically	5

Assistant Granger, in his report, highly commends the zeal and efficiency of Recorder J. B. Boutelle and Foreman E. E. Torrey; the latter served throughout the season, and the former until August 31, when he was detached from the party and directed to return to Washington.

Geodetic work.—Continuation of the transcontinental triangulation in Colorado.—At the close of the last fiscal year the party under the charge of Assistant William Eimbeck was in the field, and the arrangements for the occupation of "Treasury Mountain" and "Pikes Peak" were complete. The work was carried on during the present year as rapidly as the unfavorable weather conditions would permit, and the occupation of the former station was brought to a satisfactory conclusion by the 5th of July. Severe thunderstorms hovered almost incessantly over the mountain, and snowstorms were of frequent occurrence, so that much interruption and vexatious delay was occasioned. The same conditions prevailed at "Pikes Peak," where Assistant John Nelson had meanwhile been endeavoring to advance the direction observations, and consequently but little progress had been made when Assistant Eimbeck, after the completion of "Treasury Peak," reached that point with the main party. The most strenuous efforts were then made by the combined party to advance the operations, and advantage was taken of every clear moment, but the wretched stormy weather, accompanied usually by high winds, still continued, and at the close of July but little headway had been made, and most of the observations remained incomplete. There being no prospect of an early favorable change, and past experience having shown that August is always a bad month for observing in these high altitudes, the station was temporarily abandoned, and the time was utilized in moving the party to "Uncompahgre Peak" and preparing that station for occupation. Observations were begun at "Uncompahgre" on the 20th of August and continued until September 20, and embraced not only the usual determinations of horizontal directions and double zenith distances, but also those of latitude, azimuth, and magnetic declination, dip and intensity; a topographical sketch covering an area of 20 square miles, and based on accurate local triangulation, was also made, to serve not only as a description of the locality of the station, but also to facilitate the study of the local deflection of the plumb line. The party then returned to "Pikes Peak" and successfully completed the occupation of that station by the 9th of October. The observations at this point were of the same character as those described for "Uncompahgre Peak," but in addition a local triangulation of some magnitude was here required to connect the hypsometric work of the main triangulation with the Denver and Rio Grande railroad levels at "Colorado Springs." Owing to the breadth and flatness of the mountain top three auxiliary mountain stations had to be interpolated and occupied. At one of the lower stations of the scheme zenith distance observations on the Pikes Peak stations were made on three days, to eliminate as far as possible the errors due to local deflection, and as a further check on the local triangulation two selected distances were carefully measured by means of a standardized steel tape. The season's work closed at "Colorado Springs" on the 14th of October, and the party was then disbanded.

Throughout the season Assistants John Nelson and R. L. Faris and Recorders Willis M. Baum and Walter H. Clay served in the party and rendered valuable assistance in the various branches of the work. On the disbandment of the party Messrs. Nelson, Faris, Baum, and Clay returned to Washington and Mr. Eimbeck proceeded to Gunnison, Colo., and after attending to the settlement of party affairs and the storage and care of the instruments, camp equipage, and other public

property in his charge, also returned to Washington by the end of November. During the winter he was engaged upon the computations and reductions of his field observations, and was assisted by the above-mentioned members of the party, and also for a time by Assistants Isaac Winston and O. B. French. Assistant Eimbeck's further services on the transcontinental geodetic work in Utah are noticed in the paragraph immediately following, and those of other members of the party under appropriate geographical headings elsewhere in this report.

Geodetic work in Utah.—Selection and preparation of the Salt Lake base line and its connection with the transcontinental triangulation.—In the spring of 1896 Assistants William Eimbeck and P. A. Welker were directed to prepare for the resumption of the geodetic work in the vicinity of Ogden, Utah, and early in May the specific instructions were issued. The plan of operations was as follows: The main party under the charge of Assistant Eimbeck to select a suitable site for a base line, prepare it for measurement, and for its connection with the main triangulation to occupy the base stations and "Waddoup" primary station; an auxiliary party, under the charge of Assistant Welker, but under Assistant Eimbeck's general direction, to assist in the preliminary work and to occupy the primary stations "Antelope Island," "Ogden," and "Promonotory"; on the completion of the trigonometric connection and the incidental observations related thereto, Mr. Welker to disband the auxiliary party, join the main one, and assist in the base measurement. Messrs. Eimbeck and Welker reached the field of operations on May 23, and at once set about making the necessary preparations for the occupation of "Waddoup" and "Antelope Island," and executing the reconnaissance for the selection of the most available site for the base line. By June 19 these objects were accomplished, and about this time Assistant J. J. Gilbert, Aid C. C. Yates, and Recorder Buford A. Lynch joined the party at Kaysville. Assistant Welker organized his auxiliary party on June 20 and, accompanied by Aid C. C. Yates, at once proceeded to the occupation of "Antelope Island" station, the observations being begun on the 23d; Assistant Eimbeck, after assigning to Assistant Gilbert the duty of preparing and marking the base line and erecting piers and observing signals at its termini, proceeded to the occupation of "Waddoup," accompanied by Recorder Buford A. Lynch, and began observations on the 26th. The close of the fiscal year found the work fairly under way and the three branches of the party making excellent progress. The results of the completion of the trigonometric connection and the actual measurement of the base line will be given in the next annual report.

It may here be mentioned that the line chosen for the base is situated in the flat lands near and along the eastern shore of the Great Salt Lake between the towns of Kaysville and Hooper, Davis County, and is 11·2 kilometres in length. It is to be measured by means of the new duplex base apparatus designed by Assistant Eimbeck, and constructed in the Coast and Geodetic Survey instrument shop.

Magnetic observations at various places in the State of Montana.—During the progress of the magnetic survey inaugurated in April, 1896, by Assistant R. L. Faris, as mentioned on a previous page of this report, the magnetic elements, declination, dip and intensity, together with the necessary astronomical factors, time, azimuth, latitude, and longitude, were determined at the following-named places in the State of Montana: Glendive, Miles City, Forsyth, Billings, Bozeman, Townsend, Helena, Cascade, and Fort Benton.

For stations determined in States belonging to the Eastern and Middle Divisions, see under the appropriate geographical headings.

ABSTRACTS OF REPORTS FROM FIELD PARTIES, FISCAL YEAR 1896.

DIVISION OF ALASKA.

[Under this heading are included the coasts of Alaska which border on the North Pacific Ocean, on Bering Sea, and on the Arctic Ocean; also the inlets, sounds, bays, and rivers.]

The localities of field operations in Alaska are shown on Progress Sketches at the close of Part I.

Continuation of hydrographic and general surveys in Alaska.—At the close of the last fiscal year the party on the steamer *Patterson*, under the command of Lieut. Commander E. K. Moore, U. S. N., was engaged in the survey of Chatham and Peril straits and the adjacent bays and inlets, and had made excellent progress. The survey was continued uninterruptedly during the present year until October 2, and a large amount of work was accomplished, the various branches being assigned to different officers of the party. The general assignment of duty was as follows: To Lieut. A. G. Rogers, the tidal observations and base-line measurements; to Lieut. R. F. Lopez, the astronomical observations; to Lieut. Hugh Rodman, in charge of the steamer *Cosmos*, the main triangulation; to Ensign W. B. Hoggatt, with the steam launch *Vixen*, subsidiary triangulation and hydrography; to Ensign H. K. Benham, with the steam launch *Reynard*, subsidiary triangulation, hydrography, photography, and part of the shore line; to Yeoman H. Ford, the topography and the computing and platting of the main triangulation; to Yeoman W. G. Appleton and Master-at-Arms Hugh Rodman, the recording and platting of the hydrography and subsidiary triangulation. This detail was adhered to as closely as was practicable, and all branches of the field work were carried on simultaneously, the triangulation, however, being always kept in advance. If for any reason any branch occasionally fell behind, force was concentrated on it to bring it up, so as to keep all the work within easy reach of the vessel, and the *Patterson's* anchorages were shifted from time to time as the work progressed, so as to be always as near as possible to the field of operations. The season's work embraces the whole of Peril Strait, from its connection with Chatham Strait to the head of Hooniah Sound on the west and Fish Point on the south, with the adjacent bays and passages, and that portion of Chatham Strait lying between Peril Strait and Point Gardner, including Kelp, Whitewater, Cha-ik, Takatz, and Hootz bays and Kootznahoo Inlet. Two bases were measured, one of 700 metres at Hootz Bay, as mentioned in last year's report, and one of 1 350 metres near Pogibshi Point, in Peril Strait; astronomical observations were made at Kenasnow Island and at one end of the Pogibshi base; magnetic declination, dip, and intensity determinations at the Kenasnow Island astronomical station; the necessary tidal observations at Pogibshi Point, Bear Bay, and Killisnoo, and current observations at sundry localities. The most important current observations were those simultaneously taken at Sergius Narrows, Big Island, Adams Narrows, and midchannel off Poverotni Island, as from them was determined the point of meeting of the flood tides entering Peril Strait through Salisbury Sound on the west and Chatham Strait on the east. It was found to be to the northward of Poverotni Island, in the broad part of the strait. Good anchorages were found in Peril Strait at Pogibshi Point and Rodman Bay, and in Chatham Strait at Cha-ik Bay, Kelp Bay, and Ta Katz Bay, the latter being completely landlocked and protected from wind and sea in every direction. Kelp Bay is an extensive basin with three branches, the north one of which has a portage across to Peril Strait; canoes can pass across at ordinary high water, and boats drawing 3 or 4 feet can pass at high spring tides. The anchorage was found on the south side of the basin, in 25 fathoms

of water, but the arms are deep, except at their heads, where they terminate rather abruptly in sand flats. The hills surrounding Kelp Bay are high and steep and covered with perpetual snow, except on the upper side of the north arm, and black bears abound. Warm Spring Bay, on the west side of Chatham Strait, and about 12 miles south of Kelp Bay, also furnishes an anchorage, but it is not a good one for large vessels, as it is entirely open to easterly storms, but small craft can find a secure harbor in either of the small arms on its south side. At the head of this bay is a large cascade fed by a lake located about 200 feet above sea level, and in the same vicinity, and at a still higher level, there are hot sulphur springs, which are occasionally resorted to by the Killisnoo Indians for medicinal baths.

The weather during the season was for the most part cloudy and rainy, with occasional fogs and high winds, until August 29, when a period of very fine weather set in. Notwithstanding the unfavorable conditions, however, there were only two working days when no field work was accomplished. The season's work closed on October 2, and the *Patterson* proceeded to Sitka, where the *Cosmos* and other boats not belonging to the ship's outfit proper were stored, and thence to Mary Island and Port Simpson, arriving at the latter place on the morning of the 8th and taking on board the Alaska boundary parties of Assistants E. F. Dickins and P. A. Welker, who had finished their work a month earlier and were awaiting the vessel's arrival. The steamer *Fuca* and the schooner *Earnest* were taken in tow, and by 3 p. m. of the same day the homeward journey was resumed and Seattle was reached by October 16. The *Fuca* and *Earnest* were taken to the Puget Sound naval station at Port Orchard and laid up there, after which the *Patterson* returned to Seattle and was placed in the hands of the Puget Sound Dry Dock Company for extensive repairs. During the winter the party of the *Patterson*, temporarily quartered on the *Hassler* at Port Orchard, was engaged on the office work pertaining to the Alaska Survey.

The report of Lieut. Commander E. K. Moore furnishes much valuable information in relation to southeast Alaska generally and in particular to the portions surveyed by his party. The general features of the region operated in are similar to those of southeast Alaska generally, the country being mountainous, rugged, and thickly wooded to a height of 2 000 to 2 500 feet. On the west side of Chatham Strait and on the north side of Peril Strait the mountains rise abruptly out of the water to a height of 2 000 to 5 000 feet, the water being very deep close up to the shores, and there are very few outlying dangers, while on the eastern and southern sides of Chatham and Peril straits, respectively, the shores are less abrupt and more irregular and shoaler water is found, with some outlying rocks and reefs. The southern portion of Peril Strait, known as "The Rapids," is quite dangerous and requires the most careful navigation. Several good anchorages not previously known were discovered and surveyed, some of which will prove very useful to navigators.

The depths through the middle of Chatham Strait range from 300 to 400 fathoms, and the bottom is comparatively even, while that of Peril Strait is more irregular. On the shores of both the timber is mainly hemlock and spruce with some cedar and alder, but most of it is not valuable; in midsummer the vegetation is rank wherever there is soil enough for roots, and flowers are abundant wherever the rays of the sun can penetrate. Game was scarce owing to the severe winter of 1893–94, but fish were plentiful, especially salmon trout, dog and humpback salmon, and halibut; every arm, bight, and bay has a stream at its head, where early in the summer salmon and speckled trout abound, while later in the season these streams are literally teeming with both varieties of the former.

The only permanent settlements within the area of the season's work are Killisnoo, on the east end of Kenasnow Island, and the Indian village of Angoon, 2 miles north of the entrance of Kootznahoo Inlet, other villages being occupied only at the seasons for potato planting and digging. There are no whites at Angoon, and only from ten to forty, according to circumstances, at Killisnoo, while the Indian population of the two settlements amounts to about 800. Killisnoo has a post-office, and its main industry at the present time is the manufacture of herring oil and fertilizer and the salting of herring. The Alaska Oil and Guano Company usually employs about forty white men and sixty Indians, but owing to the depression in the market they operated this season at about one-third of their capacity. Their catch this year was 3 200 tons of fish, and their output was 102 000 gallons of oil, 500 tons of fertilizer, and 1 000 half barrels of salted herring;

they shipped, however, about 250 000 gallons of oil and 700 tons of fertilizer, most of it being last year's production.

The Pacific Coast Steamship Company runs the large and comfortable steamer *City of Topeka* regularly, twice a month throughout the year, from Seattle to Sitka, and the large and commodious steamer *Queen*, of the same line, also makes semimonthly trips during June, July, and August. They both pass through the northern part of Chatham Strait, stop at Killisnoo, and proceed thence through Peril Strait; returning, the *City of Topeka* follows the same route, while the *Queen* returns by way of Point Gardner, and is the only regular vessel at present navigating the southern waters of Chatham Strait. Two small steamers, the *Wallapa* and *Chilkat*, were started this summer over the same route as that pursued by the *City of Topeka*.

The statistics of the whole season's work, including the partial results given in the last report, are as follows:

Number of base lines measured	2
Number of signal poles erected	1 260
Number of stations occupied for horizontal angles	1 113
Number of stations occupied for vertical angles	172
Number of elevations determined trigonometrically	315
Number of stations occupied for astronomical observations	2
Number of stations occupied for magnetic observations	1
Area of topography surveyed in square statute miles	406
Length of general coast line surveyed in statute miles	690
Number of topographic sheets finished	5
Area sounded, in square geographical miles	400
Number of miles (geographical) run while sounding	2 001
Number of angles measured	15 008
Number of soundings taken	22 740
Number of specimens of bottom preserved	47
Number of current stations	2
Number of tidal stations established	2
Number of hydrographic sheets finished	11

Lieut. Commander Moore highly commends all members of the party for the zeal and efficiency displayed in the execution of the work.

The *Patterson* is now preparing for the resumption of field work and will start for Alaska early in July.

Chronometric determination of differences of longitude in Alaska; also latitude and magnetic determinations.—In March, 1896, Assistant Fremont Morse was instructed to prepare for chronometric longitude work in Alaska, and Assistants Homer P. Ritter, F. A. Young, and Aid O. B. French were directed to report to him for duty under his direction, joining him at a specified point on Puget Sound in time to connect with the steamer starting for Alaska early in April.

The plan of the season's work was as follows: Assistant Morse to occupy the astronomical station at Sitka, make the necessary time observations there, and rate his chronometers, while new stations at Kadiak Island and Unalaska were similarly occupied by Assistant H. P. Ritter and Aid O. B. French, respectively; Assistant F. A. Young to take charge of the chronometers to be carried on three or more successive round trips of the Alaska Commercial Company's steamer *Dora* and to intercompare them daily; the carried chronometers to be carefully compared with those of each of the three astronomical stations on each arrival or departure of the steamer, both by Assistant Young and the astronomer of the station; the latitude of the Kadiak and Unalaska stations to be carefully determined by a sufficient number of astronomical observations, and the magnetic elements, declination, dip, and intensity, to be determined at all three stations; also topographic surveys of the harbors and adjacent country to be made as opportunity offered without interfering with the main work of the expedition; all parts of the work to be under the general direction and general supervision of Assistant Morse.

Assistant Morse left San Francisco by steamer on March 25, was joined by the other members of the party on reaching Port Townsend, took passage on the steamer *City of Topeka* at Seattle April 2, and reached Sitka on the 8th. Here, in accordance with the programme outlined, Mr. Morse landed with his instruments and the other observers transferred their outfits to the steamer

Dora. On account of unfavorable weather time observations at Sitka were not obtained prior to the departure of the *Dora* on the 9th, but all the chronometers, twenty-five in number, were carefully intercompared. Mr. Ritter landed at Kadiak on the 14th of April and temporarily mounted his instrument in a tent, pending the construction of a pier and the erection of a wooden observatory; owing to bad weather, however, he did not succeed in getting time observations prior to the *Dora's* proceeding westward. Mr. French reached Unalaska on the 19th of April and was also prevented by thick weather from getting time determinations before the departure of the steamer on her return trip, but he succeeded in getting good observations on the following night. Mr. Young continued on the steamer in charge of the carried chronometers, and by the close of the fiscal year three round trips between the stations were nearly completed, the *Dora* being due at Sitka on July 3. Owing to the partial failure of the first trip, due to unfavorable weather at all stations, as already noted, and the further fact that the Sitka station chronometers for a time ran unsatisfactorily, a fourth trip is deemed essential, and a notification to that effect has already been sent by Assistant Morse to the other observers. The party being still in the field and all branches of the work as yet incomplete, no tabular statistics can now be given, but the full results of the season will be duly set forth in my next annual report.

Alaska Boundary Survey.—See under head of "Special operations."

SPECIAL OPERATIONS.

Erection of beacons on the coasts of Maine and Massachusetts for a naval speed-trial course.—The Navy Department having requested the cooperation of this Survey in the erection of beacons on the coasts of Maine and Massachusetts for use in laying out and marking a speed-trial course for the *Indiana* and *Katahdin*, the steamer *Bache*, Lieut. Robert G. Peck commanding, was detailed for that duty in September, 1895. Commander R. B. Bradford, of the U. S. S. *Dolphin*, in charge of the trial course, having indicated the points where these structures were needed, the *Bache's* party erected beacons at the following-named places: Entrance of Gloucester Harbor, Massachusetts; Cape Neddick, Me. (Neddick △); Kennebunkport, Me. (Boothbay △); and Timber Island, Maine (Little River △). The beacons were of the same size, and of tripod form with center pole; the tripods were constructed of 50-foot scantlings, and the top of the pole in each case was about 75 feet above the ground. In the building of two of these signals assistance was rendered by a working party from the *Dolphin*. On the completion of this duty, September 26, the *Bache* returned to her regular work on the coast of Massachusetts.

Erection of beacons on the north shore of Long Island, New York, for the naval speed-trial course.—In July, 1895, the steamer *Bache*, under the command of Lieut. Robert G. Peck, while en route to her field of work on the coast of Massachusetts, stopped at Long Island Sound for the purpose of erecting the permanent beacons desired by the Navy Department for the naval speed-trial course. Beacons were erected at the following points: Crane Neck, Mount Misery Bluff, Hallock, Tuthill, Roanoke Point, Cooper, Oregon Range, and Long Beach Range. They were all of the same type and character, viz, tripods with cage and center pole; the legs were buried to a depth of several feet, the parts below and near the ground being first thoroughly tarred, and each leg was securely braced and anchored. The tripods themselves were also strongly braced and boarded, and subsequently painted white, so as to secure the greatest degree of visibility and at the same time preserve the wood; the cages and poles were, however, with one exception, painted black, on account of showing against a sky background. On the completion of this duty the *Bache* proceeded on her way to the coast of Massachusetts, stopping en route at New London, Conn., to receive on board the Superintendent of the Coast and Geodetic Survey and the Hydrographic Inspector, who were to be carried to Buzzards Bay and Hyannis to inspect the parties at work in those localities.

Special topographic survey of the Naval Academy Grounds at Annapolis, Md.—In December, 1895, the Navy Department having requested a detailed topographical survey on a large scale of the Naval Academy grounds at Annapolis, Assistant John W. Donn was instructed to undertake the work. By special arrangement, however, all expenses of the survey, excepting the pay and subsistence of the chief of party, were to be borne by the Naval Academy, the Coast and Geodetic Survey having no balances of appropriation remaining that could be made available for the purpose.

Assistant Donn proceeded at once to Annapolis, and after conference with the Superintendent of the Naval Academy as to matters of detail, organized his party and began the field work. The scale decided upon was 1–1 000, and all natural and artificial features were accurately delineated, the contour lines being carefully traced to represent successive vertical elevations of 2 feet, and the true positions, shapes, and sizes of all buildings and constructions being shown, as also the positions of trees and minor details. A bench mark, related to mean high water, was also

established in the grounds, and to it all elevations were referred; this bench mark was also connected by a line of levels with the nearest permanent bench mark of the Coast and Geodetic Survey precise leveling.

The winter season was not the most favorable one for field operations, and considerable time was necessarily lost in consequence of inclement weather, but the survey was nevertheless successfully completed by March 9. Assistant Donn then returned to Washington, and was engaged for some time in inking and completing the sheet and preparing the necessary copies for transmission to the Navy Department; in this office work he was assisted by Assistant J. A. Flemer. Two certified copies of the topographical sheet were transmitted to the Navy Department in May, one being for the use of the Superintendent of the Naval Academy and the other for the Department files, and, as is usual in such cases, the original sheet was deposited in the archives of the Coast and Geodetic Survey.

Special hydrographic examination of the vicinity of the Dry Tortugas, at the request of the Navy Department.—In the latter part of January, 1896, the Navy Department, having decided upon the use of Tortugas Harbor as a coaling station for the larger vessels of the North Atlantic fleet during the contemplated drill and maneuvers in the Bay of Florida, and having information from the light-house inspector of the district that considerable changes of depth had taken place in the vicinity since the date of the last survey, requested that a hydrographic party of the Coast and Geodetic Survey be detailed at the earliest practicable date to make a special examination of that harbor and its approaches. Accordingly, Lieut. Robert G. Peck, commanding the steamer *Bache*, was directed to suspend temporarily the Pensacola Bay survey upon which he was engaged, proceed with his vessel to the Dry Tortugas, and make a thorough examination of the Southeast Channel and the inside deep-water anchorage; also, to make such examinations elsewhere as would enable this office to judge as to the necessity of a complete resurvey of the whole group of keys and the adjacent waters. The *Bache* arrived at Tortugas on March 2, and the examinations were immediately begun and continued to the 18th, when they were completed. Tidal observations were made continuously, day and night, throughout the whole period, so as to determine a reliable plane of reference; this, when obtained, was found to agree exactly with the one determined during the previous survey, a very satisfactory and gratifying result. The shore line of the keys was platted by means of sextant angles, and in many places quite marked changes were found to have occurred. Some changes in the configuration of the bottom have also occurred since the former survey, but these mainly affect the shoaler parts near shore, the channels being found for the most part unchanged, or changed by immaterial amounts.

The principal changes may be summarized as follows:

1. Topographic changes: The shore lines of all the keys, except Loggerhead Key, which was not examined, have changed radically: For example, Garden Key has extended both in a northeasterly and a southwesterly direction; the low island to the northward and westward of the fort is now entirely under water even at the lowest tides; Long Key has materially shifted its position; Bird, Sand, Middle, and East keys have changed radically in shape; Bush Key is less out of water than formerly, and is now destitute of vegetation, though formerly covered with bushes.

2. Hydrographic changes: The southern half of the 12-foot shoal marked by buoy No. 5 has been cut away; the "middle ground" has grown in dimensions to the northward; the shoal to the westward of Sand Key has extended considerably to westward; three shoal spots, varying in depth from $3\frac{1}{2}$ fathoms to $4\frac{1}{4}$ fathoms, have developed in different parts of the Northwest Channel.

Lieutenant Peck concludes his report with a recommendation as to a complete resurvey as follows:

> While the examination made by the *Bache*, so far as can be judged before the soundings are actually platted on the sheet, indicates no appreciable change in the deep-water ports as shown by the present chart, except those heretofore noted, yet, inasmuch as there seems to be a probability of a greater use of this harbor by vessels of the largest size, I am of the opinion that a resurvey should be made, in which the development shall be so close as to guarantee freedom from dangers which may have escaped the former survey.
>
> Though the keys will doubtless continue to show rapid and radical changes in shape and position, and banks and shoals bordering on them will continue to extend or recede, it is believed that in the deep-water parts of the channels and anchorages there is a condition of practical permanency.

The statistics of the Tortugas examinations are as follows:

Area surveyed, in square geographical miles	5
Number of miles (geographical) run while sounding	159
Number of angles measured	2 428
Number of soundings taken	7 714
Number of tidal stations occupied	1

The *Bache*, on the completion of the work, proceeded to Key West for a special examination in that harbor, and then returned to her field work in Pensacola Bay.

Resurvey of the boundary line between the United States and Mexico.—As stated in the last report, the International Boundary Commission, on the boundary line between the United States and Mexico, adjourned on the 11th of October, 1894, to meet in Washington, D. C., one year from that date, and Assistant A. T. Mosman was, in January, 1895, directed by the Honorable Secretary of State to report to the Superintendent of the United States Coast and Geodetic Survey for duty until his services as a member of the Commission should again be required. Mr. Mosman performed various field and office services, and on the arrival of the time specified (October 11, 1895), resumed his duties as a member of the Joint Commission, assisting in the preparation of maps and profiles of the boundary, the report of the field operations of the Commission, and the astronomical and geodetic results obtained by the United States representatives. He was still so engaged at the close of the fiscal year.

Laying out of a speed-trial course in Santa Barbara Channel, California.—In April, 1896, the Navy Department having requested the laying out and determination of a speed-trial course in Santa Barbara Channel for the new battle ship *Oregon*, Lieut. A. P. Osborn, commanding the steamer *Gedney*, was directed to execute that work, and on its completion to report to Admiral L. A. Beardslee, U. S. N., the president of the trial board, and render such assistance during the trial of the *Oregon* as might be required.

The course was to be from 30 to 31 nautical miles in length, starting from a range on Point Conception and running toward Santa Barbara as far as Point Goleta, where the other terminal ranges were located. The determination of the line was completed by May 9, and Lieutenant Osborn and party rendered such service as the trial board required, until the 18th, when he proceeded with the *Gedney* to San Miguel Island for the purpose of investigating reported changes in Cuylers Harbor.

The steamer *McArthur*, under the command of Lieut. James H. Sears, also, at the request of Navy Department, assisted from May 7 to 19 in the preparations for and during the speed trial of the *Oregon*, and subsequently returned to her regular work in San Francisco Bay.

Continuation of the resurvey of that part of the boundary line between the States of California and Nevada which extends from a point in Lake Tahoe to the Colorado River.—The resumption of the resurvey of the oblique boundary line between the States of California and Nevada in May, 1895, by Assistants C. H. Sinclair and W. B. Fairfield, was noticed in my last report, and an account is there given of the progress of the work to the close of that fiscal year. The continuation of the resurvey during the present fiscal year, and the results accomplished between July 1 and November 20, 1895, form the subject of a report by Assistant Sinclair, dated March 20, 1896.

The plan of party organization heretofore outlined was continued, viz, the party was divided into two main sections, one, under the charge of Assistant W. B. Fairfield, executing the triangulation, topographic sketching, and magnetic observations, while the other, under Assistant C. H. Sinclair, the chief of party, executed the ranging out of the line. The latter section was for convenience subdivided, Assistant A. L. Baldwin taking charge of the forward end of the line, selecting the location of points on ridges or locating them at proper distances in the valleys or desert regions. Owing to the long sights made possible by the topographic features of the country, heliotropes were advantageously used for getting points in line, and they also facilitated the cooperation of the two sections of the ranging-out party by enabling them to communicate with each other quickly and certainly by means of a code of signals previously agreed upon. The station T_{60}, on the summit of the White Mountains, was occupied in June, and T_{64}, overlooking the Fish Lake Valley, was partially completed when the previous fiscal year closed. From this point T_{63}, T_{62}, and T_{61}, to the northwest, were determined, and to the southeast, along the White

Mountain Range, which was crossed obliquely, and across Fish Lake Valley, numerous points were interpolated, as far as T_{79}, on the Sylvania Mountains, about 40 miles distant. T_{64} was completed July 4, and the party moved forward across Fish Lake Valley the next day. Beyond the Sylvania Mountains is a region difficult to operate in on account of the scarcity of water and provender. Assistant Baldwin started on July 7 to explore this region, and reached the summit of the Grapevine Mountains on the 11th, and communicated by heliotrope with Assistant Sinclair, who had meanwhile moved to T_{79}. The point on Grapevine Mountains was not located until the 15th, owing to delays incident to the difficulties already mentioned, but in the meantime Mr. Sinclair lined in nearer points and made some reconnaissance and erected signals for the triangulation. On the return of Assistant Baldwin, July 19, it was decided to suspend temporarily the ranging-out work and unite all sections of the party in bringing the triangulation up to the point reached by the ranging party. This was accomplished by August 10, and meanwhile arrangements had been made for sending hay and grain to the southeast, an extra six-horse team being hired for the purpose, while the party teams were utilized in distributing the feed to the different mountain stations or temporary camps. The grain and hay had to be hauled from Fish Lake Valley and other supplies from the railroad station at Bishop. The party then proceeded to the southeast, carrying on the different branches of the work simultaneously, and reached the Grapevine Mountains via the head of Death Valley and Sand Springs. At the latter point, owing to the extremely high temperature and the total absence of shade, the party suffered severely. The next water station beyond Sand Spring is at Stainінger's Ranch, and this for a time was the base of operations. From here to the next water is less than a day's travel by trail, but to get the teams there required three days, and a distance of 65 miles was traversed. The party reached the latter spring September 5, and the ranging out of the line was thence continued to the southeast end of the Great Amargosa Desert. From T_{92}, a very commanding station, points were lined in across the desert to T_{105}, on the mountain range north of Pahrump Valley, a distance of 62 miles. The next move was to Franklin Well, a distance of 40 miles, most of the road being through heavy sand. It was decided to close the ranging-out work at this point, and the party, after measuring a check base line and an azimuth, took up the triangulation remaining, to connect with that being executed by Assistant Fairfield. This was completed by October 10, and the combined party reached Bishop on October 20. Here arrangements were made for the care of the animals during the winter, the wagons were repaired and stored, and the rest of the outfit shipped to Carson City for overhauling.

The party reached Carson City October 23, and as many of the men as could be spared were then discharged. Mr. Fairfield then reoccupied certain of the triangulation stations on Lake Tahoe, while Mr. Sinclair made necessary magnetic observations at the station near the Lake Side Tavern, at the southeast end of Lake Tahoe, and at a new station at Carson City. The latter station is in the pavilion grounds, and is located about 50 metres east of the station of 1894. An azimuth was also observed and a meridian line was laid out and permanently marked. The party was then disbanded, and the officers returned to Washington, and were engaged there on their computations and reductions until again ordered to the field.

Assistant Sinclair highly commends Assistants Fairfield and Baldwin for their zeal and the intelligent interest taken by them in the work, and attributes much of the success of the season to their hearty cooperation.

A sketch showing the progress of the work and the relative positions of the determined points accompanies Mr. Sinclair's report, and the following table of statistics furnished by him shows in concise form the results accomplished:

Number of line points established	45
Number of miles of line ranged out and triangulated	162
Average distance of line stations, in miles	3·6
Longest sight observed, in miles	62
Number of bases measured	2
Number of azimuths measured	2
Number of horizontal angles measured	1 179
Number of repetitions of horizontal angles	14 023
Number of vertical angles measured	232

Number of repetitions of vertical angles	790
Number of magnetic stations occupied with magnetometer	2
Number of magnetic stations occupied with declinometer	38
Additional triangulation to connect base line, in miles	13

The further services of Assistants Sinclair, Fairfield, and Baldwin are noticed elsewhere in this report under the appropriate geographic headings.

Telegraphic determination of the difference of longitude between San Francisco, Cal., and Ellensburg, Wash.—The Director of the United States Geological Survey having, under date of July 6, 1895, requested the cooperation of the Coast and Geodetic Survey, in the determination of the longitude of Ellensburg, Wash., by telegraphic interchange of time signals between that point and San Francisco, Cal., Assistant Fremont Morse was directed to make the necessary observations at the Lafayette Park Observatory, while Mr. S. S. Gannett of the Geological Survey similarly observed at Ellensburg.

The first interchange of signals took place on July 26, but after that date foggy and cloudy weather prevented observations until July 30. July 31 and August 1 were also favorable, but were followed by another period of unfavorable weather conditions lasting until August 8, when the fifth night's observations were obtained.

As the observers did not exchange stations, it was necessary for them to observe together for personal equation, and Mr. Gannett accordingly proceeded to San Francisco for that purpose. No opportunity for observing, however, presented until August 15, and after that date another spell of bad weather set in, and Mr. Gannett was compelled by the pressure of other duties to return to Ellensburg on the 17th. Another night's observation for personal equation was much desired, but the project had to be abandoned for lack of further time, especially as there appeared to be no prospect of an early change in the weather.

On the conclusion of this work Assistant Morse, in accordance with instructions, reported to Assistant A. F. Rodgers for duty under his direction in connection with the resurvey of San Francisco Bay and Harbor. His services in this locality and subsequently in Unalaska are noticed under the proper geographical headings.

Examination of a portion of the boundary line between the States of Missouri and Iowa.—The northern boundary line of Missouri has been more or less a matter of controversy ever since the admission of that State into the Union, and in fact even prior to that date, and numerous surveys have from time to time been made by State or United States authority. Without going into the rather interesting history of the matter from the beginning, suffice it to say that the Supreme Court by decree of January 3, 1851, decided that the line surveyed and marked during the previous year by their order, and known as the Hendershott-Minor line, should be regarded as the true boundary. Unfortunately this line, which was supposed to be straight, contains many bends and changes of direction, and the courses given in the notebooks do not by any means correspond with the line as marked on the ground. For nearly forty years, however, this line was accepted by all parties, but eventually some of the marks became obliterated and disputes again arose concerning a portion of the line, first between individual land owners and finally between the States of Missouri and Iowa. The matter was again referred to the Supreme Court of the United States in December, 1895, and on February 3, 1896, a decree was issued again defining the boundary as the line run and marked by Hendershott and Minor in 1850, and appointing three commissioners to relocate and mark with durable monuments the obliterated portion which lay between the fiftieth and fifty-fifth mileposts, reckoned eastward from the old northwest corner. The Commissioners, Dwight C. Morgan, of Illinois; James Harding, of Missouri, and Peter A. Dey, of Iowa, after examining the disputed part of the line, found that it would be necessary to resurvey from the fortieth to the sixtieth mileposts, as the fiftieth, which was also found standing, was alleged to be moved out of its proper position, and most of the intervening wooden ones had disappeared. They then decided to apply to the Superintendent of the Coast and Geodetic Survey for the detail of an officer to execute a survey, and accordingly Assistant W. C. Hodgkins was directed to report to the commissioners at Davis City, Iowa, and retrace the line under their direction. Assistant A. L. Baldwin was also assigned to the party to assist in the work. Messrs. Hodgkins and Baldwin left Washington on the 6th of April and met the commissioners at Davis City on the 8th. An

examination of a portion of the line near the fortieth milepost was made the same day, and on the following day, after securing the necessary axmen and teamsters, the party moved to Pleasanton, a small village on the Iowa side of the boundary. The examination of the whole distance revealed the fact that but few of the old marks remained, but approximate positions were readily obtained by consulting the residents of the locality. The general location of the line as thus identified differed so materially in azimuth from the recorded bearings of the survey of 1850 that it was deemed inexpedient to attempt to retrace the line from that record, and it was decided instead to run a straight line between the fortieth and sixtieth mileposts and measure the whole distance with a tape, referring to this base line by rectangular offsets any of the old landmarks that might be found as the work progressed. The whole course of the original line, with its numerous bends, would thus be under rigid control by the system of rectangular coordinates and the base line would at the same time furnish the readiest means of locating on the ground the line adopted; the amount of cutting required would also be materially reduced by the opportunities offered for getting long sights from ridge to ridge. The alignment was made by Assistant Hodgkins with an 8-inch theodolite furnished with an ocular micrometer, and the opening of the line in advance was generally under the direction of Assistant Baldwin, who used an engineer's transit. The latter work was first completed and Mr. Baldwin then began the tape measure of the line, working westward from the sixtieth milepost. On reaching a point near the fifty-fourth milepost, work was temporarily suspended on account of rain, and the party returned to Pleasanton. On the 21st of April the eastward measurement was begun at the fortieth milepost and rapidly carried on to a junction with that first mentioned. A line of levels was also run to determine the differences of elevation of the successive stakes and to reduce the tape measures to a horizontal line. For the purposes of reduction, it was also necessary to keep a careful record of the tape temperatures during the measure. Notes were also made for the purpose of furnishing a topographical sketch of the strip of country traversed. The course of the boundary was very uneven, as the drainage system crosses it nearly at right angles, and some slopes were so steep as to give vertical differences of 20 feet in a distance of 25 metres. The reduction of the line was then made and the commissioners indicated, on the basis of the information obtained, the conditions which should govern the location of the intermediate mileposts. The services of two assistants being no longer necessary, Mr. Baldwin left the party on the 19th of May, and, in accordance with previous instructions, proceeded to Versailles, Mo., for the purpose of examining a proposed base line in that vicinity. Assistant Hodgkins, under the direction of the commission, completed the work of locating the intermediate marks early in June, and on the 12th and 13th made observations at Lineville for time, latitude, and azimuth. During the latter part of the season considerable time was lost on account of rainy weather. Assistant Hodgkins left Lineville on the 15th of June, and, in accordance with instructions, proceeded to Salina, Kans., and reported to Assistant F. D. Granger, who was in charge of the geodetic party operating in that locality.

It is gratifying to be able to state that the boundary commisioners have expressed themselves as well pleased with the manner in which the survey of the line was executed and with the results of the work.

Alaska boundary work.—Triangulation, topography, astronomical determinations of latitude and azimuth, and chronometric determinations of differences of longitude.—As stated in the report for 1895, the initial points of the boundary line between British Columbia and Southeast Alaska depend at present on the rather crude triangulation executed in past years by the hydrographic parties. This triangulation, while sufficiently good for mere charting purposes, for which it was only intended, does not possess the accuracy necessary for such important work as the exact location of a boundary line, its bases having been measured by rough and only approximate methods, and its angular measurements and astronomical determinations having in many cases been made by inexperienced observers. The discrepancies that have developed in fitting together and adjusting the different sections of the work prove conclusively that a better triangulation and additional astronomical observations are necessary to afford a reliable basis for the boundary survey. It was therefore determined to fit out a strong party to measure a base, determine astronomical positions, and execute a new triangulation from Port Simpson to Mary Island and to the head of Portland Canal.

The general programme of the work outlined may also for completeness be here repeated: The steamer *Patterson*, while en route to her own field work in Chatham and Peril straits, to transport the parties, with their outfits, stores, etc., from San Francisco and Seattle, and land them at their respective stations; the astronomical and chronometric longitude work to be first undertaken, astronomical stations being established at Port Simpson, Mary Island, and the head of Portland Canal, the astronomical station at Seattle being used as the base station for longitudes; Assistant Fremont Morse to occupy the Seattle observatory, while the astronomical stations at Port Simpson, Mary Island, and head of Portland Canal were simultaneously occupied by the parties of Aid O. B. French and Assistants E. F. Dickins and P. A. Welker, respectively; nine chronometers in charge of Assistant F. A. Young, to be carried on four successive trips of the steamer *City of Topeka*, between Seattle and the stations at Port Simpson and Mary Island, while the steamer *Fuca*, with five chronometers, similarly plied between Port Simpson and the head of Portland Canal; base lines to be measured at or near Port Simpson and the head of Portland Canal, and such triangulation, topography, magnetics, and other necessary work as could be accomplished without interfering with the longitude determinations to be also carried on; on the successful completion of the astronomical work, Assistant Morse to return to San Francisco, and all the Alaskan parties to be consolidated under the direction of Assistant E. F. Dickins for the execution of the main triangulation. The condition of the work at the close of the last fiscal year was as follows:

Assistant Welker's party on Portland Canal had completed the astronomical observations at Point Lion Station, measured a base 1 297 metres in length at the mouth of Salmon River, carried the triangulation from it to the mouth of Bear River, and run a traverse line from the latter point to the fifty-sixth parallel of north latitude. A topographical survey from the astronomical station to the boundary was also well advanced; Assistant E. F. Dickins had completed the astronomical observations, except latitude, at the Mary Island station; Aid O. B. French had completed the astronomical observations at the Port Simpson station, made the trigonometric connection with former stations, and observed the magnetic elements, declination, dip, and intensity; the steamer *Fuca*, carrying five chronometers, had made seven and one-half round trips between Port Simpson and Lion Point astronomical stations, thus completing this portion of the longitude work; Assistant F. A. Young, with nine chronometers, on the steamer *City of Topeka*, had completed three and a half round trips between Seattle and the stations at Port Simpson and Mary Island. The fourth trip was completed on July 7, thus finishing the whole of the longitude work.

Assistant Fremont Morse, who had been in charge of the astronomical observations at the Seattle Observatory, then dismounted and packed his instruments and proceeded to San Francisco, arriving there July 20, while Assistant Young, in accordance with modified instructions, reported to Assistant J. J. Gilbert for duty on the survey of Washington Sound, his services being no longer needed on the Alaska work.

Assistant Welker completed the Portland Canal work on July 9, and then proceeded with his party to Port Simpson, where two days were spent in making a reconnaissance for a site for a base line, but without success. The party, and that of Aid O. B. French, were then transferred to Mary Island July 12 for the purpose of assisting Assistant E. F. Dickins in the work of the main triangulation. After a careful reconnaissance a site for a base line was selected on the eastern side of Mary Island, the site being rather a poor one in some respects, but the best that the locality afforded. The preparation of the ground was difficult on account of the marshy and boggy nature of the soil, and much cutting of timber and underbrush was necessary before measurement could proceed. The line was 3 677 metres in length, and three independent tape measures of it were made by Assistant Welker, aided by Mr. C. C. Yates. The results proved very satisfactory, the extreme range of difference in the three measures being only one-fifth of an inch.

Meanwhile the triangulation from Mary Island to Port Simpson was carried on by Assistant Dickins, aided by Mr. O. B. French and Recorders H. A. Grady and R. L. Livingston, the steamer *Fuca* and a whaleboat furnishing the means of transportation from station to station. The portion across Dixon Entrance was both difficult and dangerous, as rough seas or heavy ground swells nearly always prevail there, making the landings more or less hazardous. The entire work was successfully completed by September 5, when the steamer *Fuca* returned to Mary Island for

Assistant Welker's party, and all then awaited at Port Simpson the arrival of the steamer *Patterson*. The *Patterson* arrived on the morning of October 8, and by 3 p. m. of the same day all the parties and their outfits were taken on board and the homeward journey was resumed, with the schooner *Earnest* and the steamer *Fuca* in tow. Seattle was reached on October 16 and the parties were disbanded, and Messrs. Welker, French, Yates, Grady, and Livingston returned to Washington, while Assistant Dickins, after storing his camp outfit, etc., on the steamer *Hassler* at the Port Orchard Navy-Yard, and turning the steamer *Fuca*, schooner *Earnest*, and two whaleboats over to Lieut. Commander E. K. Moore, proceeded to San Francisco.

The statistics of the season's work may be given in tabular form as follows:

Number of astronomical stations occupied	4
Number of latitudes determined astronomically	3
Number of longitudes determined chronometrically	3
Number of azimuths determined	14
Number of magnetic stations occupied	1
Area of triangulation executed, in square statute miles	630
Number of signals erected	50
Number of bases measured	2
Number of stations occupied for horizontal angles	46
Number of geographical positions determined	46
Length of traverse lines run, in statute miles	6
Area of topography surveyed, in square statute miles	20
Number of photographic negatives made for topographic use	63

Assistant Dickins was subsequently engaged at the suboffice in San Francisco in completing his records, computing his astronomical geodetic observations, and on miscellaneous office duty. On June 17 he received instructions to prepare for certain triangulation work in southern California, and until the close of the fiscal year was engaged in making the necessary arrangements. The subsequent services of the other members of the Alaska parties in other sections of the country are noticed under the appropriate geographical headings in preceding parts of this report.

Tidal records at various foreign ports.—Through the courtesy of the Hawaiian Government Survey, this office has been furnished at various times during the fiscal year with tracings from the maregrams of the self-registering tide gauge at Honolulu, and a continuous record of the tides from June 16, 1891, to March 31, 1896, is now in our possession.

The Japanese Government, in response to our request for tidal observations, has kindly furnished a copy of the tabulation of quarter-hourly readings from the automatic tide gauge at Yokohama for the calendar year 1893.

We are also indebted to the British admiralty and the French Hydrographic Office for tidal data received, as follows: From the former, a copy of tidal and current observations made in Seymour Narrows, British Columbia, during the years 1894 and 1895; from the latter, harmonic constants for Brest and St. Servan, together with hourly ordinates of the tide at Havre for the month of February, 1896.

ABSTRACT OF OFFICE ANNUAL REPORTS, FISCAL YEAR 1896.

ABSTRACT OF THE ANNUAL REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE.

In Office Report No. 1 will be found in full the annual report of Mr. O. H. Tittmann, who served as Assistant in Charge of the Office during the year, except while absent in Europe as United States delegate to the International Geodetic Association, or while acting as Superintendent during absences of the latter; on such occasions he was temporarily relieved by Assistants Andrew Braid and E. D. Preston. Assistant Tittmann's report sets forth in general terms the progress made in the various branches of the office work under his charge, calls special attention to important features, and refers for details and statistics to the accompanying annual reports of the several chiefs of divisions.

The computing division has continued under the able direction of Assistant C. A. Schott, who has found time amid the pressure of other work to prepare a number of special reports on important operations and computations. A new discussion of the secular variation of the magnetic force in the United States, and adjacent foreign countries, and a paper on the distribution of magnetic declination in the United States for the epoch January 1, 1900, may be specially mentioned as valuable contributions to our knowledge on the subject of magnetics. The former has been published as an Appendix to the Report for 1895, and the latter will appear as Appendix No. 1 of this Report. Four other appendices prepared by him, referring to the results of precise leveling in various parts of the country, will also appear in this report.

From time to time, as opportunity offered, various assistants of the Survey, when not engaged on field duty or the reductions and computations of their field results, have been assigned to the computing division; a list, with the special services performed by each, will be found in Assistant Schott's report.

The tidal division was under the direction of Mr. L. P. Shidy until the middle of July, when Assistant E. B. Latham was placed in charge. The latter was relieved in February, and was succeeded early in March by Assistant H. L. Marindin, the present chief of the division. Mr. Marindin's report is very complete and shows in detail the large amount of work accomplished during the year. Aids A. F. Zust and H. C. Denson were temporarily assigned to duty in the tidal division, the former from December 19 to June 30, and the latter from December 19 to May 5.

The drawing and engraving divisions were at the beginning of the fiscal year consolidated under the direction of Assistant W. W. Duffield, who has efficiently performed the duties of chief. The Assistant in Charge of the Office reports that the consolidation has proved beneficial and relieved him of much labor incident to coordinating the work of two divisions. He calls special attention to the unusually large output of charts during the year. Mr. Duffield's report contains much interesting matter and shows the very satisfactory progress made in all branches of the work under his charge. In the drawing section 14 drawings for charts were completed during the year, and 8 others are in progress; 14 drawings for illustrating the Annual Report were completed; 9 section maps of the District of Columbia were verified for engraving; 13 topographic and 29 hydrographic projections for field parties were constructed; a large number of original sheets were inked and prepared for registration; and 47 calls for information from Departments of the Government and from the public, many of them involving the preparation of tracings and drawings, received attention. In the engraving section 11 copperplates of new charts and 33 of new editions were completed, and 44 others were begun; numerous plates for sketches and illustrations

and for section maps of the District of Columbia were begun, continued, or completed, and 505 plates were corrected for printing. In the electrotyping and photographing section 28 bassos and 24 altos were completed, representing a deposit of nearly 1 700 pounds of copper; and 123 negatives and 1 246 silver, blue, bromide, and nigrosine prints were made. In the chart-printing section over 66 000 impressions were struck off, 60 000 of which were delivered to the chart division for issue.

A detailed statement of the contract engraving of the year will also be found in Assistant Duffield's report.

The chart division has continued, as heretofore, under the able direction of Assistant Gershom Bradford. His report gives the usual statistical information as to the publication, distribution, and issue of charts and the receipts therefrom. One table of special interest gives a comparison between the issues of the present year and those of the seven years preceding, from which it appears that the total issue has increased 25 per cent over that of last year, and 20 per cent over the average of seven years; this is partially accounted for, however, by the continued free distribution to public libraries. Mr. Bradford also reports the completion of the new edition of the Chart Catalogue, which will be published in the near future.

The instrument division has continued under the charge of Assistant J. F. Pratt, and his report shows that a large amount of work has been accomplished during the year. Special mention is made of the construction and erection of the tidal indicator for Reedy Island, Delaware River; the construction of a photographic enlarging and reducing apparatus for the drawing and engraving division; the progress made in the construction of the new tide-predicting machine for the use of the tidal division; and the construction of the 50-metre comparator for the Office of Standard Weights and Measures.

The miscellaneous division has continued under the charge of Mr. W. P. Ramsey, and his report gives full statistics relative to the distribution and sale of the various publications of the Survey, and the number of reports, appendices, bulletins, Coast Pilots, Tide Tables, and Notices to Mariners received from the Public Printer. Fourteen new agencies for the sale of charts and other publications were established during the year, 7 of them being on the Atlantic and Gulf coasts, 6 on the Pacific Coast, and 1 at Hamburg, Germany. Only 1 agency was discontinued, and the total number now existing is given as 103.

The library and archives division continued throughout the year under the direction of Mr. H. Sidney King. His report gives the usual information in regard to additions to the library and the receipt and registration of field records and sheets, etc.

In the immediate office of the Assistant in Charge, Messrs. A. B. Simons and E. B. Wills and Misses Sophie Hein and Kate Lawn have efficiently performed their respective duties. Assistants W. C. Hodgkins and E. B. Latham were for a time engaged on special duty under Assistant Tittmann's direction, the former in examinations relating to the Alaska boundary, and the latter in bringing up to date the bibliography of the Survey.

ABSTRACT OF THE ANNUAL REPORT OF THE HYDROGRAPHIC INSPECTOR.

Lieut. Commander Jeff F. Moser, U. S. N., served as Hydrographic Inspector from the beginning of the fiscal year until April 30, 1896, on which date he was relieved by Lieut. Commander H. G. O. Colby, U. S. N., who had previously been engaged on field duty in charge of the steamer *Blake*. The latter has submitted a full report of the hydrographic work executed during the year by the naval parties under his and his predecessor's direction, accompanied by reports from the naval officers in immediate charge of the hydrographic and Coast Pilot divisions of the Office, which are also under his general direction. Statistical tables, showing the results accomplished by each hydrographic field party, the number of naval officers attached to each, the list of vessels employed on the work, and the amounts of money expended for repairs of each vessel are also given.

The hydrographic division remained under the immediate charge of Lieut. Walter McLean, U. S. N., from the beginning of the fiscal year until November 7, when, his services being required by the Navy Department, he was detached from this office. He was succeeded by Lieut. Hugh Rodman, who assumed charge of the division on the 20th of December, and continued as its chief

to the close of the fiscal year. His report shows that a large amount of work has been accomplished, and that each member of the division, by his zeal and efficiency, has contributed to the satisfactory result indicated. Fifty-two hydrographic sheets have been drawn and platted during the year, and these involved the study and discussion of 255 volumes of records and the platting of 94 794 angles and 372 493 soundings. In addition to this, a large amount of miscellaneous work was attended to, such as the verification and revision of proofs, drawings, and charts, the making and verification of tracings and projections, the reduction and platting of tidal data, comparisons of old and new surveys, the indication of corrections to charts, the preparation for publication of the monthly Notices to Mariners, etc.

The Coast Pilot division also remained under the charge of Lieut. Walter McLean, U. S. N., from July 1 to October 21, at which latter date he was relieved by Ensign Glennie Tarbox, U. S. N., who continued in charge to the close of the fiscal year. The annual report of the division, rendered by the latter, shows very satisfactory progress in this branch of the work also. Part VII of the Coast Pilot publication has been completed and sent to the printer, and considerable progress has been made in the preparation of Part VIII, which will include the whole Gulf Coast of the United States. During the winter, or from January 12 to May 21, Ensign Tarbox, accompanied by Nautical Expert John Ross of the Coast Pilot division, was engaged in visiting various parts of the Gulf Coast and collecting miscellaneous information for the compilation of this volume. The full account of this work has already been given under the head of field work. The division has also attended to various other matters, such as proof reading and the correction to date of former volumes of the Coast Pilot. The employees of this division are also complimented for their highly satisfactory service.

The Hydrographic Inspector's report and the division reports above referred to are printed in full farther on under the title of "Office Report No. 2."

ABSTRACT OF THE ANNUAL REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS AND MEASURES.

Assistant Andrew Braid assumed charge of the Office of Standard Weights and Measures on July 1, 1895, and has served continuously since that date. His annual report, which is published in full as Office Report No. 4, shows that a large amount of work has been accomplished, and gives a full account of several important operations and investigations successfully carried on and completed during the year, viz, the construction of a 50-metre comparator for the more accurate determination of linear values, particularly of base bars; the redetermination of the lengths and constants of two secondary base bars; the standardization of the new "duplex" base bars by means of the 50-metre comparator and a standard in ice; the determination of the relation between the "Committee metre" and the new "Prototype metre No. 21;" and the construction of certain electrical standards. A tabular statement of the work done for other Departments and Bureaus, and for outside parties, accompanies the report.

The regular force of the office has remained unchanged, and various assistants have from time to time been detailed for short periods to aid in special operations.

Assistant Andrew Braid has also had charge of the preparation and editing of the Superintendent's Annual Report, and has on various occasions acted as Assistant in Charge of the Office of the Coast and Geodetic Survey and as executive officer.

SUPERINTENDENT'S OFFICE.

In the Superintendent's office, Assistant E. D. Preston has performed the responsible duties of executive officer, and during the absence of Assistant O. H. Tittmann in Europe and on other occasions acted as Assistant in Charge of the Office. As mentioned elsewhere, Assistant Andrew Braid had charge of the Office of Standard Weights and Measures and the preparation and editing of the Superintendent's Annual Report, and on various occasions acted also as Assistant in Charge of the Office and as executive officer.

Mr. G. L. Flower succeeded Mr. John F. Renfro as private secretary on October 4, 1895, and served for the remainder of the fiscal year. Mr. William B. Chilton served as clerk to the Superintendent throughout the year.

DISBURSING OFFICE.

Mr. R. J. Griffin served continuously as disbursing agent, and was assisted by Mr. N. G. Henry, clerk and cashier; Miss Ida M. Peck, typewriter and clerk; and Mrs. Jennie H. Fitch, clerk. His report, giving a detailed account of all expenditures made during the year for the Coast and Geodetic Survey and the Office of Standard Weights and Measures is published in full as Office Report No. 3.

SUBOFFICES.

The San Francisco suboffice throughout the year was in charge of Assistant A. F. Rodgers, who has submitted a full report of its operations.

The various field operations over which he had general direction were conducted by Assistants J. J. Gilbert, E. F. Dickins, and Fremont Morse, and Messrs. Ferdinand Westdahl and F. W. Edmonds, and have been already described under their appropriate headings in the "Abstract of field reports." Special mention, however, should be made of the continuation of the topographical resurvey of San Francisco Bay and Harbor; the investigation of reported changes in Cuylers Harbor, San Miguel Island; the continuation of tidal observations at Sausalito station; and the selection of a site for a new observatory and its connection with the Lafayette Park station and the California triangulation.

The assistants named above also took part in the computations, reductions, and general office work, and besides worked up the results of their own previous field surveys in Washington and Alaska; Messrs Ferdinand Westdahl and F. W. Edmonds also attended to the drafting and clerical duties and assisted in the voluminous correspondence and the preparation of data and information furnished in response to special calls.

Mr. Emmet Gray served as tidal observer at the Sausalito station until April 1, when he was succeeded by Mr. H. S. Ballard.

The Philadelphia suboffice was discontinued at the close of the previous fiscal year, not being deemed longer essential on account of its proximity to the main office at Washington.

UNITED STATES COAST AND GEODETIC SURVEY REPORT FOR 1896.

PART I.

FIELD AND OFFICE DETAILS.

TABULAR STATEMENTS AND ANNUAL OFFICE REPORTS.

TABLE NO. 1.—Distribution of the field parties of the Coast and Geodetic Survey upon the Atlantic, Gulf of Mexico, and Pacific coasts, and in the interior of the United States during the fiscal year ending June 30, 1896.

TABLE NO. 2.—Statistics of field and office work of the Coast and Geodetic Survey for the fiscal year, and total to June 30, 1896.

TABLE NO. 3.—Information furnished to Departments of the Government in reply to special requests, and to individuals upon application, during the fiscal year ending June 30, 1896.

OFFICE REPORT NO. 1.—Report of the Assistant in Charge of the Office for the fiscal year ending June 30, 1896

OFFICE REPORT NO. 2.—Report of the Hydrographic Inspector for the fiscal year ending June 30, 1896.

OFFICE REPORT NO. 3.—Report of the Disbursing Agent for the fiscal year ending June 30, 1896.

OFFICE REPORT NO. 4.—Report of the Assistant in Charge of the Office of Standard Weights and Measures for the fiscal year ending June 30, 1896.

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TABLE No. 1—1896.

Distribution of the field parties of the Coast and Geodetic Survey upon the Atlantic, Gulf of Mexico and Pacific coasts, and in the interior of the United States, during the fiscal year ending June 30, 1896.

I.—EASTERN DIVISION—STATES EAST OF THE MISSISSIPPI RIVER.

1. Maine.
2. New Hampshire.
3. Vermont.
4. Massachusetts.
5. Rhode Island.
6. Connecticut.
7. New York.
8. New Jersey.
9. Pennsylvania.
10. Delaware.
11. Maryland.
12. District of Columbia.
13. Virginia.
14. North Carolina.
15. South Carolina.
16. Georgia.
17. Florida.
18. Alabama.
19. Mississippi.
20. Michigan.
21. Wisconsin.
22. Ohio.
23. Indiana.
24. Illinois.
25. West Virginia.
26. Kentucky.
27. Tennessee.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work, etc.
Massachusetts and Maine.	No. 1	Telegraphic longitude determinations.	A. T. Mosman, assistant; G. R. Putnam, assistant.	Telegraphic determinations of difference of longitude between Cambridge and Calais, with incidental magnetic and gravity determinations.
Massachusetts	2	Hydrography	Lieut. Robert G. Peck, U. S. N., assistant.	Hydrographic surveys and examinations along the coast, viz, at Cohasset, Minots Ledge, Broad Sound, Nahant to Salem, and Marblehead to Manchester.
Massachusetts	3	Hydrography	Lieut. Commander H. G. O. Colby, U. S. N., assistant.	Continuation of hydrographic resurveys in Nantucket Sound and its eastern approaches, and special developments and examinations on Nantucket Shoals and the approaches of Hyannis Harbor.
Massachusetts	4	Topography	D. B. Wainwright, assistant	Topographical resurvey of Buzzards Bay—New Bedford and Mattapoiset sheets.
Massachusetts	5	Topography	J. A. Flemer, assistant	Topographical resurvey of Buzzards Bay—Wareham and Sippican sheets.
Massachusetts	6	Topography	Stehman Forney, assistant	Topographical resurvey of Buzzards Bay—Westport and Padanaram sheets.
Massachusetts	7	Topography	W. I. Vinal, assistant	Topographical resurvey of Buzzards Bay—West Falmouth and Pocasset sheets.
Massachusetts	8	Hydrography	Lieut. G. C. Hanus, U. S. N., assistant.	Hydrographic resurvey of Buzzards Bay—New Bedford Harbor and approaches and head of bay.
Massachusetts	9	Town Boundary Survey.	Henry L. Whiting, assistant and Commissioner of the Massachusetts State Survey.	Continuation of the determination of town boundaries in various parts of the State.
Rhode Island	10	Hydrography	Lieut. G. C. Hanus, U. S. N., assistant.	Examination of a reported danger to navigation in Bristol Harbor.
Rhode Island, Connecticut, and New York.	11	Hydrography	Lieut. L. M. Garrett, U. S. N., assistant.	Hydrographic surveys to the southward of Block Island Sound, off Montauk Point, and special examinations in Long Island Sound.
Rhode Island and New York.	12	Hydrography	Lieut. W. S. Benson, U. S. N., assistant.	Hydrographic surveys to the southward of Block Island Sound and off Montauk Point.
New York	13	Topography	C. T. Iardella, assistant	Continuation of the topographical resurvey of the south shores of Long Island.
New York	14	Tidal observations	J. G. Spaulding, tidal observer	Continuation of the tidal record at the automatic tidal station at Fort Hamilton, New York Harbor.
New York	15	Tidal observations	Officers of the U. S. Corps of Engineers.	Continuation and completion of the series of tidal observations at the Willets Point tidal station.
New York	16	Topography	John W. Donn, assistant	Continuation of the topographical survey of the Hudson River.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

I.—EASTERN DIVISION—STATES EAST OF THE MISSISSIPPI RIVER—Continued.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work, etc.
New York	No. 17	Topography	W. C. Hodgkins, assistant	Continuation of the topographical survey of the Hudson River.
Delaware	18	Establishing tidal station.	J. F. Pratt, assistant	Establishment of a tidal station and erection of a tidal indicator at Reedy Island, Delaware River.
Delaware, Maryland, Virginia, and New Jersey.	19	Reconnaissance and triangulation.	F. W. Perkins, assistant	Extension of the transcontinental arc eastward to Capes May and Henlopen.
District of Columbia	20	Tidal observations	Tidal Division, U. S. Coast and Geodetic Survey Office.	Continuation of the tidal record at the automatic tide-gauge station at the Washington Navy-Yard.
Massachusetts, Maine, Rhode Island, Connecticut, New Jersey, Pennsylvania, Maryland, Louisiana, Mississippi, Alabama, and Georgia.	21	Magnetic observations.	J. B. Baylor, assistant	Magnetic determinations at Nantucket, Provincetown, Cambridge, Portland, Bangor, Eastport, Providence, New Haven, New Brunswick, Philadelphia, Harrisburg, Baltimore, Donaldsonville, Cheneyville, Baton Rouge, Amite, Poplarville, Shieldsboro, Mississippi City, Mobile, Citronelle, Greenville, Montgomery, Selma, Eufaula, Opelika, Rome.
South Carolina, Florida, Virginia, Maryland, and Delaware.	22	Hydrography	Lieut. Robert G. Peck, U. S. N., assistant.	Special hydrographic examinations at various points on the Atlantic and Gulf coasts, viz, Charleston Harbor, Dry Tortugas anchorage and approaches, Key West, Blackfish Bank off Assateague Island, Fenwick Island and Isle of Wight Shoals, and Ocean City.
South Carolina	23	Tidal observations	Officers of the Corps of Engineers, U. S. A.	Tidal observations at Fort Sumter.
South Carolina	24	Hydrography	Lieut. Commander H. G. O. Colby, U. S. N., assistant; Lieut. John A. Shearman, U. S. N., assistant.	Hydrographic resurvey of Port Royal Entrance.
South Carolina	25	Establishment of a tidal station.	E. B. Latham, as istant	Establishment of a tidal station at Port Royal.
South Carolina, Florida, Arkansas, Georgia, District of Columbia, Massachusetts, and New York.	26	Telegraphic longitude determinations, etc.	C. H. Sinclair, assistant; G. R. Putnam, assistant; and Prof. John F. Hayford.	Telegraphic determinations of differences of longitude at Charleston, Key West, Atlanta, Little Rock, Washington, Cambridge, Ithaca, and incidental astronomical, magnetic, and gravity observations at the same points and also at South Boston and Newport.
Florida	27	Hydrography	Lieut. Robert G. Peck, U. S. N., assistant.	Completion of the hydrographic resurvey of Pensacola Bay and Entrance.
Alabama	28	Triangulation	F. W. Perkins, assistant	Continuation of the triangulation of the "oblique arc."
Florida, Alabama, Mississippi, and Louisiana.	29	Coast Pilot work	Ensign Glennie Tarbox, U. S N., assistant.	Hydrographic examinations along the Gulf Coast of the States named and collection of data and information for the Coast Pilot.
Kentucky, Indiana, and Illinois.	30	Magnetic observations.	R. L. Faris, assistant	Magnetic observations at Williamsburg, Lexington, Louisville, Vincennes, and Sandoval. (For other stations, see under Middle and Western Divisions.)
Kentucky and Tennessee.	31	Triangulation	Prof. A. H. Buchanan, acting assistant.	Continuation of the triangulation in northeastern Tennessee and southeastern Kentucky, and along the Kentucky, Virginia, and Tennessee State lines.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

II.—MIDDLE DIVISION—STATES AND TERRITORIES BETWEEN THE MISSISSIPPI RIVER AND THE ROCKY MOUNTAINS.

28. Minnesota.
29. North Dakota.
30. South Dakota.
31. Iowa.
32. Nebraska.
33. Missouri.
34. Kansas.
35. Arkansas.
36. Indian Territory.
37. Oklahoma Territory.
38. Louisiana.
39. Texas.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work, etc.
Louisiana	No. 32	Triangulation and base measure.	P. A. Welker, assistant	Triangulation of Lake Pontchartrain, and base measure at West End, a suburb of New Orleans.
Louisiana and Texas	33	Telegraphic longitude determinations, etc.	A. T. Mosman, assistant; G. R. Putnam, assistant.	Telegraphic determination of the difference of longitude between New Orleans and Austin, with incidental magnetic and gravity determinations.
Louisiana	34	Tidal observations	Officers of the Corps of Engineers, U. S. A.	Tabulation of the hourly ordinates for the calendar year 1895, furnished through the courtesy of the U. S. Engineer Corps.
Texas	35	Establishment of a tidal station.	E. B. Latham, assistant	Establishment of a tidal station at Point Isabel.
Arkansas	36	Telegraphic longitude determinations, etc.	C. H. Sinclair, assistant; G. R. Putnam, assistant.	Determination of the longitude of Little Rock; also incidental magnetic and gravity observations. (For other stations, see under head of Eastern Division.)
Kansas	37	Reconnaissance, triangulation, and base measure.	F. D. Granger, assistant	Continuation of the geodetic work on the transcontinental arc. The base is near Salina.
Missouri	38	Base-line examination.	A. L. Baldwin, assistant	Examination of a proposed base line near Versailles.
Kansas	39	Precise leveling	Isaac Winston, assistant	Continuation of the transcontinental line of precise levels—Holliday to Salina.
Missouri, Nebraska, North Dakota, and South Dakota.	40	Magnetic observations.	R. L. Faris, assistant	Magnetic determinations at St. Louis, Norfolk, Newport, Chadron, Yankton, Mitchell, Pierre, Aberdeen, Jamestown and Dickinson. (For other stations, see under heads of Eastern and Western Divisions.)

III.—WESTERN DIVISION—STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC.

40. California.
41. Oregon.
42. Washington.
43. Idaho.
44. Montana.
45. Wyoming.
46. Nevada.
47. Utah.
48. Colorado.
49. Arizona Territory.
50. New Mexico Territory.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work, etc.
California	No. 41	Topography, triangulation, etc.	A. F. Rodgers, assistant	Continuation of the topographic resurvey of San Francisco Bay and Harbor; trigonometric connection of new observatory with the old and with the California triangulation.
California	42	Hydrography	Lieut. Lucien Flynne, U. S. N., assistant; Lieut. A. P. Osborn, U. S. N., assistant.	Continuation of the hydrographic resurvey of San Francisco Bay and Harbor.
California	43	Hydrography	Lieut. James H. Sears, U. S. N., assistant.	Continuation of the hydrographic resurvey of San Francisco Bay and Harbor.
California	44	Hydrography	Lieut. A. P. Osborn, U. S. N., assistant.	Special hydrographic examination of Cuylers Harbor, San Miguel Island.
California	45	Topography	Ferdinand Westdahl	Special topographic examination of reported changes at Cuylers Harbor, San Miguel Island.
California	46	Tidal observations	Emmet Gray and Harris S. Ballard, observers, under the supervision of A. F. Rodgers, assistant.	Continuation of the tidal record at Sausalito tidal station.
California	47	Magnetic observations.	Fremont Morse, assistant	Magnetic observations at San Francisco and Monterey.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

III.—WESTERN DIVISION—STATES AND TERRITORIES BETWEEN THE ROCKY MOUNTAINS AND THE PACIFIC—Continued.

States.	Parties.	Operations.	Persons conducting operations.	Localities of work, etc.
Washington	No. 48	Topography	J. J. Gilbert, assistant	Continuation of the topographical survey of Washington Sound.
Colorado	49	Triangulation, etc	F. D. Granger, assistant	Continuation of the geodetic work on the transcontinental arc.
Colorado	50	Triangulation, etc	William Eimbeck, assistant	Continuation of the geodetic work on the transcontinental arc.
Utah	51	Triangulation, etc	William Eimbeck, assistant	Continuation of the geodetic work on the transcontinental arc.
Montana	52	Magnetic observations.	R. L. Faris, assistant	Magnetic determinations at Glendive, Miles City, Forsyth, Billings, Bozeman, Townsend, Helena, Cascade, and Fort Benton. (For other stations see under Eastern and Middle Divisions.)

IV.—THE DIVISION OF ALASKA, INCLUDING ITS COASTS BORDERING ON THE PACIFIC OCEAN, ON BERING SEA, AND ON THE ARCTIC OCEAN; ALSO ITS INLETS, SOUNDS, BAYS, RIVERS, AND THE ALEUTIAN AND PRIBILOF ISLANDS.

Territory.	Parties.	Operations.	Persons conducting operations.	Localities of work, etc.
Southeastern Alaska	No. 53	Hydrography and general surveys.	Lieut. Commander E. K. Moore, U. S. N., assistant.	Continuation of hydrographic and general surveys in Chatham and Peril Straits and adjacent bays and passages. The *Patterson* also furnished transportation at the close of the season to the civilian parties engaged on the Alaskan Boundary Survey.
Alaska	54	Chronometric longitude determinations, astronomical and magnetic observations.	Fremont Morse, assistant; Homer P. Ritter, assistant; F. A. Young, assistant; O. B. French, aid.	Chronometric determinations of differences of longitude at Sitka, Kadiak Island, and Unalaska; also astronomical and magnetic observations at the same points. Mr. Young in charge of transported chronometers and the others engaged on the observations.

The names of chiefs of parties engaged on the Alaska boundary work and the localities of their surveys will be found under the heading of "Special operations."

SPECIAL OPERATIONS.

States.	Parties.	Persons conducting operations.	Localities of work, etc.
Maine and Massachusetts.	No. 55	Lieut. Robert G. Peck, U. S. N., assistant.	Erection of beacons on the coasts of Maine and Massachussetts for use in laying out and marking a speed-trial course for the *Indiana* and *Katahdin*. Done in cooperation with the Navy Department at the latter's request.
New York	56	Lieut. Robert G. Peck, U. S. N., assistant.	Erection of beacons on the north shore of Long Island, for the Long Island Sound speed-trial course. Work done at the request of the Navy Department.
Maryland	57	John W. Donn, assistant	Special detailed topographic survey of the grounds of the Naval Academy at Annapolis. Work done at the request of the Navy Department.
Florida	58	Lieut. Robert G. Peck, U. S. N., assistant.	Special hydrographic examination of the Dry Tortugas deep-water anchorages and the channels leading thereto. Work done at the request of the Navy Department.
	59	A. T. Mosman, assistant, and member of the Boundary Commission.	Continuation of the office operations of the International Boundary Commission, appointed for the purpose of relocating and marking that portion of the boundary line between the United States and Mexico from El Paso to the Pacific Ocean.
California	60	Lieut. A. P. Osborn, U. S. N., assistant; Lieut. James H. Sears, U.S.N., assistant.	Laying out and marking a speed-trial course in the Santa Barbara Channel for the new battle ship *Oregon*. Work done under the supervision of Admiral L. A. Beardslee, U. S. N., president of the trial board, and at the request of the Navy Department.

Distribution of the field parties of the Coast and Geodetic Survey, etc.—Continued.

SPECIAL OPERATIONS—Continued.

States.	Parties.	Persons conducting operations.	Localities of work, etc.
California and Nevada	No. 61	C. H. Sinclair, assistant; W. B. Fairfield, assistant.	Continuation of the survey of the oblique boundary line between California and Nevada.
California and Washington.	62	Fremont Morse, assistant; S. S. Gannett, United States Geological Survey.	Cooperation with the United States Geological Survey in the determination of the difference of longitude between San Francisco and Ellensburg. Work done at the request of the Director of the United States Geological Survey.
Missouri and Iowa....	63	W. C. Hodgkins, assistant.	Examination of a portion of the boundary line between Missouri and Iowa. At the request of the Boundary Commissioners.
Southeastern Alaska and British Columbia.	64	E. F. Dickins, assistant; P. A. Welker, assistant; O. B. French, aid.	*Alaska Boundary Survey.*—Triangulation, topography, astronomical work, and chronometric determinations of differences of longitude. Astronomical stations located at Port Simpson, Mary Island, and the head of Portland Canal.
Washington..... ...	65	Fremont Morse, assistant.....	*Alaska Boundary Survey.*—Occupation of the Seattle astronomical station, in connection with the chronometric determination of Alaskan longitudes.
Southeastern Alaska and Washington.	66	F. A. Young, assistant.....	*Alaska Boundary Survey.*—Transportation of chronometers to and fro between Seattle and the Alaskan astronomical stations mentioned above.

TABLE No. 2–1896.

Statistics of field and office work of the Coast and Geodetic Survey for the fiscal year 1896, and total to June 30, 1896.

	Total to June 30, 1895.	During fiscal year 1896.	Total to June 30, 1896.
RECONNAISSANCE.			
Area in square statute miles	457 410	1 090	458 500
Parties, number of	.....	3	.....
BASE LINES.			
Primary, number of	16	.....	16
Primary, length of, in statute miles	105	.....	105
Subordinate, number of	166	4	170
Subordinate and beach measures, length of	659	11	670
TRIANGULATION.			
Area in square statute miles	314 070	10 725	324 795
Stations occupied for horizontal measures, number of	14 749	248	14 997
Geographical positions determined, number of	27 764	354	28 118
Stations occupied for vertical measures, number of	1 094	63	1 157
Elevations determined trigonometrically, number of	2 667	115	2 782
Heights of permanent bench marks by spirit leveling, number of	1 013	35	1 048
Lines of spirit leveling, length of, in statute miles	4 943	172	5 115
Triangulation and leveling parties, number of	.....	14	.....
ASTRONOMICAL WORK.			
Azimuth stations, number of	259	5	264
Latitude stations, number of	417	5	422
Longitude stations, telegraphic, number of	174	*11	177
Longitude stations, chronometric or lunar, number of	122	2	124
Astronomical parties, number of	.....	6	.....
MAGNETIC WORK.			
Stations occupied, number of	1 082	†94	1 124
Magnetic observatories occupied, number of	5	.....	5
Magnetic parties, number of	.....	7	.....
GRAVITY MEASURES.			
Home stations occupied, number of	54	5	59
Foreign stations occupied, number of	28	.....	28
Parties, number of	.....	1	.....

*Eight old stations. †Fifty-two old stations.

NOTE.—Old stations reoccupied are not again included in the totals.

Statistics of field and office work of the Coast and Geodetic Survey, etc.—Continued.

	Total to June 30, 1895.	During fiscal year 1896.	Total to June 30, 1896.
TOPOGRAPHY.			
Area surveyed, in square statute miles	38 047	*191	38 238
Length of general coast, in statute miles	11 258	345	11 603
Length of shore line, in statute miles, including rivers, creeks, and ponds	99 779	138	99 917
Length of roads, in statute miles	50 410	639	51 049
Topographical parties, number of	.....	10	.....
HYDROGRAPHY.			
Parties, number of, in charge of naval officers	.....	10	.....
Parties, number of, in charge of civilian officers	.....	0	.....
Number of miles (geographical) run while sounding	507 481	9 134	516 615
Area sounded, in square geographical miles	161 288	667	161 955
Miles run, additional, of outside or deep-sea soundings	92 955	.....	92 955
Number of soundings	21 834 932	434 314	22 269 246
Deep-sea soundings	13 270	.....	13 270
Deep-sea temperature observations	17 955	.....	17 955
Current stations, number of, occupied by hydrographic parties	.....	11	.....
Deep-sea current stations, number of	.....	0	.....
Deep-sea subcurrent observations, number of	.....	0	.....
Deep-sea surface current observations, number of	.....	0	.....
Specimens of bottom, number of	14 048	111	14 159
Automatic tide gauges established	108	3	111
Automatic tide gauges discontinued	103	2	105
Parties doing tidal work exclusively	.....	4	.....
Parties doing tidal work in connection with hydrographic work	.....	13	.....
Staff and box gauges established	2 352	78	2 430
Staff and box gauges discontinued	2 352	74	2 426
RECORDS.			
Tidal and current observations, originals, number of vols.	5 198	111	5 309
Tidal and current observations, duplicates, number of vols.	3 461	104	3 565
Aggregate years of record for automatic tide gauges	317	9	326
Tidal stations for which reductions have been made	1 712	32	1 744
Aggregate years of record reduced	341	11	352
Triangulation, originals, number of volumes	6 813	172	6 985
Triangulation, originals, number of cahiers	24	8	32
Astronomical observations, originals, number of volumes	2 239	57	2 296
Astronomical observations, originals, number of cahiers	6	2	8
Magnetic observations, originals, number of volumes	698	9	707
Magnetic observations, originals, number of cahiers	117	53	170
Pendulum observations, originals, number of volumes	22	2	24
Duplicates of above, number of volumes	7 573	192	7 765
Duplicates of above, number of cahiers	110	52	162
Geodetic leveling observations, number of vols., originals	88	78	166

*Not including topographical reconnaissance and special examinations in Alaska.

Statistics of field and office work of the Coast and Geodetic Survey, etc.—Continued.

	Total to June 30, 1895.	During fiscal year 1896.	Total to June 30, 1896.
RECORDS—continued.			
Geodetic leveling observations, number of vols., duplicates	89	46	135
Computations, number of volumes	4 395	5	4 400
Computations, number of cahiers	500	186	686
Hydrographic soundings and angles, originals, number of volumes	12 960	289	13 249
Hydrographic soundings and angles, duplicates, number of volumes	4 483	235	4 718
MAPS AND CHARTS.			
Topographic maps, originals	2 198	38	2 236
Hydrographic charts, originals	2 418	42	2 460
ENGRAVING.			
Engraved plates of charts	602	44	646
Engraved plates of preliminary charts and diagrams for the Coast and Geodetic Survey reports, and of maps of the District of Columbia	867	35	902
Engraved plates of Coast Pilot charts	80	.....	80
Engraved plates of Coast Pilot views	104	.....	104
Electrotype plates made	2 486	52	2 538
PRINTING.			
Sheets of charts and maps deposited with sale agents	505 973	27 372	533 345
Sheets of charts and maps sold at Coast and Geodetic Survey Office	.....	653	.....
Sheets of charts and maps distributed to Congress, Executive Departments, foreign Governments, libraries, etc	.....	36 516	.....
Sheets of charts and maps, total distribution	1 046 405	64 541	1 110 946

TABLE No. 3—1896.

Information furnished to Departments of the Government in reply to special requests, and to individuals upon application, during the fiscal year ending June 30, 1896.

Date.	Name.	Data furnished.
1895.		
July 1	U. S. Geological Survey, Washington, D. C.	Geographic positions and descriptions of 7 stations in New York.
1	Paul Babcock, Standard Oil Company, 26 Broadway, New York.	Information relative to the mean river level at Philadelphia, Pa.
5	C. L. Blackman, Waterbury, Conn.	Geographic position of Waterbury, Conn.
6	John Bliss & Co., 128 Front street, New York.	Manuscript copy of predicted times of high water for 1896 for 15 stations on the Atlantic coast of the United States.
8	E. F. D. Myers, president of Richmond, Fredericksburg and Potomac R. R.	Approximate heights of bench marks, from spirit leveling by the United States Coast and Geodetic Survey in 1875; also description of stations.
11	H. L. Whiting, Commissioner of the Massachusetts State Survey.	Abstract of angles and copy of 481 triangle sides within the limits of the State of Massachusetts.
15	J. L. Hill, Long Corner, Md.	Change in the magnetic declination between 1764 and 1895 in Howard County, Md.
17	Manager of the Western Union Telegraph Office, Austin, Tex.	Copy of results of telegraphic determination of difference of longitude between El Paso and Austin, Tex.
17	Fish, Game, and Forest Commission of New York.	Description of trigonometrical stations in the vicinity of Jamaica Bay, Long Island.
18	G. W. Roy, Norwich, N. Y.	Time of western elongation of Polaris for July 25, Aug. 1, 7, 13, and 19, 1895, in latitude 42° 30′ and longitude 75° 30′.
19	J. R. Bien, New York.	Remarks concerning geographical positions for a map of Pennsylvania.
19	D. E. Fox, attorney, Washington, D. C.	Three tracings from old maps of the region about Lake Pontchartrain, Louisiana.
19	Frederick Fisk, 87 Milk street, Boston, Mass.	Copy of tides observed in Charles River, Massachusetts, in 1863 and 1892.
20	Edward C. Doyle, secretary of the New York Fish, Game, and Forest Commission.	Tracing of shore line of Jamaica Bay, New York, with positions of triangulation points.
22	C. E. Hequembourg, Dunkirk, N. Y.	List of logarithmic tables ordinarily used in the computing division of the Coast and Geodetic Survey Office.
22	J. Y. McClintock, city engineer, Rochester, N. Y.	Information concerning tables of natural sines and tangents of more than 5 decimal places.
23	W. H. Brown, chief engineer Pennsylvania R. R. Co.	Height of bench mark at the United States Capitol.
24	J. Y. McClintock, city engineer, Rochester, N. Y.	Information relative to multiplying machines and 7 place tables of sines and tangents.
26	Frederick D. Fisk, Boston, Mass.	Tracing of replatting of soundings in Charles River, Mass., from hydrographic survey of 1847–1850.
29	F. E. Hoskins, Amagansett, N. Y.	Descriptions of bench marks at Fort Pond Bay and Montauk Point, New York.
29	Lieut. H. Chittenden, U. S. A., Columbus, Ohio.	Results of spirit levels; Appendix No. 11 of Report for 1892.
30	R. S. Southworth, Washington, D. C.	Magnetic declination at Washington, D. C., in 1895, and 3 magnetic pamphlets.
Aug. 1	Boston State Library.	Copy of bulletin containing the distribution of magnetic declination in Alaska in 1895.
2	F. B. Woodley, surveyor, Harpersville, Miss.	Table of secular variation of the magnetic declination in the region of central Mississippi between the years 1800 and 1900.
8	Dr. Max Doefflin, editor of New York Herald.	Four proof sheets of tide tables for 1896 for Governors Island, New York; also information relating to the tides in the vicinity of New York City.
9	T. U. Taylor, Batesville, Va.	Magnetic declination at Charlottesville, Va., in 1799 and at the present time.
9	Maj. W. Davis, U. S. A., Fort McIntosh, Tex.	Latitude and longitude of the astronomical station at Laredo, Tex.; also magnetic declination and its annual change for the same place.
10	M. Warner, C. E., Lake Pleasant, N. Y.	Geographical positions of Mount Hamilton and Mount Prospect, with distances, azimuths, and descriptions of stations.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
Aug. 12	Prof. Theodore G. White, Columbia College, New York	Eight nigrocine prints of topographical sheets of Mount Desert Island, Maine.
12	F. A. Jones, C. E., Independence, Mo.	Latitude, longitude, and elevation of the court-house at Independence, Mo.
13	W. A. Dodsworth, New York Journal of Commerce and Commercial Bulletin.	Proof sheets of tide tables for Governors Island, New York, and Sandy Hook, N. J., for the year 1896.
14	J. W. Votey, C. E., Burlington, Vt.	Geographical positions and descriptions of 8 trigonometrical stations of the Lake Champlain Survey.
15	A. A. Marshall, Archie, Mo.	Elevation of the bench mark at Archie, Mo., above the mean level of the Gulf of Mexico.
17	J. Dun, chief engineer Atchison, Topeka and Santa Fe R. R.	Elevations and descriptions of bench marks between Kansas City and Olathe, Kans.
17	W. S. Harshman, Nautical Almanac, U. S. Naval Observatory, Georgetown Heights, District of Columbia.	Proof sheets of tide tables for Astoria, Port Townsend, Sitka, St. Paul, Honolulu, Panama, San Diego, and San Francisco for the year 1896.
19	Prof. F. P. Leavenworth, University of Minnesota	Longitude and description of the Coast and Geodetic Survey astronomical station in the grounds of the University of Minnesota.
19	J. E. Turtle, assistant U. S. engineer, Warrington, Fla.	Tracing of Pensacola water front from the survey of 1894–95.
22	J. M. Nourse, surveyor, Manassas, Va.	Annual change of the magnetic declination in Prince William County, Va.
23	H. C. Lord, Columbus, Ohio	Height of union depot at Columbus, Ohio, above mean sea level.
23	F. A. Calvert, Washington, D. C	Descriptions of a number of bench marks in the District of Columbia.
27	J. P. Bogart, New Haven, Conn.	Descriptions of 5 triangulation stations in the vicinity of New Haven, Conn.
27	C. Rockwell, Portland, Oreg	Geographical positions of Mount Hood, Mount Rainier, Mount St. Helen, and Mount Adams.
30	Prof. W. H. Pegram, Trinity College, Durham, N. C	Information concerning the establishment of the port of Southport, N.C.
30	Lawrence Bradford, State Board of Health, Boston, Mass.	Tracing of high and low water lines of Salem Harbor, Massachusetts.
31	H. W. Frazer, engineer of the Meadow-land Improvement Co., Pine, Fla.	Information in regard to the difference between Atlantic and Gulf mean sea levels.
Sept. 4	J. R. Bien, New York	Geographical positions and descriptions of 4 stations on the Pennsylvania and West Virginia boundary line.
4	W. & L. E. Gurley, Troy, N. Y	Elevation of Mount Rafinesque.
4	W. H. Sims, Acting Secretary Department of the Interior, Washington, D. C.	Latitude and longitude of the astronomical station in Yellowstone Park, as determined by the Coast and Geodetic Survey in 1892.
5	E. A. Jones, Marlo, N. H	Information concerning the triangulation of New Hampshire; Appendix No. 8 of Report for 1885.
7	Riverside and Fort Lee Ferry Co., New York	Description of the 1871 bench mark at Ninety-sixth street, Hudson River, New York.
9	David E. Durie, Seattle, Wash	Description of the Seattle bench mark and results of tidal observations in 1875.
9	C. N. Dutton, Washington, D. C.	Information concerning charts of Lake Champlain; Appendix No. 7 of Report for 1887.
10	Commander W. H. Whiting, U. S. N., Pensacola, Fla.	Tracing of Pensacola Navy-Yard from original topographical sheets.
11	Wm. Elliott, Port Royal, S. C.	Times and heights of greatest tides at Hilton Head, Port Royal Sound, S. C., from Sept. 19 to 22 and from Oct. 16 to 20, 1895.
12	J. S. Burns, Wellfleet, Mass	Appendices 12, 1886, and 7, 1888, and other magnetic data.
12	J. R. Bien, New York	Approximate geographical position of Gettysburg, Pa.
13	I. W. Reagan, engineer, Fort Scott, Kans.	Longitude of the boundary line between Missouri and Kansas; also length of 1° of latitude and longitude in latitude 37° 38′ 39″.40.
14	J. P. Bogart, Commissioner of Fish and Fisheries, New Haven, Conn.	Changes of magnetic declination at Bridgeport, Conn., between 1845, 1865, and the present time.
14	Prof. W. H. Peagram, Trinity College, Durham, N. C.	A table for predicting times and heights of high and low water at Southport and Smithville, N. C.
19	The Honorable the Secretary of the Treasury, Washington, D. C.	Time and height of high and low water at Drum Point, Patuxent River, Md., for Sept. 20 and 21, 1895.
21	J. R. Bien, New York	Descriptions of trigonometrical stations in Pennsylvania.
21	W. W. Austin, Dublin, Ind.	Geographical position of Dublin, Ind.; magnetic declination of annual change at the same place; 2 magnetic pamphlets and 1 chart for 1895.
23	Prof. W. H. Peagram, Trinity College, Durham, N. C.	Lunatidal interval of high and low water for 14 stations, and a table for Moon's transit over the meridian of Greenwich.
23	D. Scully, surveyor, Austin, Nev.	Latitude, longitude, and elevation of Austin, Nev.; magnetic declination for 1895.
24	G. Bird, county surveyor, Harrisonville, Mo.	Geographical position and elevation of Harrisonville, Mo.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
Sept. 25	Lieut. Col. J. I. Rodgers, U. S. A., Fort Schuyler, N. Y.	Geographical positions, descriptions, and abstract of angles of 15 trigonometrical stations in the vicinity of Throgs Neck, New York.
27	Lieut. Col. J. I. Rodgers, U. S. A., Fort Schuyler, N. Y ...	Tracing of topography of Throgs Neck and vicinity, from original topographical sheets.
28	W. W. Austin, Dublin, Ind	Information concerning statute and nautical miles and annual change of magnetic declination.
30	J. W. Reagan, Fort Scott, Kans	Information concerning the meridional boundary line between Missouri and Kansas.
30	Commander W. H. Whiting, U. S. N., Pensacola, Fla...	Tracing of topography of region about Pensacola, Fla., from Bayou Grande to the Lagoon, from original topographical sheets.
Oct. 1	N. W. R. Straw, Gorham, Me	Elevations of Gorham, Me.; Melrose, Mass.; Highlands, Mass., and Wyoming, Mass.
2	M. A. Howe, Terre Haute, Ind.....	Magnetic declination at Terre Haute in 1874 and 1888, and annual change.
2	Prof. H. A. Gill, U. S. Commission of Fish and Fisheries.	Geographical positions and descriptions of 47 trigonometrical stations between Indian Lagoon and Light-House Point, Florida.
Oct. 3	E. P. Doyle, secretary New York Fish, Game, and Forest Commission.	A polyconic projection covering Jamaica Bay, New York, on a scale of 1-10 000.
4	Department of Marine and Fisheries, Ottawa, Canada.	Latest isogonic charts for the United States (1890) and for Alaska (1895).
4	John R. Freeman, Metropolitan Water Board, Boston, Mass.	Description of bench mark at Charleston Navy-Yard, and miscellaneous tidal information.
5	T. N. Taylor, Austin, Tex	Elevations of Humpback Mountain, Eliott Knob, and 10 other mountains in Virginia.
8	H. S. Dilworth, Centerville, Del.....	Changes in the magnetic declination in Newcastle County, Del., between 1831 and 1895, and the present rate of annual change.
15	Chas. A. Ives, attorney at law, Newport, R. I.....	Tracing of the topography of part of Conanicut Island, Rhode Island, from original topographical sheet.
15	C. M. Offley, assistant engineer, U. S. N	Value of gravity and length of seconds pendulum at latitude 45° and at Washington, D. C.; also weight of cubic inch of mercury.
16	S. R. Manning, Bloomville, Wis.....	Expressions for length of an arc of the parallel in any latitude.
17	O. A. Veazey, Dego, W. Va	Geographical positions and descriptions of 3 trigonometrical stations in West Virginia.
22	Commissioner of Fish and Fisheries, Washington, D. C.	Descriptions of 6 bench marks.
22	Lieut. F. V. Abbot, U. S. E., Charleston, S. C	Tracing of shore line and selected hydrography of the Cooper, Ashley, and Wando rivers, South Carolina, from original sheets.
23	A. C. Romig, county surveyor, Abilene, Kans	Geographical positions and descriptions of trigonometrical stations in Kansas; 2 appendixes on terrestrial magnetism.
29	Frank Butler, assistant treasurer W. U. B. Co., Texas ..	Approximate elevation of Cattle Pasture, Kimble County, Tex.
31	Harriman Bros., civil engineers and surveyors, Boston, Mass.	Geodetic data and descriptions of 7 trigonometrical stations in Penobscot Bay, Maine.
Nov. 4	S. W. O. Kennon, Intercontinental Railroad Commission, Washington, D. C.	Geographical position and elevation of a trigonometrical station in Connecticut.
5	E. S. Starr, Philadelphia, Pa	Geographical positions of towns in Pennsylvania, Maryland, and Virginia.
6	C. Barnes, Providence, R. I	Information concerning the magnetic intensity at Providence, R. I.
6	J. C. Alexander, Elkton, S. Dak	Information concerning the position of Mount St. Elias on the boundary between Alaska and British Columbia.
6	W. L. Barnes, Charlestown, Ind	Suggestions relative to the determination of the longitude of his observatory.
8	Sheldon Jackson, D. D., Bureau of Education, Washton, D. C.	Tracing showing the distribution of reindeer in Alaska.
14	Surgeon-General R. D. Murray, U. S. Marine-Hospital Service, Key West, Fla.	Tracing of the topography of Tortugas Harbor; tracing of outlines of Gulf of Mexico and West Indies, showing southern quarantine stations of the United States.
16	L. E. Cooley, Chicago, Ill	Heights of bench marks between New York and Albany; information concerning results of spirit leveling and tidal current observations in New York Bay and Harbor.
19	L. R. Risse, topographical engineer, New York	Geographical positions and determinations of 36 trigonometrical stations between Port Morris and New Rochelle, N. Y.
19	Department of Agriculture, Washington, D. C	Latitudes of 20 points in the State of Florida.
22	H. L. Whiting, Commissioner of the Massachusetts State Survey, Boston, Mass.	Values of the ratio of the metre and the foot adopted at different times.
25	R. E. Wysor, Dublin, Va	Two pamphlets on terrestrial magnetism; information concerning the annual change in magnetic declination at Dublin, Va.; reference to books on method of observing.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1895.		
Nov. 26	W. A. Gatbright, Dabneys, Va	Times of high water at Southport and Smithville, N. C., for Jan. 14, 15, 23, 24, 25, and 26, 1895.
27	S. M. Landry, U. S. Revenue-Cutter Service	Blue print of the mouth of Brazos River, Texas, from survey of 1891.
27	Lieut. Samuel Barber, U. S. A., chief signal officer, San Antonio, Tex.	Blue print from the reconnaissance for primary triangulation along the Rio Grande from Eagle Pass, Tex., to the Gulf of Mexico.
27	W. S. Dalrymple, C. E., New York	Information concerning trigonometrical points in the vicinity of New York, and in regard to methods of computation.
29	Lieut. S. Reber, U. S. A., Signal Service, San Antonio, Tex.	Descriptions of stations of the reconnaissance of the Rio Grande between Laredo and Brownsville; geographical positions of 2 stations; sketch of the reconnaissance.
29	Ladshaw & Ladshaw, civil engineers, Spartanburg, S. C.	Geographical positions and descriptions of 2 trigonometrical stations; in South Carolina; Appendices I and II, Report for 1891.
29	Geo. H. Adams, Boston, Mass	Appendices Nos. 12 of 1886, 7 of 1881, and 11 of 1889, and isogonic chart sent in response to request for information.
29	Jas. W. Reagan, Fort Scott, Kans	Geographical positions of 2 points on the Missouri and Kansas boundary line.
Dec. 2	Hyde & Sherry, civil engineers, Boston, Mass	Magnetic declination at Boston in 1895.
4	Chief of Engineers, U. S. A	Remarks concerning the relative variability of the level of the Gulf of Mexico and the Delta of the Mississippi River.
6	A. Spamer, Baltimore, Md	Geographical positions of 4 trigonometrical stations in the vicinity of Sparrow Point, Md.
7	Wm. S. Dalrymple, C. E., New York	Geographical positions of 23 trigonometrical stations in the vicinity of New York.
7	Verplanck Calvin, Adirondack Survey, Albany, N. Y.	Descriptions of 36 bench marks on the Erie and Champlain canals.
10	E. Garrison, Fremont, Mich	Three appendices and 2 charts illustrating the distribution of magnetic declination in the United States.
10	H. W. Buckman, Columbia Falls, Me	Magnetic declination at Eastport, Me., and instructions for getting the past declination in that locality from the series extending from 1600 to 1900, supplemented by a direct observation.
10	D. T. Lumley, C. E., Hartford, Conn	Table of culminations and elongations of Polaris, 1889 to 1910; 3 magnetic appendices.
12	Lieut. W. J. Glasgow, U. S. A., San Antonio, Tex	Blue print of the reconnaissance for primary triangulation along the Rio Grande from El Paso to the Gulf of Mexico.
13	Hydrographic Department of the Admiralty, London, England.	Information concerning the establishment of tidal stations on the west coast of Mexico.
14	Gen. John B. Turchin, Random, Ill	Blue print of the topographical survey of 1868 of Chattanooga and its approaches.
14	Prof. F. C. Schrader, Harvard University, Cambridge, Mass.	Three magnetic pamphlets, 2 isogonic charts of 1885, and 1 appendix relating to times of culmination and elongation of Polaris, 1889 to 1910.
19	W. B. Anderson, Andrew, Iowa	Secular variation of the magnetic declination at Dubuque; also information as to the horizontal and total intensity.
28	A. A. Scott, German Valley, N. Y	Table of azimuths of Polaris for any time in 1896.
31	W. G. Brown, Washington, D. C	Distances from Malvern Hill to Lexington, Va., and from Manassas to Lexington; elevation of Blue Ridge and Humpback.
1896.		
Jan. 2	A. Sylvester, Boston, Mass	Length of a geographical mile; also Appendix No. 12 of Report for 1881.
7	M. L. Vangan, Ellis, Va	Nine appendices on terrestrial magnetism.
8	District Commissioners' Office, Washington, D. C	Distance between Fort Totten and Hoover Hill.
8	F. P. Leavenworth, Minneapolis, Minn	Differences of longitude between Minneapolis, Minn.; Omaha, Nebr., and Madison, Wis.
9	U. S. Geological Survey, Washington, D. C	Positions of astronomical stations at Potosi and Ironton, Mo.
10	Wm. S. Dalrymple, assistant engineer, New York	Information concerning 2 bench marks at City Island, N. Y.
14	Chas. Acton Ives, attorney at law, Newport, R. I	Information concerning a bench mark at East Ferry, Jamestown, Conanicut Island, R. I.
14	F. F. Hathaway, Plattsburg, N. Y	Latitudes of Plattsburg, Ticonderoga, and Saratoga, N. Y.; distances between the same points.
15	Lieut. G. B. Harber, U. S. N., Washington, D. C	Information concerning extreme rise and fall of tides at Tacoma, Wash.
16	Henry R. Bryan, Newbern, N. C	Magnetic Appendices Nos. 7 of 1888 and 11 of 1889.
18	D. L. Wardroper, Atlanta, Ga	Geographical positions of 5 trigonometrical stations in the vicinity of Atlanta, Ga., and Chattanooga, Tenn.
15	W. S. Dalrymple, New York	Geographical positions of 3 trigonometrical stations near New York; and information relative to the Clarke and Bessel spheroids.
20	Department of public works, Philadelphia, Pa	Information as to experience with comptometers.
20	Lieut. Commander Jeff F. Moser, Washington, D. C	Description of a tidal bench mark at Beaufort River, South Carolina.
20	Lieut. Commander Richard Wainwright, U. S. N., Washington, D. C.	Tracing of vicinity of Government storehouse, Key West, Fla., from original hydrographic sheet of 1892.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1896.		
Jan. 21	Commissioners of Massachusetts State Survey, Boston, Mass.	Information concerning the connection of the Coast and Geodetic Survey triangulation of the Connecticut River Valley with the old Borden survey.
22	H. A. Brown, jr., Newbern, N. C	Table of magnetic declinations at Newbern from 1750 to 1900.
23	J. A. Holmes, State geologist of North Carolina	Geographical positions and descriptions of Hogback Mountain and Mitchells High Peak.
25	J. P. Bogart, C. E., New Haven, Conn	Specimen of computation of distance and azimuth from known geographical positions.
28	R. W. Luttrell, C. E., Galveston, Tex	Geographical positions of 7 stations of the triangulation in the vicinity of Galveston, Tex.; and information concerning the relation of the Clarke and Bessel spheroids for use in projections.
28	M. M. Weller, Cumberland, Md	Appendix No. 11 of Report for 1882, in response to application for information.
Feb. 1	Prof. Geo. Davidson, San Francisco, Cal	Tracing of Mission Bay Rock and vicinity from original hydrographic sheet of 1883.
1	D. E. Fox, attorney-at-law, Washington, D. C	Three tracings showing successive changes in the shore line of Aransas Pass, Tex., from 1853 to 1891.
1	E. E. Olcott, general manager Hudson River Line, Desbrosses street pier, New York.	Times and heights of tides at Fort Hamilton, N. Y., on Aug. 25, 26, and 27, 1895.
1	A. B. Benjamin, Stratford, Conn	The establishment of the port and mean range of tides at Stratford, Housatonic River, Conn.
1	Prof. H. G. Welty, College Park, Md	Magnetic declination at College Park, Md., for the years 1658, 1705, and 1896.
3	U. S. Geological Survey, Washington, D. C	Mean places of stars for latitude computation.
3	J. E. Turtle, U. S. Engineer's Office, Warrington, Fla	Description of the bench mark at Warrington Navy-Yard.
7	H. C. Roberts, Washington, D. C	Position of the geographical centre of the United States and remarks thereon.
7	C. C. Grove, Washington Loan and Trust Co	Geographical position and description of the trigonometrical station San Fernando, Cal.
7	Edward Jones, Cold Spring Harbor, Long Island	Magnetic declination at Cold Spring Harbor for the years 1722, 1845, and 1877.
8	E. D. Graves, chief engineer Middletown and Portland Bridge Co., Middletown, Conn.	Descriptions of the 2 tidal bench marks at Middletown and Hartford, Conn.
11	J. W. Reynolds, Peekskill, N. Y	Elevations of 3 bench marks at Dobbs Ferry and Peekskill, N. Y.
12	Lieut. W. V. Judson, U. S. E., Galveston, Tex	Description and elevation of the bench mark at Galveston, Tex.
12	J. E. Turtle, U. S. Engineer's Office, Warrington, Fla.	Tracing of shore line between Big Bayou and Bayou Chico, Florida, from original topographical sheets.
12	Josiah Pierce, Jr., Washington, D. C	Tracing showing changes in the shore line of Aransas Pass, Tex., from 1851 to 1853.
13	D. L. Wardroper, Atlanta, Ga	Description of the meridian line established by the Coast and Geodetic Survey in 1874 at Atlanta, Ga.
14	John N. Macomb, Jr., Lawrence, Kans	Elevations of 2 bench marks at Lawrence, Kans., above mean sea level of the Gulf of Mexico.
15	Prof. C. S. Downes, Cornell University, Ithaca, N. Y	References to tidal literature.
24	R. W. Luttrell, C. E., Galveston, Tex	Geographical positions of 7 trigonometrical stations on Galveston Bay.
24	W. G. Raymond, Troy, N. Y	Three pamphlets on terrestrial magnetism, in response to application for information.
24	Eastman, Gardiner & Co., Laurel, Jones County, Miss.	Magnetic declination in Jones County, Miss., for 1896; also rate of annual change in declination.
25	R. W. Luttrell, C. E., Galveston, Tex	Tracing and blue print of Galveston Bay from Highland Bayou to Red Bluff.
26	Hon. Melville Bull, M. C	Information as to the extent of the shore line of the State of Rhode Island.
26	Ladshaw & Ladshaw, Spartanburg, S. C	Two pamphlets on terrestrial magnetism and 2 copies of isogonic chart for 1885.
27	Frank A. Russell, Jacksonville, Fla	Elevations of Pueblo, Colo., Los Angeles, Cal., Phœnix, Ariz., and Santa Fe, N. Mex., above mean sea level.
27	Maj. H. C. Ripley, U. S. A., Galveston, Tex	Tracing of Aransas Pass, Tex., from original topographical sheet.
27	Hon. W. A. Jones, M. C., First district, Virginia	Tracing of Fox Islands, Chesapeake Bay, from original sheets, and computation of area.
Mar. 2	U. S. Geological Survey, Washington, D. C	Geographical position of Damascus Station, and of the North Carolina corner near the Virginia and North Carolina boundary.
2	Monroe Warner, Schuylerville, N. Y	Geographical position and description of Greenwich Station, New York, and advice respecting observations for latitude.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1896.		
Mar. 4	O. B. French, Washington, D. C	Eleven prints from negatives illustrating instruments used by the Coast and Geodetic Survey.
4	J. C. O'Connor, counselor-at-law, New York	Tracings of topography and hydrography from Long Island to Raineys Pond, Virginia.
5	Lieut. Col. W. H. H. Benyaurd, U. S. E., St. Augustine, Fla.	Geographical positions and descriptions of trigonometrical stations in the vicinity of Lake Worth, Fla.
7	Lieut. Col. W. H. H. Benyaurd, U. S. E., St. Augustine, Fla.	Geographical positions and descriptions of 32 trigonometrical stations in the vicinity of Biscayne Bay, Florida.
7	Col. P. C. Hains, U. S. E	Two papers on magnetism and declination, and information as to the annual change of declination at Baltimore, Md.
7	Lieut. Col. W. H. H. Benyaurd, U. S. E., St. Augustine, Fla.	Three tracings of topography and hydrography in the vicinity of Lake Worth, Fla., fron original sheets.
9	W. F. Wilcox, Ithaca, N. Y	Remarks on the proper methods of measuring areas on maps.
10	Col. G. S. Gillespie, U. S. E	Results of leveling up the Hudson River from Dobbs Ferry to Greenbush, and Appendix No. 14 of 1887.
11	Lieut. Col. W. H. H. Benyaurd, U. S. E., St. Augustine, Fla.	Description of 3 bench marks at Lake Worth, Miami River, and Cape Florida, Florida.
12	W. A. Gathright, Dabneys, Louisa County, Va	Times of high and low water at various points on the York River, Virginia.
12	J. L. Feller, Mount Olive, Va	Magnetic declination and its annual change at Washington, D. C.; also 2 pamphlets on terrestrial magnetism.
14	Capt. P. H. Cooper, U. S. N., Superintendent of Naval Academy, Annaoplis, Md.	Tracing of part of the original topographical sheet showing the resurvey of the Naval Academy Grounds.
17	W. L. Moore, Chief of Weather Bureau, Washington, D. C.	Geographical position and elevation above mean sea level of Pueblo, Colo.
20	Waldron Bates, counselor-at-law, Boston, Mass	Eight blue prints from tracings of original topographical sheets of Mount Desert Island, Maine.
24	O. S. Wilson, Buffalo, N. Y	Information relative to elevations at Buffalo, N. Y.
24	E. Howell, C. E., New Brunswick, N. J	Information relative to isogonic charts; secular magnetic variation at New Brunswick and Jamesburg, N. J.; Appendix No. 7 of Report for 1888.
25	D. J. Howell, Washington, D. C	Elevation of bench mark near Takoma Park, D. C.
25	Lieut. L. W. V. Kennon, U. S. A., Washington, D. C	Example of method of adjustment of a geometrical figure.
25	J. H. Goulding, Wilmington, Vt	Geographical position and elevation of trigonometrical station on Mount Haystack, Vermont, and bearings to surrounding mountains.
26	W. G. Yetter, surveyor and civil engineer, Catawissa, Pa.	Copies of magnetic reports of declination and secular change at Catawissa, Pa.
26	John Jameson, Hotel Hanover, Philadelphia, Pa	Information concerning currents in the Delaware River at and above Philadelphia, Pa.
27	L. E. Cooley, Chicago, Ill	Elevation of 24 bench marks between Albany, N. Y., and New York City.
28	George S. Wheeler, Bureau of Surveys, Philadelphia, Pa	Descriptions of the various bench marks at Philadelphia, Pa.
29	L. E. Cooley, Chicago, Ill	Description of 9 bench marks on the Champlain Canal, N. Y.
30	C. S. Noyes, attorney-at-law, New York	Tracing of topography of Rockaway Beach from original sheets of 1855-56.
Apr. 3	Leventritt & Nathan, attorneys and counselors-at-law, New York.	Height of the sea at noon on Aug. 29, 1892, at Sandy Hook, N. J., and Bath Beach, Long Island.
7	J. W. Sackett, Miama, Fla	Descriptions of bench marks at Cape Florida, Florida.
7	J. W. Morrison, Boston, Mass	Relative accuracy of certain trigonometrical stations in the vicinity of Boston, Mass.
7	Secretary of the Smithsonian Institution, Washington, D. C.	Geographical position of the Astrophysical Observatory in the Smithsonian Grounds.
8	Rear-Admiral J. R. Selfridge, U. S. N	Magnetic dip at Philadelphia in the year 1895.
9	U. S. Geological Survey, Washington, D. C	Elevations above sea level of the Gulf of Mexico of 2 bench marks at Fort Smith, Ark.
10	U. S. Navy Department, Washington, D. C	Geographical positions, descriptions, and triangle side computations of 27 trigonometrical stations on Santa Barbara Channel, California.
13	Mark Minto, Good Hope, D. C	Table of magnetic declinations at Suitland, Md., between the years 1792 and 1896.
13	F. M. Shields, Coopwood, Miss	Magnetic declination at Coopwood in 1833 and at the present time; annual magnetic change in 1896.
14	Lieut. Col. W. H. H. Benyaurd, U. S. E., St. Augustine, Fla.	Tracing of the hydrography and topography of Key Biscayne and vicinity, Florida, from original sheets.
14	Prof. J. B. Woodworth, Harvard University, Cambridge, Mass.	Photographic copy of topographical sheet of Gay Head, Marthas Vine yard, Mass.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1896.		
April 15	Lieut. Col. A. M. Damrell, U. S. E., Portland, Me.	Photographic copy of hydrography of Townsend Gut, Maine, from original sheet; copy of chart No. 315A.
16	J. P. Hall, New York Tribune office, New York	Present magnetic bearing of an old line run by compass in 1846, in Schuyler County, N. Y.
17	G. M. Donham, publisher of Maine State Yearbook, Portland, Me.	Predicted times of high and low water for Portland, Me., for the months of January, February, March, and April, 1897.
18	P. H. Grinter, mayor of Independence, Mo	Descriptions of the bench marks at Little Blue and Summit, Jackson County, Mo., and their elevations above mean level of the Gulf of Mexico.
20	Maj. J. H. Willard, U. S. E., Little Rock, Ark	Descriptions of bench marks on the line from Little Rock to Fort Smith, Ark., and their elevations above mean level of the Gulf of Mexico.
20	Chas. A. Metcalf, Salem, Mass	Descriptions of bench marks on Salem Neck, Massachusetts, with reference to plane of mean low water.
20	H. J. Ritchie, president St. Augustine and South Beach R. R., St. Augustine, Fla.	Information in regard to the tidal differences for St. Augustine given in the Tide Tables for 1896.
21	A. S. Parsons, treasurer Cambridgeport Diary Co., Cambridgeport, Mass.	Predictions of tides at San Diego, Cal.; Port Townsend, Wash.; Sitka, Alaska; Astoria, Oreg., and San Francisco, Cal., for the year 1897.
23	W. W. Austin, Dublin, Ind	Approximate geographical position of Johnstown, Cambria County, Pa.
24	Maj. W. H. Hener, U. S. E	Results of spirit leveling between Pittsburg and Marietta, and descriptions of bench marks along the route.
24	A. M. Ford, Salem, N. J	Explanation of method of deducing mean lunatidal intervals from the harmonic constants.
27	Maj. J. B. Quinne, U. S. E	Geographical positions and descriptions of 9 trigonometrical stations in the vicinity of Sabine Pass, Texas and Louisiana.
27	L. B. Hamilton, C. E., Torrington, Conn	Information concerning the magnetic declination and its annual change at Torrington, Conn.
28	U. S. Geological Survey, Washington, D. C	Geographical position and description of the astronomical station at Spokane Falls, Wash.
28	W. L. Barnes, Charlestown, Ind	Information respecting magnetic observations at Charlestown, Ind., and the annual change of declination; also 3 magnet pamphlets.
May 4	District Commissioners' Office, Washington, D. C	Description of a bench mark near Fort Reno, D. C., and its elevation above mean sea level.
4	C. E. Chandler, C. E., Norwich, Conn	Table of secular changes of magnetic declination at New London, Conn.; also Appendices Nos. 7 of 1888 and 11 of 1889.
4	Geo. W. Stadley & Co., Boston, Mass	Photographic copy of topography of Little Nahant, Massachusetts, from original sheet of the latest survey.
5	R. De Loss, Little Rock, Ark	Magnetic declination and annual change at Little Rock, Ark.
5	Commissioners of Massachusetts State Survey, Boston, Mass.	Descriptions of 10 triangulation stations in Rhode Island, Connecticut, New Hampshire, and Massachusetts.
9	U. S. Geological Survey, Washington, D. C	Geographical positions and descriptions of Hamilton and Mount Speculator trigonometrical stations, New York.
9	Prof. Geo. Davidson, San Francisco, Cal	Photographic copy of part of the original topographical sheet covering Monterey, Cal., and showing the location of batteries.
11	W. B. Getchell, city engineer, Augusta, Me	Information and data in regard to bench marks on the Kennebec River, Maine.
11	Scofield & Starr, Bridgeport, Conn	Appendix No. 8 of Report for 1888.
11	John Cruch, Campton, Ky	Appendices Nos. 7 of 1888 and 11 of 1889.
13	U. S. Geological Survey, Washington, D. C	Descriptions of 2 and elevations of 6 stations in West Virginia.
14	U. S. Geological Survey, Washington, D. C	Geographical position and description of Mount Anthony, Vermont.
15	J. D. Mocquot, Paducah, Ky	Mean solar local time for Paducah when standard time is 2 p. m.
15	Hon. Geo. W. McBride, U. S. Senate	Tracing of hydrography of Commencement Bay, Washington, from original sheet of 1892.
16	J. B. Leonard, Sevenmile Ford, Va	Table of magnetic declination between the years 1790 and 1900; example illustrating its use; 2 magnetic pamphlets.
19	U. S. Geological Survey, Washington, D. C	Geographical positions of 13 trigonometrical stations in the vicinity of the St. Albans base, West Virginia.
19	Prof. Geo. Davidson, San Francisco, Cal	Geographical positions and descriptions of 3 stations in Monterey Harbor, California.
19	U. S. Geological Survey, Washington, D. C	Descriptions of bench marks in Coos Bay, Oregon.
21	Berlin H. Wright, Penn Yan, N. Y	Information in regard to tidal data for stations in the Gulf of Mexico.
21	Massachusetts State Survey, Boston, Mass	Descriptions of trigonometrical stations Faunce and Russell in New Bedford, Mass.
23	Capt. O. M. Carter, U. S. E., Savannah, Ga	Blue prints of hydrography of Savannah River from head of Elba Island to the sea, from original sheets of 1875.

Information furnished to Departments of the Government in reply to special requests, etc.—Continued.

Date.	Name.	Data furnished.
1896.		
May 23	W. F. Wilcox, Ithaca, N. Y.	Information as to the proper manner of measuring the area of a country from its maps.
27	U. S. Geological Survey, Washington, D. C.	Description and elevation of a bench mark at Greenbush, N. Y.
28	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of trigonometrical stations Apple, Jennings, Durens, Hall, and Seay, in Tennessee.
28	Capt. O. M. Carter, U. S. E., Savannah, Ga.	Statement in regard to tidal data at Fort Pulaski and Savannah, Ga.
29	J. H. Young, Philadelphia, Pa.	Nigrocene prints of 2 original topographic sheets showing the Philadelphia water front.
29	U. S. Geological Survey, Washington, D. C.	Geographical positions of 31 trigonometrical stations on the Columbia River, Washington and Oregon.
29	T. M. Belk, Dixie, S. C.	Table of changes of magnetic declination between the years 1750 and 1900, applicable to the region of northwestern South Carolina; also 2 pamphlets on terrestrial magnetism.
June 1	W. A. Dodsworth, New York.	Copy of advance proofs of tide tables for 1897 for Governors Island, New York, and Sandy Hook, N. J.
1	H. F. Gunnison, Brooklyn Daily Eagle, Brooklyn, N. Y.	Copy of advance proofs of tide tables for 1897 for Governors Island, New York; Sandy Hook, N. J.; New London, Conn., and Willets Point, N. Y.; also data for constructing a tide table for Oyster Bay and Greenport, N. Y.
2	Capt. O. M. Carter, U. S. E., Savannah, Ga.	Duplicate of 3 volumes of tidal observations at Savannah and Fort Pulaski, Ga., in 1851–52.
2	Prof. J. E. Davies, University of Wisconsin, Madison, Wis.	Geographical positions and distances of 5 trigonometrical stations in the vicinity of Madison, Wis.
2	C. A. Campbell & Co., Boston Mass.	Copy of part of the hydrographic sheet of New Bedford Harbor, enlarged to scale of 1-2 500.
3	Bogart & Sperry, New Haven, Conn.	Bromide print of part of the topographical sheet of New Haven, Conn.
3	W. L. Barnes, Charlestown, Ind.	Geographical position of Louisville, Ky., and Appendices Nos. 8 of 1881 and 1 of 1891.
5	R. Keith, Philadelphia, Pa.	Copy of advance proofs of tide tables for 1897.
8	C. A. Marye, Richmond, Va.	Projection covering Pungoteague Beach, Virginia, for locating oyster beds.
11	Prof. Geo. Davidson, San Francisco, Cal.	Magnetic declination at Mount Conness, and its annual change; also approximate value of the declination at Mount Whitney.
12	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of trigonometrical stations Deseret, Ibepah, Ogden Peak, Mount Nebo, and Scipio.
15	U. S. Geological Survey, Washington, D. C.	Geographical positions and descriptions of 2 trigonometrical stations in Alabama and Georgia.
15	Thos. H. Kane, New York.	Information in regard to spirit leveling and magnetic declination; 8 appendices.
15	E. R. Sharwood, Philadelphia, Pa.	Tide tables for the port of Philadelphia and Delaware Bay and River.
17	W. S. Harstman, Nautical Almanac Office, U. S. Naval Observatory, Washington, D. C.	Copy of advance proofs of the tide tables for the Pacific Coast for the year 1897.
17	Kiggins and Tooker Co., New York.	Copy of advance proofs of tide tables for 1897 for San Francisco, Cal.; San Diego, Cal.; Astoria, Oreg., and Port Townsend, Wash.
17	W. Bates, Boston, Mass.	Magnetic declination for 2 places in the vicinity of Mount Desert Island, Maine.
18	J. A. Bullock, Bullock, Granville County, N. C.	Table of magnetic declinations for Granville County, N. C., and adjacent region, between the years 1750 and 1900; also present rate of annual change, and the declination change since 1780.
18	Dr. Max Doerffling, editor New York Herald, New York.	Copy of advance proofs of 1897 tide tables for Governors Island, New York, and Sandy Hook, N. J.
18	A. S. Parsons, treasurer Cambridgeport Diary Co., Cambridgeport, Mass.	Copy of advance proofs of 1897 tide tables for stations on the Pacific Coast.
19	Bogart & Sperry, New Haven, Conn.	Tracings of parts of original topographical sheets Nos. 76 and 1296 of New Haven, Conn.
23	Lieut. G. P. Howell, U. S. E., Fort Washington.	Bromide print of part of original topographical sheet of the vicinity of Sheridans Point.
24	W. S. Harshman, Nautical Almanac Office, Washington, D. C.	Copy of advance proofs of 1897 tide tables for Honolulu, Hawaiian Islands.
26	T. S. & J. D. Negus, New York.	Copy of advance proofs of 1897 tide tables for Governors Island, New York, and Sandy Hook, N. J.
30	Maj. W. R. Livermore, engineer Second light-house district, Boston, Mass.	Geographical positions of 3 light-houses in Buzzards Bay, Massachusetts; distance and azimuth between Clark and Palmer lights, Massachusetts.

OFFICE REPORT NO. 1—1895.

REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

UNITED STATES COAST AND GEODETIC SURVEY OFFICE,
Washington, D. C., June 30, 1896.

SIR: I beg leave to submit herewith the annual reports of the chiefs of the divisions of this Office, which was placed under my charge at the beginning of the fiscal year.

Mr. E. D. Preston was Acting Assistant in Charge from the middle of September to the end of October, during my absence in Europe while attending the meetings of the International Geodetic Association as United States delegate by appointment of the President.

The computing division has been continued under the able direction of Assistant C. A. Schott. I beg leave to call especial attention to the fact that the computations relating to the transcontinental arc have been advanced as far as practicable. Among the numerous reports submitted is a new discussion of the secular variation of the magnetic force in the United States and adjacent parts which has appeared as Appendix No. 1 of the Annual Report for 1895. He also completed the collection of observed magnetic declinations with a view to publishing a new isogonic chart for the epoch January 1900.

The tidal division was under the charge of Mr. L. P. Shidy until the middle of July when Assistant E. B. Latham was put in charge. The latter was relieved in February and was succeeded by Assistant H. L. Marindin who had charge from March 5 to the end of the fiscal year.

I beg leave to refer to the report of Mr. Marindin for the details of the highly important work accomplished in this division through the zealous labors of its members. Great attention has been paid to perfecting the tide tables, which in their present form reflect credit, not only on the labors of this Office, but, owing to their general usefulness to mariners engaged in the world's commerce, on the country at large. The tidal division acknowledges its indebtedness to the Corps of Engineers, United States Army, for their cooperation in securing tidal data, and also to foreign tidal offices.

The drawing and engraving division was under the efficient direction of Assistant W. W. Duffield during the whole of the fiscal year. The consolidation of the two divisions under one head has relieved the Assistant in Charge of the Office of the necessity of coordinating the labors of two separate divisions, and has therefore simplified the Office routine. Attention is called to the unusually large output of charts.

The chart division has remained under the systematic and energetic administration of Assistant Gershom Bradford, who has, in addition to the regular duties of his office, made many valuable suggestions to the chart board in preparing schemes for the publication of charts.

The instrument division has been under the charge of Assistant J. F. Pratt. The construction of the Reedy Island tidal indicator, provided for by act of Congress, was intrusted to Mr. Pratt, who not only personally directed its construction but its erection on the site selected for it. He also designed and superintended the construction of a photographic enlarging apparatus.

The miscellaneous division was under the charge of Mr. W. P. Ramsey. In addition to the

duties previously performed in this division the additional one of keeping all the accounts relating to Office expenses and of making the purchases was transferred to it at the beginning of the fiscal year.

The division of library and archives has been under the direction of Mr. H. Sidney King, who makes various recommendations in regard to work to be done in the division under his charge.

The reports without exception commend the services of the employees, and in this connection I beg leave to advert to the faithful services rendered by Mr. A. B. Simons, clerk to the Assistant in Charge, Mr. E. B. Wills, Miss Sophie Hein, and Miss Kate Lawn, who have served in the immediate office of the Assistant in Charge.

Assistants W. C. Hodgkins and E. B. Latham reported to me for special duty during the year. The former was engaged in special examinations relating to the Alaska Boundary and the latter in extending to 1896 the bibliography of the Survey as given in Appendix No. 11, Report for 1891.

Yours, very respectfully,

O. H. TITTMANN,
Assistant in Charge of the Office.

Gen. W. W. DUFFIELD,
Superintendent U. S. Coast and Geodetic Survey.

REPORT OF THE COMPUTING DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

COMPUTING DIVISION, *June 30, 1896.*

SIR: In conformity with the regulations of the Survey, I have the honor to submit herewith the annual report of the work done in the computing division of the Office during the fiscal year ending June 30, 1896.

The charge of the division has remained with the undersigned, the number of computers is the same as in the past year, and the computing division received temporary assistance during part of the year as follows:

The services of J. Pawling were dispensed with September 30, 1895, F. W. Clay taking the place vacated by him on October 22, 1895; J. B. Boutelle reported for duty in the division September 12, 1895, and remained to the close of the fiscal year; D. Hurley was attached to the division up to February 4, 1896. The following members of the field force were temporarily engaged in the division: E. B. Latham on five days in July, 1895; H. G. Ogden throughout the year; H. P. Ritter seven days in August, 1895, and between October 14, 1895, and March 2, 1896; H. C. Denson between November 8 and December 30, 1895, and from May 6 to June 16, 1896; F. D. Granger between January 24 and April 10, 1896; and I. Winston between May 1 and June 10, 1896. There was also temporarily attached to the division B. A. Lynch between October 2 and 26, 1895.

The duties devolved upon me as chief of the division include the direction of the work and distributing the same among the computers according to their special qualifications, and the timing of it to secure cooperation; also the examination and reporting of the results and the preparation of data or information required by official correspondence and relating to this division, also the supplying the charts with notes respecting names of observers and magnetic data. These duties were promptly attended to, and time was found to collect and tabulate the results of gravity researches from pendulum observations made by the Survey during the interval 1873–1895 for transmission to the International Geodetic Association in response to a call made; also to prepare for the same association a colored map showing the state of the work of triangulation in the United States up to date. I have also submitted the manuscript of a new discussion of the secular variation of the magnetic force in the United States and adjacent parts, forming Appendix No. 1 in the Annual Report for 1895, and completed the collection of observed magnetic declinations with a view of publishing a new isogonic chart for the epoch January, 1900. I have also made the following computations: The azimuth observed at Camp Davidson, Alaska, 1891; the longitude of the same camp from observations of occultations and an eclipse; the length of the secondary base line

at Tavaputs, Colorado, 1891; the time and latitude observations made by J. E. McGrath at McQuestens Post, and upon the Forty Mile Creek, Alaska, 1890–91. I have advanced the comparison of the astronomic and geodetic latitudes and azimuths of the transcontinental triangulation, and introduced the correction for variation in latitude in conformity with Dr. Chandler's researches, applying the same to observations made between 1889 and 1895, for which period the data are tolerably certain. Among reports made, the following may deserve special mention: On the geodetic position of Camp Davidson, Alaska, and the intersections of the international boundary of the Yukon River and the Forty Mile Creek in this vicinity; on the chronometric difference of longitude between Seattle, Wash., and Port Simpson, British Columbia, and between Port Simpson and Lion Point, Portland Channel (or canal), British Columbia, and on the results of the survey of this channel.

A condensed specification of the work done by each computer during the fiscal year is herewith presented. It is made up from the daily and monthly reports submitted during the year.

Edward H. Courtenay was engaged in the computations and adjustments of the following triangulations: Yukon River, Alaska, 1889–1891; Chilkat, Chilkoot, and Taiya inlets and rivers, Alaska, 1894; Port Simpson to Mary Island, Alaska, 1895; Portland Channel (or Canal), Alaska, 1888 and 1895; coast of Louisiana and Texas, 1848–90. He also attended to a number of miscellaneous geodetic computations, supplied data required for field parties, had charge of the geographical registers and of the registers of the duplicate astronomic, geodetic, and magnetic records, and assisted in the preparation of the annual geodetic statistics of the Survey. He supervised, in part, the work performed by the computers, C. Kummell, J. Pawling, and F. W. Clay, and assisted others in the performance of their work.

Myrick H. Doolittle computed and adjusted the measures of horizontal directions at the following primary stations on the transcontinental triangulation: Waas, Utah, 1893; Tavaputs, 1891; Mount Treasury, 1893–1895; Mount Elbert, 1894; Mount Ouray, 1894; Bison, 1894; Plateau, 1894–95; Pikes Peak, 1895; and Uncompahgre, 1895, Colorado. He also computed and adjusted the main triangulation in western Kansas and eastern Colorado, between La Crosse, Hays, and Arapahoe, and between Arapahoe and Pikes Peak; part of the work involved the solution of 41 normal equations; computed and adjusted the primary triangulation between Mount Ellen, Utah, and Pikes Peak, Colorado; computed the secondary positions within the same regions between Mount Ellen and Pikes Peak, 1891–1895; adjusted the auxiliary triangulations about Tavaputs, Colorado, 1891, and about Grand Junction, Colo., 1895; computed some secondary positions in Utah, 1889–1892, and commenced the tabulation of resulting vertical angles in California as part of the work of the transcontinental triangulation.

Charles H. Kummell computed apparent places of stars for latitude work, prepared abstracts of horizontal angles, and computed geographic positions of stations of the Portland Canal, Alaska, and of recent triangulation on Long Island, New York. He was also engaged on miscellaneous geodetic computations and revisions and in solving normal equations connected with figure adjustments of secondary triangulation.

John B. Boutelle, since September 12, 1895, was principally engaged in attending to the geographical registers and to the miscellaneous clerical work of the division, copying reports on the results of field work and manuscript for the Superintendent's Annual Report, preparing descriptions of stations and other miscellaneous information for use in the field work of the Survey and by other parties. He also computed the adjustment and computation of the triangulation of Connecticut River, 1891; the triangulation in connection with the speed-trial course, Long Island Sound, 1894; the triangulation about Nantucket, 1893–94; also the Delaware River, 1891, and the triangulation of the Hudson River, vicinity of Poughkeepsie, of 1854, 1857, 1858, and 1895. He also attended to various miscellaneous computations and revisions.

Daniel L. Hazard computed the following telegraphic differences of longitudes: Yuma, Ariz., and San Diego, Cal.; Yuma and Los Angeles, Cal.; Yuma and Nogales, Ariz.; Nogales and El Paso, Tex., all in 1892. El Paso and Little Rock, Ark., in 1893; San Francisco, Cal., and Eugene, Oreg., in 1894; Needles, Cal., and Santa Fe, N. Mex., in 1895; El Paso and Santa Fe in 1895; computed transits and moon culminations for longitude of Camp Davidson, 1889–1891; astronomic observations on Forty Mile Creek; the traverse line of the Yukon River between Camp Davidson and

McQuesten's Post, and the traverse line of the Forty Mile Creek up to the boundary line, Alaska; the chronometric difference of longitude between Seattle, Wash., and Port Simpson, British Columbia, and between Port Simpson and Lion Point, British Columbia, and between Port Simpson and Mary Island; and the latitude of Camp Davidson. He also computed the azimuths at Port Simpson, 1895; and two azimuths on the California and Nevada oblique boundary line of 1894–95; and the magnetic observations of 1895 and part of 1896 observed by Smith, Baylor, Buchanan, and other observers. Mr. Hazard also assisted me in bringing up the magnetic observations of the country from their latest date to the epoch 1900, and computed the following astronomic azimuths: Mount Nebo, 1887; Ogden Peak, 1888, in Utah; Pilot Peak, 1889, in Nevada; Ibepah, 1889; Wasatch, 1890; Patmos Head, 1890; Ogden Station, 1891; Waddoup, 1892; Promontory, 1892; Deseret, 1892; Antelope, 1892, in Utah; Mount Ellen, 1891; Tavaputs, 1891; Mount Waas, 1893, Mount Ouray, 1894, Mount Treasury, 1893, Gunnison, 1893, Pikes Peak, 1895, Grand Junction, 1895, in Colorado; Russell Southeast Base, Kansas, 1893; and Salt Lake City, Utah, 1893. He also assisted in proof reading for Annual Report. I again desire to call attention to the great amount of work performed by this computer.

Harry F. Flynn was principally engaged in astronomic latitude computations. The locations were as follows: Lion Point and Fort Simpson, British Columbia, 1895; Mary Island, Alaska, 1895; Cape May, N. J., 1891; Carson City, Nev., 1893; Adams, Kans., 1888; Mount Waas, 1893; Deseret, 1892; Waddoup, 1892; Promontory, 1892, all in Utah; Gunnison, 1893; Grand Junction, 1886; Mount Treasury, 1893, and Mount Ouray, 1894, all in Colorado. He revised and tabulated the results of spirit leveling in the vicinity of Kansas City and certain localities in New York and in Missouri, computed the traverse line of the Forty Mile Creek, Alaska, read proof of part of the Annual Report of the Superintendent, made miscellaneous magnetic computations, and prepared all mean places of stars for latitude work.

Lilian Pike assisted in the computations for latitudes, preparing apparent places of stars and computing the micrometric values; computed geographical positions and heights on the Stikene River, Alaska, 1893; reduced spirit levels in the vicinity of Kansas City, Mo., 1891; attended to miscellaneous computations and to the preparation of magnetic tables needed for the reduction of the declinations to the epoch 1900.

Jesse Pawling computed the tertiary triangulation on the Hudson River of Assistant J. W. Donn in 1894, attended to miscellaneous revisions and geodetic work, and assisted in the computations of the tidal division.

Francis W. Clay was engaged in the computations of the triangulation about Mary Island, Alaska, 1895; revised abstracts of horizontal directions; computed geographic positions on the Yukon River, Alaska, near the boundary; revised geodetic levels and prepared route diagram; assisted in the preparation of magnetic charts and in plotting positions of magnetic stations and performing various miscellaneous duties of computation, revision, and duplication.

Daniel Hurley attended to clerical duties, principally to the copying of descriptions of stations for field parties.

The following members of the field or other parties were temporarily engaged in the computing division:

Herbert G. Ogden was engaged in the computations of spirit levels in Missouri and Kansas; computed the triangulation of Yukon River, vicinity of Camp Davidson, Alaska, 1889–1891; computed apparent places of stars for latitudes; computed and adjusted the triangulation of Possession Sound, Washington, 1884–85; deduced the length of the 30-mile trial-speed course, Santa Barbara Channel, 1896; and attended to some miscellaneous geodetic work.

Homer P. Ritter assisted in the computation of the triangulation of Yukon River near the boundary, 1890–91; computed the line of spirit levels, New York to Albany, 1894; computed geographic positions of the Chilkat and Chilkoot inlets and rivers, Alaska, 1894; and attended to miscellaneous matters.

Buford A. Lynch was engaged in preparing duplicates of descriptions of stations and other miscellaneous matter.

Hugh C. Denson was engaged in the reduction of the line of spirit levelings between Richmond and Washington, D. C.

Frank D. Granger was engaged in the solution of equations and in computations of geographical positions.

Isaac Winston was engaged in preparing results of spirit leveling for publication.

Yours, respectfully,

CHAS. A. SCHOTT,
Assistant in Charge of Computing Division.

Mr. O. H. TITTMANN,
Assistant in Charge of Office.

REPORT OF THE TIDAL DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

TIDAL DIVISION, *June 30, 1896.*

SIR: I have the honor to submit the following report of the tidal division for the fiscal year ending June 30, 1896:

The Tide Tables for 1896 were read and revised in proof. The corresponding volume for 1897, which is similar in form to that of the preceding year, was prepared for publication, and all but 31 pages of it was read and revised in proof within the year. The predictions for 1897 have been strengthened at a number of stations by extending the analysis of observations wherever practicable, and several hundred new stations were added to the list of subordinate points. Full predictions were made for the first time for Willets Point, N. Y., where the tides have an average range of more than 7 feet, and which, from its position at the entrance to the East River, seemed a desirable addition. The full predictions for Marseilles, France, were discontinued because, having a tide of only about half a foot mean range, it was considered of no practical importance to navigation. The predictions for Savannah Entrance, Georgia, which were formerly given for Fort Pulaski, are now given for Tybee Island Light, because we have better observations there. The predictions for San Francisco, Cal., which were formerly given for North Beach, are now given for Fort Point, in the Golden Gate, as being nearer the bar, and because our tidal observations were made there. The table of sunrise and sunset has been extended so as to contain 81 degrees instead of 63 degrees of latitude in each hemisphere, and the times of rising and setting are given for every fifth instead of every seventh day.

The work of preparing the tide tables for 1898 was taken up as soon as the tables for 1897 were out of the way, and predictions have been made for 28 stations.

Harmonic analyses have been made from a year each of hourly ordinates at Willets Point, N. Y.; Biloxi, Miss.; Port Eads, La.; Mazatlan, Mexico; Sheerness, England, and Cape Town, Africa. At Baltimore, Md., a year of high and low waters has been analyzed. For St. Johns, Newfoundland; Vera Cruz, Mexico, and St. Michael, Alaska, short series of hourly ordinates were reduced. The total work done on the harmonic analyses during the year is the equivalent of the complete analysis of about eight years of continuous records.

The nonharmonic reductions completed during the year consist of 22 series, the equivalent of about three years of continuous observations.

A table of the coefficients for correcting the uneliminated effect of one harmonic component upon another has been computed for series of 16 different lengths, varying from about a month up to one year. These coefficients will be of more especial use for short series, but will improve the results from even a whole year of harmonic analysis.

The proof of sheets of Appendix No. 7, Report for 1894, constituting Part III of a Manual of Tides, was read and revised. The preparation of Parts I and II of this Manual has been continued. It is expected that these two parts will be completed in time to constitute an appendix to the Report for 1896.

The location of all tidal stations, where a year or more of observations has been obtained, was indicated upon a base chart by symbols denoting series of various lengths.

Tide notes have been prepared and furnished for 182 stations on 60 charts.

Requisitions from 16 field parties have been filled, requiring the description of 61 bench marks and tidal data for 17 stations.

Tidal information has been called for by 55 persons not connected with the Survey, the response to which required the preparation of 35 descriptions of bench marks, current tables for 6 stations, and tidal data for 106 stations, together with technical letters explaining tidal phenomena.

An aggregate of about eight and one-half years of record from automatic tide gauges has been received, examined, and registered. There were 111 original and 104 duplicate volumes of tidal observations made by hydrographic parties with staff and box gauges received, examined, and registered during the year. About two years of tabulated hourly heights of the sea, high and low waters, temperature and density of the sea, and meteorological data were received.

Continuation of the tidal record at the automatic gauge station at Willets Point, Long Island, N. Y.—The automatic tide gauge established July 1, 1891, at Willets Point, Long Island, N. Y., has been kept in successful operation by the kind supervision of officers of the Corps of Engineers, U. S. A., stationed at that point.

The record for March, 1896, was lost because of ice, and at the request of the officer in charge the series was discontinued early in June, 1896. The observers were Lieuts. R. R. Raymond and William H. Brown, U. S. A.

Automatic tide gauge and tide indicator maintained in operation at Fort Hamilton, The Narrows, New York Harbor.—The automatic tide gauge and tide indicator established in December, 1892, and in May, 1893, on the wharf of Fort Hamilton, New York Harbor, by the permission of the commanding officer of the fort, have been kept in successful operation during the fiscal year. The gauge and indicator have been in charge of Mr. J. G. Spaulding throughout the year.

Automatic tide gauge and tide indicator established at Reedy Island Quarantine Station, Delaware.—An automatic tide gauge and tide indicator were established at Reedy Island Quarantine Station, Delaware, in January, 1896, and continued in successful operation to the close of the fiscal year.

The gauge and indicator are under the direction of Dr. A. H. Glennan, surgeon Marine-Hospital Service, with Mr. Harry Hehl as observer. The tide indicator is similar to the one at The Narrows, New York Harbor, described in Notice to Mariners, No. 177, for February, 1894.

Continuation of the tidal record at the automatic gauge station at Washington (navy-yard), D. C.—A continuous record has been obtained for the fiscal year from the automatic tide gauge established in July, 1891, at Washington (navy-yard), D. C. The gauge has been kept in operation by members of the tidal division of the Office, Assistant Henry L. Marindin, chief of the division.

Continuation of the tidal record at Fort Sumter, Charleston Harbor, South Carolina.—The automatic tide gauge established in March, 1894, at Fort Sumter, Charleston Harbor, South Carolina, has been kept in successful operation by the supervision of officers of the Corps of Engineers, U. S. A., stationed at the fort.

The record is generally kept by the officer in charge until tabulated for use in the harbor improvements, and then the original is sent to this Office to keep. During the fiscal year we have received the record from March 17, 1894, to March 1, 1896.

Automatic tide gauge established at Port Royal Naval Station, South Carolina.—An automatic tide gauge was established at Port Royal Naval Station, South Carolina, in April 1896, by the permission of the commanding officer of the station. The gauge has been in charge of Mr. B. W. Weeks, who has kept it in successful operation to the close of the fiscal year.

Tidal observations from Port Eads, La.—The Corps of Engineers, U. S. A., kindly loaned us the record from their automatic tidal gauge at Port Eads, La., for the calendar year 1895, from which we take tabulated hourly ordinates.

Automatic tide gauge established at Brazos Santiago Light-House, Texas.—An automatic tide gauge was established at Brazos Santiago Light-House, Texas, in March, 1896. This gauge was located inside of a narrow and shallow passage leading to a large lagoon. The range of tide was only about half a foot, so that the station was discontinued June 26, 1896. The gauge was in charge of Mr. William Anderson.

Continuation of the tidal record at the automatic gauge station at Sausalito, Cal.—The automatic tide gauge station at Sausalito, Cal., which was begun in February, 1877, has been kept in

successful operation during the fiscal year under the direction of Assistant A. F. Rodgers. The observers were Mr. E. Gray and Mr. H. S. Ballard.

Automatic tide gauge at Honolulu, Hawaiian Islands.—Through the courtesy of the Hawaiian Government Survey this Office has been furnished, during the fiscal year, with tracings from the automatic tide gauge at Honolulu, Hawaiian Islands, from July 1, 1894, to March 31, 1896, making a continuous record since June 16, 1891. Mr. Curtis J. Lyons has been in charge of the gauge.

Tidal observations from Yokohama, Japan.—In response to our request for tidal observations the Japanese Government has furnished us with quarter-hourly readings from its automatic tide gauge at Yokohama for the calender year 1893.

Tidal and current observations from the Admiralty, London, England.—In reply to our request the Admiralty sent us a copy of their tidal and current observations in Seymour Narrows, British Columbia, made in 1894 and 1895.

Tidal observations from the Service Hydrographique de la Marine, Paris, France.—In reply to our request the hydrographic office sent us harmonic constants for Brest and St. Servan, together with hourly ordinates of the tide at Havre for the month of February, 1896.

Tidal and current observations registered and reductions made in the tidal division for the fiscal year 1896.

Hydrography.	Total to June 30, 1895.	During fiscal year 1896.	Total to June 30, 1896.
Automatic tide gauges established	108	3	111
Automatic tide gauges discontinued	103	2	105
Parties doing tidal work exclusively	.....	4	.....
Parties doing tidal work in connection with hydrographic work	.....	13	.....
Staff and box gauges established	2 352	78	2 430
Staff and box gauges discontinued	2 352	74	2 426
RECORDS.			
Tidal and current observations, originals, volumes	5 198	111	5 309
Tidal and current observations, duplicates, volumes	3 461	104	3 565
Aggregate years of record from automatic gauges	317	9	326
Tidal stations for which reductions have been made	1 712	32	1 744
Aggregate years of record reduced	341	11	352

The following persons were employed in this division for the periods given:

Assistant E. B. Latham, July 18, 1895, to February 24, 1896.
Assistant H. L. Marindin, March 5, 1896, to June 30, 1896.
Mr. L. P. Shidy, the whole year.
Mr. F. M. Little, the whole year.
Mr. R. A. Harris, the whole year.
Miss Alice G. Reville, the whole year.
Mrs. Virginia Harrison, the whole year.
Mr. D. S. Bliss, the whole year.
Miss Gertrude P. Harrison, July 1 to November 30, 1895.
Mr. F. C. Kendrick, July 1 to 31, 1895.
Mr. B. A. Lynch, August 1 to September 30, 1895.
Mr. Jesse Pawling, August 24 to 31, 1895.
Mr. John Dale, August 26 to 31, 1895.
Miss Sophie Hein, August 26 to 31, 1895.
Mr. Ernest Whitehead, January 18 to June 30, 1896.
Mr. Daniel Hurley, February 5 to June 30, 1896.
Mr. James A. Dorsey, messenger, July 1, 1895, to April 21, 1896, and May 19 to 26, 1896.

The following aids were temporarily assigned to this division for the periods mentioned:

Mr. A. F. Zust, December 19, 1895, to June 30, 1896.
Mr. H. C. Denson, December 19, 1895, to May 5, 1896.

In conclusion permit me to renew the recommendation of the report of the preceding year, that

provision be made for at least two additional computers at $900 per annum. We have a great mass of accumulated tidal records which can not be used for the benefit of navigation unless the working force of this division is increased.

It gives me pleasure to state that during the time I have been in charge of the division its members have been industrious and zealous in the discharge of their duty.

Respectfully, yours,

HENRY L. MARINDIN,
Assistant in Charge of the Tidal Division.

Mr. O. H. TITTMANN,
Assistant in Charge of the Office.

REPORT OF THE DRAWING AND ENGRAVING DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

DRAWING AND ENGRAVING DIVISION, *June 30, 1896.*

SIR: I have the honor to submit the annual report of the drawing and engraving division for the fiscal year ending June 30, 1896.

SECTION NO. 1.

DRAWING.

The changes in the personnel have been as follows:

Mr. W. R. Doores resigned his position as a draftsman November 22, 1895.

Mr. J. T. Watkins was appointed a draftsman, duly certified by the Civil Service Commission, December 18, 1895, and was transferred to the Hydrographic Inspector's office for duty February 1, 1896.

Mr. C. V. Martin reported for duty as a draftsman on April 15, 1896, having been duly certified by the Civil Service Commission.

Otherwise the force is what it was in previous years.

Mr. A. Lindenkohl has been employed in collecting information, correcting and revising the charts from recent surveys, constructing projections on copper plates, correcting progress sketches for the Annual Report, and making chart showing isothermal lines of the Gulf of Mexico; Mr. H. Lindenkohl in reductions and drawings for charts to be published by engraving or by photolithography, and correcting progress sketches for the Annual Report; Mr. E. H. Fowler in reduction of surveys for engraving or photolithographs, and in construction of projections for field parties, preparing schemes for the District Survey for engraving, and tracing of the Alaska boundary for the photolithographer; Mr. E. J. Sommer in preparing atlas for the Alaska Boundary Commission, constructing map of southeast Alaska, and on computation and adjustment of work in southeast Alaska, and progress sketches for the Annual Report; Mr. D. M. Hildreth on drawings for charts to be published by photolithography, making projections for field parties, compiling topographical sheet of the Yukon River and Forty Mile Creek; Mr. C. H. Deetz on drawings for charts to be published by photolithography, and bringing up to date the diagrams of the original topographical sheets, correcting progress sketches for the Annual Report, replatting old hydrography, and clerical work; Mr. E. P. Ellis on drawings of charts for photolithographing, temperature and specific gravity charts, Gulf of Mexico, and letter tracings; Mr. Paul Von Erichsen in inking original topographical sheets and sheets of the Alaska Boundary Atlas, temperature and specific gravity charts, tracings of triangulation sketches, and measuring areas; Mr. W. R. Doores on drawings of new charts for photolithographing, and making tracings for outside parties, and lettering sheets of the Alaska Boundary Atlas. Mr. Doores resigned his position on November 22, 1895, and went to the War Department as a draftsman in the Engineer Service. Mr. C. Mahon on clerical work. Mr. J. T. Watkins was employed in making copies of progress sketches and sketches for the Annual Report. Mr. C. V. Martin has been employed in making a tracing of the northeastern water boundary and on diagrams of hydrographic sheets.

During the year the following drawings have been commenced for engraving on plates or photolithographing, viz:

Chart No.	Title.	Scale.
246	New edition Boston Harbor	1-20 000
263	Oyster River Point to Milford, Conn	1-10 000
259	Madison to Guilford	1-10 000
445	Charleston and vicinity	1-20 000
258	Clinton Harbor and approaches	1-10 000
	Atlas of the Alaska Boundary Commission, 13 sheets and index diagram	1-160 000
8214	Saginaw and Security bays, Alaska	1-10 000
337	Boston Harbor	1-40 000
8074	Harbors of Dixon Entrance and Clarence Strait	1-20 000
257	Cornfield Point to Duck Island	1-10 000
473	San Carlos Bay and Caloosa River	1-40 000
6140	Columbia River Entrance	1-40 000
5705	Caspar Anchorage	1-10 000
9375	St. Michael Bay, Alaska	1-20 000
5706	Noyo Anchorage and approaches	1-10 000
490	Pensacola Entrance	1-30 000
8160	Zarembo Island, Alaska	1-80 000
6003	Umpqua River, Oregon	1-20 000
5126	Santa Barbara Island, California.	
281	Hudson River	1-40 000
8075	Revillagegido Channel, Alaska	1-80 000
	Map of southeastern Alaska	1-800 000

During the year drawings have been completed for photolithographing or engraving as follows:

Chart No.	Title.	Chart No.	Title.
246	Boston Harbor.	445	Charleston Harbor and vicinity.
263	Oyster Bay Point to Milford.	473	San Carlos Bay and Caloosa River.
259	Madison to Guilford.	9375	St. Michael Bay.
258	Clinton Harbor and approaches.	5705	Caspar Anchorage and approaches.
257	Cornfield Point to Duck Island.		Map of southeastern Alaska.
6140	Columbia River Entrance.	5706	Noyo Anchorage and approaches.
8074	Harbors of Dixon Entrance and Clarence Strait.	5126	Santa Barbara Island.
		5971	Coquille River Entrance, Oregon.

Fourteen drawings were made for publication, illustrating the Annual Report.

Nine section maps of the District of Columbia have been verified for engraving.

Thirteen topographic and 29 hydrographic projections were constructed for field parties. A large number of original plane-table sheets have been inked and prepared for registration. The registration of the photolithograph work has been continued in this division for the fiscal year ending June 30, 1896.

Thirteen new charts, 16 new editions, and 2 reprints were furnished during the year, making an aggregate of 9 124 sheets, together with sheets Nos. 1 to 13, inclusive, and index diagram of the Alaska Boundary Atlas, making 14 maps of 100 copies each, 1 400; also current chart of Hell Gate, New York, 500 copies, and special proofs of base map and different triangulation sketches, aggregating 320 copies, for distribution; making in all 11 344 prints furnished by photolithography for the chart room.

The following information was furnished to outside parties:

July 16, 1895: Mr. Fox, attorney; three tracings from old maps of region of Lake Pontchartrain, Louisiana.

July 20, 1895: Mr. Edward C. Doyle, secretary of New York Fish, Game, and Forest Commission; tracing of Jamaica Bay, with triangulation points.

July 26, 1895: Mr. Frederick D. Fish, Boston, Mass.; tracing of replatting of soundings of Charles River by Lieuts. Davis and McBlair, 1847–1850.

August 12, 1895: Mr. Theodore G. White, Columbia College, New York; nigrosene prints of topographical sheets of Mount Desert Island, Maine.

August 19, 1895: United States Engineers, J. E. Turtle, assistant engineer, Warrenton, Fla.; tracing of Pensacola water front from survey of 1894–95.

August 30, 1895: Mr. Laurence Bradford, assistant, State Board of Health, Boston, Mass.; tracing of high and low water line, Salem Harbor, Massachusetts.

September 10, 1895: Commander W. H. Whiting, U. S. N., Pensacola, Fla.; tracing of Pensacola Navy-Yard, from topographical sheets Nos. 1895 and 2189.

September 27, 1895: Lieut. Col. John G. Rodgers, Fort Schuyler, N. Y.; tracing of Throgs Neck and vicinity, from topographical sheets Nos. 1515 and 1725.

September 30, 1895: Commander W. H. Whiting, U. S. N., Pensacola, Fla.; tracing of region about Pensacola, Fla., from Bayou Grande to the Lagoon, from topographical sheets Nos. 2187 and 2189.

October 3, 1895: E. P. Doyle, secretary of the New York Fish, Game, and Forest Commission, New York City; projection covering Jamaica Bay, New York.

October 15, 1895: Charles Acton Ives, attorney at law, Newport, R. I.; tracing of part of Conanicut Island, Rhode Island, from topographical sheet No. 1119.

October 22, 1895: Lieut. F. V. Abbot, United States Engineers, Charleston, S. C.; tracing of selected hydrography and shore line of the Ashley, Cooper, and Wando rivers, South Carolina.

November 8, 1895: Sheldon Jackson, D. D., Bureau of Education; tracing showing the distribution of reindeer in Alaska.

November 14, 1895: Surgeon-General R. D. Murray, United States Marine-Hospital Service, Key West, Fla.; tracing of Tortugas Harbor and tracings of the Gulf of Mexico and West Indies, showing southern quarantine stations of the United States.

November 27, 1895: S. M. Landry, second lieutenant, United States Revenue-Cutter Service; blue print of mouth of Brazos River, Texas, surveyed in 1891.

November 27, 1895: Samuel Barber, first lieutenant Signal Corps, chief signal office, San Antonio, Tex.; blue print of a reconnaissance for primary triangulation along the Rio Grande, from Eagle Pass, Tex., to the Gulf of Mexico, in 1894.

December 4, 1895: Gen. John B. Turchin, Random, Ill.; blue print of topographical sheet No. 926, Chattanooga and its approaches, surveyed in 1863.

December 12, 1895: W. J. Glasgow, second lieutenant First Cavalry, aid-de-camp, acting engineer officer, San Antonio, Tex.; blue print reconnaissance for primary triangulation along the Rio Grande, from El Paso to the Gulf of Mexico, in 1894.

January 20, 1896: Richard Wainwright, lieutenant commander United States Navy, Washington, D. C.; tracing of the vicinity of Government storehouse, Key West, Fla.; from hydrographic sheet No. 1518, and sketch by hydrographic party in 1892.

February 1, 1896: Prof. George Davidson, San Francisco, Cal.; tracing of Mission Bay Rock and vicinity, from hydrographic sheet No. 1883.

February 1, 1896: Mr. E. D. Fox, attorney at law, Washington, D. C.; three tracings showing successive changes in shore line of Aransas Pass, Tex., from 1853 to 1891.

February 12, 1896: J. E. Turtle, assistant engineer, United States engineer's office, Warrington, Fla.; tracing of shore line between Big Bayou and Bayou Chico, Florida, from topographical sheets Nos. 1895 and 1894.

February 11, 1896: Josiah Pierce, jr., No. 1323 Massachusetts avenue, Washington, D. C.; tracing showing changes in shore line of Aransas Pass, Tex., 1851 to 1853.

February 14, 1896: Capt. P. H. Cooper, Superintendent Naval Academy; tracing of part of sheet 1896, resurvey of the Naval Academy Grounds.

February 14 and 25, 1896: R. W. Luttrell, civil engineer, Galveston, Tex.; tracing and blue print of Galveston Bay, from Highland Bayou to Red Bluff.

February 20, 1896: Prof. George Davidson, San Francisco, Cal.; blue print of topographical sheet of Yukon River and Forty Mile Creek, Alaska.

February 26, 1896: Hon Melville Bull, M. C.; extent of shore line of Rhode Island.

February 27, 1896: Maj. H. C. Ripley, Galveston, Tex.; tracing of Aransas Pass; from topographical sheet No. 823.

February 27, 1896: Hon. W. A. Jones, M. C., First district of Virginia; tracing of Fox Islands, Chesapeake Bay, and computed area.

March 4, 1896: Mr. O. B. French, aid, Coast and Geodetic Survey, Washington, D. C.; eleven prints from negatives, of instruments used by the Survey.

March 4, 1896: J. C. O'Conor, counselor at law, New York; tracing of topography and hydrography from Long Island to Raineys Pond, Virginia.

March 7, 1896: Lieutenant-Colonel Benyaurd, Corps of Engineers, St. Augustine, Fla.; three tracings of topography and hydrography, vicinity of Lake Worth, Fla.

March 14, 1896: Capt. P. H. Cooper, Superintendent Naval Academy; tracing of part of sheet 1896, resurvey of the Naval Academy Grounds.

March 20, 1896: Mr. Waldren Bates, counselor at law, Boston, Mass.; eight blue prints from tracings of topographical sheet of Mount Desert Island, Maine.

March 30, 1896: Mr. C. S. Noyes, attorney at law, New York; tracing of Rockaway Beach, from surveys in 1855–56.

April 14, 1896: Lieut. Col. W. H. H. Benyaurd, Corps of Engineers, St. Augustine, Fla.; tracing of the hydrography and topography around Key Biscayne and vicinity, Florida, from the original sheets.

April 3, 1896: J. B. Woodworth, Harvard University, Cambridge, Mass.; photographic copy of topographic sheet of Gay Head, Marthas Vineyard, Mass.

April 15, 1896: Lieut. Col. A. M. Damrell, Corps of Engineers, Portland, Me.; photographic copy of hydrography of Townsend Gut, Maine; also copy of chart 315 (a).

May 4, 1896: George W. Stadley & Co., Boston, Mass.; photographic copy of Little Nahant, Massachusetts, from latest surveys.

May 19, 1896: Prof. George Davidson, San Francisco, Cal.; photographic copy of part of topographical sheet No. 357, covering town of Monterey and showing location of batteries.

May 15, 1896: Senator George W. McBride; tracing of hydrographic sheet of Commencement Bay, Washington, survey of 1892.

May 20, 1896: G. H. Young, Philadelphia, Pa.; nigrosene prints of topographical sheets Nos. 2144 and 2144 (2), Philadelphia water front.

May 23, 1896: Capt. O. M. Carter, Corps United States Engineers, U. S. A.; blue prints of hydrography of Savannah River, 1875, from head of Elba Island to the sea.

June 2, 1896: C. A. Campbell & Co., Boston, Mass.; copy of part of hydrographic sheet, New Bedford Harbor, enlarged to scale of 1–2 500.

June 3, 1896: Bogart & Sperry, New Haven, Conn.; bromide print of part of topographical sheet No. 1447 (a), New Haven, Conn.

June 8, 1896: C. A. Marye, Richmond, Va.; projection of Pungoteague Beach, Virginia, for locating oyster beds.

June 12 and 19, 1896: Bogart & Sperry, New Haven, Conn.; tracing of parts of topographical sheets Nos. 76 and 1296, New Haven, Conn.

June 23, 1896: Lieutenant Howell, Corps of United States Engineers, Fort Washington; one bromide print of part of topographical sheet No. 947, vicinity of Sheridans Point, scale 1–15 000.

SECTION NO. 2.

ENGRAVING.

Number of new charts completed	11
Number of new editions of charts completed	33
Number of sketches and illustrations completed	2
Number of new printing plates reissued	1
Number of section maps of the District of Columbia (four plates each)	32
Number of new charts commenced	19
Number of new editions of charts commenced	25
Number of sketches and illustrations	2
Number of section maps of the District of Columbia commenced (four plates each)	48
Number of printing plates reissue commenced	1
Number of chart plates corrected for printing	488
Number of chart plates printed for chart division	1 058
Number of sketches and illustrations corrected for printing	17
Number of plates in progress during the year not completed	23

Number of unfinished plates on hand at the close of the year, viz:		
New charts		23
New editions of charts		6
Sketches and illustrations		53

ELECTROTYPING.

Number of pounds of copper deposited		1 689½
Number of square inches of surface on which deposited		62 495
Number of plates made, viz:		
Bassos	28	
Altos	24	
	—	52

Of this number, one basso plate was made for the Hydrographic Office, Navy Department.

PHOTOGRAPHING.

Number of negatives made		123
Number of blue prints made		683
Number of silver prints made		214
Number of bromide prints made		210
Number of nigrosene prints made		17
Number of chronograph scales		4

PRINTING.

Number of charts delivered to chart division		59 409
Number of impressions for chart division	60 008	
Number of impressions for Assistant in Charge of the Office	1 344	
Number of impressions for the District of Columbia Survey	4 112	
Number of impressions for engraving division	592	
Number of impressions for lithographer's transfer proofs	146	
Total number of impressions		66 202

The force of engravers has remained as reported in the Annual Report, June 30, 1895.

The old or expert engravers have been employed, as heretofore stated, on the branches of work which they have made specialties, with the exception of such interruption as was necessary through the corrections arising from resurveys, and work necessary to prepare the plates for publication. This fiscal year has been an exception in this character of work, for most of the important charts have been corrected from surveys made by the United States Engineers, involving a great deal of change, not only in the work itself but also in notes to give the necessary credit for the work.

In this particular it has been of great advantage to the engraving division, for where a reduction of new work has been needed to advance a plate for publication, the work or reduction has been made with the least possible delay, and as a consequence we have saved time and been enabled to give the latest information on the charts before they were published. There is no question that, for the good of the service, the consolidation of the two divisions was just what was needed to enhance the value of our work and improve the general condition of the charts.

Contracts were awarded to R. F. Bartle & Co., June 28, 1895, for engraving outlines, hydrography, topography, etc., on 10 charts, as follows, the work to be completed within two years:

Chart No.	Title.	Scale.
362	New Haven Harbor, Connecticut	1–20 000
200	Vermilion Bay to Pecan Island	1–80 000
271	Rye Neck to New Rochelle	1–10 000
247	Hyannis Harbor	1–20 000
5525	Mare Island Strait	1–10 000
6185	Willapa Bay	1–40 000
6303	Port Angelis	1–10 000
353 (2)	Newport Harbor	1–20 000
213	Nantucket Shoals	1–80 000
8240	Sitka Sound, Alaska	1–80 000

During this fiscal year they have completed four charts, viz:

Chart No.	Title.	Scale.
200	Vermilion Bay to Pecan Island	1–80 000
271	Rye Neck to New Rochelle	1–10 000
274	Hyannis Harbor	1–20 000
353 (2)	Newport Harbor	1–20 000

They also completed eight sheets of the topographical map of the District of Columbia, in all 32 plates; also progress sketch No. 16, Nevada and Utah, scale 1–1 000 000.

Although the requisitions for printing from the chart division during the latter part of the fiscal year decreased to such an extent that the presses did not have more than half the work to keep them up to full time, yet the average through the year was by far in excess of any previous years, viz, by about 14 000 copies for the chart division. This is mainly due to the management of Mr. D. N. Hoover, the foreman in charge.

The personnel of the printing rooms was changed during the year for the good of the service, as follows:

Richard S. Bright, printer, was transferred to the Bureau of Engraving and Printing September 12, 1895, and James L. Smith, printer, was transferred from that Bureau to the Office September 13, 1895, in place of Mr. Bright.

W. M. Conn was appointed as a printer's help July 15, 1895.

William H. Waddington, printer's help, was dismissed January 31, 1896, for cause, and Charles Buckingham, employed on temporary roll, was appointed in his place.

Richard J. Fondren was appointed February 7, 1896, as a laborer, and detailed to printing rooms as a help during the time when there was a great deal of work to be done.

The electrotype and photograph rooms, under the management of Mr. Louis P. Keyser, have been very properly carried on and have been very successful in the development of all kinds of work that required intelligent and businesslike capacity.

The general work of the divisions has been performed by Mr. John H. Smoot, clerk, in his usual acceptable manner.

The correspondence and detail work connected with photolithographing was performed by Mr. John H. Hobgood in a very satisfactory manner until he was transferred to the General Post-Office Department March 20, 1896. He was succeeded by Mr. Arthur H. Bailey on the 16th of April, 1896, who was duly certified by the Civil Service Commission, and has displayed fine ability in conducting the business assigned to him, and in a manner highly acceptable to the Office.

It gives me much pleasure to testify to the general interest taken in the work in both divisions by the employees, and to their close attention to their respective duties.

Respectfully submitted.

WILL WARD DUFFIELD,
Assistant in Charge of the Drawing and Engraving Division.

Mr. O. H. TITTMANN,
Assistant in Charge of the Office.

REPORT OF THE CHART DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

CHART DIVISION, *June 30, 1896.*

SIR: I have the honor to submit the following report of the chart division for the fiscal year ending June 30, 1896:

This division has been under my charge during the year, and the following-named persons have been attached to it, whose general duties have been as noted:

Miss L. A. Mapes, bookkeeping and correspondence.

Mr. H. R. Garland, issuing and correcting charts.

Mr. A. G. Randall, correcting charts.
Mr. Neil Bryant, receiving and stamping charts.
Miss M. L. Handlan, coloring charts.
Mrs. H. S. Graves, coloring charts.
Mr. Archie Upperman, mounting sheets and joining charts.
Mr. Preston Boisseau, messenger.

The changes in the force have been as follows:

Mrs. H. S. Graves, assigned to the division July 10.
Mr. Preston Boisseau, transferred April 25.

With the exception of Mr. Boisseau, whose duties as messenger have, since his transfer, been performed by detail from the Office, the persons above mentioned are still on duty.

The following table represents in brief the more important features of the relation of the chart issue of this year to that of the seven years next preceding:

Comparison of issues of charts during the fiscal years noted.

Year.	Total.		Free distribution.		Gross sales.*		Net sales.*	
	Copies.	Values.	Copies.	Values.	Copies.	Values.	Copies.	Values.
1889.....	49 312	$20 096	21 088	$8 266	28 224	$11 830	26 540	$11 280
1890.....	63 152	26 178	30 112	12 121	33 040	14 057	31 806	13 575
1891.....	52 959	23 457	20 811	8 846	32 148	14 611	28 473	13 141
1892.....	52 675	23 041	23 451	9 831	29 224	13 209	27 214	12 506
1893.....	55 026	24 215	27 310	11 805	27 716	12 409	25 366	11 605
1894.....	51 671	22 476	27 702	11 845	23 969	10 631	21 230	9 595
1895.....	51 456	22 280	24 892	10 507	26 564	11 773	23 136	10 405
1896.....	64 541	26 440	36 516	14 037	28 025	12 403	25 278	11 249

* Commission to sales agents not deducted.

The total issue is 25 per cent larger than that of last year and 20 per cent larger than the average of the previous seven years. The net sales (gross sales less copies returned by sales agents) have increased 9 per cent in copies and 8 per cent in value as compared with the previous year, and are 4 per cent less in copies and value than the average of the previous seven years. The net sales show a steady decrease from 1890 to 1894, and have increased since at about the same ratio.

The distribution of charts to libraries has been continued, and the large number sent accounts to a considerable degree for the exceptionally large total issue this year.

The new edition of the chart catalogue has been prepared, and its publication is expected in the near future. The edition of 1894 is exhausted, about 1 000 copies having been distributed during the year.

The correspondence for the year amounted to 2 719 letters written.

There have been delivered to this division for issue during the past year 50 new charts and maps from copperplate, and 15 new lithographic charts, viz:

Date.	Catalogue No.	Title.
		ENGRAVED.
1895.		
Oct. 28	199	Point Au Fer to Marsh Island, Louisiana.
1896.		
Jan. 16	197	Barataria Bay to Terrebonne Bay, Louisiana. Also 48 section maps of the District of Columbia on a scale of 1–4 800, Nos. 3101 to 3129, 3131 to 3139, 3141 to 3144, 3151 to 3154, and 3161 to 3164.
		LITHOGRAPHED.
1895.		
July 5	256	Connecticut River, Rocky Hill to Hartford, Conn.
July 5	264	Milford to Bridgeport, Conn.

Date.	Catalogue No.	Title.
		LITHOGRAPHED—continued.
1895.		
Aug. 2	272	New Rochelle to Throgs Neck, New York.
Aug. 2	273	Throgs Neck to Randalls Island, New York.
Oct. 16	8214	Saginaw and Security bays, Alaska.
Nov. 29	258	Clinton Harbor and approaches, Connecticut.
Nov. 29	259	Madison to Guilford, Conn.
Dec. 7	263	Oyster River Point to Milford, Conn.
1896.		
Jan. 13	257	Cornfield Point to Duck Island, Connecticut.
Apr. 29	445	Charleston and vicinity, South Carolina.
May 15	473	San Carlos Bay and Caloosa River, Florida.
May 15	8074	Harbor charts: Dixon Entrance and Clarence Strait, Alaska.
May 18	5705	Caspar Anchorage and approaches, California.
June 3	9375	St. Michael Bay, with subsketch, Point Romanof to St. Michael, Alaska.
June 26	246	Boston Harbor, Massachusetts.

Forty-one new copperplate editions of charts and 14 new lithographic editions, 55 in all, have been delivered to this division for issue.

The receipts, issues, and general distribution of charts are given in the following table:

	July 1, 1895, to June 30, 1896.	
	Number.	Value.
ISSUES OF CHARTS.		
Sales agents	27 372	$12 124·75
Sales by office and chart division	653	278·00
Congressional account	2 856	1 327·90
Hydrographic Office, Navy	9 655	4 049·80
Light-House Board	2 098	822·90
Coast and Geodetic Survey Office	4 180	1 726·60
Executive Departments	4 243	1 756·25
Foreign Governments	409	168·00
Libraries	12 753	4 046·00
Miscellaneous	322	139·65
Total	64 541	26 439·85
Condemned	5 213	2 157·95
Total issued and condemned	69 754	28 597·80
CHARTS ON HAND AND RECEIVED.		
On hand, by count, July 1, 1895	34 280	12 680·95
Received from engraving division	59 409	24 641·30
Received from lithographers	9 336	3 762·40
Returned	2 754	1 158·00
Total on hand and received	105 779	42 242·65
Total issued and condemned	69 754	28 597·80
On hand, by book, July 1, 1896	36 025	13 644·85
Difference between book and count	58	30·80
On hand, by count, July 1, 1896	35 967	13 614·05

Very respectfully, yours,

GERSHOM BRADFORD,
Assistant in Charge of the Chart Division.

Mr. O. H. TITTMANN,
Assistant in Charge of the Office.

REPORT OF THE MISCELLANEOUS DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

MISCELLANEOUS DIVISION, *June 30, 1896.*

SIR: I have the honor to submit the following report of the miscellaneous division for the fiscal year ending June 30, 1896:

The duties of the division include the correspondence with sales agents relating to the supply and sale of charts, Coast Pilots, and Tide Tables, and keeping the accounts connected therewith; the purchase, custody, and issue of stationery used in the Office and by the field parties, and all miscellaneous supplies for the Office, and the keeping of accounts of all expenditures for those purposes; the printing and issue of the Annual Reports and all other publications of the Office, including all record books, blank forms, etc., used in the transaction of the work of the Office and field parties; the care and general supervision of the Office buildings, and other duties of a miscellaneous character.

The following statement partially shows the work done in the division during the year:

Letters written	3 681
Quarterly statements of sales agents examined and verified	276
Circulars to sales agents issued	52
Charts sent to sales agents	27 372
Orders for purchases issued	927
Requisitions made for printing and binding	76
Requisitions for stationery filled	377
Requisitions for miscellaneous supplies and repairs filled	819
Annual Reports distributed (see tabulated statement)	5 020
Appendices to Annual Reports	1 877
Tide Tables issued	6 580
Atlantic Coast Pilots issued	4
Subdivisions, Atlantic Local Coast Pilot, issued	40
United States Coast Pilots, Atlantic Coast, issued	734
Pacific Coast Pilot, Alaska, Part I, issued	47
Pacific Coast Pilot, "California, Oregon, and Washington," issued	23
Bulletins issued	982
Notices to Mariners issued	569
Treatise on projections, Craig	5
Deep-sea sounding and dredging, Sigsbee	23
Tidal researches, Ferrel	2
Tables for converting customary and metric weights and measures	57

Fourteen agencies for the sale of publications were established during the year, viz, 7 on the Atlantic and Gulf coasts, 6 on the Pacific Coast, and 1 at Hamburg, Germany. One agency on the Atlantic Coast was discontinued. The total number of agencies on June 30, 1896, was 103.

The following publications were sent to press: Annual Report of the Superintendent for the fiscal year ending June 30, 1895; Supplement to United States Coast Pilot, Atlantic Coast, Parts I–II, III, IV, V, VI, VII; Tide Tables for the year 1897; Pacific Coast Tide Tables for the years 1896 and 1897; Catalogue of Charts and other Publications, 1896; Bulletin 35, and Notices to Mariners, Nos. 194 to 208, inclusive.

The distribution of Annual Reports was as follows:

Date of report.	Domestic distribution.		Foreign distribution.		Total.
	To institutions.	To individuals.	To institutions.	To individuals.	
1851	3	5	.....	1	9
1852	2	5	.....	.....	7
1853	2	5	.....	.....	7
1854	3	4	.....	.....	7
1855	1	4	1	.....	6
1856	2	5	.....	1	8
1857	3	4	.....	.....	7
1858	1	1	.....	.....	2
1859	2	4	.....	1	7
1860	4	5	.....	.....	9
1861	2	6	.....	.....	8
1862	2	4	.....	.....	6
1863	2	5	.....	1	8
1864	.....	1	.....	.....	1
1865	1	4	.....	.....	5
1866	3	4	.....	.....	7
1867	3	6	.....	.....	9
1868	7	5	.....	.....	12
1869	1	2	.....	.....	3
1870	1	1	.....	.....	2
1871	1	7	.....	1	9
1872	4	5	.....	.....	9
1873	6	6	.....	2	14
1874	8	6	.....	2	16
1875	4	6	.....	2	12
1876	10	7	.....	2	19
1877	7	7	.....	2	16
1878	8	9	.....	2	19
1879	14	11	1	2	28
1880	37	16	1	3	57
1881	14	12	1	2	29
1882	18	11	1	3	33
1883	18	11	1	3	33
1884	29	15	1	4	49
1885	14	10	1	3	28
1886	8	9	.....	2	19
1887	12	9	1	3	25
1888	18	11	2	2	33
1889	24	12	2	4	42
1890	27	12	2	3	44
1891, Part 1	21	13	2	7	43
1891, Part 2	53	15	3	4	75
1892, Part 1	28	15	2	8	53
1892, Part 2	88	17	3	4	112
1893, Part 1	190	236	2	91	519
1893, Part 2	634	746	21	252	1 653
1894, Part 1	151	247	1	87	486
1894, Part 2	429	722	17	247	1 415
Total	1 920	2 283	66	751	5 020

The following publications were received from the Public Printer, viz:

Name of publication.	No. of copies.
Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1893, Part 1	900
Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1893, Part 2	2 200
Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1894, Part 1	700
Report of the Superintendent of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1894, Part 2	1 520
Appendix No. 11, Report for 1893—"On the variation of latitude at San Francisco, Cal., from observations made in cooperation with the International Geodetic Association, 1891, 1892"	300
Appendix No. 12, Report for 1893—"Determinations of latitude, gravity, and the magnetic elements at stations in the Hawaiian Islands, including a result for the mean density of the earth, 1891, 1892"	500
Appendix No. 1, Report for 1894—"Relative determinations of gravity with half-second pendulums and other pendulum investigations, with a report on a geologic examination of some of the gravity stations"	350
Appendix No. 2, Report for 1894—"Telegraphic determinations of the force of gravity at Baltimore, Md., from simultaneous pendulum observations at Washington and Baltimore"	250
Appendix No. 4, Report for 1894—"Distribution of the magnetic declination in Alaska and adjacent waters for the year 1895, with two charts"	250
Appendix No. 7, Report for 1894—"Manual of tides, Part III"	500
Appendix No. 8, Report for 1894—"Notes on some instruments recently made in the Coast and Geodetic Survey Office"	250
Appendix No. 9, Report for 1894—"Formulæ and tables for the computation of geodetic positions (fourth revised and enlarged edition)"	1 000
Appendix No. 10, Report for 1894—"Geographic positions in the State of Massachusetts, 1832 to 1890 (second revised and enlarged edition)"	500
Bulletin No. 35, Alaska—"General information relating to the vicinity of Chatham and Peril straits and Cooks Inlet and the region to the westward"	2 000
Tide Tables for the year 1896	7 711
Tide Tables of the Pacific Coast of the United States for the year 1896	2 500
United States Coast Pilot, Atlantic Coast, Part VII—"From Chesapeake Bay entrance to Key West"	1 000
Supplement to United States Coast Pilot, Atlantic Coast, Parts I-II, III, IV, V, VI, VII—"Rules of the road at sea and in harbors, rivers, and inland waters (except the Great Lakes and their connecting and tributary waters, as far east as Montreal)"	1 000
Circular No. 1—"General instructions for hydrographic parties, 1894"	500
NOTICES TO MARINERS.	
No. 194, June, 1895—Chart corrections during the month	9 500
No. 195, July, 1895—Chart corrections during the month	9 500
No. 196, August, 1895—Chart corrections during the month	9 500
No. 197, September, 1895—Chart corrections during the month	9 500
No. 198, October, 1895—Chart corrections during the month	9 500
No. 199, November, 1895—Chart corrections during the month	9 500
No. 200, December, 1895—Chart corrections during the month	9 500
No. 201—Index to Notices to Mariners, 1895	9 500
No. 202—Tidal indicator in Delaware River, Delaware	9 500
No. 203, January, 1896—Chart corrections during the month	9 500
No. 204, February, 1896—Chart corrections during the month	9 500
No. 205, March, 1896—Chart corrections during the month	5 500
No. 206, April, 1896—Chart corrections during the month	5 500
No. 207, May, 1896—Chart corrections during the month	5 500

The following-named persons were employed in the division during the year:

Freeman R. Green, clerk.
Marie L. Fout, writer.
P. J. Mullen, engineer.
David Parker, watchman.
John W. Drum, watchman.
J. A. McDowell, watchman.
J. A. Dorsey, watchman, appointed May 25, 1896.
Ed. D. Scott, messenger.
Charles Over, messenger.
Thomas McGoines, messenger.
Charles H. Jones, messenger.
William R. McLane, messenger.
John W. Miner, messenger.
Owen E. McNeill, messenger, appointed June 1, 1896.
Attrell Richardson, packer and folder.

Horace Dyer, fireman.
Baylor Crutchfield, laborer, November 2, 1895, to May 14, 1896.
John H. Brown, laborer.
Boston Brown, laborer.
John H. Mason, laborer.
Virginia McGlincey, laborer.
Alfred Gilbert, extra laborer.
Walter Y. Clark, extra laborer.
Henry G. Williams, extra laborer, February and March, 1896.

In closing this report I desire to express my thanks to each and every employee in this division for the efficient manner in which they have performed their duties. I have found them ready and willing at all times to assist in anything that they were required to do.

Respectfully,

W. P. RAMSEY,
Chief of the Miscellaneous Division.

Mr. O. H. TITTMANN,
Assistant in Charge of the Office.

REPORT OF THE INSTRUMENT DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

INSTRUMENT DIVISION, *June 30, 1896.*

SIR: I have the honor to submit the following report of the work of the instrument division for the year ending June 30, 1896.

This division has to make the needed repairs to instruments, plan and construct new apparatus and instruments, determine their constants so far as it is practicable to do so at the Office, purchase new instruments, send out, receive, and account for all instruments and general property used in the field and the various divisions of the Office, and select all new instruments and material required for carrying on its varieties of work.

The following-named persons were employed in the division during the year:

William C. Maupin, clerk.
E. G. Fischer, chief instrument maker.
Otto Storm, mechanician.
Clement Jacomini, instrument maker.
W. R. Whitman, instrument maker.
S. A. Kearney, instrument maker.
C. E. Regennas, instrument maker.
M. Lauxmann, instrument maker.
H. O. French, carpenter.
G. W. Clarvoe, carpenter.
C. N. Darnall, carpenter.
J. W. Hunter, messenger.

During the month of December, 1895, I was absent on field duty, erecting a large tidal indicator at Reedy Island, Delaware, and Assistant H. L. Marindin acted as chief of the division during that time.

The major part of the work in the instrument and carpenter shops is in the nature of repairs and reconstruction, most of the new work being of special and unusual design.

The following tables, Nos. I and II, give statistics of repairs and new work, respectively, and Table No. III a list of instruments purchased:

TABLE NO. I.—*Summary of instruments repaired and remodeled between July 1, 1895, and June 30, 1896.*

Instrument.	Number.	Instrument.	Number.
Alidades, plane table	8	Plate printing presses	5
Base bars	3	Prismatic compasses	15
Base bar cut-off	1	Proportional dividers	2
Base bar, 3-metre fractional	1	Protractors, three-arm	20
Base bar trestles	6	Ruling machine	1
Binoculars	21	Sextants	24
Calender press	1	Sextant mirrors, resilvered	200
Chart racks	2	Signal lamps	12
Chronographs	12	Station transit	1
Clocks, hydrographic	12	Theodolites	42
Clocks for the Office		Tide gauges	6
Compass declinometer	1	Tide predicting machine	1
Compasses, liquid	3	Tidal reading board	1
Dip circles, "Kew"	6	Tide staff	1
Draw telescope	1	Transits, astronomical	6
Gas engines	2	Transits, engineer's	2
Gradienters	2	Transit sectors	3
Heliotropes	14	Vertical circles	2
Level, geodetic	1	Vertical collimator	1
Level, "Y"	1	Zenith telescope	1
Leveling rods	6	REPAIR WORK FOR OFFICE OF STANDARD WEIGHTS AND MEASURES.	
Longitude telegraph apparatus, sets of	2		
Magnetometers	9	State balance, large size	1
Meridian instruments	4	State set of standard weights	1
Micrometer microscopes	2	Steel tape	1
Parallel rulers	24	Total number of instruments repaired and remodeled	507
Pendulum apparatus	1		
Plane tables	8		

TABLE NO. II.—*New instruments made between July 1, 1895, and June 30, 1896.*

Instrument.	Number.	Instrument.	Number.
Adjusting pins	200	Microscope micrometers for 50-metre comparator	4
Aligning plummet pendulum for base bars	1	Negative cases for "Archives"	3
Base-bar sectors	3	Pivots for dip needles	12
Bumping copperplate punch	1	Plane-table clamps	96
Buoy stamps	2	Plate frames, electrotyping	7
Camera, enlarging	1	Punches, stencils	2
Chronograph scales, glass	6	Reducing frames, hair	3
Comparator, 50 metres long, and shed	1	Reflectors for tidal work	2
Dip-circle needles, one set of apparatus for making pivots	1	Tent car, geodetic leveling	1
Drying racks, sets of, for plate-printing rooms	2	Tripod, heliotrope	1
File cases, Office	6	Tripod, theodolite	1
Float tubes, for tidal indicator	1	Tripod, transit sector	1
Fuming case, photographic	1	Vat, electrotyping	1
High frequency coil for United States Hospital Service	1	Weights, engraver's	4
Heliotrope, portable, aligning	1	Wetting boards, printing	6
Ink-slab covers	14	NEW INSTRUMENTS AND APPARATUS MADE FOR THE OFFICE OF STANDARD WEIGHTS AND MEASURES.	
Letter gauges	27		
Level block	1	Comparator illuminators	2
Leyden-jar covers for United States Marine-Hospital Service	6	Mercurial distilling apparatus	1
Magnetometer stand	1	Total number of instruments and apparatus constructed	426
Metric scale for Mexican Government	1		

TABLE NO. III.—*Instruments and apparatus purchased between July 1, 1895, and June 30, 1896.*

Instrument.	Number.	Instrument.	Number.
Balances, spring	6	Objectives, photographic	4
Battery cells	12	Opisometers	4
Bow pens	9	Parallel rulers	8
Clocks, hydrographic	24	Plate holder, photographic	1
Calculating machine, "Brunswiga"	1	Spacing dividers, standard	6
Coddington magnifiers	2	Straightedges, steel	6
Comptograph	1	Thermometers	12
Diaphragm shutter, photographic	1	Triangles, steel, 20-inch	2
Dividers	12	Triangles, celluloid	8
Dividers, hair-spring	12	Transit theodolites	2
Drawing pens	12	Zenith telescope	1
Galvanometer, testing	1	Total number of instruments purchased	154
Logs, taffrail	2		
Magnifiers, achromatic triplets	5		

One hundred and eighty requisitions have been received from field parties and from the Office. The filling of many of these has required several days' work of the entire working force. This work and the repair and construction of carrying and packing cases for field instruments is not shown in the foregoing tables.

The construction of a 50-metre comparator and protecting shed, with the necessary adjusting to insure successful operation, has extensively drawn on the resources of the division, 335½ working days of the various members of the skilled force having been devoted to it.

A photographic enlarging and reducing apparatus has been designed and completed for the photographic house. This apparatus is very comprehensive in design and sufficiently large for map purposes. Negatives up to 24 inches can be used in it, enlargements can be made up to 4 by 5 feet, and reductions down to lantern slides or even less size.

The design and working drawings for, and also the construction of all the mechanical parts for a tidal indicator with a dial 30 feet in diameter were made in the division, after which it was erected at Reedy Island quarantine pier, Delaware River, under the direction of the chief of the division. This indicator has now been in successful operation for six months.

Detailed drawings for a tide-predicting machine, from data furnished by the tidal division, have been made, and the work of constructing the machine in the shops is as well advanced as the more important work would permit, about 400 of the working parts having been completed.

I have to call your attention to the very poor and trying light in the instrument shop during the winter months.

The books and accounts of the division and the inventories of the field parties are in a very satisfactory condition.

A detailed account of each day's work of each employee is kept on file in the division.

It is with pleasure that I have to state that there is a hearty and conscientious interest shown by the various employees of the division in their respective duties.

Respectfully, yours,

J. F. PRATT,
Assistant in Charge of the Instrument Division.

Mr. O. H. TITTMANN,
Assistant in Charge of the Office.

REPORT OF THE LIBRARY AND ARCHIVES DIVISION, COAST AND GEODETIC SURVEY OFFICE, FOR THE FISCAL YEAR ENDED JUNE 30, 1896.

LIBRARY AND ARCHIVES DIVISION, *June 30, 1896.*

SIR: I have the honor to submit the following report of the library and archives division for the fiscal year ended June 30, 1896:

LIBRARY.

The card catalogue has been brought up to date. In accordance with the recommendation made in my report last year the shelves in the library have been numbered consecutively, from 1 to 875, the numbers placed on the title pages of the books thereon and entered on the catalogue cards, so that now the location of any book in the library can be ascertained by consulting the card catalogue.

The library is becoming overcrowded and more shelf room is needed. I would recommend that the two rooms on the second floor, over those now occupied by the library, be fitted up with cases and shelving for the use of the library.

A large number of United States Coast and Geodetic Survey charts, turned over to the library by the chart division, has been filed and arranged on shelves in the front room on fourth floor of "fireproof" for future reference.

Only 72 volumes have been added by purchase to the library during the fiscal year, as against 202 volumes purchased last year. Many new works recently published should be added to the library.

Summary of books, maps, serials, etc., added to the library during the fiscal year ended June 30, 1896:

Books purchased (volumes)	72
Books obtained by exchange, presented, and published (volumes)	421
Serials and pamphlets purchased	734
Serials and pamphlets obtained by exchange, presented, and published	1 878
Maps purchased	1
Maps and charts received by exchange and published	878

Books and periodicals sent to bindery to be bound, 172. These were not returned during the fiscal year.

ARCHIVES.

Nothing has been done this fiscal year in preparing original records and computations for binding, as Mr. E. H. Courtenay could not be spared from the computing division for that purpose. This work should be resumed as soon as practicable.

The work of preparing original sounding records for binding, suspended last year, has not been taken up again for lack of proper help. This work, however, I think should be done in the hydrographic division, in the same way as the tidal records have been prepared for binding in the tidal division.

No tidal records have been prepared for binding for some years in consequence of the tidal division not having any available force to put on that work.

The collection of log books has been removed from the back room of fourth story of "fireproof" to the front room of third story. The back room of fourth story is still very much crowded, and I would recommend that the hall rooms on third and fourth floors of "fireproof" be fitted up with cases and shelving so that the back room of fourth floor can be relieved of a part of its contents. If these rooms were properly supplied with cases and shelving the boxes of "bottom specimens" could be placed on shelves and thus become accessible. There should also be put in some cases suitable for holding charts, as those in front room of fourth floor are about filled up. More rack room is needed for filing tubes containing original sheets, and I would recommend that the racks now in use be extended upward to the ceiling.

Number of volumes of geodetic records and computations returned from the bindery	76
Number of volumes of original records of soundings returned from the bindery	67

Summary of original and duplicate records, computations, original sheets, etc., received and registered in the archives during the fiscal year ended June 30, 1896:

Original observations, 727 volumes, 97 cahiers, 197 sheets, 27 traces, 2 packages, and 74 rolls; duplicate observations, 571 volumes, 54 cahiers, 200 sheets, and 27 traces; field computations, 1 volume and 95 cahiers; office computations, 1 volume and 91 cahiers; photography, 40 negatives, 9 lantern slides, and 42 prints; log books, 48 volumes; specimens of sea bottom, 111 bottles; descriptive reports, topographic sheets, 5 cahiers; descriptive reports, hydrographic sheets, 10 cahiers; topographic sheets, 38; hydrographic sheets, 42.

FORCE OF THE DIVISION.

Mr. Artemas Martin was employed in this division as clerk during the whole fiscal year. He had charge of registering all records and sheets and of filing the originals in the archives, and answered calls for the same, answered calls for books, and kept account thereof. He also had charge of the preparing of books and periodicals for binding and of the preparation of monthly reports, etc., which duties, with many others, he has performed in a faithful, efficient, and satisfactory manner.

Mr. John Dale resigned September 16, 1895, to practice medicine in his native State. I deeply regret the resignation of Mr. Dale, as he was an efficient and useful clerk.

Mr. Edward F. Lopez was appointed to the vacancy caused by the resignation of Mr. John Dale, and reported for duty October 3, 1895, and has been on duty in this division since that time. His duties have been various. He finished the uncompleted work of filing and listing the charts in front room on fourth floor of "fireproof;" answered calls for charts and maps; assisted in numbering the shelves and books in the library and in entering the numbers on the catalogue cards, and made out cards for new books as they came in. He has performed his duties efficiently and satisfactorily.

Mr. William H. Butler was employed in this division as messenger during the whole fiscal year, and has performed his duties faithfully and efficiently and made himself especially useful in many ways.

Mr. Buford A. Lynch was assigned to this division October 26, 1895, and was employed therein from that date to June 30, 1896, when he was assigned to field duty. Mr. Lynch assisted in numbering the shelves, books, etc., in the library, and was also engaged in typewriting.

Mr. James A. Dorsey was temporarily assigned to this division April 20, 1896, and employed herein from that date to noon of May 19, 1896, when he returned to the tidal division.

Mr. Henry G. Williams was temporarily assigned to this division April 20, 1896. He reported sick May 20, and did not report to this division thereafter.

Mr. Dorsey and Mr. Williams were employed in moving the collection of log books from back room of fourth floor of "fireproof" to front room on third floor and arranging them on shelves; also in shifting sounding books in cases in back room on second floor of "fireproof."

Respectfully, yours,

H. SIDNEY KING,
Chief of Library and Archives Division.

Mr. O. H. TITTMANN,
Assistant in Charge of the Office.

OFFICE REPORT NO. 2—1896.

REPORT OF THE HYDROGRAPHIC INSPECTOR FOR THE FISCAL YEAR 1896.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE HYDROGRAPHIC INSPECTOR,
Washington, D. C., June 30, 1896.

SIR: I have the honor to submit the following report of hydrographic progress, including the movements and care of the Coast Survey vessels and the reports of the chief of the hydrographic division and chief of the Coast Pilot party. There is appended a list of the officers of the Navy who have been connected with the Survey during the past year and a list showing the duty that those remaining are engaged in at the end of the year 1895–96.

Lieut. Commander Jeff. F. Moser, U. S. N., was Hydrographic Inspector from the beginning of the fiscal year to April 30, 1896, on which date he was relieved by Lieut. Commander H. G. O. Colby, U. S. N.

HYDROGRAPHY—ATLANTIC COAST.

At the beginning of the fiscal year the steamer *Blake* was undergoing repairs at Jersey City, which were completed on July 18, 1895. On the same day Lieut. Commander H. G. O. Colby, U. S. N., Assistant, Coast and Geodetic Survey, assumed command of the vessel, and on July 20 sailed for Hyannis, Mass., arriving on July 22, and immediately prepared to carry out your instructions of May 17, commencing work on July 23.

The work assigned to the *Blake* consisted of the hydrography north of Pollock Rip Slough; examination of certain reported shoals in the vicinity of Pollock Rip; the resurvey of the eastern entrance of Nantucket Sound, between Monomoy Point and Great Point, Nantucket, and special developments of dangers in the approach to Hyannis Harbor.

The hydrography in the entrance to Nantucket Sound included a close development of the greater part of Handkerchief Shoal, the passage between this shoal and Monomoy Point, a general survey of Butlers Hole, and the area lying south of these localities and extending to Great Point, Nantucket.

The latter work presented serious difficulties. The conflicting tidal currents, the scarcity of signals, the utter lack of ranges, the prevailing southwest winds with accompanying very rough weather, made the work dangerous as well as difficult. In the open passage the limits of the working ground necessitated the running of a series of short lines, with frequent turnings in a strong tideway among lobster pots and nets, and directly in the path of an immense number of coastwise vessels of every description, besides numerous small craft and fishing boats. In face of these difficulties the results of this survey have been very satisfactory, and settling, as they did, many doubtful points, were at once introduced on all charts. The closing up of this gap completes the resurvey of Nantucket and Vineyard sounds and their various approaches.

At odd times during the season the *Blake's* party was engaged in looking for rocks and shoals in the vicinity of Hyannis and West Chop. Careful searches, both with lead and drag, were made in all cases finally determined. Bad weather setting in in October and continuing during the first part of November, the season's work was closed on November 7. After obtaining at New Bedford

a new whaleboat, the *Blake* sailed for Baltimore, Md., stopping at Newport, New York, and Patuxent River, and arriving at Baltimore on November 21, 1895, where she remained under repairs until January 21, 1896, when she started for Port Royal, S. C., stopping at Hampton Roads on account of bad weather; she arrived at Port Royal on the evening of January 27, 1896.

In regard to the locality surveyed by the *Blake* last summer—the eastern entrance to Nantucket Sound—I strongly recommend that more frequent examinations of this locality be made. The heavy northeast gales cause a constant shifting of the shoals and channels, and the great importance of these channels, in my opinion, makes annual examinations necessary.

On January 23 the Port Royal Sound work was commenced by searching for points. Many difficulties in making a start were experienced, there being nothing to start from owing to the loss and destruction of triangulation stations by the storm of 1893. Two points were found and with these other stations were established, and the work begun, carrying the signals out beyond the bar by using trees and pumping them into the sand. Sounding was commenced on March 3, and continued until June 29, when the vessel was ordered to New York to refit for the season's work in Buzzards Bay.

Lieut. Commander H. G. O. Colby, U. S. N., was detached from the *Blake* on April 20, leaving Lieut. John A. Shearman, U. S. N., in charge until relieved by Lieut. Commander A. Dunlap, U. S. N., May 25. As I omitted in my report of last summer's work, while in command of the *Blake*, to commend the several officers of this party, I take pleasure in doing so now. Lieuts. John A. Shearman and W. S. Benson, U. S. N., and Ensigns A. T. Long, H. A. Wiley, and J. H. Reid, U. S. N., deserve credit for their untiring zeal and the accuracy displayed in the work.

At the beginning of the fiscal year the steamer *Bache*, under the command of Lieut. R. G. Peck, U. S. N., Assistant, Coast and Geodetic Survey, was engaged at the request of the Navy Department in the establishment of a trial course for the use of naval vessels in Long Island Sound. On July 25, having erected the necessary beacons, she proceeded to New London, Conn., and thence, with the Superintendent and Hydrographic Inspector on board, on a tour of inspection to the parties working in the vicinity of New Bedford, Hyannis, and Boston, arriving at the latter place on July 30, 1895.

On August 5, having fitted out the Coast and Geodetic Survey steam launch stored at the navy-yard, the *Bache* left Boston to engage in the special examination and development of dangers in the vicinity of Minots Ledge Light-House, Boston Light-House, Broad Sound, and along the coast between Nahant and the entrance to Salem Harbor. The very large number of separate examinations kept the party employed until September, when the work was begun on the resurvey of the waters between Marblehead and Manchester. On November 1, having completed this work, the *Bache* returned to Boston. From September 18 to 27 the vessel and party was engaged in erecting beacons on the coast of Maine and Massachusetts for a speed-trial course for the U. S. S. *Indiana* and *Katahdin*. The hydrographic work of the season is shown on five sheets, scale 1-10 000.

Of the resurvey of Boston Bay and its approaches, as projected, all the hydrography, with the exception of a sheet extending from Manchester to Gloucester, and the outside sheet covering the approaches, has been finished. This resurvey, as far as completed, is very thorough, and I most earnestly recommend that it be taken up and completed as soon as circumstances will permit, and a photolithographic chart of Salem Harbor be published as soon as possible on a scale of 1-20 000. Certain prominent landmarks on the shore of Boston Bay have been already indicated on the charts.

On November 6 the *Bache* left Boston for New York with steam launch No. 25 in tow; having turned the launch over to the *Eagre* at New Bedford, Mass., she arrived at New York on November 12, where some slight repairs were made and the vessel prepared for her season's work on the Southern coast.

On January 7, 1896, the *Bache* left New York, picked up at Hampton Roads the Coast Pilot party for transportation to Pensacola, Fla., and arrived at Charleston, S. C., on January 14. After making several special examinations, and taking on board a whaleboat for transportation, she left on January 20, arriving at Pensacola on January 29. The work of the season in Pensacola Bay consisted of hydrography to connect the previous work of the survey inside the bay with the work of the United States engineers on the bar and in the entrance; also a comprehensive system of

comparative tidal observations throughout the whole bay and its tributaries, to establish a plane for the reduction of the soundings of the different parties engaged in the resurvey of the bay. On February 20, 1896, Lieutenant Peck proceeded with his party to Dry Tortugas, Fla., where he made examinations in the channels and located buoys as requested by the Navy Department. Lieutenant Peck reports the shore line of all the keys (except Loggerhead Key, which was not examined) as radically changed, but that there is no appreciable change in the deep-water channels. From Tortugas the *Bache* proceeded to Key West Harbor where the rock on which the *Raleigh* struck was located and developed. Returning to Pensacola on March 29, the work was resumed and successfully finished on April 18, completing the resurvey of these waters.

On April 27 the *Bache* left Pensacola carrying a naphtha launch to be delivered at Baltimore, Md. Off Matanzas Inlet a specimen of the water from the sea spring in that locality was obtained for the Rensselaer Polytechnic Institute; on arrival at Baltimore, May 6, the naphtha launch was turned over to the schooner *Matchless*. Leaving Baltimore on May 12, examinations were made on Blackfish Bank, off Assateague, Virginia, on Isle of Wight Shoal, Fenwick Island Shoal, and off Ocean City, Md.; these finished, the *Bache* returned to New York May 30, 1896, and is now undergoing slight repairs and preparing for work on the Eastern coast.

The results of the work performed by Lieutenant Peck and the party under his command have been highly satisfactory. All the work shows the same excellent judgment and perfect execution as in former seasons.

The schooner *Eagre*, under the command of Lieut. G. C. Hanus, U. S. N., Assistant, Coast and Geodetic Survey, at the beginning of the fiscal year was engaged in the hydrographic resurvey of New Bedford Harbor and approaches. This work was continued until the latter part of December when it was stopped by the weather. During January and February, while in New Bedford and no field work possible, the boats and steam launches attached to the vessel were overhauled and repaired, and the vessel refitted for work of the ensuing season. As soon as the weather permitted, the hydrography of the inner harbor of New Bedford was resumed, and on April 16, 1896, completed.

The resurvey of New Bedford Harbor and its approaches, shown on four hydrographic sheets on a scale of 1–10 000, is very complete. Numerous dangers were discovered. I would strongly recommend that this survey be at once utilized and a new chart of Bedford Harbor, on a scale of 1–20 000, be published for issue as soon as possible.

On April 21 the *Eagre* sailed from New Bedford Harbor; between this date and May 2 stations for current and comparative tidal observations were occupied and signals erected for the continuation of the hydrography in Buzzards Bay.

On May 2 headquarters were established at Marion, Mass., and on May 4 sounding was commenced at the head of Buzzards Bay. At the end of the fiscal year the party is continuing the resurvey at the head of the bay.

Special acknowledgment is due Lieutenant Hanus for the excellence and accuracy of the work performed by his party. His experience, gained in previous long duty on the Coast and Geodetic Survey, has specially fitted him for this work.

The steamer *Endeavor*, under the command of Lieut. L. M. Garrett, U. S. N., Assistant, Coast and Geodetic Survey, at the beginning of the fiscal year was engaged in making special examinations in Long Island Sound near Davids Island and off Kelsey Point. On August 5 she reached the working ground of the season, which covered the waters lying to the southward of Block Island Sound and the east end of Long Island, including outlying dangers off Montauk Point.

Sounding commenced on August 20 and continued until stopped by bad weather on November 11, 1895, leaving the work unfinished. Lieutenant Garrett had been instructed to develop the 30-fathom curve by lines of soundings run 1 mile apart, but it was found that the 30-fathom curve, with but few exceptions, extended outside the limits of the sheet that was furnished him. The work executed by Lieutenant Garrett and the party under his command is in every respect excellent and reflects great credit on the party.

The *Endeavor* arrived in Baltimore on November 19, 1895, and remained there on account of appropriations being insufficient to send her South. On April 20, 1896, Lieut. L. M. Garrett, U. S. N., was detached from duty in the Coast and Geodetic Survey, and on May 6 Lieut. W. S.

Benson, U. S. N., assumed command of the vessel and party. Leaving Baltimore on May 13, the *Endeavor* arrived on the working ground of the previous season on May 18, and is at present engaged in continuing the hydrography heretofore mentioned.

This party has been shorthanded since Lieutenant Benson took command, there being only one other officer, Lieut. J. J. Blandin, U. S. N., attached to the vessel. Great credit is due the party for the amount and excellence of their work, for, notwithstanding the need of more help, they have accomplished as much and the work is as good as has ever been done.

HYDROGRAPHY—PACIFIC COAST.

The work on the Pacific Coast has, with the exception of the *Patterson's* surveys in southeast Alaska, consisted almost entirely of the resurvey of San Francisco Bay and its approaches.

At the beginning of the fiscal year the steamer *Patterson* and her party, under the command of Lieut. Commander E. K. Moore, U. S. N., Assistant Coast and Geodetic Survey, was actively engaged in the survey of southeast Alaska, the season having begun on May 13. The area covered during the season of 1895 embraced that portion of Chatham Strait between Point Augusta and Peril Strait, Peril Strait from its junction with Chatham Strait to Suloria Point, and Hooniah Sound. At the close of the season, October 6, 1895, 11 hydrographic sheets, on various scales, had been finished, and these show the hydrographic survey of the area covered.

The work, as in former seasons, comprised astronomical observations, measurements of base lines, triangulation, topography, and hydrography, including very complete tidal and occasional current observations.

The results obtained are very satisfactory, the records including 11 hydrographic sheets, 5 topographic sheets, and the tidal and current data referred to above. The topographic work has been largely increased and materially improved by the addition of contour lines to the sheets.

Acknowledgment is due Lieutenant-Commander Moore for the thoroughness of this work and for the exhaustive reports upon the territory covered. A synopsis of these reports has been published as Bulletin No. 35.

On October 6 the *Patterson* left Sitka and proceeded to Fort Simpson. Having taken on board two civilian parties engaged in the boundary survey, she left Fort Simpson, towing the *Fuca* and *Earnest*, on October 8, and on October 16 arrived at Seattle, Wash., having touched at Departure Bay and Victoria, British Columbia, on her way.

Upon arrival at Seattle repairs on hull and machinery were begun. During the progress of repairs the party was engaged in preparing for the office the data obtained during the season The vessel is now ready for the next season's work.

The steamer *Gedney* remained in charge of Lieut. Lucian Flynne, U. S. N., Assistant Coast and Geodetic Survey, until July 22, when Lieut. A. P. Osborn, U. S. N., Assistant Coast and Goedetic Survey, assumed command of the party. During the fiscal year she has, together with the steamer *McArthur*, been engaged in the resurvey of San Francisco Bay and its approaches.

In the resurvey of this bay—the most important harbor of the Pacific Coast of America—it is aimed to make the work as accurate and complete as our present methods and means admit. It has been planned to include the entire bay, its approaches, San Pablo Bay, and all headwaters; the work to be done, as far as practicable, on the same scale, using a uniform, rectangular system of lines, with special developments of rocks, shoals, and city water fronts.

During the year work has been prosecuted by the *Gedney* on three sheets, two of which have been completed. These last cover that part of the bay lying between Fort Point, West Berkeley, and Point Izabel, including Richardson Bay and Raccoon Strait. Considerable progress has been made on the third sheet, which lies to the northward of the completed work. Progress on the Fort Point sheet was unavoidably slow on account of tides and unfavorable weather, but when work was prevented by such conditions in one locality it was prosecuted in another, thus utilizing the resources of the party to the greatest advantage. The work was closed on December 4, 1895, on account of unfavorable weather, the *Gedney* proceeding to Oakland, Cal., to prosecute the office work and prepare the vessel for the continuation of the work.

On April 1, 1896, the *Gedney* resumed and carried on the work till April 10, when she was ordered to Santa Barbara Channel to establish the course for the speed trial of the U. S. S.

Oregon. The duty connected with the trial was finished on May 18, and she proceeded to San Miguel Island, California, to make an examination of Cuylers Harbor. Having completed this work on May 20, the *Gedney* returned to San Francisco and resumed her work in the bay.

To meet the wishes of the Navy Department, which greatly desired a resurvey of Mare Island Strait, Lieutenant Osborn took up that part of the work on June 9, and successfully completed it on June 18. He then resumed work where left off, and is still engaged in its prosecution at the end of the year. The finished sheets show every sign of the accuracy desired, and the results are in every way satisfactory.

The steamer *McArthur*, commanded by Lieut. James H. Sears, U. S. N., Assistant, Coast and Geodetic Survey, has been engaged during the entire fiscal year, with the exception of thirteen days, in the resurvey of San Francisco Bay and its approaches. The work done by this party is comprised in sheets covering the Golden Gate and Bonita Channel and the area lying between San Francisco, Yerba Buena Island, and Oakland, and extending southward nearly to Point Avisadero. Separate sheets show work done along the water front of San Francisco, Mission Bay, and Sonoma Rock, the last named being on a scale of 1–10 000.

The party is now engaged on the hydrography between West Berkeley and San Francisco. The work has been greatly interfered with by the prevalence of high winds and fogs during the middle of the day; this necessitates beginning work at daylight. Better conditions are anticipated for the work in the southern portion of the bay.

During thirteen days, May 7 to May 19, the *McArthur* was on duty in connection with the speed trial of the U. S. S. *Oregon* in Santa Barbara Channel.

Necessary repairs were made to this vessel during the year on days when it was impossible to prosecute the hydrographic work.

The work done in San Francisco Bay by the *McArthur* follows the plan described in the report of the hydrography done by the *Gedney*, and is also entirely satisfactory in all respects.

Statement of hydrographic surveys executed during the fiscal year ending June 30, 1896.

Parties.	Localities.	Surveyed by—	No. of sheets.	Scale.	Number of—					Remarks.
					Vols.	Angles.	Soundings.	Miles.	Square miles.	
1	Manchester to Marblehead, Mass.	R. G. Peck, U.S.N.	1	10 000	15	6 521	21 297	405		
1	Nahant to Cat Island and Salem Harbor (additional work).	.....do.....	.....	10 000	7	2 683	7 983	78	38½	Platted on sheets 2197 and 2200.
1	Entrance to Boston Harbor (additional work for 3 sheets).	.....do.....	.....	10 000	4	280	681	10		Platted on sheets 2129, 2133, 2146.
2	East of Monomoy Island, Massachusetts.	H. G. O. Colby, U. S. N.	1	20 000	5	1 654	5 910	132		
2	Eastern entrance to Nantucket Sound including Handkerchief Shoal.	.....do.....	1	20 000	9	4 174	17 814	334	37	Platted on sheet 1880.
2	Nantucket Sound, off Hyannis Harbor, Massachusetts (additional work).	.....do.....	.....	20 000	3	1 002	3 588	46		Platted on sheet 1832.
2	Off West Chop, Marthas Vineyard, location of rock.	.....do.....	.....	20 000	1	23	2	.....		
3	New Bedford Harbor and approaches.	G. C. Hanus, U. S. N.	4	10 000	95	26 352	151 264	2 093	35	
3	Buzzards Bay, northern part (season of 1896).	.....do.....	*2	10 000	*25	9 500	57 410	639	*10	
4	Off east end of Long Island, and off Block Island Sound.	L. M. Garrett, U. S. N.	1	40 000	7	3 688	10 887	753	208	
4	North shore of Long Island Sound, off Cornfield Point, Duck Island, and Kelseys Point.	... .do.....	.....	10 000	3	1 054	2 554	59	.....	Platted on sheet 1603c.
4	Davids Island Harbor, New York.	.... do.....	1	10 000	2	627	1 912	25	1	
5	Off Montauk Point, Long Island.	W. S. Benson, U. S. N.	.....	40 000	4	3 200	9 019	367	10	

Statement of hydrographic surveys executed during the fiscal year ending June 30, 1896—Continued.

Parties.	Localities.	Surveyed by—	No. of sheets.	Scale.	Number of—					Remarks.
					Vols.	Angles.	Soundings.	Miles.	Square miles.	
6	Fenwick Island Shoal, Isle of Wight Shoal, and Blackfish Bank, Delaware and Virginia.	R. G. Peck, U.S.N.	.....	40 000	2	608	3 857	100	8	Platted on sheets 212 and 298.
6	Charleston Harbor (additional work).	.....do.....	.....	10 000	2	194	885	9	.....	Platted on sheet 2222.
6	Entrance to Key West Harbor, determination of rocks.	.....do.....	1	20 000	2	116	538	6	.....	
6	Tortugas Harbor, Florida.....	.....do.....	1	10 000	6	2 428	7 714	159	5	
6	Pensacola Bay, entrance to Grand Bayou.	.....do.....	1	10 000	9	2 781	10 519	199	8	
7	Entrance to Port Royal Sound, South Carolina.	H. G. O. Colby, U. S. N., and A. Dunlap, U.S.N.	2	20 000	28	10 224	58 412	1 244	28	
8	Trial course of U. S. S. Oregon, Santa Barbara Channel, California.	A. P. Osborn, U. S. N.	1	80 000	.....	.....	.....	.....	.....	
8	Cuylers Harbor, San Miguel Island, California.	.....do.....	1	20 000	2	152	423	15	1	
8	San Francisco Bay; Fort Point to E'd and N'd, Alcatraz Island to Bluff Point.	.....do.....	2	10 000	22	11 028	22 919	630	20½	
8	Mare Island Strait, California.....	.....do.....	1	10 000	4	1 336	5 022	75	1½	
9	Entrance to San Francisco Bay, California.	J. H. Sears, U.S.N.	2	10 000	8	8 252	15 197	293	5	
10	Chatham and Peril straits, southeast Alaska.	E. K. Moore, U. S. N.	11	Various.	15	12 508	18 740	1 501	250½	Covered 406 square miles of topography; run in 690 miles of shore line.
10	Sitka Harbor (additional work on Harbor Rock).	.....do.....	.....	10 000	1	8	157	2	.....	Platted on sheet 2174.
	Grand total for year ending June 30, 1896.....		34	Various.	281	110 393	434 314	9 134	667	

*Estimated.

Party No. 1 was engaged for a time in establishing a trial course for naval vessels in Long Island Sound.

Party No. 8 was engaged in establishing course in Santa Barbara Channel for the speed trial of the U. S. S. *Oregon* from April 20 to May 9, 1896.

Party No. 9 assisted in speed trial of U. S. S. *Oregon* from May 7 to 19, 1896.

Party No. 10 was part of time engaged in transporting boundary survey parties.

Number of specimens of bottom, 111; current stations occupied by hydrographic parties, 11.

HYDROGRAPHIC DIVISION.

Lieut. Walter McLean, U. S. N., Assistant, Coast and Geodetic Survey, having been detached from duty on the Survey on November 7, 1895, the division was under the personal supervision of the Hydrographic Inspector until December 20, when Lieut. Hugh Rodman, U. S. N., Assistant, Coast and Geodetic Survey, assumed charge. The numerous duties of this division have been ably and intelligently carried on. Through the courtesy of the Office of United States Engineers, which now furnishes this Office with blue prints of all improvements affecting charts, much additional and very valuable data have been obtained and utilized; this has resulted in increasing the work of chart correction. I would call attention to the report of Lieutenant Rodman relating to the work performed by the division and his recommendations with regard to the employees. Lieutenant Rodman has displayed unusual zeal and intelligence in the conduct of the work of this division, his previous duty on the Coast and Geodetic Survey having specially fitted him for the work.

In regard to the draftsmen connected with this Office, I respectfully refer you to the report of Lieutenant Rodman. I fully concur with him and approve his recommendations.

The report of the chief of the hydrographic division is forwarded herewith.

COAST PILOT PARTY.

This party, at the beginning of the fiscal year, was under the charge of Lieut. Walter McLean, U. S. N., Assistant, Coast and Geodetic Survey, who performed the duties of chief of the party in addition to his duties in charge of the hydrographic division. On October 21, 1895, Ensign G. Tarbox, U. S. N., Assistant, Coast and Geodetic Survey, assumed charge, and has continued the work of his predecessors.

The work of this party is well known through the publications it prepares. From January 12 to May 21, 1896, the party was engaged in work in the field covering the coast of the Gulf of Mexico between Key West and New Orleans, in the schooner *Transit*. The report of the party submitted by Ensign Tarbox suggests the preparation of a second edition of the United States Coast Pilot, Part VI, which I earnestly recommend.

I beg to express my appreciation of the services of Ensign Tarbox while in charge of this party. The interest and zeal displayed by him, both in the office and field, merit special notice, as also do the services of Mr. John Ross, the nautical expert, for his ability and worth; his zeal has for many years merited my approbation, and I can recommend him for any further advancement it may be possible to give him.

I forward herewith the report of the chief of the Coast Pilot party.

REPAIRS AND MAINTENANCE OF VESSELS.

ATLANTIC COAST.

The following repairs were made to the different vessels during the fiscal year:

Blake.—The principal repairs to this vessel were as follows: Cabin water-closets, gig, boilers, anchor engine, feed and injection thermometer, and blowpipe sleeve were repaired; manhole plates enlarged; portion of deck calked; deck under galley and drum room was renewed; pressed-brick floor laid in galley; plank-sheer, port and starboard, mainsail repaired; new apron was put in, air ports releaded; pilot house remodeled and enlarged; vessel was docked; 2 new whaleboats, springs for low-pressure valve, gaskets for manhole, 1 handwheel, brass gland for air pump, new flatboat, new pump for steam launch, snatch block, new quarter-deck awning, a set of automatic releasing hooks, wild-cat for windlass, and new gaff supplied, and galley stove repaired. Total expenditure, $3 235·63.

Bache.—This vessel was supplied with cradle for launch, new range for galley, new propeller, patch on after-shaft alley, and bulkhead distiller coils, and water-closets, valves, etc., were repaired. Total expenditure, $544·10.

Eagre.—This vessel was extensively overhauled during the prevoius fiscal year. During this year anchors for launches, sails and spars for boats, deck lights, new oil tank, grate bars for launches, new W. R. stovepipe, new fire bricks for galley, new cable and limber chain, new awnings, and new hose coupling for fire pump were supplied. A diver was several times employed to find a leak, and when located the hull in its vicinity was repaired. Windlass, water-closets, centreboard and centreboard well, coal bunkers, galley range, forecastle stove, water tanks, cable, electric battery, keel and bow of whaleboat, and cutter were repaired. New swivels and connecting shackles furnished for cable. Deck calked. Launches 22, 23, and 25 were overhauled and repaired generally. Total expenditure, $1 730·70. Launches 22, 23, and 25 will again be extensively overhauled and new boilers supplied them at the end of the present season.

Endeavor.—The repairs to this vessel were as follows: She was docked, calked, and metal replaced where necessary, painted, boiler and engine overhauled and repaired generally, reversing engine repaired, and minor repairs made to put her in good condition. She was supplied with copper core for launch tank, new wild-cat for windlass, grate lining and cement for galley stove, drip cup and strainer, 2 pans for reeling engine, copper pan for launch bilge, etc. Total expenditure, $754·20.

Matchless.—This vessel was being rebuilt at the end of the last fiscal year. She was finished during this, and will be a very serviceable addition to the complement of vessels. At present it is the intention to fit her out and put her in commission for work in Cheasapeake Bay.

PACIFIC COAST.

Gedney.—The repairs to this vessel embraced repairs to main boiler, steam gauge of steam launch, galley range, oil tanks, main engine, throttle valve and crosshead connections, bilge pump, air pump, Blake pump, steam launch, deck stanchions, boats, etc. She was supplied with a new water tank, grate bars for furnace of ship and steam launch, 2 coal-hole frames, 4 new deck plates with lights and ventilators, copper keel condenser and smokestack for steam launch, grate for galley range, new crosshead brasses for main engine, and new piston rod for launch. Socket bolts and rivets for main boiler were renewed. Total expenditure, $515·95.

McArthur.—This vessel received repairs to the amount of $1 353·74. These consisted of new cylinder complete in place with piston valve, two patches of steel in water space of condenser, new cast-off rod and repairs to throat rings of same, holes in bracket rebored, main guides trued and lined up, 6 new piston springs and bolts, air pump rebored and 3 seats refaced, rod of air pump trued and new brass sleeve for same, new rock shaft and pin for reversing gear, 4 iron turn buckles, rods and fittings for boiler braces, brass whistle lever, wrought-iron eyebolts for lower booms, 6 bunker rings with gratings and covers, 3 new water-closets put in place, new floor in berth deck, pipe fittings and asbestus for new steam heater in berth deck, new galvanized iron tank; new pump and repairs to boiler of launch No. 28, new gangway ladder, new gratings over tiller, and repairs to water-closets, etc.

Patterson.—The hull of this vessel being in need of very extensive overhauling and repairs, a contract was entered into with the Puget Sound Dry Dock Company for them. Under this contract the copper was all stripped and the outside planking removed to the keel on the forward body, to the garboards on the after body, and to the bilge keels or rolling chocks amidships, with occasional strakes between that and the keel. There were removed and renewed: Forward.—The stem, apron, deadwood, breast and deck hooks, 60 feet of the main keelson, 30 feet of the two sister keelsons, 26 frames on each side, most of them the whole length; the greater part of the ceiling, some of it running the whole length; 7 forward beams on the main deck, with the planking and waterways; 3 beams scarfed and 3 graved, new waterways and thick strake, with a part of the planking in the port gangway; fore hatch coaming and mast partners, main deck calked and payed, the berth deck renewed and calked, with various other minor parts. Aft.—The sternpost (scarfed to straddle the shaft), rudder post, aprons, deadwood, shaft log, 3 deck and cant hooks, 26 frames on the starboard and 27 on the port side, in part, including cants, ceiling cabin deck, 2 knees under the mizzenmast beam and 2 knees on the deck hook, rudder casing, storeroom bulkheads, and other minor parts. Amidships.—Ten frames on the starboard side and 8 on the port were renewed in part. The old diagonal braces were cleaned up, painted, and renewed where very badly rusted. The plank sheer or covering board and chock were renewed the whole length and the hand rail repaired and replaced with new stanchions. The vessel was left open to ventilate as far as practicable, but otherwise everything was replaced as on the original plans, except that the copper fastening was not carried as high as in the old, but the butt fastenings were made of copper to the water line. The vessel was replanked almost entirely anew, there being a few old planks left on the bottom amidships and around the quarter high up. There were four good threads of oakum used in calking, the seams payed, the bottom tarred, felted, and coppered. All repairs were confined to the hull, main deck, and below it, except a new forehatch and some other small parts on the upper deck which were too rotten to hold together. The outside was given three coats of paint, as was also the new inside work, and the old paint touched up. New bottoms were put in the water tanks, two ventilators renewed to the afterhold, berth-deck air ports overhauled and repaired, and a new oil tank furnished. All boats, rigging, and sails were overhauled, and minor repairs made by the ship's force. A new auxiliary boiler was supplied and the main boiler retubed. The main boiler and steam drum were stripped and scaled, and, with the main steam pipe, covered with asbestus cement and coated with canvas. The main steam pipe was repaired and altered, new main sea valve for circulating pump furnished, throttle valve and check valve repaired and refitted, new bushings and packing rings supplied, high and low pressure cylinders, quadrants trued and case hardened and pins trued and holes bushed, new eccentric straps and brasses supplied, new floor laid around auxiliary boiler, new damper, floor and baffle plates, main boiler, and other minor repairs made. Total expenditures, $21 911·14.

There remain still some extensive repairs to be made to the *Patterson's* hull, which for want of time and money could not be made, and which it is intended to complete on the return of the vessel from Alaska this fall.

To the *Quick*, *Transit*, *Spy*, *Fuca*, and *Tarry Not* such repairs were made as tended to their preservation, the *Transit* and *Quick* each being supplied with a new suit of sails.

The *Hassler* was used by the officers and men of the *Patterson* for quarters while the repairs were being made to the latter vessel. The *Hassler* was docked and her bottom painted.

Mr. J. H. Roeth, hydrographic inspector's clerk, is most valuable and efficient, and he has performed all his duties to my entire satisfaction.

Very respectfully,

H. G. O. COLBY,
Lieutenant-Commander, U. S. N.,
Hydrographic Inspector Coast and Geodetic Survey.

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey.

REPORT OF THE HYDROGRAPHIC DIVISION FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

UNITED STATES COAST AND GEODETIC SURVEY,
Washington, D. C., June 30, 1896.

SIR: I have the honor to submit the following report of the work of the hydrographic division during the fiscal year ending June 30, 1896:

Lieut. Walter McLean, U. S. N., was in charge until his detachment, November 7, 1895. I assumed charge on reporting for duty on December 20, 1895, the Hydrographic Inspector personally supervising during the interval.

The general routine and methods of previous years have been followed, with the cultivation of more intimate relations with the Corps of Engineers, United State Army, whereby our charts have been vastly benefited by the addition of numerous and valuable improvements and surveys made by them.

The following synopsis will show briefly the amount of work done by the division:

Number of volumes platted	255
Number of angles platted	94 794
Number of soundings platted	372 493
Number of miles platted	8 854
Number of sheets platted	52

In addition to this there has been much miscellaneous work, including verification and revision of proofs, drawings, and charts; tracings and projections made and verified; tidal data reduced and platted; comparisons of hydrography and topography, and other work too numerous to mention. In the one item alone of keeping the charts corrected over 700 corrections have been added, necessitating over 2 000 corrections to our standard charts.

The monthly Notice to Mariners has been revised and the items given at greater length. Its publication has been prompt.

Owing to the zeal and efficiency of all the employees the work of the division has been in every way satisfactory, and has been kept up to date. The chief draftsman of this division, Mr. W. C. Willenbucher, is invaluable; he is prompt, reliable, and efficient in all he undertakes.

The work of Mr. F. C. Donn and Mr. J. T. Watkins is all that could be desired, and shows thoroughness at all times. I would earnestly recommend that the salary of Mr. Watkins be increased to $1 200, for the reason that much difficulty has been experienced in retaining a good draftsman here in consequence of insufficient salary. The work required of him calls for special knowledge and experience in this particular line, and he has proven himself very efficient in every particular.

On Mr. E. H. Wyvill devolves the important work of correcting the standard charts of the

office, and, in my opinion, no one could be better fitted for the place. The position can only be filled by an intelligent man who has had a training both at sea and on shore. It requires a nautical experience as well as a knowledge of drawing and geodesy, in all of which Mr. Wyvill is well posted. I would suggest that his title be changed to nautical expert, and that his salary be increased to $1 800.

Very respectfully,

HUGH RODMAN,
Lieutenant, U. S. N.,
Chief of Hydrographic Division.

Lieut. Commander H. G. O. COLBY, U. S. N.,
Hydrographic Inspector Coast and Geodetic Survey, Washington, D. C.

REPORT OF THE COAST PILOT PARTY FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

UNITED STATES COAST AND GEODETIC SURVEY,
Washington, D. C., June 30, 1896.

SIR: I have the honor to submit the following report of the work of the Coast Pilot party for the fiscal year ending June 30, 1896. Under the general direction of the Superintendent and the supervision of the Hydrographic Inspector, the duties of this party involve the execution of work in the field and in the office.

The party was under the charge of Lieut. Walter McLean, U. S. N., from July 1 to October 21, 1895, and since the latter date I have had charge of the work.

At the beginning of the fiscal year the party was engaged in reading proof of United States Coast Pilot, Atlantic Coast, Part VII, from Chesapeake Bay Entrance to Key West; in compiling and reading proof of a supplement (containing rules of the road) for Coast Pilot volumes already published, and in preparing and sending interrogatories covering the coast of the United States bordering on the Gulf of Mexico. On September 20, 1895, the last proofs of United States Coast Pilot, Part VII, were sent to the printer, and on October 26, 1895, the first bound copies of this volume were received for issue.

After the last proofs of United States Coast Pilot, Part VII, had been sent to the printer the party was engaged in compiling manuscript for United States Coast Pilot, Atlantic Coast, Part VIII, which will include the coast of the United States bordering the Gulf of Mexico between Key West and the Rio Grande. This work was continued until January 12, 1896, when, under instructions from the Superintendent, I, accompanied by Mr. John Ross, reported on board the Coast and Geodetic Survey steamer *Bache*, and on the arrival of that vessel at Pensacola, Fla., organized a party on board the Coast and Geodetic Survey schooner *Transit* for Coast Pilot work afloat. Under the Superintendent's instructions, accompanied by Mr. Ross, I returned to the office on May 21, 1896, and continued the compilation of United States Coast Pilot, Part VIII.

The report covering the work of the Coast Pilot party while in the field was submitted to the Superintendent on May 29, 1896. In this connection I would state that some of the principal anchorages visited show marked changes in the channels in their entrances, if not in depth at least in direction, since the last surveys. Among these I would mention East Pass (into St. Georges Sound), St. Andrews Bay, Horn Island Anchorage, and Ship Island Anchorage. In my opinion, a resurvey of these entrances would enable the buoys to be more advantageously located and more correctly plotted on the charts, the usefulness of which would be greatly increased thereby.

Besides the preparation of manuscript for new Coast Pilot volumes and reading proof of the same, the party has corrected to date of issue all Coast Pilot volumes issued from this Office. This important and necessary work involves considerable labor, and has been increasing steadily in amount. The reduction of the price of Coast Pilot volumes to 50 cents each has more than doubled the issue of volumes from this Office and has correspondingly increased the work of correction. The routine work of the party in keeping records of changes, reported dangers,

hydrographic examinations, new information available, and other data which may be used in the compilation or correction of Coast Pilot volumes is very considerable and constant.

I would call attention to the necessity for a new (second) edition of United States Coast Pilot, Atlantic Coast, Part VI, Chesapeake Bay and Tributaries. The first edition was published in 1889, and is therefore 7 years old. Since its publication, changes affecting the volume, amounting to several hundred, have occurred. These necessitated corrections, which are now inserted in each volume issued. They detract greatly from the appearance and usefulness of the book, and in many cases entirely change the text. Of the first edition, 1 500 copies were printed and 667 copies issued, leaving 843 copies on hand at the end of the fiscal year June 30, 1896.

I would suggest that, when the manuscript for United States Coast Pilot, Part VIII, has been sent to the printer, manuscript for a second edition of 600 volumes of Part VI be prepared, and that when the volume is printed the unsold copies of the first edition be canceled.

Mr. John Ross, nautical expert of the party, has been employed, partly in the office and partly in the field, during the entire fiscal year in the collection of data and the compilation of manuscript for the new edition of Part VIII of the Coast Pilot. It gives me great pleasure to testify to the valuable services he has rendered the work, both in the office and in the field.

Mr. Talbot Pulizzi has been employed during the entire fiscal year in copying manuscript, entering corrections in Coast Pilot volumes, and keeping posted the files of the party, all to my entire satisfaction.

Very respectfully,

GLENNIE TARBOX,
Ensign, U. S. N.,
In Charge of Coast Pilot Party.

Lieut. Commander H. G. O. COLBY, U. S. N.,
Hydrographic Inspector Coast and Geodetic Survey,
Washington, D. C.

List of naval officers attached to the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1896.

Name.	Date attached.	Date detached.	Remarks.
LIEUTENANT-COMMANDERS.			
H. G. O. Colby	July 18, 1895 Reattached Apr. 30, 1896		Still in service.
A. Dunlap	May 21, 1896		Still in service.
Jeff F. Moser	Oct. 30, 1893	Apr. 30, 1896	
E. K. Moore	Jan. 18, 1895		Still in service.
LIEUTENANTS.			
A. P. Osborn	July 22, 1895		Still in service.
R. G. Peck	June 1, 1893		Still in service.
G. W. Mentz	July 9, 1892	July 18, 1895	
G. C. Hanus	Feb. 7, 1895		Still in service.
Lucian Flynne	June 6, 1892	July 22, 1895	
J. A. Shearman	Jan. 8, 1894		Still in service.
James H. Sears	Mar. 31, 1894		Still in service.
Walter McLean	Aug. 21, 1893	Nov. 7, 1895	
W. S. Benson	Jan. 6, 1894	Nov. 26, 1895	
	May 6, 1896		Still in service.
A. G. Rodgers	Nov. 15, 1894		Still in service.
A. C. Almy	Mar. 12, 1894	Feb. 15, 1896	
L. M. Garrett	July 3, 1893	Apr. 30, 1896	
C. S. Ripley	May 17, 1892	Oct. 15, 1895	
E. H. Tillman	Jan. 4, 1895		Still in service.
R. F. Lopez	July 20, 1893		Still in service.
LIEUTENANTS (JUNIOR GRADE).			
Hugh Rodman	Apr. 1, 1891	Nov. 19, 1895	
	Dec. 20, 1895		Still in service.
J. J. Blandin	Oct. 21, 1893		Still in service.
W. B. Hoggatt	Jan. 17, 1894		Still in service.
C. M. McCormick	Apr. 25, 1893	Nov. 25, 1895	

List of naval officers attached to the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1896—Continued.

Name.	Date attached.	Date detached.	Remarks.
ENSIGNS.			
G. Tarbox	Oct. 19, 1895		Still in service.
W. W. Gilmer	Dec. 19, 1895		Still in service.
W. A. Edgar	Oct. 11, 1894		Still in service.
W. H. Faust	Apr. 7, 1896		Still in service.
H. K. Hines	Oct. 27, 1894		Still in service.
N. A. McCully	Nov. 26, 1894		Still in service.
Andrew J. Long	Apr. 23, 1895		Still in service.
C. Churchill	Feb. 18, 1895	Jan. 14, 1896	
C. M. Stone	Feb. 20, 1895		Still in service.
A. H. Davis	Jan. 7, 1895		Still in service.
F. M. Russell	Jan. 7, 1895		Still in service.
John F. Hubbard	Oct. 13, 1895		Still in service.
M. L. Miller	May 19, 1896		Still in service.
H. K. Benham	Mar. 3, 1894	Dec. 15, 1895	
James H. Reid	Dec. 9, 1895		Still in service.
H. A. Wiley	Jan. 1, 1896		Still in service.
G. B. Bradshaw	Feb. 11, 1896		Still in service.
PASSED ASSISTANT SURGEONS.			
E. R. Stitt	Dec. 17, 1895	June 15, 1896	
George H. Barber	July 10, 1893	Dec. 5, 1895	
R. M. Kennedy	Sept. 26, 1894		Still in service.
Charles M. DeValin	June 29, 1896		Still in service.
B. R. Ward	July 2, 1894	Mar. 25, 1896	
PASSED ASSISTANT PAYMASTER.			
John Q. Lovell	Mar. 2, 1895		Still in service.
PASSED ASSISTANT ENGINEER.			
K. McAlpine	July 4, 1892	July 16, 1895	
ASSISTANT ENGINEERS.			
Andrew McAllister	Jan. 18, 1894	Nov. 18, 1895	
Stanford E. Moses	Apr. 10, 1895	Nov. 5, 1895	

RECAPITULATION.

Lieutenant-commanders	4
Lieutenants	15
Lieutenants (junior grade)	4
Ensigns	17
Passed assistant surgeons	5
Passed assistant paymaster	1
Passed assistant engineer	1
Assistant engineers	2
Total	49

NOTE.—From a statement immediately following, it appears that of the 49 officers above named, 33 were on duty in the Survey at the close of the fiscal year.

List of naval officers attached to the United States Coast and Geodetic Survey June 30, 1896.

Coast and Geodetic Survey Office.—Lieut. Commander H. G. O. Colby, Hydrographic Inspector; Lieut. Hugh Rodman, chief of hydrographic division; Ensign G. Tarbox, chief of Coast Pilot party; P. A. Paymaster John Q. Lovell, in charge Navy pay accounts.

Steamer Blake (Atlantic Coast).—Lieut. Commander A. Dunlap, commanding; Lieut. J. A. Shearman; Ensigns A. T. Long, James H. Reid, and H. A. Wiley; P. A. Surg, C. M. DeValin.

Steamer Bache (Atlantic Coast).—Lieut. Robert G. Peck, commanding; Lieut. E. H. Tillman; Ensigns H. K. Hines, A. H. Davis, and F. M. Russell.

Schooner Eagre (Atlantic Coast).—Lieut. G. C. Hanus, commanding; Ensigns W. A. Edgar, John F. Hubbard.

Steamer Endeavor (Atlantic Coast).—Lieut. W. S. Benson, commanding; Lieut. J. J. Blandin.

Steamer Patterson (Pacific Coast).—Lieut. Commander E. K. Moore, commanding; Lieuts. A. G. Rodgers, R. F. Lopez, W. B. Hoggatt; Ensigns W. W. Gilmer and G. B. Bradshaw; P. A. Surg. R. M. Kennedy.

Steamer Gedney (Pacific Coast).—Lieut. A. P. Osborn, commanding; Ensigns H. K. Faust and C. M. Stone.

Steamer McArthur (Pacific Coast).—Lieut. James H. Sears, commanding; Ensigns N. A. McCully and M. L. Miller.

Names of vessels, their tonnage, etc., in the service of the United States Coast and Geodetic Survey during the fiscal year ending June 30, 1896.

No.	Name of vessel.	Tonnage.	Complement of—	
			Officers.	Men.
1	Steamer Patterson	453	12	46
2	Steamer Hassler	319	10	34
3	Steamer Blake	235	10	38
4	Steamer Bache	182	10	38
5	Steamer Gedney	174	8	29
6	Steamer McArthur	130	7	30
7	Steamer Endeavor	86	7	24
8	Steamer Cosmos	25	3	7
1	Schooner Eagre	192	6	26
2	Schooner Earnest	80	5	18
3	Schooner Matchless	95	5	14
4	Schooner Quick	63	4	12
5	Schooner Transit	43	3	9
6	Schooner Spy	35	3	9

RECAPITULATION.

Steamers	8
Schooners	6
Total	14

OFFICE REPORT NO. 3—1896.

REPORT OF THE DISBURSING AGENT FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., June 30, 1896.

SIR: I have the honor to submit the following report of the disbursing office for the fiscal year ending June 30, 1896:

The aggregate of advances to chiefs of field parties during the year was $113 816·83. The total disbursements on adjusted accounts were $410 961·52. The number of vouchers, bills, etc., adjusted and paid was 16 057. Additional statistics of the work accomplished will be found on file in this office.

The annual report of expenditures of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1895, was forwarded to the Superintendent on January 1, 1896. The report for the fiscal year just ended is being compiled, and will be ready for transmission to Congress early in the coming calendar year.

The adjustment and settlement of the accounts of this Bureau during the year have been kept, as far as circumstances would permit, nearly up to date. I would also state that all accounts audited and paid in this office have been promptly forwarded to the Auditor for the Treasury Department for his action thereon, and his promptness in settling the same, and that, too, without the disallowance of a single cent during the entire fiscal year, continues to be a source of much gratification to this office.

The force of the office for the fiscal year has been as follows: Mr. N. G. Henry, clerk and cashier; Miss Ida M. Peck, typewriter and clerk; Mrs. Jennie H. Fitch, clerk.

Respectfully, yours,

R. J. GRIFFIN, *Disbursing Agent.*

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey,
Washington, D. C.

EXPENDITURES, COAST AND GEODETIC SURVEY, 1896.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., November 16, 1896.

SIR: I have the honor to transmit herewith the annual report of expenditures made by this office for the fiscal year ending June 30, 1896.

Respectfully, yours, R. J. GRIFFIN, *Disbursing Agent.*

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey,
Washington, D. C.

Statement of the expenditures of the United States Coast and Geodetic Survey for the fiscal year ending June 30, 1896.

[Prepared pursuant to act approved March 3, 1853.]

SALARIES—PAY OF FIELD OFFICERS.

To whom paid.	Time employed.	Amount.
SUPERINTENDENT.		
W. W. Duffield	One year	$5 000·00
ASSISTANTS.		
Charles A. Schott	One year	4 000·00
Aug. F. Rodgers	do	4 000·00
Otto H. Tittmann	do	3 199·50
Andrew Braid	do	3 000·00
A. T. Mosman	do	3 000·00
Herbert G. Ogden	do	2 951·06
Will Ward Duffield	do	3 000·00
John W. Donn	Eleven months fifteen days	2 397·00
Erasmus D. Preston	One year	2 500·00
Cephas H. Sinclair	do	2 500·00
William Eimbeck	do	2 500·00
F. Walley Perkins	do	2 200·00
Frank D. Granger	do	2 140·22
J. J. Gilbert	do	2 200·00
Henry L. Marindin	do	2 200·00
John F. Pratt	do	2 200·00
Edmund F. Dickins	do	2 200·00
Dallas B. Wainwright	do	2 200·00
Isaac Winston	do	1 999·90
William C. Hodgkins	do	2 000·00
Philip A. Welker	do	2 000·00
James B. Baylor	do	2 000·00
John A. Flemer	do	2 000·00
Stehman Forney	do	2 000·00
Charles H. Van Orden	Ten months twenty-six days	255·39
Gershom Bradford	One year	1 800·00
Fremont Morse	do	1 800·00
Walter B. Fairfield	do	1 800·00
John Nelson	do	1 638·46
Henry L. Whiting	do	1 600·00
W. Irving Vinal	do	1 600·00
Charles T. Iardella	do	1 419·28
George R. Putnam	do	1 400·00
E. B. Latham	do	1 400·00
Fred A. Young	do	1 200·00
Albert L. Baldwin	do	1 200·00
Homer P. Ritter	do	1 200·00
Robert L. Faris	Eleven months twenty-four days	1 176·96
AIDS.		
Robert L. Faris	Seven days	17·12
Owen B. French	One year	880·43
Hugh C. Denson	do	877·74
Charles C. Yates	do	900·00
Albert F. Zust	Ten months twelve days	728·84
Expenditures		88 281·93
Appropriation		90 400·00
Expenditures		88 281·93
Unexpended balance		2 118·07

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

SALARIES—PAY OF OFFICE FORCE, 1896.

To whom paid.	Time employed.	Amount.
DISBURSING AGENT.		
Robert J. Griffin	One year	$2 200·00
GENERAL OFFICE ASSISTANT.		
Walter P. Ramsey	One year	1 800·00
CHIEF OF DIVISION OF LIBRARY AND ARCHIVES.		
H. Sidney King	One year	1 800·00
CLERKS TO SUPERINTENDENT.		
John F. Renfro	Three months three days	309·78
George L. Flower	Eight months twenty-eight days	890·20
CLERK TO ASSISTANT IN CHARGE.		
Adelbert B. Simons	One year	1 000·00
CLERKS.		
William B. Chilton	One year	1 650·00
Nicholas G. Henry	do	1 650·00
John H. Smoot	do	1 400·00
William C. Maupin	do	1 400·00
Artemas Martin	do	1 400·00
Eugene B. Wills	do	1 200·00
Freeman R. Green	do	1 200·00
Frank W. Edmonds	do	1 200·00
J. Henry Roeth	do	1 200·00
Asa G. Randall	do	1 200·00
Sophie S. Hein	do	1 000·00
Jennie H. Fitch	do	1 000·00
Alice G. Reville	do	978·26
CHART CORRECTORS.		
Edward H. Wyvill	One year	1 200·00
Ida M. Peck	do	1 200·00
Henry R. Garland	do	900·00
Archie Upperman	do	720·00
Mary L. Handlan	do	720·00
WRITERS.		
Lily A. Mapes	One year	900·00
Virginia Harrison	do	900·00
Kate Lawn	do	800·00
John Dale	Two months sixteen days	152·50
Deane S. Bliss	One year	720·00
John S. Hobgood	Eight months eleven days	516·28
Marie L. Fout	One year	710·22
Hetty S. Graves	Eleven months twenty-two days	702·44
Edw. F. Lopez	Eight months twenty-eight days	536·14
A. H. Bailey	Two months fifteen days	150·37
Daniel Hurley	One year	573·11
DRAFTSMEN.		
Adolph Lindenkohl	One year	2 400·00
Henry Lindenkohl	do	2 200·00
Edwin H. Fowler	do	2 000·00
William C. Willenbucher	do	2 000·00
Ferdinand Westdahl	do	1 800·00
Ernest J. Sommer	do	1 800·00
Frank C. Donn	do	1 800·00
David M. Hildreth	do	1 400·00
Charles H. Deetz	do	1 400·00
Edmund P. Ellis	do	1 200·00
Charles Mahon	do	1 000·00
Paul Erichsen	do	1 000·00
Francis W. Clay	Three months twenty-one days	251·90

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

SALARIES—PAY OF OFFICE FORCE, 1896—Continued.

To whom paid.	Time employed.	Amount.
DRAFTSMEN—continued.		
William R. Doores	Four months twenty-two days	$350·93
John T. Watkins	Six months twenty-two days	484·23
Claude V. Martin	Two months sixteen days	190·36
COMPUTERS.		
Edward H. Courtnay	One year	2 000·00
Myrick H. Doolittle	do	2 000·00
John B. Boutelle	do	1 600·00
Leland P. Shidy	do	1 600·00
Frank M. Little	do	1 595·65
Daniel L. Hazard	do	1 400·00
Rollin A. Harris	do	1 400·00
Charles H. Kummell	do	1 200·00
Harry F. Flynn	do	1 200·00
Lilian Pike	do	1 000·00
Jesse Pawling, jr	Two months twenty-eight days	244·49
Francis W. Clay	Eight months ten days	684·82
COPPERPLATE ENGRAVERS.		
William A. Thompson	One year	2 000·00
Henry M. Knight	do	2 000·00
William H. Davis	do	1 800·00
Edward H. Sipe	do	1 800·00
William F. Peabody	do	1 600·00
Henry L. Thompson	do	1 600·00
William A. Van Doren	do	1 200·00
Alfred H. Sefton	do	1 200·00
Peter H. Geddes	do	1 000·00
George Hergesheimer	do	900·00
Frank G. Wurdemann	do	862·17
Harry R. McCabe	do	900·00
William Mackenzie	do	900·00
Rowland H. Ford	do	400·00
ELECTROTYPER AND PHOTOGRAPHER.		
Louis P. Keyser	One year	1 800·00
ASSISTANT ELECTROTYPER AND PHOTOGRAPHER.		
Roy Thomas	One year	700·00
PLATE PRINTERS.		
D. N. Hoover	One year	1 600·00
Charles J. Harlow	do	1 000·00
Richard S. Bright	Two months twelve days	201·01
Eberhard Fordan	One year	998·64
Neil Bryant	do	1 000·00
George B. Crawford	do	1 000·00
James L. Smith	Nine months eighteen days	797·55
PLATE PRINTERS' HELPERS.		
Charles F. Locraft	One year	700·00
William H. Waddington	Seven months	408·65
Louis L. Williams	One year	700·00
Paul Dexter	do	700·00
Frank C. Gohre	do	699·05
William M. Conn	do	670·49
Charles Buckingham	Five months	290·40
INSTRUMENT MAKERS.		
Ernest G. Fischer	One year	1 633·69
Clement Jacomini	do	1 200·00
William R. Whitman	do	1 000·00
Stephen A. Kearney	do	1 000·00
Clarence E. Regennas	do	1 000·00
Michael Lauxmann, jr	do	900·00

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

SALARIES—PAY OF OFFICE FORCE, 1896—Continued.

To whom paid.	Time employed.	Amount.
CARPENTERS.		
Horace O. French	One year	$1 200·00
George W. Clarvoe	do	1 000·00
Charles N. Darnall	do	893·50
ENGINEER.		
P. J. Mullen	One year	1 000·00
WATCHMEN.		
David Parker	One year	880·00
John W. Drum	do	880·00
J. A. Dorsey	One month seven days	83·10
FIREMEN.		
Horace Dyer	One year	630·00
William H. Butler	Two months sixteen days	116·51
MESSENGERS.		
Edw. D. Scott	One year	880·00
Charles Over	do	820·00
Charles H. Jones	do	820·00
William R. McLane	do	820·00
Vicente Denis	do	820·00
Thomas McGoines	do	820·00
J. A. Dorsey	Ten months twenty-four days	735·79
John W. Reed	One year	700·00
George Newman	do	700·00
John W. Miner	do	640·00
Preston Boisseau	Nine months twenty-four days	522·20
John W. Hunter	One year	640·00
William H. Butler	Nine months fourteen days	447·50
Dennis E. White	One year	550·00
Owen E. McNeille	One month	45·30
PACKER AND FOLDER.		
Attrell Richardson	One year	630·00
LABORERS.		
J. H. Brown	One year	630·00
Baylor Crutchfield	Seven months twenty-nine days	415·93
Hans Bowdwin	One year	550·00
Boston Brown	do	550·00
John H. Mason	do	365·00
Virginia McGlincy	do	365·00
Expenditures		131 333·16
Appropriation		132 670·00
Expenditures		131 333·16
Unexpended balance		1 336·84

RECAPITULATION.

Pay of field officers	88 281·93
Pay of office force	131 333·16
Expenditures	219 615·09
Total sum appropriated for salaries	223 070·00
Total sum expended for salaries	219 615·09
Unexpended balance	3 454·91

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

PARTY EXPENSES, 1896.

ATLANTIC COAST.

To whom paid.	On what account.	Amount.
F. T. Akin & Co	Coal and stores for steamer Blake	$449·38
W. S. Benson, U. S. N.	Hydrography, steamer Endeavor	23·47
H. G. O. Colby, U. S. N.	Hydrography, steamer Blake	2 841·15
John W. Donn	Triangulation and topography	1 538·51
W. W. Duffield	Commutation	22·50
A. Dunlap, U. S. N.	Hydrography, steamer Blake	860·80
J. A. Flemer	Topography	1 090·66
Stehman Forney	....do	1 414·98
L. M. Garrett, U. S. N.	Hydrography, steamer Endeavor	376·53
George W. Knox Express Co.	Transportation	1·10
G. C. Hanus, U. S. N.	Hydrography, steamer Eagre	1 986·00
A. E. Hathaway	Repairing wagon and harness	24·00
W. C. Hodgkins	Topography	1 146·87
C. T. Iardella	....do	1 652·88
George McGaw	Storage	8·00
Robert G. Peck, U. S. N.	Hydrography, steamer Bache	2 477·01
John Steele	Storage and pasturage	56·00
W. Irving Vinal	Topography	1 348·58
D. B. Wainwright	....do	1 373·45
Expenditures		18 691·87
Appropriation		18 000·00
Add 10 per cent from tides, etc		500·00
Add 10 per cent from magnetics		200·00
Total		18 700·00
Expenditures		18 691·87
Unexpended balance		8·13

GULF COAST, ETC.

To whom paid.	On what account.	Amount.
George W. Knox Express Co.	Transportation	$9·21
George Olsen	....do	5·00
Robert G. Peck	Hydrography, steamer Bache	299·95
F. Walley Perkins	Triangulation	5 603·92
P. A. Welker	Combined operations	2 624·51
Amount disbursed		8 542·59
Railroad accounts referred for settlement		37·41
Expenditures		8 580·00
Appropriation		7 800·00
Add 6 per cent from Navy travel, etc		180·00
Add 10 per cent from objects not named		600·00
Total		8 580·00
Expenditures		8 580·00

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

PARTY EXPENSES, 1896—Continued.

OFFSHORE WORK, ETC.

To whom paid.	On what account.	Amount.
J. J. Blandin, U. S. N	Hydrography, steamer Endeavor	$349·47
H. G. O. Colby, U. S. N	Hydrography, steamer Blake	423·73
A. Dunlap, U. S. N	do	102·00
L. M. Garrett, U. S. N	Hydrography, steamer Endeavor	1 449·96
Inspector Seventh light-house district.	Oil for steamer Bache	22·84
Robert G. Peck, U. S. N	Hydrography, steamer Bache	2 575·95
J. A. Shearman, U. S. N	Hydrography, steamer Blake	170·84
Expenditures		5 094·79
Appropriation		5 000·00
Add 1 per cent from Pacific Coast		150·00
Total		5 150·00
Expenditures		5 094·79
Unexpended balance		55·21

PACIFC COAST.

To whom paid.	On what account.	Amount.
E. F. Dickins	Storage	$34·00
Lucian Flynne, U. S. N	Hydrography, steamer Gedney	222·69
J. J. Gilbert	Triangulation and topography	1 699·75
A. P. Osborn, U. S. N	Hydrography, steamer Gedney	4 852·59
J. F. Pratt	Storage	42·00
Revenue-Cutter Service	Flags for steamer Gedney	49·00
Aug. F. Rodgers	Triangulation and topography	2 476·61
James H. Sears, U. S. N	Hydrography, steamer McArthur	5 150·59
Amount disbursed		14 527·23
Railroad accounts referred for settlement		12·00
Expenditures		14 539·23
Apropriation		15 000·00
Less 1 per cent transferred to offshore work, etc	$150·00	
Expenditures	14 539·23	
		14 689·23
Unexpended balance		310·77

TIDES, ETC.

To whom paid.	On what account.	Amount.
William Anderson	Brazos Light Station tidal	$193·52
W. S. Benson, U. S. N	Tidal observations, steamer Endeavor	627·50
J. J. Blandin, U. S. N	do	65·81
L. M. Garrett, U. S. N	do	163·86
G. C. Hanus, U. S. N	Tidal observations, schooner Eagre	472·90
E. B. Latham	Establishing tide stations	350·21
Henry L. Marindin	Washington tidal and storage	53·50
Revenue-Cutter Service	Flags for steamer Endeavor and schooner Eagre.	45·95
Aug. F. Rodgers	Sausalito and San Francisco tidal	1 101·77
J. G. Spaulding	Fort Hamilton tidal	1 058·36
O. H. Tittmann	do	62·47
B. W. Weeks	Port Royal tidal	153·20
Expenditures		4 349·05
Appropriation		5 000·00
Less 10 per cent transferred to Atlantic Coast	$500·00	
Expenditures	4 349·05	
		4 849·05
Unexpended balance		150·95

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

PARTY EXPENSES, 1896—Continued.

REEDY ISLAND TIDE GAUGE.

To whom paid.	On what account.	Amount.
J. F. Pratt	Establishing tide gauge at Reedy Island.	$699.68
Appropriation		700.00
Expenditures		699.68
Unexpended balance		.32

COAST PILOT, ETC.

To whom paid.	On what account.	Amount.
G. C. Hanus, U. S. N.	Locating reported danger	$14.30
Talbot Pulizzi	Services	900.00
John Ross	do	1 500.00
Glennie Tarbox, U. S. N.	Hydrographic examination	332.63
Expenditures		2 746.93
Appropriation		3 000.00
Expenditures		2 746.93
Unexpended balance		253.07

MAGNETICS.

To whom paid.	On what account.	Amount.
James B. Baylor	Magnetic observations	$842.13
R. L. Faris	do	403.69
George R. Putnam	do	307.21
Aug. F. Rodgers	do	42.99
Expenditures		1 596.02
Appropriation		2 000.00
Less 10 per cent transferred to Atlantic Coast	$200.00	
Expenditures	1 596.02	
		1 796.02
Unexpended balance		203.98

LEVELING.

To whom paid.	On what account.	Amount.
Isaac Winston	Precise leveling	$2 156.68
Amount disbursed		2 156.68
Railroad accounts referred for settlement		47.09
Expenditures		2 203.77
Appropriation		2 500.00
Expenditures		2 203.77
Unexpended balance		296.23

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

PARTY EXPENSES, 1896—Continued.

GRAVITY, ETC.

To whom paid.	On what account.	Amount.
A. T. Mosman	Longitudes	$729·33
George R. Putnam	do	851·40
C. H. Sinclair	do	676·31
Expenditures		2 257·04
Appropriation		2 500·00
Expenditures		2 257·04
Unexpended balance		242·96

NAVY TRAVEL, ETC.

To whom paid.	On what account.	Amount.
W. S. Benson, U. S. N	Mileage	$14·72
G. B. Bradshaw, U. S. N	do	239·92
H. G. O. Colby, U. S. N	do	215·60
C. M. De Valin, U. S. N	do	83·84
John W. Donn	Special survey	234·57
A. Dunlop, U. S. N	Mileage	46.80
W. H. Faust, U. S. N	do	253·52
Stehman Forney	Traveling expenses	3·75
L. M. Garrett, U. S. N	Mileage	38·00
W. W. Gilmer, U. S. N	do	72·08
G. C. Hanus, U. S. N	do	16·80
John F. Hubbard, U. S. N	do	35·76
W. McLean, U. S. N	do	6.40
M. L. Miller, U. S. N	do	2·96
Jeff. F. Moser, U. S. N	do	923·36
A. P. Osborn, U. S. N	do	263·04
Robert G. Peck, U. S. N	do	42·88
J. H. Reid, U. S. N	do	3·76
Hugh Rodman, U. S. N	do	48·32
Glennie Tarbox, U. S. N	do	126·80
B. R. Ward, U. S. N	do	6·40
H. A. Wiley, U. S. N	do	15·04
Expenditures		2 694·32
Appropriation		3 000·00
Less 6 per cent transferred to Gulf Coast, etc	$180·00	
Expenditures	2 694·32	
		2 874·32
Unexpended balance		125·68

OBJECTS NOT NAMED.

To whom paid.	On what account.	Amount.
Baker & Richards	Stores for steamer Hassler	$6·90
W. W. Duffield	Traveling expenses	33·65
John Hoodless	Services	173·00
Charles Johnson	do	600·00
W. O. Luscombe	Storage	5·27
McKenzie, Oerting & Co	Stores for schooner Spy	21·45
Fremont Morse	Astronomical	52·90
George Olsen	Services	437·85
Aug. F. Rodgers	Astronomical and moving observatory	1 596·38
Carl F. Schiodt	Services	550·00
O. H. Tittmann	Traveling expenses as delegate to International Geodetic Conference.	333·22

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

PARTY EXPENSES, 1896—Continued.

OBJECTS NOT NAMED—Continued.

To whom paid.	On what account.	Amount.
Henry L. Whiting	Traveling expenses	$20·75
S. F. Whitmarsh	Storage	23·00
William E. Woodall & Co	Stores for schooner Matchless	54·20
Expenditures		3 908·57
Appropriation		6 000·00
Less 10 per cent transferred to Gulf Coast, etc	$600·00	
Expenditures	3 908·57	
		4 508·57
Unexpended balance		1 491·43

RECAPITULATION.

[Showing expenditures in gross by subitems.]

Subitems.	Amount.
Atlantic Coast	$18 691·87
Gulf Coast, etc	8 542·59
Offshore work, etc	5 094·79
Pacific Coast	14 527·23
Tides, etc	4 349·05
Reedy Island tide gauge	699·68
Coast Pilot, etc	2 746·93
Magnetics	1 596·02
Leveling	2 156·68
Gravity, etc	2 257·04
Navy travel, etc	2 694·32
Objects not named	3 908·57
Amount disbursed	67 264·77
Railroad accounts referred for settlement	96·50
Total expenditures	67 361·27
Total amount appropriated for party expenses, 1896	70 500·00
Total amount expended for party expenses, 1896	67 361·27
Unexpended balance	3 138·73

CLASSIFICATION OF EXPENDITURES FOR PARTY EXPENSES, 1896.

On what account.	Amount.
Triangulation	$9 366·20
Topography	12 006·33
Hydrography	30 153·75
Coast Pilot	2 746·93
Leveling	2 203·77
Magnetics	1 596·02
Geographical positions	2 257·04
Tidal operations	4 349·05
Establishing tide indicator at Reedy Island	699·68
Astronomical work and moving Presidio Observatory	1 649·28
Traveling expenses of delegate to International Geodetic Conference	333·22
Total	67 361·27

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

PARTY EXPENSES, 1895 AND 1896.

ALASKA.

To whom paid.	On what account.	Amount.
Bureau of Equipment, Navy	Coal for steamer Patterson	$402.56
E. K. Moore, U. S. N	Hydrography, steamer Patterson	8 547.16
Fremont Morse	Longitudes	1 885.88
Revenue-Cutter Service	Flags for steamer Patterson	46.50
Expenditures		10 882.10
Balance on hand, report for 1895		12 646.00
Less 5 per cent of appropriation transferred to transcontinental work	$750.00	
Expenditures	10 882.10	
		11 632.10
Present unexpended balance		1 013.90

STATE SURVEYS.

To whom paid.	On what account.	Amount.
John Barlow	Pasturage	$393.02
A. H. Buchanan	Triangulation	1 143.07
Thomas Hughes	Storage	4.18
F. Walley Perkins	Triangulation	3 419.06
C. H. Sinclair	California and Nevada boundary	5 815.01
Amount disbursed		10 774.34
Railroad accounts referred for settlement		121.92
Expenditures		10 896.26
Balance on hand, report for 1895		11 124.89
Received from F. Walley Perkins, repayment to credit of appropriation		3.40
		11 128.29
Expenditures		10 896.26
Present unexpended balance		232.03

TRANSCONTINENTAL WORK.

To whom paid.	On what account.	Amount.
A. L. Baldwin	Reconnaissance	$73.22
William Eimbeck	Triangulation	7 879.66
F. D. Granger	do	4 618.01
F. Walley Perkins	Storage and pasturage	138.00
P. A. Welker	Triangulation	660.61
Amount disbursed		13 369.50
Railroad accounts referred for settlement		113.11
Expenditures		13 482.61
Appropriation		13 000.00
Add 5 per cent from Alaska		750.00
Total		13 750.00
Expenditures		13 482.61
Unexpended balance		267.39

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

PARTY EXPENSES, 1895 AND 1896—Continued.

RECAPITULATION.

[Showing expenditures in gross by subitems.]

Subitems.	Amount.
Alaska	$10 882·10
State surveys	10 774·34
Transcontinental work	13 369·50
Amount disbursed	35 025·94
Railroad accounts referred for settlement	235·03
Expenditures	35 260·97
Balance on hand, report for 1895	36 770·89
Repayment by F. Walley Perkins to credit of State surveys	3·40
Total	36 774·29
Expended since, as above	35 260·97
Present unexpended balance	1 513·32

ALASKA BOUNDARY SURVEY.

[FROM JANUARY 1, 1896, TO OCTOBER 31, 1896.]

To whom paid.	On what account.	Amount.
W. W. Duffield	Traveling expenses	$40·25
H. J. Wallace	Storage	6·00
Amount disbursed		46·25
Railroad accounts referred for settlement		20·00
Expenditures		66·25
Unexpended balance on hand Jan. 1, 1896		649·37
Expenditures		66·25
Present unexpended balance		583·12

REPAIRS OF VESSELS, 1896.

To whom paid.	On what account.	Amount.
American Ship Windlass Co	Steamer Blake	$43·00
W. S. Benson, U. S. N	Steamer Endeavor	114·00
John A. Berg	Schooner Quick	112·88
W. H. Birch & Co	Steamer McArthur	1 072·00
W. H. H. Bixler & Co	Schooner Matchless	294·01
H. G. Clay, Jr., & Co	Steam launch No. 28	325·00
H. G. O. Colby, U. S. N	Steamer Blake	1 582·09
Davis Coast Wrecking Co	Schooner Eagre	65·00
A. Dunlap, U. S. N	Steamer Blake	149·64
Lucian Flynne, U. S. N	Steamer Gedney	12·00
L. M. Garrett, U. S. N	Steamer Endeavor	570·20
J. J. Gilbert	Steam launch Tarry Not	3·50
G. C. Hanus, U. S. N	Schooner Eagre	1 665·70
John Hoodless	Schooners Quick and Spy	330·25
E. K. Moore, U. S. N	Steamers Patterson and Hassler	22 225·14
Jeff. F. Moser, U. S. N	Schooner Matchless	47·15
A. P. Osborn, U. S. N	Steamer Gedney	503·95
Robert G. Peck, U. S. N	Steamer Bache	602·10
C. S. Rossiter & Co	Schooner Matchless	260·00
James H. Sears, U. S. N	Steamer McArthur	281·74
Stevenson & McGee	Schooner Matchless	390·00
Glennie Tarbox, U. S. N	Schooner Transit	159·44
William E. Woodall & Co	Steamer Blake and Schooner Matchless	6 987·06
Expenditures		37 795·85
Appropriation		38 000·00
Expenditures		37 795·85
Unexpended balance		204·15

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

REPAIRS OF VESSELS, 1896—Continued.

CLASSIFICATION OF EXPENDITURES FOR REPAIRS OF VESSELS.

Name of vessel.	Amount.
Steamer Bache	$602·10
Steamer Blake	3 035·63
Schooner Eagre	1 730·70
Steamer Endeavor	684·20
Steamer Gedney	515·95
Steamer Hassler	328·00
Schooner Matchless	6 717·32
Steamer McArthur	1 353·74
Steamer Patterson	21 897·14
Schooner Quick	161·63
Schooner Spy	281·50
Steam launch Tarry Not	3·50
Schooner Transit	159·44
Steam launch No. 28	325·00
Total	37 795·85

PUBLISHING OBSERVATIONS, 1896.

To whom paid.	On what account.	Amount.
Gertrude Harrison	Services	$229·03
F. L. Kendrick	do	50·00
Buford Lynch	do	468·97
Ernest Whitehead	do	247·58
Expenditures		995·58
Appropriations		1 000·00
Expenditures		995·58
Unexpended balance		4·42

GENERAL EXPENSES, 1896.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS.

To whom paid.	On what account.	Amount.
The Alfred Ely Co	Instrument and carpenter shops	$84·94
American Engineer Car Builder and Railroad Journal.	Subscriptions	1·00
American Journal of Commerce	Books	·75
D. Appleton & Co	Subscriptions	5·00
William Ballantine & Sons	Books	4·20
D. Ballauf	Instrument shop	12·00
Bausch & Lomb Optical Co	Instruments and instrument shop	143·38
Benedict & Burnham Manufacturing Co.	Instrument shop	189·80
A. Berger	do	42·50
Thomas Binnix	do	1·60
John Bliss & Co	Instruments	48·00
Andrew W. Boyd	Books	15·00
Brown & Sharp Manufacturing Co.	Instruments and instrument shop	110·74
Buffalo Dental Manufacturing Co	Instrument shop	54·36
J. H. Bunnell & Co	Instruments	25·00
W. H. Butler	Instrument and carpenter shops	4·33
The Carborundum Co	Instruments and instrument shop	36·13
John Chatillon & Son	Instrument shop	8·25
J. H. Chesley & Co	Instrument and carpenter shops and drawing division.	67·34
Church & Stephenson	Carpenter shop	25·00
Cincinnati Varnish Co	do	2·70

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

GENERAL EXPENSES, 1896—Continued.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS—Continued.

To whom paid.	On what account.	Amount.
William D. Clark & Co	Instrument and carpenter shops	$26.01
Cushman Chuck Co	Instrument shop	3.00
Edward S. Dana	Subscriptions	6.00
Darling, Brown & Co	Drawing division	36.00
John Dickerson	Instrument shop	10.00
Henry Disston & Sons	Instruments	1.65
Doremus & Just	Instruments and instrument shop	6.00
Alfred Ely & Co	Instrument shop	8.45
E. Morrison Paper Co	do	1.00
The Engineering Magazine Co	Subscriptions	3.00
George T. Ennis	Instrument shop	152.50
J. C. Ergood & Co	do	6.48
W. F. Evans & Sons	do	15.33
Felt & Tarrant Manufacturing Co	Instruments	350.00
C. B. Fenton & Co	Instrument shop	.60
M. N. Forney	Subscriptions	1.50
Geological Publishing Co	do	3.50
Z. D. Gilman	Instrument and carpenter shops	4.25
Ginn & Co	Subscriptions	2.50
Otto Coelze	Instrument shop	4.00
Henry J. Green	Instruments	30.00
Hanlon & Goodman	Carpenter shop	3.42
Robert N. Harper	Drawing division	3.00
R. M. Harrover	Instrument and carpenter shops	3.40
Louis S. Hayden	Books	1.50
Henry McShane Manufacturing Co	Instrument shop	1.67
Herz Hoffa	do	.50
John Boland Book and Stationery Co	Books	3.25
Johns Hopkins Press	Subscriptions	5.00
Jones & Laughlin, Limited	Instrument shop	12.17
M. E. Kahler	Instruments and instrument shop	140.45
J. Karr	Instrument shop	52.00
W. H. Kemp & Co	do	12.94
J. B. Kendall	Instrument and carpenter shops	4.34
W. L. King	Instrument shop	12.90
James B. Lambie	Instrument and carpenter shops	49.10
Julius Lansburgh	Instrument shop	11.15
Leland & Faulconer Maunfacturing Co.	Carpenter shop	81.00
Lemcke & Duechner	Books and subscriptions	41.00
Melville Lindsay	Instrument shop	5.95
Loeb Bros	do	1.60
W. H. Lowdermilk & Co	Books and subscriptions	76.22
Lutz Bros	Instruments and instrument shop	33.65
Mackall Bros. & Flemer	Instrument and carpenter shops	2.93
The Macmillan Co	Subscriptions	3.00
Mahn & Co	Instruments	675.00
R. H. Mallalieu	Instrument shop	42.50
F. P. May & Co	Instrument and carpenter shops	12.01
McFadden Co	do	13.06
W. H. Mehler	Instrument shop	1.75
E. K. Moore	do	30.00
Munn & Co	Subscriptions	7.00
George F. Muth & Co	Instrument and carpenter shops and drawing division.	26.49
T. S. & J. D. Negus	Instruments	257.00
John C. Parker	Books	5.00
Phosphor Bronze Smelting Co., Limited.	Instrument shop	10.03
Charles S. Platt	do	15.52
Publishers Weekly	Subscriptions	5.00
E. J. Pullman	Instrument shop	3.60
William Ramsey	do	16.50
Rand, McNally & Co	Books	9.25
Reed & Prince Manufacturing Co	Instrument and carpenter shops	12.25
Hugh Reilly	do	72.83
E. S. Ritchie & Sons	Instrument shop	25.90
Rochester Optical Co	Instruments	1.45

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

GENERAL EXPENSES, 1896—Continued.

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS—Continued.

To whom paid.	On what account.	Amount.
August P. Rodgers	Instrument shop and books	$11·75
Scheller & Stevens	Instrument shop	4·14
Fred. A. Schmidt	Instruments, instrument shop, and drawing division.	206·30
C. A. Schneider's Son	Instrument shop	5·00
L. H. Schneider's Son	Instrument and carpenter shops	44·40
Science	Subscriptions	5·00
Seth Thomas Clock Co	Instruments	62·40
George A. Shehan	Carpenter shop	401·90
Shoemaker & Busch	Instrument shop	3·25
M. Silverberg & Co	Carpenter shop	2·16
Thomas W. Smith	....do	·76
Thomas Somerville & Sons	Instrument shop	·80
Gustav E. Stechert	Books and subscriptions	201·75
Ormond Stone	Books	2·00
Sussfeld, Lorsch & Co	Instruments	90·00
University of Chicago	Subscriptions	5·00
United States Naval Institute	....do	3·50
Julius Wamschoff	Instruments	1 154·69
F. Weber & Co	Drawing division	23·63
B. Westermann & Co	Books and subscriptions	4·39
Wetherill & Bros	Carpenter shop	11·03
Louis Weule	Instruments and instrument shop	101·50
Williams & Hanks	Instrument shop	14·69
Willsey & Wood	Books	10·00
Amount disbursed		5 728·11
Account settled by Auditor, for calculating machine		101·22
Expenditures		5 829·33
Appropriation		8 000·00
Expenditures		5 829·33
Unexpended balance		2 170·67

COPPER PLATES, CHART PAPER, PRINTING INK; COPPER, ZINC, AND CHEMICALS FOR ELECTROTYPING AND PHOTOGRAPHING; ENGRAVING, PRINTING, PHOTOGRAPHING, AND ELECTROTYPING SUPPLIES; EXTRA ENGRAVING AND DRAWING; PHOTOLITHOGRAPHING AND PRINTING FROM STONE AND COPPER FOR IMMEDIATE USE.

To whom paid.	On what account.	Amount.
J. C. Addison	Chart paper	$2 756·30
James L. Barbour & Son	Printing supplies	1·22
Charles E. Barrick	Electrotyping supplies	44·00
Charles Becker	Printing supplies	1·25
Julius Bein & Co	Photolithographing	980·25
B. F. T. Bell	Printing supplies	2·00
Henry H. Brown	Photographing and electrotyping supplies.	25·25
Bureau Engraving and Printing	Printing supplies	951·17
W. H. Butler	....do	21·20
J. H. Chesley & Co	....do	·50
Cincinnati Varnish Co	Photographing supplies	·86
W. D. Clark & Co	Printing supplies	179·45
Clendennin Bros	Copper plates	730·66
Easton & Rupp	Printing supplies	7·90
Z. D. Gilman	Engraving, printing, photographing, and electrotyping supplies.	88·68
The Gillin Printing Co	Photolithographing	923·53
Goodyear Rubber Co	Photographing supplies	1·75
Andrew B. Graham	Photolithographing	316·26
H. Hoffa	Engraving supplies	14·00
Jones & Laughlin, Limited	Printing supplies	17·92
J. B. Kendall	Electrotyping supplies	13·08

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

GENERAL EXPENSES, 1896—Continued.

COPPER PLATES, CHART PAPER, PRINTING INK, COPPER, ZINC, AND CHEMICALS FOR ELECTROTYPING AND PHOTOGRAPHING, ETC.—Continued.

To whom paid.	On what account.	Amount.
James B. Lambie	Printing supplies	$0.35
Lansburgh & Bros	do	4.75
Loeb Bros	do	14.76
Mackall Bros. & Flemer	Printing, photolithographing, and electrotyping supplies.	26.13
Mackey Print Paper Co	Photographing and electrotyping supplies.	20.25
Manhattan Supply Co	Copper plates	471.16
Mathiessen & Hayden	Zinc	170.78
F. P. May & Co	Printing supplies	1.30
Robert Mayer & Co	do	23.00
W. H. Mehler	Printing and electrotyping supplies	7.00
E. Morrison Paper Co	Printing supplies	6.60
Mount Holly Paper Co	Chart paper	11.70
Charles A. Muddiman	Printing supplies	3.06
George F. Muth & Co	Printing, photographing, and electrotyping supplies.	24.70
The Norris Peters Co	Photolithographing	52.00
New York Steel and Copper Plate Co.	Copper plates	240.00
The Otto Gas Engine Works	Printing supplies	4.40
Peter Adams Co	Chart paper and printing supplies	707.12
Peter Adams Paper Co	Chart paper	38.20
E. J. Pullman	Photographic and electrotyping supplies.	68.05
E. J. Pullman & Son	Photographing supplies	13.50
Hugh Reilly	Printing supplies	89.62
Aug. F. Rodgers	Photographing supplies	.20
Scheller & Stevens	do	.66
L. H. Schneider's Son	Printing supplies	2.48
C. Schneider	do	4.00
Fred. A. Schmidt	do	8.01
Shoemaker & Busch	Printing and electrotyping supplies	84.75
Aug. C. Taylor & Co	Printing supplies	9.70
F. S. Williams & Co	do	.75
Expenditures		9 186.21
Appropriation		18 000.00
Received from Hydrographic Office, Navy Department, for electrotyping done for that Bureau		38.60
		18 038.60
Expenditures		9 186.21
Unexpended balance		8 852.39

STATIONERY, TRANSPORTATION OF INSTRUMENTS AND SUPPLIES, OFFICE WAGON AND HORSES, FUEL, GAS, TELEGRAMS, ICE, AND WASHING.

To whom paid.	On what account.	Amount.
Adams Express Co	Transportation	$101.26
J. C. Addison	Stationery	6.00
William Ballantyne & Son	do	6.70
H. Baumgarten	do	11.19
J. Baumgarten & Son	do	.48
William H. Brown	Fuel	758.00
James Connor	Office horse	28.75
E. Morrison Paper Co	Stationery	6.60
Eugene Dietzzen Co	do	16.80
George W. Knox Express Co	Transportation	11.43
Holmes & Co	Stationery	6.78
J. F. W. Dorman Co	do	4.43
Lancaster Pen Co	do	66.00
Nanny D. Lee	Washing	141.48

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

GENERAL EXPENSES, 1896—Continued.

STATIONERY, TRANSPORTATION OF INSTRUMENTS AND SUPPLIES, OFFICE WAGON AND HORSES, FUEL, GAS, TELEGRAMS, ICE, AND WASHING—Continued.

To whom paid.	On what account.	Amount.
Lemcke & Buchner	Transportation	$0.30
Lutz & Bro	Office horse	12.75
McDermott Carriage Co	Office wagon	.60
N. G. Mengert	Transportation	43.55
George F. Muth & Co	Stationery	7.70
John C. Parker	....do	42.55
People's Dispatch Co	Transportation	.40
Postal Cable Telegraph Co	Telegrams	2.26
Aug. F. Rodgers	Stationery and washing	15.37
Nicholas Schlegel	Office horses	100.00
Fred A. Schmidt	Stationery	92.17
B. F. Shaw	Office horse	253.10
Smithsonian Institution	Transportation	24.95
Stephenson's Express	....do	12.15
Tice & Lynch	....do	2.15
Trustees of George L. Sheriff	Fuel	155.60
United States Express Co	Transportation	48.37
Washington Gas Light Co	Gas	1 643.13
Western Union Telegraph Co	Telegrams	96.11
E. M. Willis	Ice	122.42
Amount disbursed		3 841.53
Accounts settled by Auditor, for stationery and telegrams		1 032.65
Expenditures		4 874.18
Appropriation		6 000.00
Expenditures		4 874.18
Unexpended balance		1 125.82

MISCELLANEOUS EXPENSES, CONTINGENCIES OF ALL KINDS, OFFICE FURNITURE, REPAIRS, EXTRA LABOR, AND TRAVELING EXPENSES (OFFICE).

To whom paid.	On what account.	Amount.
J. C. Addison	Contingencies	$0.75
James A. Andrews	Repairs	10.00
Charles E. Barrick	Contingencies and repairs	94.50
Beck Bro	Contingencies	2.50
James Bennett	....do	94.00
Thomas Binnix	....do	51.50
Blum Bros	....do	22.64
David S. Brown & Co	....do	8.97
Brown & Sharpe Manufacturing Co	....do	7.24
Charles Buckingham	Extra labor	280.65
N. Bunch & Co	Contingencies	3.50
W. H. Butler	....do	4.24
The Capitol Press Co	Advertising	3.15
J. H. Chesley & Co	Contingencies and office furniture	45.47
Chesapeake and Potomac Telephone Co.	Exchange rental	102.50
Dorsey Claggett	Contingencies	2.50
W. D. Clark & Co	....do	236.84
Walter Y. Clark	Extra labor	600.00
James F. Collins	Contingencies	59.00
M. G. Copeland & Co	....do	41.36
W. B. Coppersmith	Extra labor	12.00
Craig & Harding	Office furniture	5.25
J. W. Drew & Co	Contingencies	6.25
Will Ward Duffield	Traveling expenses (office)	73.30
Otto Duke & Co	Office furniture	136.00
J. C. Ergood & Co	Contingencies	18.16
Evening Star Newspaper Co	Advertising	22.20
R. J. Fondren	Extra labor	241.38
Frank Freeman	Contingencies	13.00

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

GENERAL EXPENSES, 1896—Continued.

MISCELLANEOUS EXPENSES, CONTINGENCIES OF ALL KINDS, OFFICE FURNITURE, REPAIRS, EXTRA LABOR, AND TRAVELING EXPENSES (OFFICE)—Continued.

To whom paid.	On what account.	Amount.
John C. Gaither	Extra labor	$12·00
Richard Gasch	Contingencies	13·20
Alfred Gilbert	Extra labor	360·00
Francis Harral	Contingencies	11·25
R. M. Harrover	....do	70·00
The Hatchet	Advertising	4·10
Henry McShane Manufacturing Co.	Contingencies	3·02
Charles P. Holden	....do	6·00
Henry Jones & Co	....do	1·50
L. M. Kathman	....do	12·00
J. B. Kendall	....do	2·12
Kennedy & Du Perow	....do	2·50
W. L. King	....do	2·50
James B. Lambie	....do	·99
Julius Lansburgh	Contingencies and office furniture	154·03
Lutz & Bro	Contingencies	·50
W. L. McLeod	Repairs	125·00
F. P. May & Co	Contingencies	10·60
Manhattan Supply Co	....do	8·94
W. H. Mehler	....do	2·19
Edward Miller	....do	12·00
J. T. Mockabie	....do	8·00
W. B. Moses & Son	Contingencies and office furniture	42·00
Charles A. Muddiman	Contingencies	10·69
George F. Muth Co	....do	11·08
National Building Register	Advertising	9·00
John C. Parker	Contingencies	15·00
Thomas Pearsall, Jr	....do	6·97
Thomas C. Plummer	....do	8·00
Isaac B. Potts	....do	5·23
E. D. Preston	Traveling expenses (office)	4·25
Hugh Reilly	Contingencies	·76
The Republic	Advertising	2·40
Revenue Cutter Service	Contingencies	7·35
The Review	Advertising	3·40
Aug. F. Rodgers	Contingencies	32·32
E. G. Schafer & Co	....do	6·89
L. H. Schneider's Son	....do	10·09
George A. Shehan	....do	278·75
Shoemaker & Busch	....do	20·17
Smith Premier Typewriter Co	....do	90·00
Thomas Somerville & Sons	....do	5·92
Standard Oil Co	....do	3·06
J. R. Stine & Co	....do	2·75
O. H. Tittmann	Traveling expenses (office)	17·00
H. O. Towles	Office furniture	7·00
United Typewriter Supplies	Contingencies	90·00
Vokes Tribune	Advertising	12·60
Washington News Publishing Co	....do	3·90
Washington Post Co	....do	22·20
Washington Sentinel	....do	4·00
Washington Times	....do	13·30
John Walsh	Contingencies	21·00
J. E. Watts	....do	·85
Wetherell & Bro	....do	7·35
James P. Willett	Post-office box rent	20·00
Henry G. Williams	Extra labor	445·16
Wilmarth & Edmonston	Contingencies	4·40
Wyckoff, Seamans & Benedict	....do	113·31
Expenditures		4 379·44
Appropriation		4 500·00
Expenditures		4 379·44
Unexpended balance		120·56

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

GENERAL EXPENSES, 1896—Continued.

CLASSIFICATION OF EXPENDITURES FOR GENERAL EXPENSES, 1896.

On what account.	Amount.	On what account.	Amount.
Instruments	$3 280·20	Transportation of instruments and supplies	$244·56
Instrument shop	1 296·52	Office horse and wagon	395·20
Carpenter shop	673·37	Fuel	913·60
Drawing division	143·88	Gas	1 643·13
Books	282·97	Telegrams	101·51
Subscriptions	152·39	Ice	122·42
Copper plates	1 074·92	Washing	142·63
Chart paper	3 503·12	Miscellaneous expenses and contingencies of all kinds	1 955·99
Engraving, printing, photographing, and electrotyping supplies	2 326·83	Office furniture	189·71
Photolithographing and printing from stone and copper for immediate use	2 281·34	Repairs	188·00
Stationery	1 311·13	Extra labor	1 951·19
		Traveling expenses (office)	94·55
		Total	24 269·16

RECAPITULATION.

[Showing expenditures in gross (by subitems) on account of appropriation for general expenses, 1896.]

Subitems.	Amount.
Instruments, instrument shop, carpenter shop, drawing division, books, maps, charts, and subscriptions	$5 728·11
Copper plates, chart paper, printing ink, copper, zinc, and chemicals for electrotyping and photographing; engraving, printing, photographing, and electrotyping supplies; extra engraving and drawing; photolithographing and printing from stone and copper for immediate use	9 186·21
Stationery, transportation of instruments and supplies, office wagon and horses, fuel, gas, telegrams, ice, and washing	3 841·53
Miscellaneous expenses, contingencies of all kinds, office furniture, repairs, extra labor, and traveling expenses (office)	4 379·44
Total disbursements	23 135·29
Accounts settled by Auditor, for calculating machine, stationery, and telegrams	1 133·87
Total expenditures	24 269·16
Total amount appropriated for general expenses, 1896	36 500·00
Received from Hydrographic Office, Navy Department, for electrotyping done for that Bureau	38.60
	36 538·60
Total amount expended for general expenses, 1896	24 269·16
Unexpended balance	12 269·44

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

SALARIES—STANDARD WEIGHTS AND MEASURES, 1896.

To whom paid.	Time employed.	Amount.
ADJUSTER.		
Louis A. Fischer	One year	$1 500·00
MECHANICIAN.		
Otto Storm	One year	1 250·00
ASSISTANT MESSENGER.		
Charles A. Harbaugh	One year	720·00
WATCHMAN.		
James A. McDowell	One year	720·00
Expenditures		4 190·00
Appropriation		4 190·00
Expenditures		4 190·00

CONTINGENT EXPENSES—STANDARD WEIGHTS AND MEASURES, 1896.

MATERIALS, APPARATUS, AND INCIDENTAL EXPENSES.

To whom paid.	On what account.	Amount.
William D. Clark & Co	Material	$7·63
J. F. Collins	Apparatus	35·00
J. C. Ergood & Co	Materials	·50
General Electric Co	do	16·20
Z. D. Gilman	do	31·83
Emil Grenier	Apparatus	12·50
Holmes & Co	Materials	·87
Julius Lansburgh	do	35·55
F. P. May & Co	do	1·44
Queen & Co	do	3·55
George A. Shehan	do	15·84
George B. Webb	do	12·50
Wyckoff, Seamans & Benedict	Repairing typewriter	16·00
Amount disbursed		189·41
Accounts with foreign countries referred to Auditor for settlement		261·96
Expenditures		451·37
Appropriation		500·00
Expenditures		451·37
Unexpended balance		48·63

Statement of the expenditures of the United States Coast and Geodetic Survey—Continued.

CONTINGENT EXPENSES—STANDARD WEIGHTS AND MEASURES, 1896—Continued.

GENERAL RECAPITULATION.

[Showing appropriations, expenditures, and balances for the fiscal year ending June 30, 1896; also on account of Alaska Boundary Survey and party expenses, 1895 and 1896.]

Name of appropriation.	Appropriated.	Expended.	Balances.
Salaries:			
Pay of field officers	$90 400·00	$88 281·93	$2 118·07
Pay of office force	132 670·00	131 333·16	1 336·84
Party expenses	70 500·00	67 361·27	3 138·73
Alaska Boundary Survey—balance from last report	649·37	66·25	583·12
Repairs of vessels	38 000·00	37 795·85	204·15
Publishing observations	1 000·00	995·58	4·42
Party expenses, 1895 and 1896:			
Balance from last report ..... $36 770·89			
Repayment from F. Walley Perkins ..... 3·40	36 774·29	35 260·97	1 513·32
General expenses:			
Sundry civil act Mar. 2, 1895 . 36 500·00			
Received from Hydrographic Office, Navy Department... 38·60	36 538·60	24 269·16	12 269·44
Salaries—Weights and Measures	4 190·00	4 190·00	·0·00
Contingent expenses—Weights and Measures	500·00	451·37	48·63
Total	411 222·26	390 005·54	21 216·72

Appropriations and expenses.		Amount.
Amounts appropriated and available as follows:		
Appropriation for Coast and Geodetic Survey proper for fiscal year ending June 30, 1896, sundry civil act, Mar. 2, 1895		$369 070·00
Appropriation for Office of Standard Weights and Measures, legislative act, Mar. 2, 1895		4 690·00
Balance from last report on account of Alaska Boundary Survey		649·37
Balance from last report on account of party expenses, 1895 and 1896	$36 770.89	36 774·29
Received from F. Walley Perkins on account of party expenses, 1895 and 1896	3·40	
Received from Hydrographic Office on account of general expenses		38·60
		411 222·26
Amounts expended as follows:		
For Coast and Geodetic Survey	$385 297·92	
For Office of Standard Weights and Measures	4 641·37	
For Alaska Boundary Survey	66·25	
		390 005·54
Total unexpended balance		21 216·72

The balances on these appropriations are subject to reduction on account of outstanding obligations, and the total unexpended balance will be reduced accordingly.

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1895.

PARTY EXPENSES, 1895.

MAGNETICS.

To whom paid.	On what account.	Amount.
L. G. Schultz	Magnetic observations	$16·89
Balance on hand, report for 1895		39·57
Expended since, as above		16·89
Present unexpended balance		22·68

RECAPITULATION.

[Showing expenditures in gross by subitems.]

Subitems.	Amount.
Magnetics	$16·89
Balance on hand, report for 1895	5 292·57
Expended since, as above	16·89
Present unexpended balance	5 275·68

INSTRUMENTS, INSTRUMENT SHOP, CARPENTER SHOP, DRAWING DIVISION, BOOKS, MAPS, CHARTS, AND SUBSCRIPTIONS.

To whom paid.	On what account.	Amount.
American Journal of Commerce	Books and subscriptions	$13·20
Louis P. Casella	Instruments	583·92
Gustav E. Stechert	Books	12·00
Expenditures		609·12
Balance on hand, report for 1895		5 461·01
Expended since, as above		609·12
Present unexpended balance		4 851·89

COPPER PLATES, CHART PAPER, ETC.

To whom paid.	On what account.	Amount.
R. F. Bartle & Co	Extra engraving	$1 855·36
Balance on hand, report for 1895		6 054·76
Expended since, as above		1 855·36
Present unexpended balance		4 199·40

MISCELLANEOUS EXPENSES, CONTINGENCIES OF ALL KINDS, OFFICE FURNITURE, REPAIRS, EXTRA LABOR, AND TRAVELING EXPENSES (OFFICE).

To whom paid.	On what account.	Amount.
Evening Star Newspaper Co	Advertisement	$5·10
Unexpended balance, report for 1895		1 821·37
Expended since, as above		5·10
Present unexpended balance		1 816·27

Expenditures since last report on account of the appropriations for the service of the fiscal year ending June 30, 1895—Continued.

PARTY EXPENSES, 1895—Continued.

RECAPITULATION.

[Showing expenditures by subitems.]

Subitems.	Amount.
Instruments, instrument shop, etc	$609·12
Copper plates, chart paper, etc	1 855·36
Miscellaneous expenses, etc	5·10
Expenditures	2 469·58
Balance on hand, report for 1895	15 062·65
Expended since, as above	2 469·58
Present unexpended balance	12 593·07

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF THE DISBURSING AGENT,
Washington, D. C., November 1, 1896.

I certify that the foregoing statement is a correct exhibit of all expenditures for the United States Coast and Geodetic Survey, and for the Office of Standard Weights and Measures, for the fiscal year ending June 30, 1896, and for all preceding years embraced within the limits of the law for making such expenditures, including all accounts paid up to the close of business on October 31, 1896.

R. J. GRIFFIN,
Disbursing Agent, United States Coast and Geodetic Survey.

Approved:
W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey.

OFFICE REPORT NO. 4—1896.

REPORT OF THE ASSISTANT IN CHARGE OF THE OFFICE OF STANDARD WEIGHTS AND MEASURES FOR THE FISCAL YEAR ENDING JUNE 30, 1896.

UNITED STATES COAST AND GEODETIC SURVEY,
OFFICE OF STANDARD WEIGHTS AND MEASURES,
Washington, D. C., June 30, 1896.

SIR: I have the honor to submit the annual report of the Office of Standard Weights and Measures for the fiscal year ending June 30, 1896.

The usual operations of verification and adjustment of weights, capacity measures, standards of length, etc., for other Departments of the Government, States, institutions of learning, engineers and surveyors, manufacturers and private parties, have been carried on during the year, and, notwithstanding the limited force of the Office, prompt response has been made to all calls for information.

Messrs. L. A. Fischer and C. A. Harbaugh have, as heretofore, efficiently performed the various duties devolving upon them, and have served continuously throughout the year.

Mr. Fischer, in addition to his regular duties, prepared the weights and measures exhibit for the Atlanta Exposition and installed it there, being absent for that purpose from August 26 to September 9. He was again called to Atlanta, in connection with the Treasury Department exhibit, on December 2 and remained until the 10th. He also rendered valuable assistance in the important special observations and investigations mentioned farther on, viz, the determination of the value of the Committee Metre in terms of the international prototype, the construction of the 50-metre comparator, the verification of the lengths and constants of the secondary base bars Nos. 13 and 14, and the standardization and determination of constants of the new duplex base bars Nos. 15 and 16.

Mr. Harbaugh's duties have been of a miscellaneous character, including the comparison of alcoholometers, etching of steel tapes, assisting in tape comparisons, indexing records, typewriting, etc. In addition to attending to the clerical work of the Weights and Measures Office, he has also done all the typewriting for the Superintendent's Annual Report.

The mechanician, Mr. Otto Storm, has, for the greater part of the year, been detailed to the instrument division, his services not being continuously required in the Weights and Measures Office. On the other hand, when emergencies required the performance of considerable work—as the construction of apparatus in a limited time—the instrument division has reciprocated by temporarily putting on it as many mechanicians as were necessary. In this way the new cut-off apparatus and the new microscopes for the 50-metre comparator were constructed, and the arrangement has proved mutually beneficial.

Laborer R. B. Crutchfield was assigned to the Office on May 15 and served for the remainder of the year. He assisted in the examination of specimens of sea water and performed miscellaneous duty.

Electrical units.—Assistant G. R. Putnam was assigned to duty under my direction on October 21, and so continued until January, rendering valuable service, especially in the matter of preparing for the making and testing of electrical standards. He constructed, in accordance with the specifications published by the National Academy of Sciences under date of February 20, 1895, six standard Clark Cells, and subsequently compared them with each other and with the standard Carhart Cell in the possession of this Office, and discussed and computed the observations. As a preliminary to the testing of the Clark Cells the Resistance boxes to be used were carefully investigated and intercompared, and their resistances determined in terms of the standard No. 75; the

various galvanometers used were also subjected to a rigid examination. Mr. Putnam also assisted in the observations for the determination of the relation between the Committee Metre and the Prototype Metre No. 21.

Some progress has been made in the acquiring of other electrical standards, but as the annual appropriation for the purchase of material and apparatus, and for incidental expenses, is only $500, the work necessarily proceeds slowly, and some time will elapse before we can hope to have a reasonably complete outfit for the determination and verification of electrical units.

Committee Metre.—The International Prototype Metre being now regarded as our fundamental standard of length, the determination of the relation of the old Committee Metre thereto is a matter of great importance, and several series of observations have from time to time been made. The direct comparisons made during the previous year by Mr. L. A. Fischer, while very accordant among themselves, gave a value slightly different from what was expected, and it was deemed advisable to further test the matter by means of a method not depending on the reflection of threads in the ends of the Committee Metre. Accordingly, as stated in the Report for 1895, two auxiliary abutting pieces were made, each with a fine line drawn upon it. These were used during the observations of this year, being held in contact with the ends of the metre by means of light springs, and the lines observed in direct comparison with those on Prototype Metre No. 21, thus obviating the possible uncertainties of estimating the midway point between a thread or spider line and its reflection. The value of the abutting pieces was at different times carefully determined by bringing their abutting surfaces together and then measuring the distance between their lines by means of a microscope micrometer. Comparisons between the Committee Metre and Prototype Metre No. 21 were made by Messrs. Fischer, Putnam, and myself, during January and February, 1896, the abutting pieces being frequently shifted in position and occasionally interchanged. It was found that for any given position the results by the three observers were practically identical, but that the interchange of abutting pieces, and sometimes their mere reversal without interchange, produced a variation, the range of observations being about 4 microns. Unfortunately the ends of the Committee Metre are not now true planes, and defects and irregularities of surface are plainly visible. The variation of results is doubtless due to this fact, and I am of the opinion, as stated in my February report, that a further multiplication of observations will be useless and that a closer approximation of the true original value of the Committee Metre can not now be obtained. Taking the mean of all observations by the various methods, however, the resulting error of the Committee Metre does not appear to exceed one micron.

50-Metre comparator.—Occasion having arisen for the verification of the lengths and constants of secondary base bars Nos. 13 and 14 on account of their having been in a railway accident, and also for the standardization of the new duplex bars designed by Assistant William Eimbeck and recently constructed by the instrument division, it became necessary to consider the best and most expeditious methods of accomplishing the work, and as none of the apparatus and facilities available were entirely satisfactory, it was decided to recommend the construction of a permanent 50-metre comparator. This, by enabling us to make with any set of bars repeated measures of a known distance determined by means of a standard in melting ice and consequently at a constant temperature, it was believed would afford the most accurate results, and with a not unreasonable expenditure of time and labor.

The recommendation having been approved by you, the necessary plans and drawings were at once prepared by Mr. L. A. Fischer, and the construction was begun in November, and by the cooperation of the instrument division completed in January.

As the comparator was essentially of the same design as the temporary 100-metre one used in connection with the measurement of the Holton Base in 1892, and which has been fully described by Assistant R. S. Woodward in Appendix No. 8 of Report for 1892, it is unnecessary to enter here into details. The following particulars, however, should be stated: The terminal piers, 50 metres apart, are of brick, solidly built, and resting on 4 by 4 feet concrete foundations extending to a depth of 5 feet below the surface of the ground. Each concrete foundation weighs approximately 5 tons. The micrometer microscopes mounted on these piers were specially made for the purpose, and have each a magnifying power of about 50 diameters; one turn of the micrometer = 75 microns, and consequently each division = $0^{\mu}.75$. The intermediate microscopes have

a somewhat smaller power, and were so constructed as to have a value of 1 micron per division of micrometer; they are supported on cedar posts, firmly set in the ground to a depth of 3 to 3½ feet, at intervals of 5 metres, and carefully aligned. In the concrete bases of the terminal piers are set bronze bolts, having spherical heads, which fit into the conical aperture of the cut-off apparatus (also described in Assistant Woodward's report above referred to), and the centres of these spheres define the termini of the 50-metre base. The pier microscopes, by means of the cut-off apparatus, can be accurately referred at any time to the ground marks, observations in the direct and reversed position of the cut-off scale being always taken and the attached level readings recorded.

As first constructed the wooden base, carrying the tracks for the movement of the carriages of the iced bar apparatus, was continuous from end to end, the rails of the tracks only being so separated as to provide room for expansion, but after using it a short time it was found necessary to divide the wooden frame into sections to eliminate the cumulative effects of its expansion or contraction, as during measures with the secondary bars their trestles rested on this base.

The standard 5-metre bar, designated as B_{17}, the trough for supporting it immersed in melting ice, and the accompanying carriages for trundling it along the track of the comparator, are the same ones used at Holton, and the general method of use is also the same as described by Assistant Woodward.

In March, after completing a number of measures with the secondary bars, the annoying discovery was made that the pier foundations were not as stable as had been expected, and that the distance between the terminal marks of the base line did not remain constant. The changes in distance were quite perceptible in amount, and for a time were continuous in one direction, but subsequently the direction was reversed, and the line gradually more than regained its original length. These changes considerably increased the amount of work required to derive accurate lengths for the bars under examination, as it became necessary that each set of measures should be immediately preceded and followed by a new iced bar determination of the length of the base.

The varying lengths of the base line are well shown by the following tabulation of the 38 iced bar measures, the amount by which the base exceeded or fell short of 50 metres being given in microns with the appropriate sign. In these results all corrections for iced bar length, micrometer readings, cut-off inclination, grade, alignment, etc., have been applied.

Iced bar measures of 50-metre base.

No. of measure.	Date.	Base—50 metres, in microns.	Daily means, in microns.	No. of measure.	Date.	Base—50 metres, in microns.	Daily means, in microns.
1	Feb. 25	+ 50		20	Apr. 7	—458	
2	....do	+ 6	+ 28	21	....do	—525	
3	Mar. 9	— 55		22	....do	—489	
4	....do	— 47		23	....do	—481	—488
5	....do	— 136	— 79	24	Apr. 8	—384	
6	Mar. 10	— 48		25	....do	—384	
7	....do	— 97		26	....do	—394	—387
8	....do	— 95		27	Apr. 14	— 76	
9	....do	— 15		28	....do	— 17	
10	....do	— 52		29	....do	— 29	— 41
11	....do	— 35	— 57	30	Apr. 18	+117	
12	Mar. 31	—1 216		31	....do	+192	
13	....do	—1 278		32	....do	+145	+151
14	....do	—1 251	—1 248	33	May 7	+677	
15	Apr. 2	—1 075		34	....do	+744	
16	....do	—1 092		35	....do	+676	+699
17	....do	—1 125	—1 097	36	May 8	+712	
18	Apr. 4	— 817		37	....do	+675	
19	....do	— 827	— 822	38	....do	+701	+696

The measures of February 25, being the first made, were regarded as experimental, and consequently the difference between them and those of March 9 did not attract special attention, especially as the latter were confirmed by the observations of the following day. On March 10

six independent measures were made, and it will be seen that their extreme range is only 82 microns, and that in all the subsequent observations the daily range was even smaller, in some cases not exceeding 10 microns. The marked shortening of the base by nearly 1 200 microns, as shown by the observations of March 31, therefore stands out prominently, as does also the progressive lengthening from that date to May 7, when the maximum length was reached. We have, from the daily means for the extreme range of lengths observed, the difference between $-1\,248\mu$ and $+699\mu$, or $1\,947\mu$, equal to nearly 2 millimetres.

We have conclusive proof that the shortening occurred *after March 20* and before March 31, and that it must therefore have been a comparatively sudden one, but we do not know that the results of March 31 represent the actual minimum length, as the systematic lengthening may have been already in progress at that date.

Observations by means of levels suitably mounted on the piers and their bases, and occasional cut-off readings, show that the movements still continue, but apparently to a less extent than formerly. It is hoped that after the lapse of a year from the date of construction a more permanent and stable condition will be reached.

Base bar comparisons.—The redetermination of the lengths and constants of secondary base bars Nos. 13 and 14, and the standardization of the new Duplex bars Nos. 15 and 16 have already been referred to under the head of the 50-metre comparator. The comparisons of the former were duly completed in April, and gave results practically identical with those previously obtained, showing that the bars had not been injured by the jarring received in the railway accident.

The resulting combined length of bars No. 13 and 14, at a temperature of 0°·0 C., was 10·000003 metres $+3{\cdot}1\mu$. Subsequently special night and day observations were made to determine the "lag" of thermometers, the result being that under the conditions then existing the "lag" was $+0°{\cdot}19$, the sign depending upon whether the temperature was rising or falling. This differs slightly from the mean value derived at Holton, viz, $+0°{\cdot}25$, but it must be borne in mind that special conditions necessarily affect the result, as the "lag" depends not only on the actual amount of changes of temperature but also on their rapidity.

The new duplex base bars Nos. 15 and 16 each consist of two components, the prominent feature of the apparatus being its yielding two simultaneous measures of a base by two different metals having widely different coefficients of expansion, so that the temperatures during a measure can be deduced more accurately than by indications of thermometers. In the standardization observations, however, thermometers were used, three for each bar, but the record furnishes the means of computing results independently of them. The behavior of the whole apparatus during the various measures and tests was excellent, and I am more than ever convinced that with proper handling it will yield results far superior to any other base apparatus yet devised. The difficulty of obtaining the true temperature of the bars during a measure in the field has heretofore been the greatest source of uncertainty in primary bases, and I believe that the introduction of the duplex principle will mark an era in accurate base measurement. To be sure the measurement of a base throughout by means of a standard bar in ice would be the ideal method, but the difficulties in the way of its practical use in the field and the great expense involved in preparing the line would necessarily forbid its adoption.

The comparisons of the duplex bars were made at various dates from March 20 to May 8 so as to include a good range of temperatures, and generally four complete measures with each component were made on each day of observation. The temperatures ranged from 0°·0 to 29°·0 C., and 32 determinations of the value of 10 bar lengths (for each component) were obtained. The extreme range of these determinations for single measures was 0·37 millimeter and for the means of daily results 0·26 millimeter. The results for any one day never differed by more than 0·16 millimeter, and the mean of daily variations was only 0·08 millimeter.

The coefficients of expansion of the steel and brass components, and the differential coefficient, from a mean of 16 results in each case, were found to be as follows:

For steel components 0·00001153 ± 4
For brass components 0·00001856 ± 3
Differential coefficient 0·00000703 ± 1

The combined lengths of bars Nos. 15 and 16, as deduced from the observations, adopting the above coefficients, are as follows:

	m.	μ
At 25°·117 C. steel No. 15 + No. 16	= 10·000000	± 2·2
At 25°·142 C. brass No. 15 + No. 16	= 10·000000	± 1·9
At 25°·183 C. steel and brass are of equal length	= 10·000007	± 2·0

In constructing these bars the intention was to have them as nearly as possible of standard length at 25°·0 C., that being about the mean temperature expected in the field observations, and the above figures show how closely the chief mechanician of the instrument division approximated the desired result.

All micrometer readings, cut-off observations, and contacts during the progress of the work were made by Mr. L. A. Fischer and myself, and the sector readings, scale readings, setting up and adjustment of intermediate microscopes, etc., by various Assistants detailed from time to time to assist in the work. Assistant Isaac Winston served throughout as recorder, and also took part in the sector adjustments, and the following members of the normal force aided for shorter or longer periods as they could be spared from other duties: D. B. Wainwright, W. C. Hodgkins, W. I. Vinal, A. L. Baldwin, O. B. French, R. L. Faris, and C. C. Yates. All performed their various parts acceptably, and my thanks are due to them for their hearty cooperation and the zeal displayed in the successful prosecution of the work.

Superintendent's Annual Report, etc.—In addition to the control and supervision of the Office of Standard Weights and Measures, I have also attended to the preparation, compilation, and editing of the Superintendent's Annual Report, and have, at various times during the year, acted as Assistant in Charge of the Office and as executive officer, viz:

As Assistant in Charge of Office from July 22 to July 31.
As executive officer from August 26 to August 31.
As executive officer from September 9 to November 9.
As Assistant in Charge of Office from November 18 to November 22.
As executive officer from February 10 to February 15.
As Assistant in Charge of Office from March 21 to March 28.
As executive officer from May 18 to May 25.
As Assistant in Charge of Office from May 25 to May 29.

I have also served as a member of the publication board and the special committee appointed to consider the methods to be employed in future precise leveling.

In conclusion I beg to refer again to the services of Adjuster L. A. Fischer, which are invaluable, and to renew the recommendation that provision be made in the annual estimates for a substantial increase of his compensation. For Mr. C. A. Harbaugh I also earnestly recommend an increase of pay and a change of rating.

Accompanying this report is an abstract of verifications, determinations, and standardizations made during the year for other departments and for outside parties.

Yours, respectfully,

ANDREW BRAID,
Assistant, Coast and Geodetic Survey, in Charge of Office of Standard Weights and Measures.

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey, and of Office of Standard Weights and Measures.

Abstract of verifications, determinations, standardizations, etc., of weights and measures made during the fiscal year 1896.

Date.	Name.	Service.
1895.		
July	United States Coast and Geodetic Survey	Six thermometers compared.
	Troemner, Henry, Philadelphia, Pa	Weights compared.
	Eimer & Amend, New York	Weights compared.
	Ladd, Prof. E. F., Fargo, N. Dak	Information furnished.
	Osborn, W. B., Clarksburg, W. Va	Information furnished.
	Hoag, Prof. William R., Minneapolis, Minn	Tape compared.
	Harman & Evans, Peoria, Ill	Tape compared.
August	North Dakota, governor of	Information furnished.
	Case School of Applied Science, Cleveland, Ohio	Kilogramme compared.
	Allen, H. C., Syracuse, N. Y	Tape compared.
	United States Internal Revenue Bureau	Alcoholometres compared.
September	Darling, C. P., Huntington, N. Y	Tape compared.
	Dunn, E. C., Alexandria, Va	Two tapes compared.
	Roe, Justus, Patchogue, N. Y	Tape compared.
	United States Internal Revenue Bureau	Two hundred and seventy alcoholometres compared.
	Keuffel & Esser, New York	Tape compared.
	Middletown and Portland Bridge Co., Middletown, Conn.	Tape compared.
	Naglevoort, Prof. J. B., Chicago, Ill	Weights compared.
	Middletown and Portland Bridge Co., Middletown, Conn.	Tape compared.
October	Chicago Stamping Co., Chicago, Ill	Pint measure compared.
	Keuffel & Esser, New York	Tapes compared.
	United States Geological Survey	Two tapes compared.
	United States Coast and Geodetic Survey	Two spring balances compared.
November	Read, Willet W., Niagara Falls, N. Y	Tape compared.
	Perkins, T. P., Boston, Mass	Tape compared.
	Wright, F. W., Schenectady, N. Y	Information furnished.
	Cole, Howard J., New York	Tape compared.
	United States Coast and Geodetic Survey	Three tapes compared.
	Balcom, S. F., Akron, Ohio	Tape compared.
	Lufkin Rule Co., Saginaw, Mich	Tape compared.
	Webster, Charles E., South Bethlehem, Pa	Tape compared.
	Perkins, T. P., Boston, Mass	Information furnished.
December	Wright, T. W., Schenectady, N. Y	Information furnished.
	Treasurer and receiver-general of the State of Massachusetts.	Information furnished.
	Hodgson, Fred. T., New York	Information furnished.
	The Lutz Co., Guttenberg, N. J	Two foot rules compared.
	Welker, P. A., Assistant U. S. C. & G. S	Two tapes compared.
	Henry Heil Chemical Co., St. Louis, Mo	Gramme weights compared.
	United States Coast and Geodetic Survey	Tape compared.
1896.		
January	United States Coast and Geodetic Survey	Tape compared.
	Sylvester, Allen, Boston, Mass	Information furnished.
	Pratt, N. R., Willimantic, Conn	Tape compared.
	F. E. Brandis Sons & Co., Brooklyn, N. Y	Tape compared.
	Oldberg, Prof. Oscar, Chicago, Ill	Information furnished.
	Soltmann, E. G., New York	Tape compared.
	Treasury Department	Information furnished.
	Soltmann, E. G., New York	Tape compared.
	Bogart, J. P., New Haven, Conn	Information furnished.
February	Simpson, Lieut. W. A., Fort Adams, R. I	Information furnished.
	United States Coast and Geodetic Survey	Tape compared.
	Committee on Coinage, Weights, and Measures, House of Representatives.	Information furnished.
	North Dakota Agricultural College	Information furnished.
	United States Naval Observatory	Inertia bars compared.
	United States Coast and Geodetic Survey	Tape compared.
	United States Coast and Geodetic Survey	Two balances compared.
March	Lufkin Rule Co., Saginaw, Mich	Two tapes compared.
	Allen, Farrington & Co., Syracuse, N. Y	Tape compared.
	Gilman, Z. D., Washington, D. C	Alcohol tested.
	De Nyse, W. H., Longbranch City, N. J	Tape compared.
	Mann, H. E., Ashtabula, Ohio	Tape compared.
	Soltmann, E. G., New York	Two tapes compared.
	Fairbanks Scale Co., Baltimore, Md	Two 50-pound weights compared.
April	Deputy sealer of weights and measures, Boston, Mass.	Information furnished.

Abstract of verifications, determinations, standardizations, etc., of weights and measures made during the fiscal year 1896—Continued.

Date.	Name.	Service.
1896.		
April.....	Queen & Co., Philadelphia	Tape compared.
	Treasury Department.....	Information furnished.
	Fairchild, J. F., Mount Vernon, N. Y	Two tapes compared.
	Jackson, A. C., Erie, Pa	Information furnished.
	Hildebrand, P. T., Orangeburg, S. C.....	Weights and yard compared.
	United States Coast and Geodetic Survey	Twenty-three tapes compared.
	United States Geological Survey	Tape compared.
	United States Internal Revenue Bureau.....	Information furnished.
	Rogers, Prof. William, Watreville, Me.....	Thermometer compared.
	Queen & Co., Philadelphia.....	Tape compared.
	Allen, Farrington & Co, Syracuse, N. Y.....	Tape compared.
	Park, M. C. H., Waco, Tex.....	Information furnished.
May	United States Coast and Geodetic Survey.....	Two tapes compared.
	Kelsey, F. C., Salt Lake City, Utah	Tape compared.
	Montana, State of.....	Information furnished.
	Iowa, University of.....	Tape compared.
	Wisconsin, University of.....	Tape compared.
	Yale University, New Haven, Conn.....	Metre and 100 gramme weight compared.
	Treasury Department.....	Information furnished.
	United States Coast and Geodetic Survey.....	Spring balance compared.
	Fairmont College, Wichita, Kans.....	Information furnished.
June	Massachusetts, State of.....	Avoirdupois weights compared.
	Loomis, A. C., Mattoon, Ill.....	Tape compared.
	Soltmann, E. G., New York	Tape compared.
	United States Coast and Geodetic Survey.....	Secondary base bars compared.
	Breed, O. C., Fulton, N. Y.....	Tape compared.
	United States Geological Survey	Leveling rod compared.
	Señor Guillermo B. y Puga, Mexican Boundary Commission.	Information furnished.
	Winston, Isaac, Assistant C. & G. S.....	Two leveling rods compared.
Various dates between February and May.	United States Coast and Geodetic Survey.....	Determination of lengths and constants of secondary base bars Nos. 13 and 14.
	United States Coast and Geodetic Survey.....	Standardization of duplex base bars Nos. 15 and 16.
	United States Coast and Geodetic Survey.....	Fifteen thermometers compared for base bars.

UNITED STATES
COAST AND GEODETIC SURVEY
SKETCH OF GENERAL PROGRESS
JUNE 30, 1896.
Eastern Sheet

Scale 5,000,000

Statute Miles

50 40 30 20 10 0 50 100 150 200

105° 100° 95° 90° 85° 80° 75° 70°

50° 45° 40° 35° 30° 25° 20°

NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
INDIAN TERR.
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MARYLAND
DELAWARE
NEW JERSEY
CONN.
R.I.
MASS.
VERMONT
NEW HAMPSHIRE
MAINE
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
GULF OF MEXICO
ATLANTIC OCEAN
YUCATAN
CUBA
BAHAMAS
MEXICO

Bismarck, Deadwood, Pierre, Yankton, Omaha, Des Moines, Dubuque, Davenport, Rock Island, Peoria, Rockford, Quincy, Springfield, Atchison, Topeka, Kansas City, St. Louis, Cairo, Guthrie, Memphis, Little Rock, Dallas, Shreveport, Waco, Austin, Houston, Galveston, San Antonio, Eagle Pass, Laredo, Corpus Christi, Brazos R., Rio Grande, Matamoras, Monterey, Tampico, Vera Cruz, Duluth, St. Paul, St. Peters, Fond du Lac, Milwaukee, Fairie du Chien, Chicago, Indianapolis, Terre Haute, Evansville, Cincinnati, Louisville, Lexington, Columbus, Toledo, Cleveland, Detroit, Fort Wayne, Logansport, Grand Rapids, Lansing, Saginaw, Buffalo, Rochester, Toronto, Ottawa, Montreal, Quebec, Ogdensburg, Albany, Utica, Syracuse, Springfield, Providence, New York, Pittsburg, Wheeling, Zanesville, Cumberland, Baltimore, Annapolis, Washington, Philadelphia, Harrisburg, Williamsport, Poughkeepsie, Fredericksburg, Richmond, Norfolk, Lynchburg, Raleigh, Newbern, Wilmington, Charleston, Columbia, Georgetown, Savannah, Macon, Augusta, Atlanta, Chattanooga, Huntsville, Montgomery, Mobile, Pensacola, Tallahassee, Jacksonville, St. Augustine, Fernandina, Keys, Cape Canaveral, Cape Hatteras, Tortugas, Key West, Tampa, Nassau, Havana, Cienfuegos, C. San Antonio, Cape Catoche, Progreso, Campeche, Belize, Isle of Pines, Sandy Hook, Axis of the Gulf Stream

EXPLANATION OF SYMBOLS

- Primary Triangulation
- Secondary / Tertiary ..... Triangulation
- Reconnaissance
- Surveyed Topography
- ..do..... In-shore Hydrography
- ..do..... Off-shore ..... do.
- Lines of Deep Sea Soundings
- ..do..... Geodetic Levelling

No. 1.

UNITED STATES
COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30, 1896.

Eastern Sheet

Scale 5,000,000

Statute Miles
50 40 30 20 10 0 50 100 150 200

LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ONTARIO
LAKE ERIE
MINNESOTA
WISCONSIN
MICHIGAN
IOWA
ILLINOIS
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSOURI
ARKANSAS
MISSISSIPPI
LOUISIANA
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
NEW JERSEY
MARYLAND
DELAWARE
ATLANTIC OCEAN
GULF OF MEXICO
YUCATAN
CUBA
BAHAMAS

Duluth, St. Paul, St. Peters, Fond du Lac, Winona, Milwaukee, Grand Rapids, Saginaw, Detroit, Buffalo, Toronto, Ottawa, Ogdensburg, Rochester, Albany, Springfield, Providence, Fall River, Cape Cod, Boston, Portland, Bangor, Calais, St. John, Cape Sable, QUEBEC, MONTREAL, Dubuque, CHICAGO, Davenport, Rock Island, Peoria, Des Moines, Fort Wayne, Toledo, Cleveland, Pittsburg, Harrisburg, Reading, Trenton, PHILADELPHIA, Poughkeepsie, Williamsport, NEW YORK, Keokuk, Quincy, Springfield, Terre Haute, Indianapolis, Logansport, Columbus, Zanesville, Wheeling, Cumberland, BALTIMORE, Annapolis, WASHINGTON, Kansas City, ST. LOUIS, Madison, Louisville, Lexington, Evansville, Fredericksburg, Richmond, Lynchburg, Norfolk, Cairo, Nashville, Knoxville, Chattanooga, Raleigh, Newberne, Cape Hatteras, Memphis, Huntsville, Columbia, Georgetown, Wilmington, Little Rock, Helena, Atlanta, Augusta, Charleston, Macon, Savannah, Shreveport, Vicksburg, Jackson, Montgomery, Natchez, Fernandina, Jacksonville, Tallahassee, St. Augustine, Mobile, Pensacola, Baton Rouge, NEW ORLEANS, Houston, Galveston, Cape Canaveral, Tampa, Key West, Tortugas, Nassau, HAVANA, Cienfuegos, C. San Antonio, Santiago de Cuba, Cape Catoche, Progreso, Campeche, Frontera, Belize, Area of the Gulf Stream Warmest Band

EXPLANATION OF SYMBOLS

Primary Triangulation
Secondary, Tertiary } Triangulation
Reconnaissance
Surveyed Topography
do. In-shore Hydrography
do. Off-shore do.
Lines of Deep Sea Soundings
do. Geodetic Levelling

95° 90° 85° 80° 75° 70° 65°
45° 40° 35° 30° 25° 20°

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES
COAST AND GEODETIC SURVEY

SKETCH OF GENERAL PROGRESS

JUNE 30. 1896.

Western Sheet

Scale 5.000000

Statute Miles

50 40 30 20 10 0 50 100 150 200

EXPLANATION OF SYMBOLS

- Primary Triangulation
- Secondary / Tertiary ..... Triangulation
- Reconnaissance
- Surveyed Topography
- ....do.... In-shore Hydrography
- ....do.... Off-shore ....do....
- Lines of Deep Sea Soundings
- ....do.... Geodetic Levelling

125° 120° 115° 110° 105° 100° 95°

60° 55° 50° 45° 40° 35° 30° 25° 20°

WASHINGTON
OREGON
CALIFORNIA
IDAHO
NEVADA
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
INDIAN TER.
TEXAS
MINNESOTA
IOWA
MISSOURI
LOWER CALIFORNIA
MEXICO
PACIFIC OCEAN
GULF OF MEXICO

Cape Flattery
Port Townsend
Seattle
Tacoma
Olympia
Astoria
Portland
Salem
Walla Walla
Lewiston
Boise City
Cape Mendocino
Eureka
Humboldt Bay
Cape Blanco
Crescent City
Klamath R.
Trinidad
Reading
Sacramento
San Francisco
Monterey
Virginia City
Helena
Butte
Bismarck
Deadwood
Pierre
Yankton
Omaha
Cheyenne
Ogden City
Salt Lake City
Denver
Pueblo
Atchison
Topeka
Kansas City
Guthrie
Santa Fe
Albuquerque
Prescott
Tucson
Los Angeles
Santa Barbara
Pt. Concepcion
San Diego
Guadalupe I.
Cerros I.
Cape San Lazaro
La Paz
Cape San Lucas
Guaymas
El Paso del Norte
El Paso
Presidio del Norte
Chihuahua
Eagle Pass
Laredo
Corpus Christi
Matamoras
Rio Grande
Monterey
Dallas
Waco
Austin
San Antonio
Galveston
Houston
Mazatlan
San Blas
Cape Corrientes
Manzanilla
Tampico
Vera Cruz

115° 110° 105° 100° 95° 90°

50° 45° 40° 35° 30° 25° 20°

MONTANA
NORTH DAKOTA
MINNESOTA
LAKE SUPERIOR
Helena
Bismarck
Duluth
Virginia City
SOUTH DAKOTA
Deadwood
Pierre
St. Paul
St. Peters
WISCONSIN
Fond du Lac
Milwaukee
Prairie du Chien
WYOMING
Yankton
Dubuque
Ogden City
Salt Lake City
IOWA
Des Moines
Davenport
Rock Island
Peoria
ILLINOIS
NEBRASKA
Cheyenne
Omaha
Keokuk
Quincy
Springfield
Denver
COLORADO
Atchison
Topeka
Kansas City
MISSOURI
Fuebla
KANSAS
Jefferson City
St. Louis
Cairo
OHIO
RIVER
Santa Fe
Albuquerque
NEW MEXICO
OKLAHOMA
INDIAN TERR.
Guthrie
Memphis
Little Rock
ARKANSAS
Helena
MISSISSIPPI
Tucson
El Paso del Norte
El Paso
Dallas
Waco
Natchez
LOUISIANA
Baton Rouge
Austin
NEW ORLEANS
Presidio del Norte
Houston
San Antonio
Galveston
Chihuahua
Eagle Pass
Indianola
Corpus Christi
Laredo
Mazatlan
Matamoras
Rio Grande
Monterey
GULF OF MEXICO
Tampico
San Blas
Cape Corrientes
Manzanilla
MEXICO
Vera Cruz
Campeche
Frontera

GENERAL CHART OF

ALASKA

Scale $36\frac{1}{000}000$

Compiled from United States and Russian Authorities

ALL SOUNDINGS IN FATHOMS, HEIGHTS IN FEET

Published Oct 1895, W. W. DUFFIELD, Superintendent
Verified; O. H. Tittmann, Assistant in charge of the Office
J. F. Moser, Lieut. Comdr. U.S.N, Hydrographic Inspector

(Date of first publication 1890)

Statute Miles
20 10 0 20 40 60 80 100 120 140 160 180 200 220

Nautical Miles
20 10 0 20 40 60 80 100 120 140 160 180 200 220

Kilometres
50 0 50 100 150 200 250 300 350 400 450

Note. *One Kilometre or 1000 metres = 3280.83 ft. = $\frac{5}{8}$ of a statute mile nearly. One statute mile = 1609.35 metres.*

EASTERN SIBERIA

ARCTIC

ALASKA

CHUKCHI SEA

GULF OF ANADIR

GULF OF KAMCHATKA

KRONOTSKI BAY

OLIUTORSK GULF

UKINSK BAY

CHAUN BAY

COMANDORSKI IDS.

BERING SEA

ALEUTIA

ANDREANOF ISLANDS

NEAR ISLANDS

RAT ISLANDS

100 fathom curve

East from Greenwich

PLATE No. 2461

MACKENZIE BAY
Mackenzie River
Rocky Mountains
DISTRICT OF YUKON
BRITISH COLUMBIA
ALASKA
GULF OF ALASKA
PACIFIC OCEAN
Davidson Mts.
Franklin Mts.
Romanzof Mts.
Mt. McKinley
Mt. St. Elias
Mt. Natazhat
Mt. Logan
Mt. Hendnilla
Mt. Sushina
Mt. Chigmagak
Mt. Becharof
Mt. Katmai
Mt. Wrangell
Mt. Blackburn
Mt. Sanford
Mt. Hayes
Mt. Gilmore
Mt. Godenough
Mt. Greenough
Davis Gilbert Mts.
Richardson Mts.
Buckland Mts.
Halkett I.
Pullen I.
Whale I.
Pelly Mountains
Selwyn Mts.
Campbell Mts.
Glenlyon Mts.
Logan Mts.
Tasekila Mts.
Slogeon Mts.
Cassiar Mts.
Seminole Hills
Big Salmon R.
Lewis R.
Pelly River
Little Salmon R.
Upper Ramparts
Lower Ramparts
Rat Lake
Fort Yukon
Fort Reliance
Fort Selkirk
Fort Graham
Fort Wrangell
Fort Simpson
Fort Good Hope
Fort McPherson
Arctic Circle
Yarh. 40° E. in 1895
Yarh. 35° E. in 1895
Yarh. 30° E. in 1895
Yarh. 25° E. in 1895
Yarh. 20° E. in 1895
Porthlock Bank
Admiralty I.
Baranof I.
Chichagof I.
Kruzof I.
Sitka
Cape Spencer
Cape Edgecumbe
Cape Ommaney
Cape Muzon
Cape Knox
Cape Clear
Cape St. Elias
Cape Elizabeth
Cape Douglas
Cape Newenham
Cape Constantine
Cape Sarichef
Cape Lisburne
Cape Simpson
Dixon Entrance
Chatham Strait
Icy Strait
Peril Strait
Stephens Passage
Clarence Strait
Behring Sea
Bristol Bay
Kuskokwim R.
Yukon R.
Porcupine R.
Peel River
Red River
Liard R.
Stikine R.
Nass River
Skeena R.
Fraser R.
Thompson R.
Columbia R.
Kootenay R.
Athabasca R.
Slave R.
Great Bear L.
Great Slave L.
Great Fish L.
Athabasca L.
Lake Winnipeg
Lake Winnipegosis
Lake Manitoba
Lake of the Woods
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
Lake Champlain
Lake George
Lake Memphremagog
Lake Timiskaming
Lake Nipissing
Lake Simcoe
Lake Temiscaming
Lake Abitibi
Lake Mistassini
Lake St. John
Lake Kenogami
Lake Edward
Lake Temiscouata
Lake Metapedia
Lake Matapedia
Lake Megantic
Lake Memphremagog
Lake Champlain
Lake George
Lake Winnipeg
Lake Manitoba
Lake of the Woods
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
Lake Champlain
Lake George
Lake Memphremagog
Lake Timiskaming
Lake Nipissing
Lake Simcoe
Lake Temiscaming
Lake Abitibi
Lake Mistassini
Lake St. John
Lake Kenogami
Lake Edward
Lake Temiscouata
Lake Metapedia
Lake Matapedia
Lake Megantic
West from Greenwich
152° 150° 148° 146° 144° 142° 140° 138° 136° 134° 132° 130° 128° 126° 124° 122° 120° 118° 116°
62° 60° 58° 56° 54° 52° 50° 48°
162° 160° 158° 156° 154° 152° 150° 148° 146° 144° 142° 140° 138°

Sketch showing the Progress of Surveys in
SOUTH EAST ALASKA
Scale 1/1 200,000
Nautical Miles
Statute Miles
Kilometres
Cape Yaktag
Icy Cape
Malaspina Glacier
Mt. Logan
Mt. Newton
Mt. St. Elias
Mt. Huxley
Mt. Augusta
Mt. Vancouver
Mt. Cook
Mt. Hubbard
Crater
Mt. Seattle
Pt. Manby
Yakutat Bay
Khantaak I.
Ocean Cape
Yakutat
Alsek River
Grand Plateau Glacier
Cape Fairweather
Mt. Fairweather
Harbor Point
Icy Point
Cape Spencer
Cross Sound
Cape Cross
Icy Strait
Glacier Bay
Muir Glacier
Chichagof Island
Cape Edward
Cape Georgiana
Cape Edgecumbe
Sitka
Sitka Sound
Baranof Island
Chatham Strait
Admiralty Island
Juneau
Taku R.
Lynn Canal
Sullivan I.
Port Snettisham
Stephens Passage
Frederick Sound
Kupreanof I.
Kuiu I.
Cape Ommaney
Christian Sound
Sumner Strait
Zarembo I.
Wrangell
Wrangell I.
Stikine R.
Kosciusko I.
Iphigenia Bay
Cape Addington
Cape Bartolome
Prince of Wales Island
Cleveland Peninsula
Revillagigedo Island
Behm Canal
Cape Muzon
Cape Chacon
Dixon Entrance
Cape Knox
North I.
Dundas I.
Zayas I.
Portland Canal
Observatory Inlet
Graham I.
British Columbia

Positions and Connections of

Telegraphic Longitude Stations

from 1846 to June 30, 1896.

D O M I N I O N O F C A N A D A

W A S H I N G T O N

O R E G O N

M O N T A N A

N O R T H D A K O T A

S O U T H D A K O T A

W Y O M I N G

N E B R A S K A

U T A H

C O L O R A D O

K A N S A S

A R I Z O N A

N E W M E X I C O

O K L A H O M A

T E X A S

I O W A

M I N N E S O T A

W I S C O N S I N

I L L I N O I S

M I C H I G A N

I N D I A N A

O H I O

K E N T U C K Y

T E N N E S S E E

M I S S I S S I P P I

A L A B A M A

G E O R G I A

S O U T H C A R O L I N A

N O R T H C A R O L I N A

V I R G I N I A

W E S T V I R G I N I A

P E N N S Y L V A N I A

N E W Y O R K

V E R M O N T

N E W H A M P S H I R E

M A I N E

L A K E S U P E R I O R

L A K E M I C H I G A N

L A K E H U R O N

L A K E E R I E

L A K E O N T A R I O

P A C I F I C O C E A N

A T L A N T I C O C E A N

G U L F O F M E X I C O

Seattle · Tacoma · Olympia · Kalama · Portland · Walla Walla · Spokane Falls · Helena · Yellow Stone · Boise City · Ogden · Salt Lake City · Virginia City · Carson City · Austin · Eureka · Summit · Macy · Verdi · Elliot Annex · San Francisco · Mt. Hamilton · Los Angeles · Needles · Prescott · Santa Fe · San Diego · Yuma · Fort Selden · Boundary Cor. · El Paso · Morelos · Mexico · Trinidad · Denver · Grand Junction · Gunnison · Colorado Springs · Wallace · Ellsworth · Omaha · Sherman · Cheyenne · Bushnell · Julesburg · Lincoln · Topeka · Kansas City · St. Louis · Jefferson City · Cedar Falls · Minneapolis · St. Paul · La Crosse · Madison · Chicago · Detroit · Lansing · Toledo · Cleveland · Buffalo · Rochester · Albany · Troy · Utica · Syracuse · Oswego · Binghamton · Elmira · Corning · Dunkirk · Erie · Titusville · Oil City · Warren · Bradford · Olean · Jamestown · Meadville · Pittsburgh · Altoona · Philadelphia · Harrisburg · Reading · Lancaster · Columbia · Cape May · New York · Carpenter · Burlington · Montpelier · Plattsburgh · Ogdensburg · Cape Vincent · Kingston · Poughkeepsie · Hartford · Providence · Boston · Portland · Bangor · Calais · Fredericton · To St. John, N.B. & onward to N.S. · To St. Peter Bay & onward to N.S. · To St. Peter's Road on Bay · Indianapolis · Logansport · Union City · Springfield · Macon · Mattoon · Effingham · Vincennes · Terre Haute · Evansville · Louisville · Lexington · Frankfort · Richmond · Ironton · Parkersburg · Point Pleasant · Huntington · Ashland · Portsmouth · South Point · Ripley · Maysville · Charleston · Gauley Bridge · Staunton · Charlottesville · Lynchburg · Petersburg · Richmond · Norfolk · Givens Mills · London · Bristol · Jellico · Oakland · Gilbert · Cairo · Paducah · Hickman · Nashville · Tullahoma · Chattanooga · Knoxville · Asheville · Salisbury · Greensboro · Raleigh · Wilmington · Columbia · Charleston · Augusta · Atlanta · Macon · Savannah · Montgomery · Eufaula · Peach Tree · Vicksburg · Jackson · Jacksonville · Natchez · Baton Rouge · New Orleans · Mobile · Pensacola · Tallahassee · Apalachicola · Cedar Keys · St. Augustine · Gainesville · Ponta Rasa · Key West · Galveston · Head of Passes · Austin · Laredo · Brownsville · Tennessee · Memphis · Little Rock · Helena · Texarkana · Greenville · Nassau · Kingston · Jamaica

Stations and connections to June 30, 1895 ——●——●——

" " " between 1892-4-1894 ·····○·····○·····

Station connection without change of observers – – – – –

" " by other than C.&G.S. parties –·–·–·–·–

U. S. Coast and Geodetic Survey

W. W. Duffield, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

1896

Statute Miles 0 100 200 300 400

Kilometres 0 100 200 300 400 500 600 700 800

125° 120° 117° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65° West from Greenwich

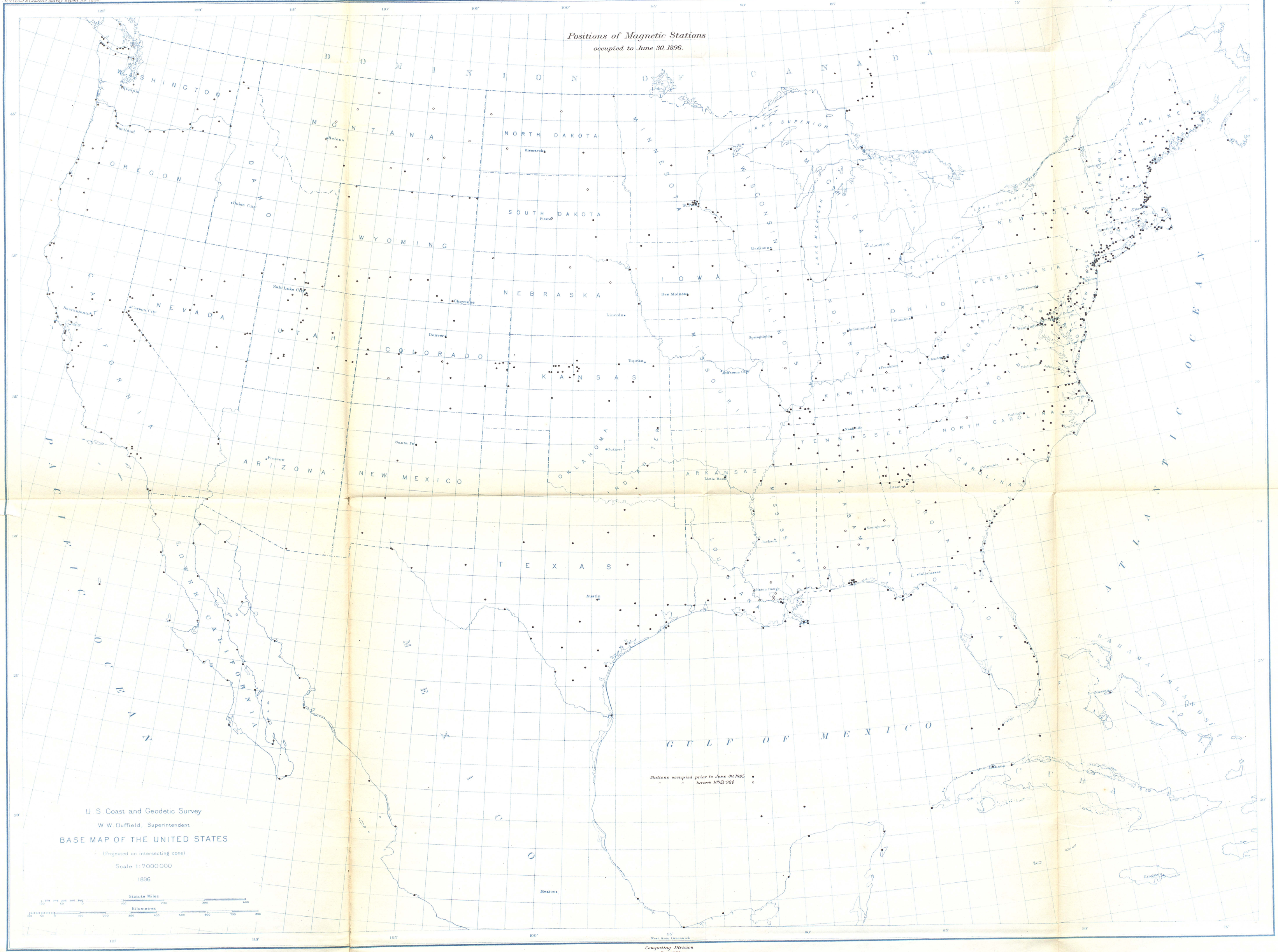
55° 50° 45° 40° 35° 30° 25° 20°

Computing Division

Oct. 1896.

Positions of Magnetic Stations

occupied to June 30, 1896.



U. S. Coast and Geodetic Survey

W. W. Duffield, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

1896

Statute Miles

Kilometres

Longitude West from Greenwich

Computing Division
Oct. 1896.

Routes of Geodetic Spirit Leveling and Positions of Gravity and Tide Stations to June 30 1896.

D O M I N I O N O F C A N A D A

W A S H I N G T O N

O R E G O N

M O N T A N A

N O R T H D A K O T A

S O U T H D A K O T A

W Y O M I N G

N E B R A S K A

N E V A D A

U T A H

C O L O R A D O

K A N S A S

I O W A

M I N N E S O T A

W I S C O N S I N

M I C H I G A N

N E W Y O R K

P E N N S Y L V A N I A

O H I O

K E N T U C K Y

T E N N E S S E E

V I R G I N I A

N O R T H C A R O L I N A

S O U T H C A R O L I N A

G E O R G I A

F L O R I D A

A L A B A M A

M I S S I S S I P P I

L O U I S I A N A

A R K A N S A S

O K L A H O M A

T E X A S

C A L I F O R N I A

A R I Z O N A

N E W M E X I C O

M A I N E

V E R M O N T

N E W H A M P S H I R E

M A S S A C H U S E T T S

C O N N E C T I C U T

Olympia
Portland
Helena
Bismarck
Boise City
St. Paul
Pierre
Madison
Lansing
Salt Lake City
Cheyenne
Sacramento
Carson City
Denver
Lincoln
Des Moines
Springfield
Topeka
Jefferson City
Indianapolis
Columbus
Frankfort
Charleston
Harrisburg
Washington
Richmond
Raleigh
Nashville
Prescott
Santa Fe
Guthrie
Little Rock
Jackson
Atlanta
Montgomery
Tallahassee
Baton Rouge
Austin
Mexico
Augusta
Montpelier
Concord
Boston
Providence
Hartford
Albany
Trenton
Dover
Annapolis
Nassau
Habana
Kingston

Lines of levels run prior to June 30 1895 ——
" " " " between 1895-96 ——
" " " " by U.S. Engineers - - -

Gravity stations prior to June 30 1895
" " between 1895-96

The location of Tide Stations are shown thus:
Where series of Observations of 1 to 3 years
" " " " " 3 " 9 "
" " " " " 9 and more years
The letter d affixed to the symbol indicates that daily predictions for that station are given in the Tide Tables.

U. S Coast and Geodetic Survey

W. W. Duffield, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

1896

Statute Miles

Kilometres

125° 120° 115° 110° 105° 100° 95° 90° 85° 80° 75° 70° 65°

45° 40° 35° 30° 25° 20°

West from Greenwich

Computing Division
Oct. 1896.

Distribution of the principal astronomic stations occupied by the U.S. Coast and Geodetic Survey for Latitude, Longitude and Azimuth to June 30, 1896.

U. S. Coast and Geodetic Survey

W. W. Duffield, Superintendent.

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

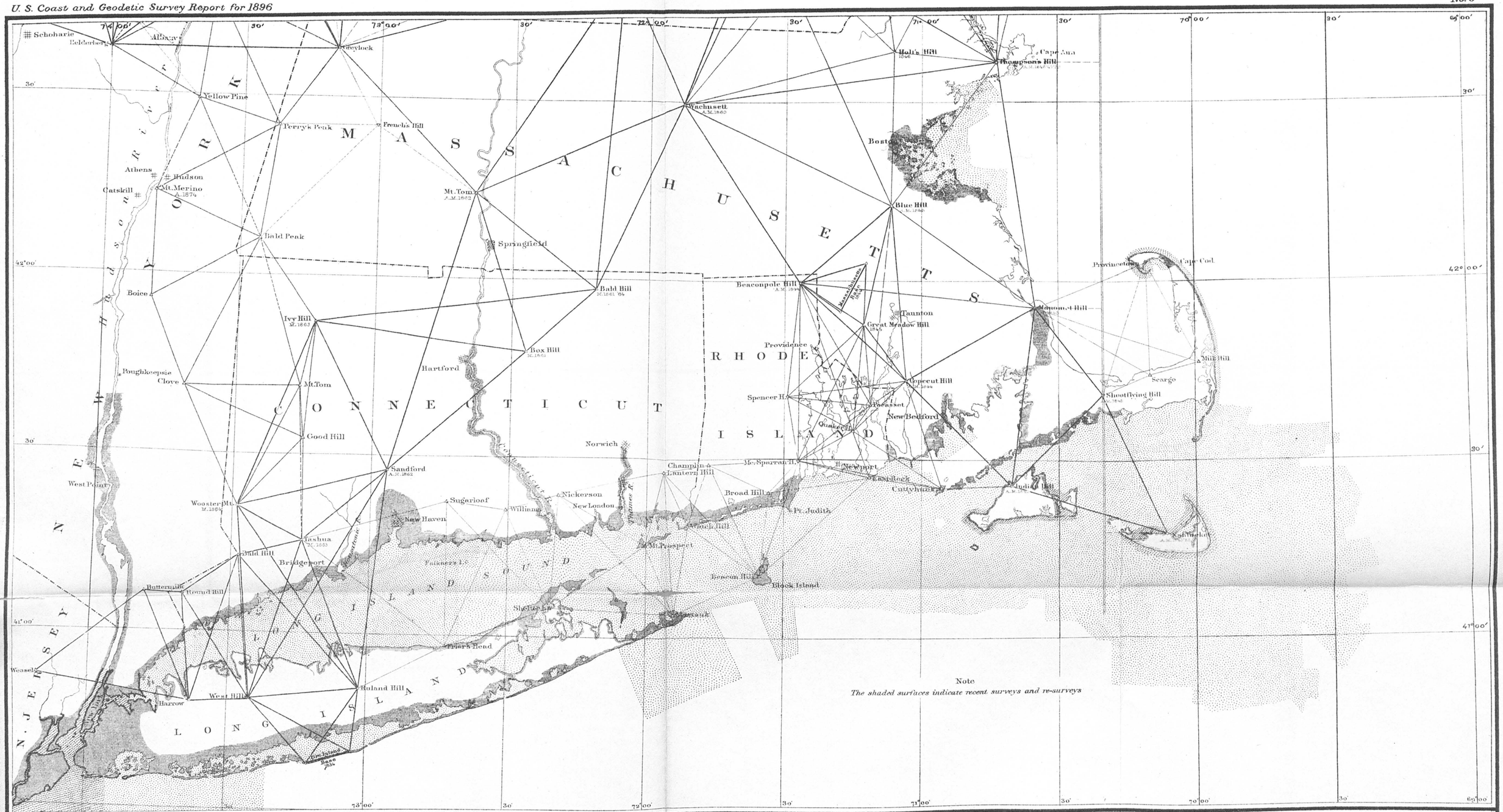
1896

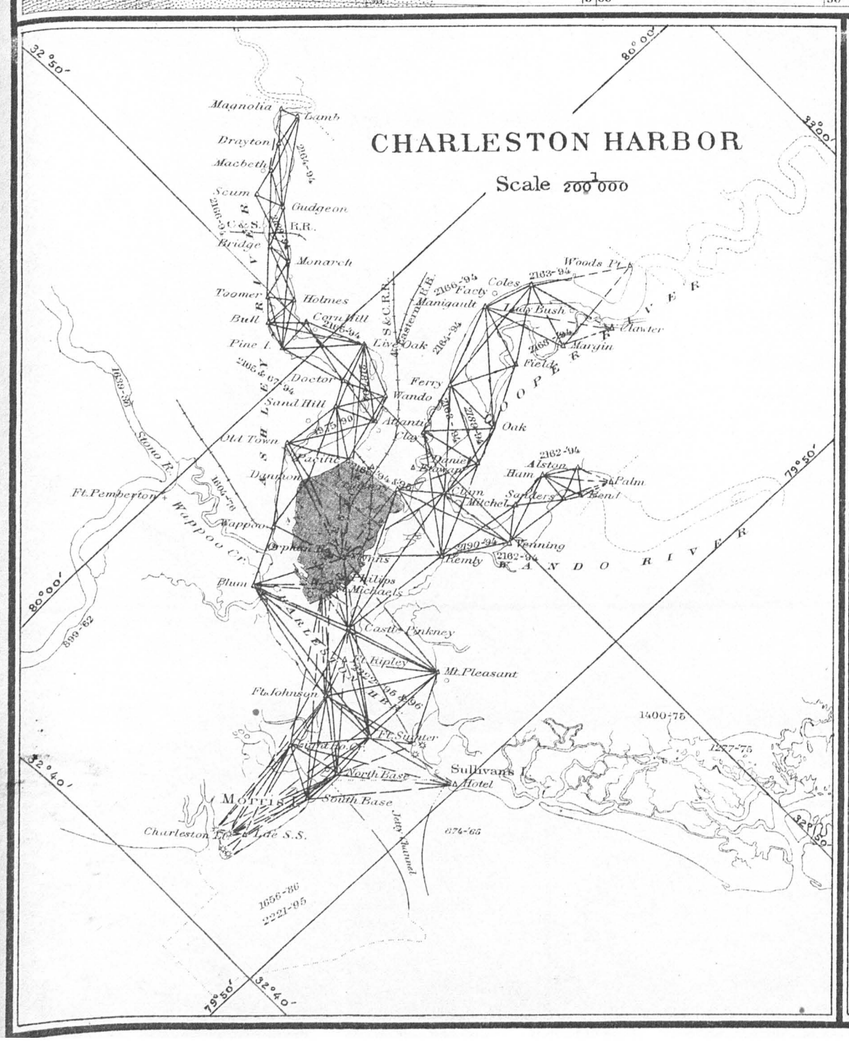
Statute Miles

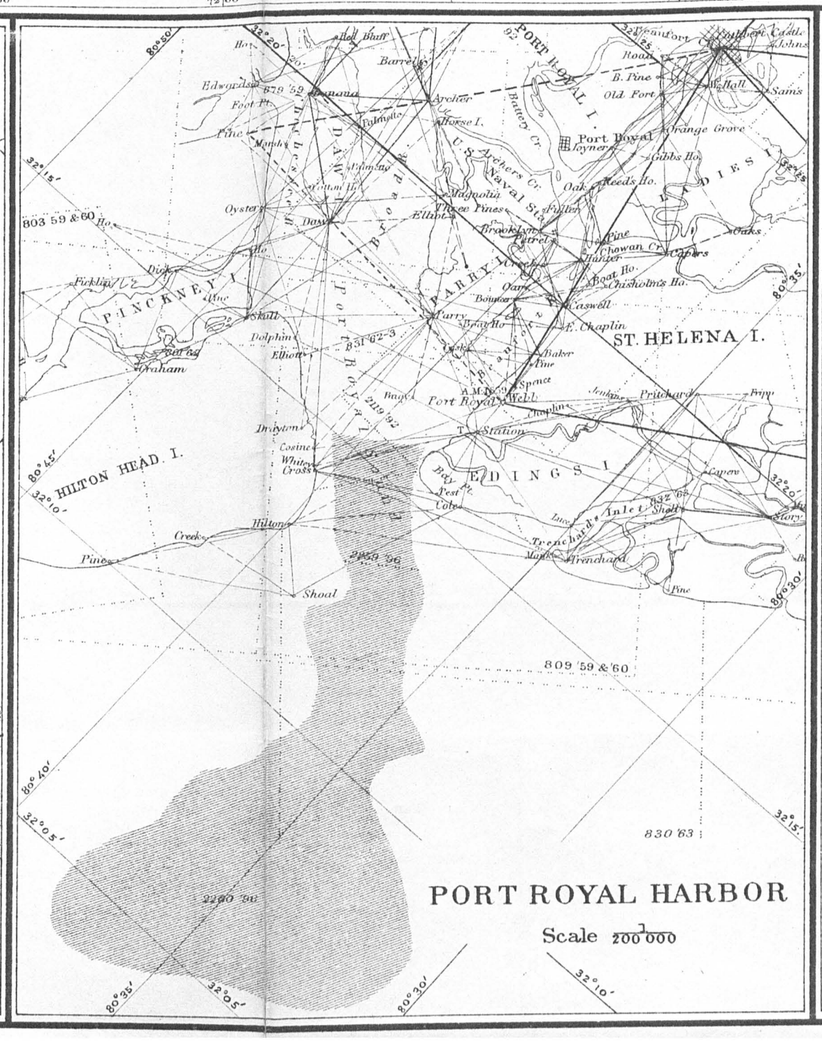
Kilometres

Explanation of Signs:
- Latitude Stations
- Longitude "
- Azimuth "
- Combination Stations with open dots for the fiscal year 1895½ to 1896½.

Computing Division
Oct. 1896.







SKETCH OF THE COAST
FROM
CAPE ANN TO NEW YORK
SHOWING
PROGRESS OF SURVEYS
WITH
SUB-SKETCHES OF
CHARLESTON AND PORT ROYAL HARBORS
Scale 1/1000000

SKETCH SHOWING
PROGRESS OF SURVEYS ON THE
GULF COAST
LAKE PONTCHARTRAIN
MOBILE AND PENSACOLA BAYS
WITH SUB-SKETCH OF
TORTUGAS HARBOR
Scale 1/600 000
LOUISIANA
MISSISSIPPI
ALABAMA
FLORIDA
LAKE PONTCHARTRAIN
Lake Maurepas
NEW ORLEANS
MISSISSIPPI SOUND
MOBILE BAY
Chandeleur Sound
Breton Sound
Little Lake
TORTUGAS HARBOR
Scale 1/400 000
Tortugas

PLATE No. 573

No. 11

UNITED STATES COAST AND GEODETIC SURVEY

SKETCH OF THE COAST OF WASHINGTON WITH SUB-SKETCH OF SAN FRANCISCO HARBOR

Scale $\frac{1}{600\,000}$

SAN FRANCISCO HARBOR

Scale $\frac{1}{60\,000}$

Boundary between U.S. and British Columbia.

Supplementary Surveys in San Francisco Bay

Topographical Sheets Nos. 1614, 1616, 1617, 1618, 1619, 1620, 1621, 1622, 1625, 1629, 1631, 1632 in 1881, '82, 2195, 2206, 2206, 2207 in 1894–95.

Hydrographic Sheets Nos. 1522, '82, 1982, 1983, '88, 1628, '84, 2244 in 1895, 2246, 2254 in 1896.

Resurvey of San Pablo Bay.

Topographical Sheets Nos. 1696, '86, 1697, '86, 1825, '86, 1826, '86, & '87, 1827, '87.

Hydrographic Sheets Nos. 1779, '86, 1801, '87.

Resurvey of Suisun Bay.

Topographical Sheets Nos. 1803, '86, 1804, '87, 1793, 86, '87, 1848, '87, 1830, 1855, '88, 1847, '87, '88, 1892, 1893, 1972, 1973, and 1974, in 1888.

Hydrographic Sheets Nos. 1780 and 1781, '86, 1784 and 1785, '87, 2021, 2023, 2024, and 2025 in 1890.

NOTES

A. Signifies Astronomical Station
M. do. Magnetic do.
T. do. Tidal do.
X. do. Current do.

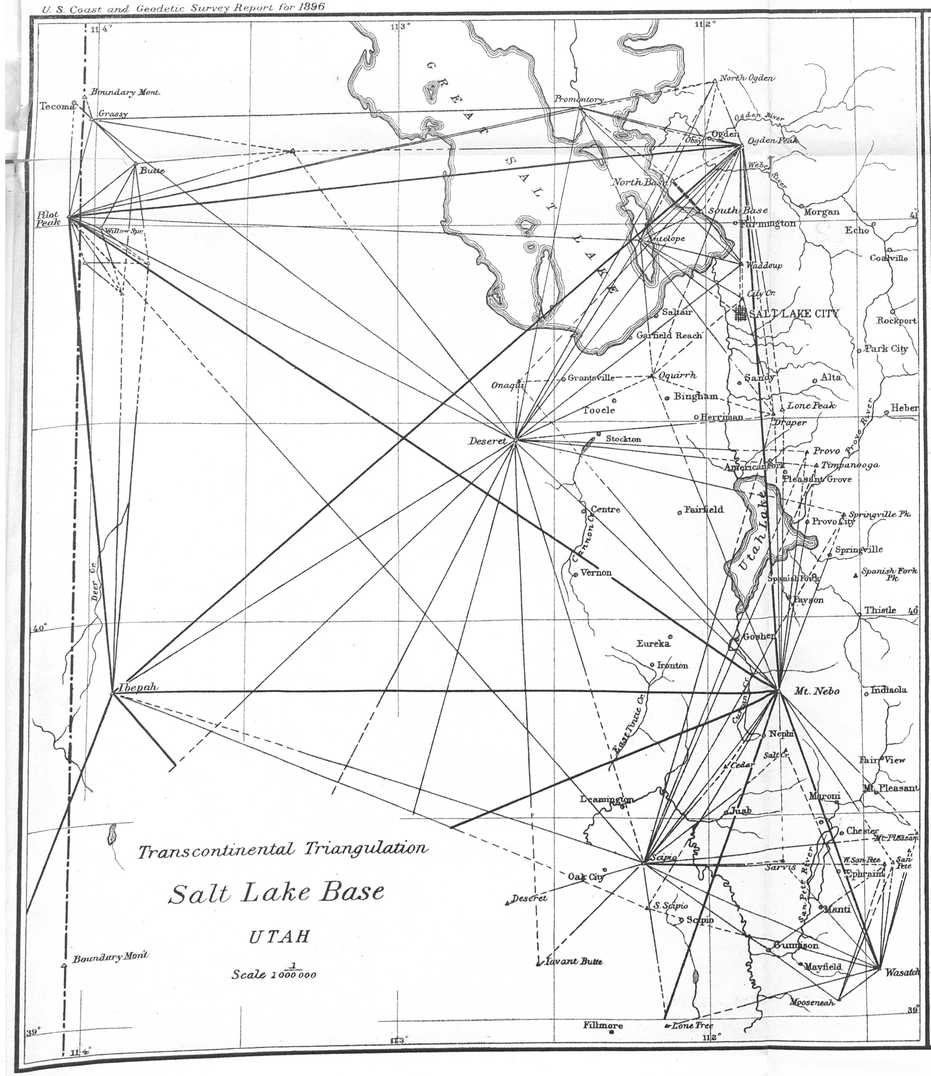
do. do. Lines between Primary occupied Stations
do. do. do. do. do. and unoccupied Stations
do. do. do. do. unoccupied Stations
do. do. do. Secondary occupied Stations
do. do. do. do. do. and unoccupied Stations
do. do. do. do. unoccupied Stations
do. do. do. Tertiary occupied Stations
do. do. do. do. do. and unoccupied Stations
do. do. do. do. unoccupied Stations
do. do. Limits of Topographic Sheets
do. do. Hydrographic Sheets

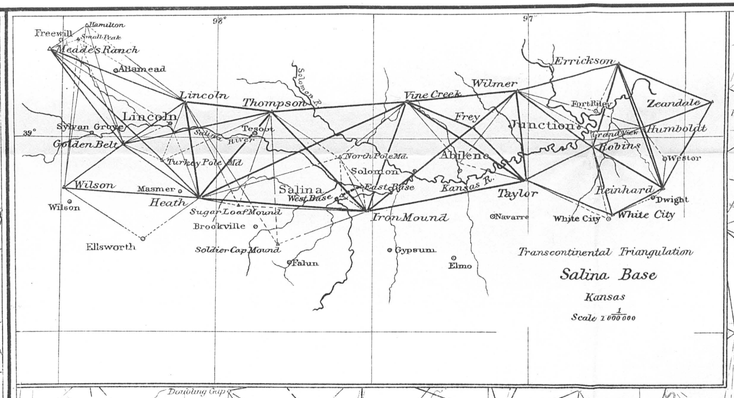
Vertical figures designate the number of Topographic Sheets
Inclined do. do. do. Hydrographic Sheets
The dotted shore line is unsurveyed

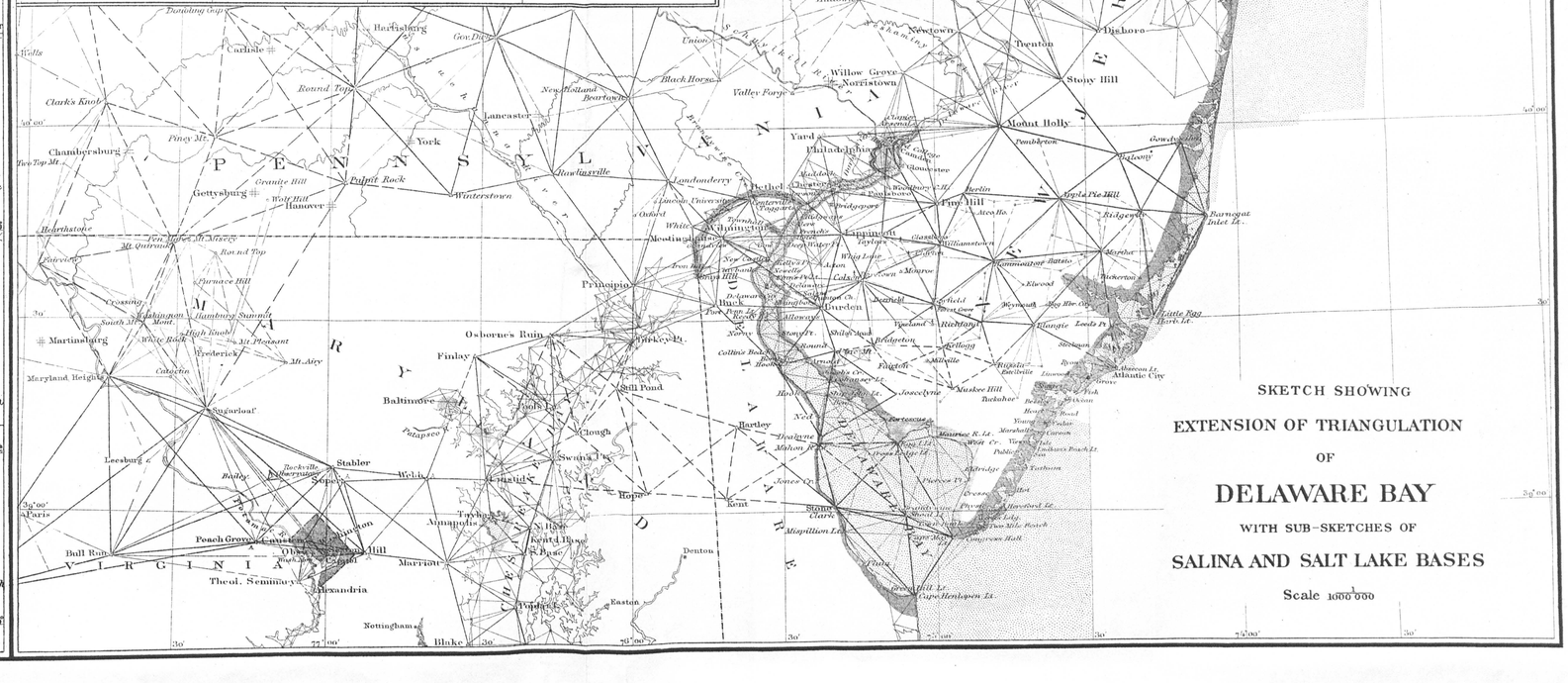
Statute Miles

Kilometres

Note. One kilometre or 1000 metres = 3280.83 ft. = $\frac{5}{8}$ of a statute mile nearly. One statute mile = 1609.35 metres







SKETCH SHOWING

EXTENSION OF TRIANGULATION

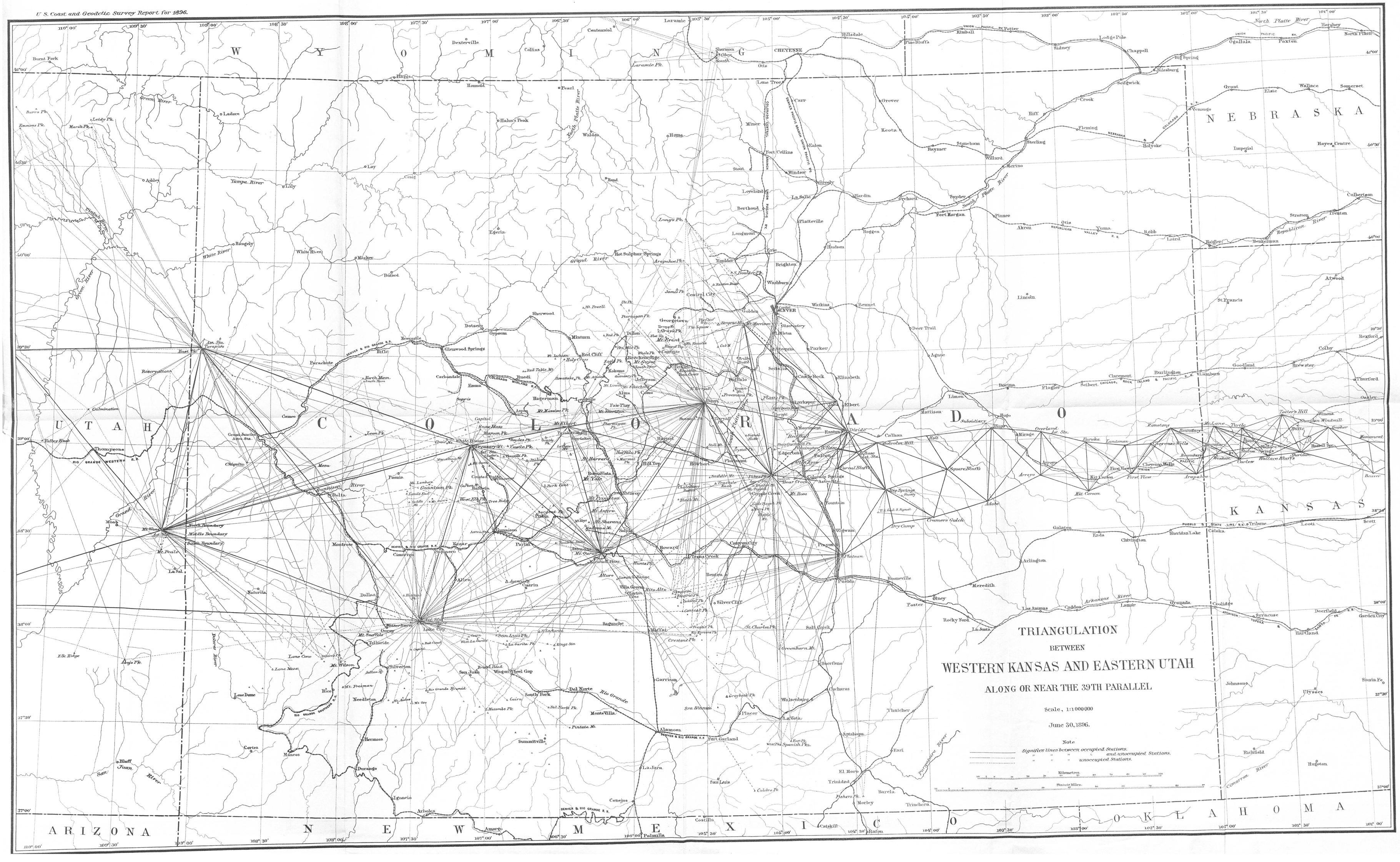
OF

DELAWARE BAY

WITH SUB-SKETCHES OF

SALINA AND SALT LAKE BASES

Scale 1/1 000 000


TRIANGULATION
BETWEEN
WESTERN KANSAS AND EASTERN UTAH
ALONG OR NEAR THE 39TH PARALLEL
Scale, 1:1000000
June 30, 1896.
Note
Signifies lines between occupied Stations.
" " " " and unoccupied Stations.
" " " unoccupied Stations.
Kilometres.
Statute Miles.
WYOMING
NEBRASKA
KANSAS
OKLAHOMA
COLORADO
UTAH
ARIZONA
NEW MEXICO
CHEYENNE
DENVER
North Platte River
South Platte River
Republican River
Arkansas River
Rio Grande
Grand River
Green River
Yampa River
White River
Gunnison River
Uintah River
Dolores River
San Juan River
Purgatoire River
Cimarron River
Colorado River
Reservations

TRIANGULATION
BETWEEN
ATLANTA AND MOBILE
WITH
SUB-SKETCH OF
EASTERN TENNESSEE
AND
WESTERN NORTH CAROLINA
Scale 1/1000000
ALABAMA
GEORGIA
VIRGINIA
TENNESSEE
NORTH CAROLINA
Athens
Capshaw
Smithers
Rainbow Mt.
Monte Sano
HUNTSVILLE
Weeden Mt.
Madkin Mt.
Decatur
Gunters
Roes Mt.
Somerville
Wilsons Mt.
Danville
GUNTERSVILLE
Moores Hill
Summit
Aurora
Warnock
Blount Springs
Cahaba
Little Peak
Bald Rock
Birmingham
Bessemer
Laurel
Penitentiary Mt.
Munford
Mt. Parnassus
Talladega
Alpine
Horn
Childersburg
Hickock Mt.
Kahatchee
Columbiana
Peak
E. Peak
Weogufka
Jamison
Bryant
Perry
Mt. Pisgah
Wilder
Parker
Wetumpka
Robinsons Springs
Selma
Water Tower
Capitol
Montgomery
Lowndesboro
Lovers Leap
Ethridge
Mt. Carmel
Bargenier
County Line
Fatama
Lower Peach Tree Ast. Sta.
Lookout Hill
Midway
Creagh
White
Pollard
Coon
Red Hill
Dean
Cold Creek
Minette
Mobile
Spring Hill
Daphne
St. Elmo
Cedar Pt.
Ft. Morgan
Sand I. Lt.
Dauphine I.
Pt. aux Pins
W. Base
E. Base
Alabama River
Tombigbee River
Mobile Bay
Stevenson
Tennessee River
Kashe's
High Pt.
Round Top
Lookout
Pigeon Mt.
Gulf Pt.
Pea Ridge
Baileys Gap
Johns Mt.
Cohutta or Cowpen
Grassy Mt.
Blood
Dome Mt.
Dahlonega
Walker Mt.
Grassy
Sharp Top Mt.
Brandon
Round Top Hill
S. W. End Taylors Ridge
S. E. Point Lookout
Lavender Mt.
Water Tower
Coosa
Rome
Pine Log Mt.
Sawnee Mt.
Pine Mt.
Rocky City Lookout Mt.
Waisner
Indian
Carnes
Sweat Mt.
Kenesaw Mt.
Lost Mt.
Court Ho.
Nat. Cem.
Marietta
Academy
N. Base
S. Base
Stone Mt.
Capitol
Barracks
ATLANTA
Lower Mt.
Terrapin Mt.
Hurricane Mt.
Peak B.
Peak C.
Peak D.
Peak A.
Coldwater W. Peak.
Chechahaw
High Peak
Clinch
Marion
Abington
Mendota
Big Knob
Rogers
White Top
Balsam Mt.
Gate City
Wildcat
Cloud
Dunn
Bristol
Damascus
Blountville
N. Carolina Corner
Fishers Peak
Buffalo
Taylorsville
Smoky Range Summit
Grandmother
Grandfather
Bullhead
Saddle Mt.
Warrior
Moore
Hanging Bluff
Lauratown Mt.
Pilot
Holston
Negro Mt.
Elk Knob
Rogersville
Short
Chimney Top
Jonesboro
Rogersville Junct.
Limestone
Greenville
Elizabethtown
Flat Top Mt.
Wilkesboro
Roan High Bluff
High Knob
Grandfathers Chin
Forehead
Big Butt
Bakersville
Poore
Triple Summit
Mocksville
Marshall
Mt. Mitchell
Mt. Hallback
High Pinnacle
Big Craggy Mt.
Morganton
Statesville
Simonton College
Young
Dunn's Mt.
West Drowning Cr. Mt.
East Drowning Cr. Mt.
Bakers Knob
Hickory Knob
Silver Creek Knob
Asheville
Anderson
Hominy Gap
Little Pisgah
Lincolnton C.H.
Bear Wallow Mt.
Pinnacle Mt. or Bald Mt.
Rutherfordton
Cold Mt.
Mt. Pisgah
Richland Balsam Mt.
Devils Courthouse
Tennessee Bald Mt. or Mt. Hardy
Tryon Mt.
Eastern Summit
Shelbyville
Dallas
Spencer Mt.
Crowders Mt.
King
Charlotte
Hogback
Glassy Rock
Henry Mt.
Long Wooded Ridge
Thicketty
Caesars Head Hotel
Rich Mt.
Pinnacle
Table Rock
Fodderstack Mt.
Rocky Summit
Wooded Summit
Yadkin River
South Yadkin R.
French Broad R.
Catawba R.
88°00′
87°30′
87°00′
86°30′
86°00′
85°30′
85°00′
84°30′
84°00′
83°00′
82°30′
82°00′
81°30′
81°00′
80°30′
37°00′
36°30′
36°00′
35°30′
35°00′
34°30′
34°00′
33°30′
33°00′
32°30′
32°00′
31°30′
31°00′
30°30′

No 15

PROGRESS SKETCH
SHOWING TRIANGULATION OF
PORTLAND CANAL AND VICINITY.
S. E. ALASKA
Scale 1/200 000
Statute Miles
Nautical Miles
Kilometres
PORTLAND CANAL
BEHM CANAL
REVILLAGIGEDO CHANNEL
THORNE ARM
SMEATON BAY
BOCA DE QUADRA
Marten Arm
Badger Bay
Weasel Cove
Vixen Bay
Mink Bay
FELICE STRAIT
MARY I.
DUKE I.
DIXON ENTRANCE
ZAYAS I.
DUNDAS I.
CHATHAM SOUND
NAKAT INLET
WILLARD INLET
FILLMORE INLET
FILLMORE I.
Edward Passage
Wales Passage
Winter Harbor
WALES I.
HIDDEN INLET
PEARSE INLET
PEARSE ISLAND
SOMERVILLE I.
Steamer Passage
Quinamass Bay
Nasoga Gulf
Mylor
Peninsula
Nass Bay
Observatory Inlet
Union Bay
Work Channel
Compton I.
Port Simpson
Tongass Vill.
Port Tongass
Kanaghunut
Sitklan I.
Salmon River
Bear River
Glacier
Camp
Witness Tree
Moss
56th Parallel

Mt. Lola

Rose Peak

Rose Knob

Iron Monument

Observatory

Tahoe City

Deadman Pt.

Genoa Pt.

LAKE TAHOE

Rubicon

Blaisdell

Castle Rock

Bullion

Lake Shore

Tallac Pk.

Fallen Leaf L.

Freels

Bijou

120 Mer. 2.51.'93.

Mc. Como

Rock Cliff

Barber

Bald

Ridge

Gold Hill

Knoll

High Pk.

Dome

Lake

Round Top

Pine Fol.

N.E. Cairn

Flat

Mahogany

Don

East Sister

Middle Sister

Sweetwater

West Walker

Red

Long

Sugar Loaf

Bald Pk.

Beauty Pk.

Aurora Pk.

West Brawley

Spring Pk.

Bodie Pole

Lake View

Cedar

Sag

Slope

Top

Southern Rock Trail

Queen

City

Peach

Lava

Queen Sta.

Bodie

Mt. Grant

Mt. Conness

White Mt.

Sheet No. 1

BOUNDARY SURVEY BETWEEN CALIFORNIA AND NEVADA

Scale, 1:400,000.

Statute Miles.

Nautical Miles.

20' 10' 120° 00' 50' 40' 30' 20' 10' 116° 00' 50' 40' 30' 20'

38° 30' 20' 10' 39° 00' 30' 20' 10' 32° 00' 50' 40' 30' 20' 10' 35° 00' 50'

NEVADA

CALIFORNIA

ARIZONA

Ft. Mohave

N.W. Post

S.E. Post

Rock

Pebble

Pyramid

Peaks

Bench

Sand

Gravel

Colorado River

Hill

W. Base

E. Base

Knoll

Long Pier

Bar

SUB SKETCH OF SOUTHERN END OF BOUNDARY

Scale, 1:400,000.

Statute Miles.

Nautical Miles.

50' 40' 114° 30'

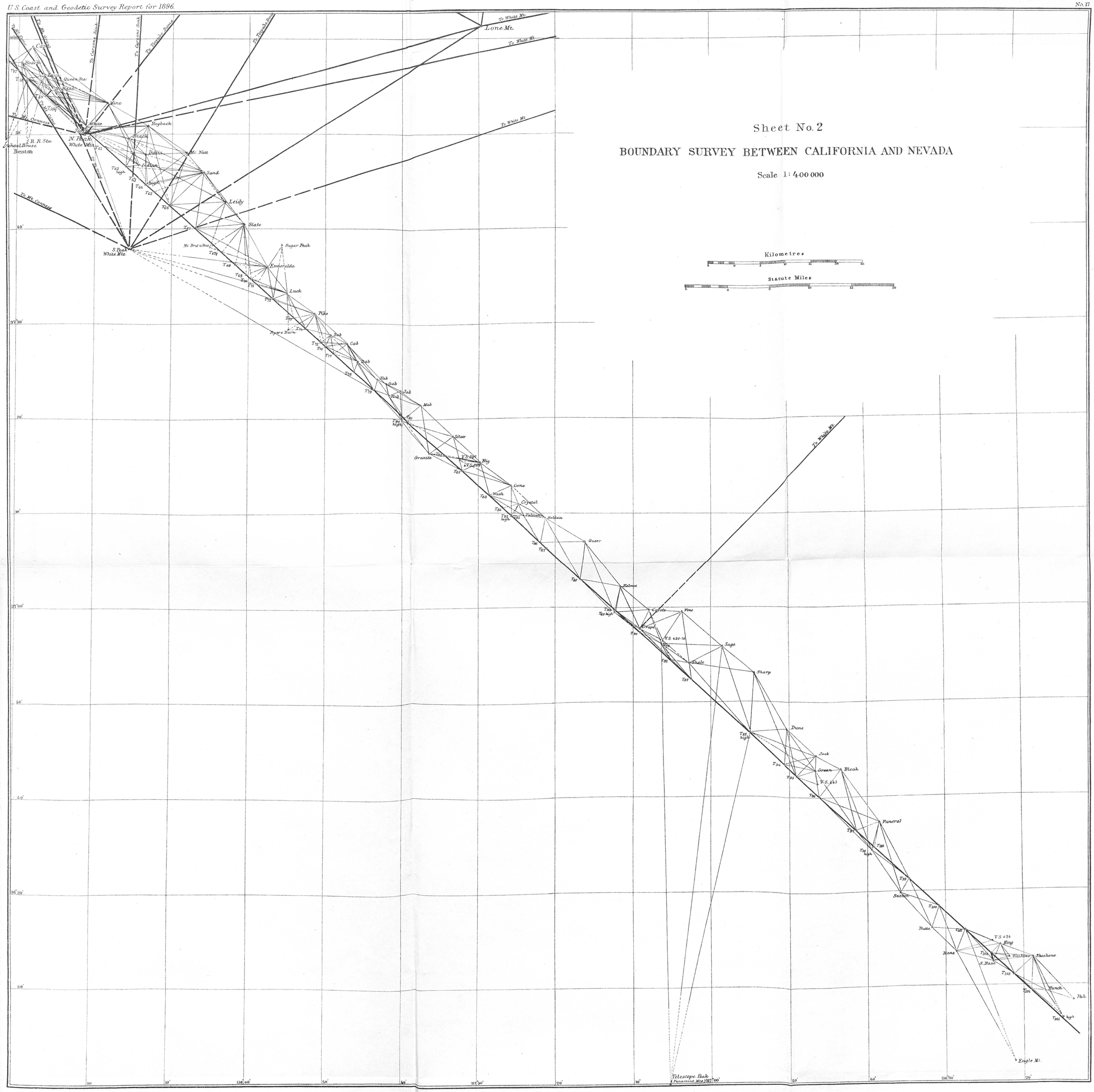
Sheet No. 2

BOUNDARY SURVEY BETWEEN CALIFORNIA AND NEVADA

Scale 1:400 000

Kilometres 0 5 10 15 20 25

Statute Miles 5 0 5 10 15 20



UNITED STATES COAST AND GEODETIC SURVEY.

PART II.

APPENDICES RELATING TO THE METHODS, DISCUSSIONS, AND RESULTS OF THE COAST AND GEODETIC SURVEY.

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DISTRIBUTION OF THE MAGNETIC DECLINATION IN THE UNITED STATES FOR THE EPOCH JANUARY 1, 1900.

[Third edition, with three charts.]

By CHARLES A. SCHOTT, *Assistant.*

Submitted for publication October 17, 1896.

Introduction.—Since the last publication by the Survey of a paper showing for a given date the distribution of the magnetic declination within the area of the United States nearly eight years have elapsed, an interval sufficiently long to have produced marked changes in the values of the declination as well as in the delineation of the isogonic curves from their aspect in the year 1890. A new edition, based upon a new discussion of the material on hand, and a chart exhibiting the results for an epoch nearer to the present time were thus called for. It is well known that the changes of the delineation, and consequently also its geographic distribution, are caused by the operation of the secular variation, the laws of which, while fairly made out for stations located on the coasts, are yet but imperfectly understood for the interior of the country; and this is particularly true for the more recently settled parts. Hence a first and indispensable step toward improved results was a new discussion of the secular variation. This was accordingly made, and is contained in the Annual Report of the Survey of last year. (Vide Appendix No. 1, 1895, pp. 167–320.) The study of this subject, as yet obscure in its origin, has been steadily pursued by the Survey, and the increased demand for its results may be judged of by the fact that seven editions have been exhausted.

The improvements introduced in the present paper on the distribution of the declination, for which the epoch January, 1900, has been selected, consist of—

(1) The introduction of additional observations made since the publication of 1889 and the additions to the collection of data other than those directly contributed by the Survey.

(2) The extension and increase of our knowledge of the secular variation, thus giving increased precision to the "reduction to epoch;" that is, to the sign and amount of correction to be applied to the *observed* value to produce what it would be should the observation be made in January, 1900.

In spite of the very limited means at the disposal of the Survey,[1] the progress in our knowledge of the distribution of magnetism within our borders though slow has been steady, as may be seen from the historical account given in the introduction to the second edition of the paper; yet west of the Mississippi River, and particularly in the Northwestern States, there are vast regions

[1] For the fiscal year 1895-96 the amount appropriated for magnetic research was but one-fiftieth part of that given for the general field work of the Survey, and in consequence the maintenance of the magnetic observatory near San Antonio, Tex., where self-registering instruments had been at work during five years, had to be given up in March, 1895.

which for the present have to be covered by interpolated values. Moreover, the recognition of disturbed regions and the exposition of the disturbances by means of lines of equal anomaly have so far received little consideration, but in the future will demand a large share of attention as a desirable, interesting, and fruitful study, for which it is hoped the necessary means will be forthcoming. In judging thus of the amount and character of the work in terrestrial magnetism accomplished so far by the Survey, the fact of its very limited resources should be borne in mind.

Looking to future expansion of activity and in part explanatory of the method pursued in bringing out the results of this paper, a few words bearing on the manner of conducting magnetic surveys may find a proper place here. Referring to surveys on land and of limited area, such as that of one of our States of average size, one or two field parties observing at each station declination, dip, and intensity, and operating, say, for one, two, or maybe more years, according to facilities for travel and depending on the density of distribution of stations, may secure a fair knowledge of the magnetic force within the border lines. Should a magnetic observatory, centrally located and provided with automatically registering instruments, be available during the time of the survey, all field results could be differentially corrected for diurnal variation and for disturbances, as well as for annual change, simply by comparisons of simultaneous values found by the traveling party and as recorded at the base station. The assumption that the character of disturbances changes but slowly with distance can safely be made. The analysis of local disturbances may be followed out to any desired extent. Such surveys may be repeated at certain intervals, say one-fourth of a century.[1]

For an area forming a considerable part of the earth's surface, such as that presented by the United States, the above method becomes impracticable by reason of its great expense in providing for a multitude of instruments and observers; hence a different method has to be followed, and is the one adopted by the Survey. It consists in gaining as accurate a knowledge of the laws of the secular variation as possible by selecting a series of well-distributed so-called secular-variation stations, particularly those for which we possess a number of old observations, and supplementing these by modern observations repeated every few years (say five or ten or more years, according to circumstances). If, then, the Survey directs its observers to places where their work will tell to best advantage, as, for instance, in the central part of a region destitute of magnetic stations, and at the same time collects all other results within its boundaries, no matter when or by whom observed, we can refer all to any epoch we choose[2] and discuss and chart them as in the first method.

This paper, being restricted to the consideration of declinations, contains a collection of observed and reduced (to epoch 1900·0) values at over 3 500 places, while the number of secular-variation stations (in Appendix No. 1, Report for 1895) was 118, with an aggregate of more than 1 430 observations (annual values).

Magnetic surveys conducted at sea of necessity gather their material from cruises, and these researches are generally isolated rather than partaking of a systematic and complete character. Intensities, when expressed in absolute measure, must depend on observations at base stations on land, and the disturbing influences on magnetic observations made on board ship must be investigated under the various conditions of a cruise and the results be corrected accordingly. The secular variation is ascertained from a discussion of results obtained on islands and at coast stations. Isomagnetic curves thrown over the oceanic expanse of the survey will be greatly strengthened in their proper location by joining and merging into the trend of any corresponding system of curves covering adjacent coasts. Isomagnetic lines may be constructed graphically or by application of analysis. The latter mathematical process of interpolation, for instance, was applied in case of the

[1] As examples of this method of conducting surveys, we may refer to the following publications: "A magnetic survey of the British Isles for the epoch January 1, 1886," by A. W. Rücker and T. E. Thorpe, Phil. Trans. Roy. Soc. vol. 181, London 1890; "Détermination des éléments magnétiques en France," par M. Th. Moureaux, Paris, 1886; and "A magnetic survey of the Netherlands for the epoch January 1, 1891," by Dr. Van Rijckevorsel, Nieuwe Verhandelingen van het Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte te Rotterdam, 1895. The magnetic survey of the State of Missouri, made between 1878 and 1882 by Prof. F. E. Nipher, approximates to this system, but for thorough analysis of local disturbances a greater number of stations for dip and intensity would be desirable.

[2] Provided it be within the limits of our knowledge of the secular variation.

isogonics for Bering Sea and the northeast Pacific adjacent to Alaska. (See Appendix No. 4, Report for 1894.) The chart accompanying that paper is for the epoch 1895. The scanty and imperfect information of the annual change ranging over so large an extent as Alaska, with its adjacent waters, hardly warrants an extension in time to a later date, but this has been done without much additional labor by shifting the lines by the accumulated amount proportional to the intervals between them, thus keeping in use the general expression for this region as established in 1894, viz:

$$\begin{aligned} D = &-27^\circ\cdot7288 - 0\cdot71688\ \varphi_1 + 0\cdot73731\ \lambda_1 \cos\varphi \\ &- 0\cdot023982\ \varphi_1^2 + 0\cdot070893\ \varphi_1\lambda_1 \cos\varphi + 0\cdot010915\ \lambda_1^2 \cos^2\varphi \\ &- 0\cdot0005744\ \varphi_1^3 + 0\cdot0025613\ \varphi_1^2\lambda_1 \cos\varphi + 0\cdot0001956\ \varphi_1\lambda_1^2 \cos^2\varphi - 0\cdot0003342\ \lambda_1^3 \cos^3\varphi \end{aligned}$$

where D=the declination for 1895·0 and $\varphi_1 = \varphi - 59^\circ\cdot02$ and $\lambda_1 = \lambda - 145^\circ\cdot12$, as given in Appendix 4, Report for 1894, Part II, page 98. To obtain the declination at any place in Alaska for any date between now and 1900, a correction for the annual change must be applied, for which the following approximate or conjectured values are all that is now available.

Along the Arctic Coast from longitude 145° W. to Point Barrow +12′, at Icy Cape +9′·5, at Cape Lisburne +8′·5, in Kotzebue Sound +7′·1, at Port Clarence +7′·3, at St. Michael +6′·5, at Nunivak Island +5′·0, at Hagmeister Island +4′·5, at the Pribilof Islands +3′·6, at Unalaska Island +3′·0, at the Shumagin Islands +4′, at Kadiak Island +4′, at Port Etches +3′; along the 141° boundary line, on the Arctic Coast +10′, at the Porcupine River +6′, at Fort Yukon +4′·4, at junction of Yukon River and Forty Mile Creek +3′; at Sitka −2′, and in southeastern Alaska, Wrangell, and Port Simpson −2′·5 to −3′.

NOTE.—A + sign indicates diminishing east declination; a — sign indicates increasing east declination.

TABLE OF THE MOST RECENT MAGNETIC DECLINATIONS OBSERVED IN THE UNITED STATES AND ADJACENT REGIONS.

The arrangement of the tabulation of the declinations collected[1] to date, but giving only the *latest* observation at each place, is the same as that of the preceding edition of 1889, viz, for each State, Territory, and geographical subdivision two groups are formed, the first composed wholly of stations occupied by Coast and Geodetic Survey observers, the second of stations occupied by other observers. There are a few exceptions to this for special reasons. The stations are arranged according to their latitudes, beginning with the lowest and ending with the highest, which renders it quite easy to find in what localities magnetic observations have been made. In this edition all special references to the source whence the observations were derived are omitted in order to relieve the paper from unnecessary heaviness; this remark, however, does not apply to newly added data. Footnotes relating to index corrections of compasses or to improvements of geographical positions are likewise omitted, all of which special information can be found in the preceding edition. Some concentration has also been effected, omitting the results at stations closely crowded together, say within a square mile, or demanding condensation for other reasons, and substituting for them a mean value.

The contents of the first, second, and third columns of the general table are sufficiently indicated by the respective headings; the next two columns give the date (the year and fraction) of observation and the observed declination (in degrees and fraction), a + sign indicating west, a — sign east declination. The column headed △ D contains the reduction of the observed value to the adopted epoch 1900·0, which is derived directly from the discussion of the secular variation at suitably selected stations as given in last year's Annual Report; a + indicates increasing west (or decreasing east) declination, a — sign the reverse motion of the north end of the magnetic needle. To facilitate the evaluation (in time and space) of △ D, a special set of secular change tables was prepared. These give for every secular variation station and for every even year between 1830 and 1900, the reduction directly, together with its proper sign. If for any reason the change is

[1]It is hardly necessary to state that such a collection can not claim to be in any degree exhaustive, as it is only through cooperation of those who may enjoy special facilities or have access to old records that this state can be approached.

unknown or doubtful, the fact is indicated by a blank in this and the next column. The resulting values[1] ready for the next operation of charting are presented in the column headed D_{1900} and the table closes with stating the observer's name and an occasional reference when required.

The great inequality in the density of the distribution of stations in the several States or subdivisions may be judged by the following table of number of stations in each, as given in this paper:

State or subdivision.	Number.	State or subdivision.	Number.	State or subdivision.	Number.
Alabama	20	Nevada	114	Parts of British Possessions and Dominion of Canada to longitude 75° W.	111
Alaska	128	New Hampshire	18	Same between longitudes 75° and 90° W.	121
Arizona	54	New Jersey	128	Parts of British Possessions and Northwest Territory, south of latitude 51° and west of longitude 90°	98
Arkansas	25	New Mexico	57	Same north of latitude 51° and west of longitude 90°	144
California	83	New York	248	Waters adjacent to Alaska and eastern Siberia	61
Colorado	58	North Carolina	34		
Connecticut	32	North Dakota	21		
Delaware	9	Ohio	96		
District of Columbia	31	Oklahoma	0		
Florida	48	Oregon	60		
Georgia	56	Pennsylvania	114		
Idaho	55	Rhode Island	9		
Illinois	42	South Carolina	14		
Indiana	15	South Dakota	18		
Indian Territory	8	Tennessee	23		
Iowa	35	Texas	57		
Kansas	38	Utah	84		
Kentucky	31	Vermont	14		
Louisiana	38	Virginia	54	Total number of stations within United States	2 903
Maine	77	Washington	107		
Maryland	28	West Virginia	21		
Massachusetts	53	Wisconsin	58	Total number of stations tabulated	3 591
Michigan	237	Wyoming	61		
Minnesota	48	Parts of West Indies, Central America, and Mexico to longitude 100° W.	54		
Mississippi	22				
Missouri	129				
Montana	66				
Nebraska	27	Mexico west of 100° W.	99		

THE ISOGONIC CHART OF THE UNITED STATES FOR THE EPOCH JANUARY, 1900.—CONSTRUCTION OF THE LINES OF EQUAL DECLINATION.

Having thus obtained our material, ready to hand for charting, an account of this process must next be given. First, we have to remark that a graphical method for drawing the isogonic curves was preferred to an analytical one, since their general curvature was sufficiently well known and no very large spaces barren of magnetic stations were encountered. Such, however, was not the case with Alaska and adjacent parts of the ocean, where the use of a mathematical expression, with its cumbersome adjunct, the method of least squares, had to be resorted to in order to secure definiteness of location. These curves are here reproduced, with the effect of the secular change during five years applied to refer them to the year 1900 (see chart No. 3). The curves are necessarily smooth, as, depending on the roots of an equation which is a steady function of the latitude and longitude, they do not take cognizance of local disturbances, which, however, are supposed to be less frequent over sea than on land areas. When speaking here of magnetic disturbances we do not mean temporary ones, occurring during observations, but refer to regions permanently disturbed, i. e., showing an irregular and anomalous distribution as compared with an equable distribution over surrounding regions. These disturbed areas often present difficulty in attempting to recognize and represent them, on account of their variation in extent and the amount of deviation. If the latter is small it may mix itself up with observing error; on the other hand, if the extent be restricted, say to a few square kilometres or to a few square miles, they may entirely escape recognition from want of observation within the area. These irregularities may be spread over areas hundreds of times as great, in which case they can be properly represented even on a chart of small scale. Disturbances in distribution are shown by the distor-

[1] They are given to the nearest tenth of a degree (i. e., within $\pm 3'$), an accuracy commensurate with or exceeding that which the data themselves may possess.

tions of the isomagnetic curves traversing the disturbed region; if of small extent they are known as "local" disturbances; if of wide range they have been termed "regional," but no sharp distinction between them is possible. The older observations and all those made by means of the compass are subject to large probable errors, which may be roughly estimated as between $\pm 5'$ and $\pm 15'$ or more (those made at sea as $\pm 30'$ or more), whereas the results obtained by means of the magnetometer, which instrument is almost exclusively employed by the Survey, may be depended upon generally within $\pm 1'$ to $\pm 3'$. Errors introduced through the reduction to epoch will, cæteris paribus, be proportional to the elapsed time. Thus, in following the observed values too closely, there is danger that our isomagnetic curves represent by their sinuosities observing errors rather than abnormal distribution of magnetism. On this account the tabular values were divided into two groups of results of greater and of less reliability, and when plotted this division was recognized as a help toward the most probable position and form of the curves. In many cases the geological formation of the region, particularly if consisting of igneous rock, will of itself point out probable limits of the disturbed region. It need hardly be remarked that the employment of a graphical process of interpolation does not exclude the use of analytical treatment; on the contrary, the two methods may be applied together with advantage, as supplementary to one another, but just how far to follow minute deflections and how much to generalize must, in a large measure, remain a matter of judgment and experience.

In places on the chart where, from want of adequate information, the position of the isogonic curves are doubtful or indeterminate the fact is indicated by broken lines.

The use of the accompanying chart No. 1 is quite simple. The declination for any place within its borders is either had by inspection or by simple interpolation between the two adjacent curves; the value found is for 1900·0; for any other year (and fraction) a reduction for secular change between the epoch and given date must be applied. The contents of Appendix No. 1, Report for 1895, supply this reduction for the past time as well as up to the year 1900 and roughly for a few years beyond. For convenience, however, a map (No. 2) is appended to this paper, which shows the *annual* change of the declination during the period 1890–1900, expressed in minutes of arc, + for increasing west or decreasing east declination and — for the reverse motion. The amount varies in time, but not sufficiently during the brief interval of ten years to cause any serious inaccuracy; its variation with geographical position must be estimated from the map.

It gives me pleasure to acknowledge the effective services of Mr. D. L. Hazard for applying the tabular reduction to epoch, and of Mr. F. W. Clay for plotting the position of the stations on the chart. The plotting and the running in of the curves were done on a chart of scale 1/5 000 000 and the latter were then transferred to the more convenient chart of scale 1/7 000 000.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ALABAMA.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Fort Morgan.	30 14	88 01	1847·40	−7·07	+2·8	−4·3	R. H. Fauntleroy and J. S. Ruth.	
Mobile.	30 42	88 03	1896·26	−4·52		4·6	J. B. Baylor.	C. & G. S. archives.
Citronelle.	31 05	88 14	1896·18	−4·69	+0·3	4·4		
Greenville.	31 50	86 36	1896·20	−3·78	+0·3	3·5		
Lower Peachtree.	31 50	87 37	1857·33	−6·04	+2·1	3·9	G. W. Dean.	
Eufaula.	31 54	85 08	1896·24	−2·92	+0·3	2·6	J. B. Baylor.	C. & G. S. archives.
Montgomery.	32 22	86 18	1896·21	−2·90	+0·3	2·6		
Selma.	32 24	87 05	1896·22	−3·16	+0·3	2·9		
Opelika.	32 37	85 25	1896·25	−3·03	+0·2	2·8		
Indian Mt.	34 02	85 26	1875·65	−4·18	+1·3	2·9	F. P. Webber.	
Decatur.	34 37	86 59	1881·66	−5·17	+1·0	4·2	J. B. Baylor.	C. & G. S. archives.
Huntsville.	34 44	86 35	1890·42	−3·70	+0·5	3·2		
Florence.	34 48	87 43	1890·41	−4·26		−3·8		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ALABAMA—Continued.

Name of station.	Lat.	*Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II.	° ′	° ′		°	°	°		
Mt. Vernon. U. S. Arsenal.	31 06	88 01	1870·8	—6·45	+1·8	—4·6	W. W. Carson.	Letter to office.
Evergreen.	31 26	87 05	1875·40	—5·53	+1·6	3·9	J. M. Poole.	
Cahaba.	32 18	87 10	1860·3	—6·17	+2·2	4·0	W. Scott.	
Tuskegee.	32 26	85 45	1888·5	—3·92	+0·8	3·1	W. C. Torrance.	
Tuscaloosa.	33 12	87 40	1875·44	—6·08	+1·5	4·6	J. M. Poole.	
Birmingham.	33 32	86 48	1875·44	—4·44	+1·4	3·0	J. M. Poole.	
Madison.	34 41	86 48	1875·41	—5·19	+1·3	—3·9	F. E. Hilgard.	

ALASKA.

Group I.								
Amchitka Island, Constantine Harbor.	51 24	E179 12	1873·58	— 7·28			W. H. Dall.	
Adakh Island, Bay of Seven Islands.	51 49	176 52	1873·61	—13·87				
Kyska Island, Kyska Harbor.	51 59	E177 30	1873·55	—11·11				
Atka Island, Nazan Bay.	52 11	174 15	1873·65	—16·96				
Attu Island, Chichagof Harbor.	52 56	E173 12	1873·48	— 7·72				
Unalaska Isd., Cove Pt.	53 24	167 30	1880·75	—16·26			W. H. Dall & M. Baker.	
Unalaska Isd., Iliuliuk Harbor.	53 53	166 32	1896·33	—17·73		—17·8	O. B. French.	C. & G. S. archives.
Portland Canal, S. Base.	54 46	130 24	1888·59	—29·62	—0·5	30·1	A. N. Wood.	
Howcan Mission, Kaigani Strait.	54 50	132 50	1881·67	—27·06			H. E. Nichols.	
Little Koniushi Island, Shumagin Islands.	55 03	159 23	1880·54	—21·42			W. H. Dall & M. Baker.	
Dolgoi Island, south end.	55 03	161 43	1880·56	—17·98				
Tamgas Harbor.	55 04	131 28	1883·59	—28·58	—0·7	29·3	H. E. Nichols.	
Dolgoi Isd., Belkofski Settlement.	55 05	162 00	1880·56	—21·43			W. H. Dall & M. Baker.	
Mary Isd., near custom-house.	55 06	131 14	1895·54	—28·36	—0·2	28·6	O. B. French.	C. & G. S. archives.
Bay, Portland Canal.	55 13	130 04	1888·66	—27·74	—0·5	28·2	A. N. Wood.	
Humboldt Harbor, Popof Isd.	55 19	160 31	1880·55	—20·28			W. H. Dall & M. Baker.	
Pen Island, Tongass Narrows.	55 23	131 44	1885·61	—28·12	—0·6	28·7	R. A. Marr.	
Kasaan Bay, Prince of Wales Archipelago.	55 30	132 19	1880·35	—27·80			W. H. Dall & M. Baker.	
Union Bay.	55 45	132 12	1885·60	—30·50	—0·6	31·1	R. A. Marr.	
Chirikof Island.	55 48	155 43	1874·45	—23·02			W. H. Dall.	
Chiachi Islands.	55 52	159 05	1874·48	—21·93				
Port Moeller.	55 55	160 35	1874·61	—21·37				
Head of Portland Canal.	55 56	130 00	1888·52	—30·14	—0·5	30·6	A. N. Wood.	
Dewey Anchorage, Clarence Strait.	55 56	132 22	1886·69	—28·50	—0·6	29.1	C. C. Marsh.	
Burroughs Bay, Unuk River.	56 02	131 06	1893·39	—30·40	—0·3	—30·7	H. W. Edmonds.	C. & G. S. archives.

* East longitude is indicated by an E prefixed.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ALASKA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Port McArthur, Sumner Strait.	56 04	134 06	1886·57	—27·83	—0·5	—28·3	C. C. Marsh.	
Semidi Islands.	56 05	156 39	1874·45	—22·95			W. H. Dall.	
Chican Village.	56 09	133 28	1886·54	—33·00	—0·5	33·5	C. C. Marsh.	
Point Chican.	56 09	133 36	1886·58	—29·42	—0·5	29·9		
Shakan, Pr. of Wales Isd.	56 09	133 38	1881·62	—30·05			H. E. Nichols.	
Chignik Bay.	56 19	158 24	1874·46	—22·03			W. H. Dall.	
East Base, Red Bay, Sumner Strait.	56 20	133 15	1886·43	—29·67	—0·5	30.2	C. C. Marsh.	
North Base, Fort Wrangell.	56 27	132 23	1886·5	—29·33	—0·5	29·8		
Fort Wrangell, Etolin Hbr.	56 28	132 23	1893·48	—29·64	—0·3	29·9	G. R. Putnam.	C. & G. S. archives.
East Base, Duncan Canal.	56 36	133 06	1887·57	—30·10	—0·5	30·6	C. C. Marsh.	
South Base, Frederick Sound.	56 55	132 51	1887·44	—29·63	—0·5	30·1		
Portage Bay, Frederick Sound.	57 00	133 20	1887·49	—30·49	—0·5	31·0		
Sitka, parade ground.	57 03	135 20	1896·55	—29·66		29·4	F. Morse.	C. & G. S. archives.
St. Paul Isd., Pribilof Islands.	57 07	170 19	1891·59	—17·02	+0·5	16·5	T. C. Mendenhall.	
Woewodski.	57 10	134 15	1889·49	—29·58	—0·4	30·0	A. N. Wood.	
Cape Fanshaw, Frederick Sound.	57 11	133 34	1887·54	—30·08	—0·4	30·5	C. C. Marsh.	
Cleveland Passage, Cape Fanshaw.	57 12	133 30	1889·33	—30·22	—0·4	30·6	A. N. Wood.	C. & G. S. archives.
Poke.	57 27	133 50	1889·53	—30·27	—0·4	30·7		
Killisnoo.	57 27	134 30	1895·69	—29·47	—0·2	29·7	R. F. Lopez.	
Clot, Holkham Bay.	57 41	133 28	1889·72	—28·20	—0·4	28·6	A. N. Wood.	
Kadiak Isd., St. Paul.	57 48	152 22	1896·45	—24·56			H. P. Ritter.	
Port Althorp, Cross Sound.	58 12	136 24	1880·46	—32·26			W. H. Dall & M. Baker.	
Auke Point.	58 12	134 33	1890·51	—30·73	—0·2	30·9	H. C. Poundstone.	C. & G. S. archives.
Hat, Taku River.	58 12	134 09	1893·47	—31·03	—0·1	31·1	J. E. McGrath.	
Funter Bay.	58 14	134 55	1890·68	—30·25	—0·2	30·4	H. C. Poundstone.	
Point Lena, Lynn Canal.	58 24	134 46	1890·42	—30·40	—0·2	30·6		
Taku River, ast. station.	58 26	133 59	1893·56	—30·27	—0·1	30·4	O. B. French.	
Taku River, Island.	58 30	133 54	1893·42	—30·82	—0·1	30·9	S. B. Tinsley.	
" " Duck.	58 31	133 52	1893·43	—30·87	—0·1	31·0		
" " Terrace	58 31	133 46	1893·44	—30·95	—0·1	31·0		
" " Islet.	58 32	133 44	1893·44	—30·20	—0·1	30·3		
" " Fishery	58 32	133 41	1893·47	—32·10	—0·1	32·2		
" " Wood.	58 34	133 40	1893·47	—32·42	—0·1	32·5		
" " Lean.	58 34	133 40	1893·47	—31·47	—0·1	31·6		
" " Nob.	58 35	133 40	1893·48	—31·97	—0·1	32·1		
" " Shoal.	58 35	133 38	1893·52	—32·57	—0·1	32·7		
" " Fast.	58 36	133 35	1893·51	—31·63	—0·1	31·7		
Lituya Bay.	58 37	137 40	1874·37	—30·05			W. H. Dall.	
La Perouse, Lituya Bay.	58 38	137 41	1894·62	—30·17	0·0	30·2	J. E. McGrath.	C. & G. S. archives.
Hagmeister Island.	58 48	160 50	1874·60	—22·88			W. H. Dall.	
Camp Muir, Glacier Bay.	58 50	136 05	1890·69	—30·43	+0·1	30·3	H. F. Reid.	
Anchorage Pt., Chilkat Inlet.	59 10	135 28	1894·53	—30·48	+0·1	30·4	J. F. Hayford.	C. & G. S. archives.
Chilkat.	59 12	135 27	1890·55	—30·65	+0·1	—30·6	H. C. Poundstone.	
Chilkoot.	59 12	135 21	1890·59	—19·65?				

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ALASKA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Dalton, Chilkat River.	59 20	135 48	1894·52	−31·95	+0·1	−31·8		
Open, Chilkat River.	59 21	135 48	1894·52	−31·91	+0·1	31·8		
Light, Chilkat River.	59 23	135 53	1894·50	−29·92	+0·1	29·8	A. L. Baldwin.	C. & G. S. archives.
Koh-klux, Chilkat River.	59 24	135 53	1894·49	−24·14?				
Dangerous Cape.	59 24	151 53	1880·51	−24·54			W. H. Dall & M. Baker.	
Limber, Taiya River.	59 32	135 20	1894·60	−32·15	+0·1	32·0	J. F. Pratt.	C. & G. S. archives.
Ocean Cape, Yakutat Bay.	59 33	139 52	1892·66	−30·40	+0·1	30·3	J. E. McGrath.	C. & G. S. archives.
Yakutat Bay, Port Mulgrave, Khantaak Island.	59 34	139 47	1892·67	−29·93	+0·1	29·8	J. H. Turner.	
Coal Point, Ogolnoi.	59 36	151 24	1880·50	−25·81			W. H. Dall & M. Baker.	
Malaspina S. W. Base.	59 44	140 12	1894·5	−30·72	+0·1	30·6		
Malaspina N. E. Base.	59 45	140 06	1892·58	−30·70	+0·2	30·5	J. E. McGrath.	C. & G. S. archives.
Mt. Hoorts, Yakutat Bay.	59 45	139 32	1892·63	−30·85	+0·2	30·6		
Yahtse E. Base.	59 49	141 08	1894·6	−30·49	+0·1	30·4		
Port Etches, near Phipps Point.	60 21	146 38	1874·41	−29·16			W. H. Dall.	
Nunivak Isd., Cape Etonin.	60 25	166 08	1874·58	−21·56				
Saint Michael.	63 29	162 01	1891·41	−23·04	+0·9	22·1	H. W. Edmonds.	C. & G. S. archives.
Camp Davidson, Yukon River.	64 41	140 55	1891·4	−35·72	+0·4	35·3	J. E. McGrath.	
Port Clarence, near Point Spencer.	65 16	166 51	1880·69	−22·75			W. H. Dall & M. Baker.	
Chamisso Harbor, Kotzebue Sound.	66 13	161 49	1880·66	−26·82				
Fort Yukon, Yukon River.	66 34	145 18	1890·60	−35·20	+0·7	34·5	H. W. Edmonds.	C. & G. S. archives.
Camp Colonna Porcupine River.	67 25	140 59	1890·46	−38·11	+0·95	37·2		
Valley of Three Rivers.	68 37	141 00	1890·3	−40·55	+1·62	38·9	J. H. Turner.	
Near Cape Lisburne.	68 53	166 06	1880·64	−25·71			W. H. Dall & M. Baker.	
Mouth of Firth River.	69 24	140 00	1890·3	−43·37	+1·94	41·4	J. H. Turner.	C. & G. S. archives.
Near Icy Cape.	70 13	162 15	1880·65	−30·10			W. H. Dall & M. Baker.	
Uglaamie near Point Barrow.	71 18	156 40	1883·16	−35·62	+3·37	−32·3	P. H. Ray.	
Group II.								
Peak of Iron Island.	51 58	E178 23	1849·5	−14·00			M. D. Tebenkof.	
Chichagof Harbor, Attu Island.	52 56	E173 13	1894·5	−10·0	+0·3	− 9·7	A. F. Fechteler.	U. S. S. Albatross.
Straits between Unalaska and Sedaghur.	53 46	166 12	1789·5	−19·5			J. H. Cox.	
Croyalgu Island.	54 17	164 47	1826·5	−20·83			F. W. Beechey.	
Belkofski Bay, Bailey Harbor.	55 09	162 07	1879·5	−21·13			G. W. Bailey.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ALASKA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Amak Island.	55 27	164 02	1827·5	−21·25			F. P. Lütke.	
Portage Bay.	55 35	160 38	1893·7	−20·33	+0·4	−19·9	Z. L. Tanner.	Notice to Mariners, Dec., 1893.
Wrangell Harbor.	56 59	157 57	1827·5	−24·0			F. P. Lütke.	
Kadiak near Cape Greville.	57 20	152 51	1839·5	−26·73			E. Belcher.	
Cape Suwarof.	58 42	157 00	1827·5	−26·25			F. P. Lütke.	
Cape Black.	58 43	162 05	1827·5	−25·17				
Kachemak Bay, Cook Inlet.	59 30	151 45	1892·27	−25·0	+0·5	24·5	Z. L. Tanner.	Rep. on Fish and Fisheries, 1892.
Kachemak Bay, Cook Inlet.	59 46	151 09	1895·8	−24·58	+0·3	24·3	F. N. Curtiss.	Letter to office.
Disenchantment Bay, Puerto del Desengano.	59 51	139 50	1791·50	−32·40			Don A. Malaspina.	Nat. Geogr. Mag. Vol. III, 1891.
Disenchantment Bay, Puerto del Desengano.	60 00	139 50	1791·50	−32·82				
Norton Sound.	63 28	161 42	1827·5	−30·5			F. P. Lütke.	
Saint Lawrence Is'd.	63 43	171 23	1879·6	−19·08			A. Wykander.	
Cape Good Hope.	66 03	164 30	1826·5	−29·47			F. W. Beechey.	
Cape Deceit.	66 06	162 36	1826·5	−30·30				
Cape Krusenstern.	67 11	163 37	1826·5	−30·20				
Pt. Hope, near end of spit.	68 19	166 46	1889·69	−23·17	+1·5	21·7	C. H. Stockton.	Notice to Mariners, Nov., 1889.
Pt. Demarcation.	69 41	141 00	1837·54	−48·38			Th. Simpson.	
Pt. Anxiety.	70 10	147 30	1837·55	−45·0				
Foggy Island.	70 16	147 38	1825·5	−43·25			J. Franklin.	
Icy Cape near Indian Village.	70 20	161 52	1889·68	−28·85	+1·7	27·2	C. H. Stockton.	Notice to Mariners, Nov., 1889.
Cross Island.	70 28	147 52	1889·60	−38·67	+2·1	36·6		
On ice, NW. of Anxiety Point.	70 31	148 34	1850·5	−44·62			R. J. Le M. Maclure.	
Wainwright Inlet.	70 35	160 36	1880·64	−38·45			C. L. Hooper.	
Wainwright Inlet.	70 37	160 03	1849·5	−36·68			H. Kellett.	
Point Comfort.	70 43	152 14	1837·57	−43·13			Th. Simpson.	
Boat Extreme.	71 02	154 23	1837·58	−42·60				
Cape Smyth, signal station near Pt. Barrow.	71 18	156 39	1889·59	−33·67		32·5	C. H. Stockton.	Notice to Mariners, Nov., 1889.
Plover Point / Point Barrow	71 21	156 16	1853·66	−40·35		−32·5	R. Maguire.	

ARIZONA.

Group I.								
Nogales, Public School Grounds.	31 20	110 56	1892·30	−12·41	+0·3	−12·1	O. B. French.	C. & G. S. archives.
Yuma, in the corral.	32 44	114 37	1892·22	−13·49	+0·3	−13·2		
Group II.								
Santa Cruz River.	31 18	110 31	1855·4	−11·75	+0·5	−11·2	W. H. Emory.	
International Boundary Station, No. 8.	31 20	109 15	1892·6	−11·95	+0·3	11·6	J. F. Hayford.	C. & G. S. archives.
International Boundary Station, No. 9.	31 20	109 43	1892·7	−12·38	+0·3	−12·1		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ARIZONA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
International Boundary Station, No. 10.	31 20	110 10	1892·8	−12·31	+0·3	−12·0	J. F. Hayford.	C. & G. S. archives.
International Boundary Station, No. 11.	31 20	110 34	1892·9	−12·08	+0·3	11·8		
Fort Bowie.	32 10	109 50	1873·5	−13·80	+0·6	13·2	G. M. Wheeler.	
Fort Grant.	32 37	110 40	1873·5	−13·82	+0·6	13·2	W. T. Rossell.	
San Pedro River.	32 43	110 34	1873·5	−12·82	+0·6	12·2	S. E. Tillman.	
Gila Junction.	32 43	114 33	1851·5	−12·83	+0·3	12·5	W. H. Emory.	
Pueblo Vieja, Safords P. O.	32 49	109 37	1873·5	−14·18	+0·6	13·6	S. E. Tillman.	
San Pedro.	32 59	110 40	1851·5	−12·42	+0·3	12·1	W. H. Emory.	
San Francisco River.	33 02	109 17	1873·5	−12·37	+0·6	11·8	R. L. Hoxie.	
Pimos Villages.	33 07	111 44	1851·5	−12·87	+0·3	12·6	W. H. Emory.	
Big Hills.	33 23	109 55	1873·5	−13·10	+0·6	12·5	S. E. Tillman.	
Prieto Crossing.	33 34	109 55	1873·5	−12·60	+0·6	12·0		
Camp Apache.	33 47	109 57	1871·5	−14·18	+0·6	13·6	D. W. Lockwood.	
Escudilla Peak.	33 59	109 06	1873·5	−12·55	+0·6	12·0	R. L. Hoxie.	
Williams River.	34 13	113 33	1854·12	−13·68	+0·4	13·3	J. C. Ives.	
Williams River.	34 17	113 26	1854·13	−13·40	+0·4	13·0		
Colorado River.	34 23	114 06	1854·14	−14·13	+0·4	13·7		
Tule Springs.	34 32	109 06	1873·5	−13·61	+0·6	13·0	R. L. Hoxie.	
Williams River.	34 32	113 28	1854·10	−13·97	+0·4	13·6	J. C. Ives.	
Bouchès Fork.	34 33	110 04	1871·5	−14·86	+0·6	14·3	D. W. Lockwood.	
Williams River.	34 36	113 28	1854·10	−14·03	+0·4	13·6	J. C. Ives.	
Camp 130.	34 36	114 16	1854·15	−13·85	+0·4	13·4		
Camp 132.	34 46	114 23	1854·15	−13·60	+0·4	13·2		
Deer Spring.	34 50	109 04	1873·5	−13·89	+0·6	13·3	R. L. Hoxie.	
Camp 135.	34 52	114 32	1854·16	−13·93	+0·4	13·5	J. C. Ives.	
Colorado Chiquito or Flax River.	34 53	110 04	1853·93	−13·70	+0·4	13·3		
Rattlesnake Canyon.	34 56	112 17	1871·5	−14·70	+0·6	14·1	D. W. Lockwood.	
Pueblo Creek.	34 56	112 46	1854·06	−13·98	+0·4	13·6	J. C. Ives.	
Near Rio Puerco of the West.	34 58	109 52	1853·92	−14·00	+0·4	13·6		
Williams River.	34 59	112 57	1854·06	−14·80	+0·4	14·4		
Colorado Chiquito.	35 00	110 25	1853·93	−13·67	+0·4	13·3		
Colorado Chiquito.	35 01	110 30	1853·94	−13·35	+0·4	13·0		
Big Horse Spring.	35 01	113 36	1854·09	−14·30	+0·4	13·9		
Near Lithodendron Creek.	35 02	109 41	1853·92	−13·55	+0·4	13·2		
Camp Mohave.	35 02	114 37	1875·7	−14·75	+0·6	14·2	E. Bergland.	
Jacobs Well.	35 04	109 14	1853·91	−13·73	+0·4	13·3	J. C. Ives.	
Navajo Spring.	35 06	109 20	1853·91	−13·38	+0·4	13·0		
Carrito Creek.	35 06	109 32	1853·92	−13·90	+0·4	13·5		
Williams River.	35 07	113 13	1854·08	−13·67	+0·4	13·3		
White Cliff Creek.	35 08	113 31	1854·09	−14·70	+0·4	14·3		
Relief Springs, Lockwood Springs.	35 09	112 10	1871·5	−14·37	+0·6	13·8	D. W. Lockwood.	
Colorado Chiquito.	35 12	110 37	1853·95	−13·65	+0·4	13·2	J. C. Ives.	
Saroux Spring.	35 17	111 39	1853·99	−13·87	+0·4	13·5		
Colorado Chiquito.	35 18	110 53	1853·96	−13·70	+0·4	13·3		
Cedar Creek.	35 21	112 20	1854·03	−13·82	+0·4	13·4		
Canyon Spring.	35 45	113 50	1871·5	−14·10	+0·6	13·5	D. W. Lockwood.	
Moencopie Canyon.	36 08	111 08	1873·5	−14·40	+0·6	13·8	R. L. Hoxie.	
Green Springs.	36 11	111 17	1873·5	−15·47	+0·6	14·9		
Limestone Water Pocket.	36 32	111 32	1873·5	−15·26	+0·6	−14·7		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ARKANSAS.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Helena.	34 32	90 35	1890·37	−6·11	+0·6	−5·5	J. B. Baylor	C. & G. S. archives.
Little Rock, Arsenal Grounds.	34 44	92 16	1896·26	−6·81	+0·2	−6·6	G. R. Putnam.	C. & G. S. archives.
Group II.								
Washita or Saline River.	34 00	92 00	1804·5	−8·33	....	....	W. Dunbar.	
Isaac Creek.	34 04	92 39	1870·3	−7·50	+1·8	−5·7	S. T. Abert.	
Clarendon, Court-House.	34 43	91 20	1888·93	−6·97	+0·8	6·2	C. E. Taft.	J. C. Branner, letter to Office.
Lonoke, Court-House.	34 49	91 54	1888·93	−6·97	+0·8	6·2	C. E. Taft.	J. C. Branner, letter to Office.
Blues Point.	34 50	90 26	1879·17	−6·23	+1·4	4·8	J. A. Ockerson.	
Williams Landing.	34 50	92 30	1870·3	−7·27	+1·8	5·5	S. T. Abert.	
Marianna, School House.	34 51	90 55	1888·90	−6·30	+0·8	5·5	C. E. Taft.	J. C. Branner, letter to Office.
Opposite Buck Island.	34 52	90 20	1879·14	−6·57	+1·5	5·1	J. Eisenmann.	
Scanlan Landing.	35 02	90 16	1878·06	−6·95	+1·5	5·4	C. F. Powell.	
Forrest City, School House.	35 02	90 49	1888·90	−6·22	+0·8	5·4	C. E. Taft.	J. C. Branner, letter to Office.
Stouts Landing.	35 07	92 50	1870·3	−7·73	+1·9	5·8	S. T. Abert.	
Greenwood, Court-House.	35 12	94 20	1888·96	−7·80	+0·8	7·0	C. E. Taft.	J. C. Branner, letter to Office.
Hog Thief Bend.	35 17	93 03	1870·3	−8·32	+1·9	6·4	S. T. Abert.	
Delaware Creek.	35 17	93 15	1870·3	−8·42	+1·9	6·5	S. T. Abert.	
Charleston, School House.	35 18	94 04	1888·96	−7·97	+0·8	7·2	C. E. Taft.	J. C. Branner, letter to Office.
Shoal Creek.	35 20	93 25	1870·3	−8·50	+1·9	6·6	S. T. Abert.	
Roseville.	35 22	93 47	1870·3	−8·83	+1·9	6·9	S. T. Abert.	
Profile Rock.	35 23	93 31	1870·3	−8·57	+1·9	6·7	S. T. Abert.	
Fort Smith.	35 23	94 26	1888·96	−8·38	+0·8	7·6	C. E. Taft.	J. C. Branner, letter to Office.
Earn's Landing.	35 27	94 04	1870·3	−9·00	+1·9	7·1	S. T. Abert.	
Clarksville, Court-House.	35 28	93 30	1888·99	−7·30	+0·8	6·5	C. E. Taft.	J. C. Branner, letter to Office.
Fayetteville, Court-House.	36 02	94 15	1888·98	−7·97	+0·8	7·2	A. Winslow.	J. C. Branner, letter to Office.
Buffalo, White River.	36 12	92 30	1878·5	−8·00	+1·5	−6·5	C. R. Sutter & D. W. Wellman.	

CALIFORNIA.

Group I.								
San Diego, La Playa.	32 42	117 14	1892·11	−13·37	....	−13·0	G. R. Putnam.	C. & G. S. archives.
San Diego, City Park.	32 43	117 10	1892·09	−13·94	+0·2	13·7	G. R. Putnam.	C. & G. S. archives.
San Pedro.	33 44	118 17	1881·28	−14·45	+0·3	14·2	H. E. Nichols.	
Los Angeles, SE. Base.	33 48	117 57	1890·33	−13·43	+0·2	13·2	J. J. Gilbert.	C. & G. S. archives.
Dominguez Hill.	33 52	118 14	1870·18	−15·35	+0·3	15·1	S. R. Throckmorton.	
Los Angeles, NW. Base.	33 55	118 04	1890·43	−14·45	+0·2	14·2	I. Winston.	C. & G. S. archives.
Los Angeles, magnetic obs'y.	34 03	118 15	1889·38	−14·41	+0·2	14·2	R. E. Halter.	
Los Angeles, Elysian Park.	34 04	118 15	1892·14	−14·46	+0·2	14·3	G. R. Putnam.	C. & G. S. archives.
San Buenaventura.	34 16	119 16	1870·05	−15·13	+0·2	14·9	S. R. Throckmorton.	
Santa Barbara.	34 25	119 42	1881·28	−14·86	....	−14·6	H. E. Nichols.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

CALIFORNIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°.		
Point Conception.	34 27	120 27	1872·93	—14·86	+0·2	—14·7	S. R. Throckmorton.	
Needles.	34 50	114 36	1895·18	—14·23	+0·1	14·1	E. Smith.	C. & G. S. archives.
Cal. & Nev. Boundary 35° Post.	35 00	114 39	1893·48	—14·62	+0·1	14·5	C. H. Sinclair.	C. & G. S. archives.
San Luis Obispo.	35 11	120 44	1881·29	—15·61	+0·2	15·4	H. E. Nichols.	
Mount Toro.	36 32	121 36	1885·08	—15·95	—0·2	16·2	F. Morse.	
Monterey.	36 36	121 54	1896·04	—16·24	....	16·1	F. Morse.	
Point Pinos.	36 38	121 56	1873·66	—15·92	—0·3	16·2	S. R. Throckmorton.	
Loma Prieta or Mt. Bache.	37 07	121 51	1884·18	—16·10	—0·2	16·3	R. A. Marr.	
Mt. Hamilton, Lick Observatory.	37 20	121 38	1888·83	—15·84	—0·1	15·9	R. A. Marr.	
Sierra Morena.	37 24	122 18	1884·03	—16·64	—0·1	16·7	R. A. Marr.	
Mocho.	37 29	121 33	1887·66	—16·59	—0·1	16·7	F. Morse.	
Presidio, San Francisco.	37 48	122 27	1896·02	—16·77	.....	16·7	F. Morse.	
Mount Diablo.	37 53	121 55	1884·91	—16·71	—0·1	16·8	R. A. Marr.	
Mt. Tamalpais or Table Mt.	37 55	122 36	1879·84	—16·00	—0·1	16·1	E. Hergesheimer.	
Mount Conness.	37 58	119 19	1890·66	—15·26	0·0	15·3	I. Winston.	C. & G. S. archives.
Punta de los Reyes.	38 00	122 59	1853·1	—15·58	—0·8	16·4	G. Davidson & J. S. Lawson.	
Mare Island Navy-Yard.	38 06	122 16	1887·28	—17·13	—0·1	17·2	C. C. Marsh.	
Tomales Bay.	38 11	122 57	1857·10	—16·01	—0·7	16·7	G. Davidson.	
Bodega.	38 18	123 00	1860·56	—16·31	—0·6	16·9	G. Davidson.	
Vaca.	38 22	122 05	1880·89	—17·19	—0·1	17·3	E. F. Dickins.	
Ross Mtn.	38 30	123 07	1860·04	—16·39	—0·6	17·0	G. Davidson.	
Sacramento, Capitol Grounds.	38 36	121 30	1889·03	—15·88	—0·1	16·0	R. A. Marr.	
Monticello.	38 40	122 11	1880·77	—17·21	—0·1	17·3	J. J. Gilbert.	
Point Arena.	38 55	123 42	1889·12	—17·21	—0·1	17·3	R. A. Marr.	
Lake Tahoe.	38 55	120 05	1879·72	—16·80	—0·1	16·9	E. Hergesheimer.	
Lake Tahoe, SE., astronomic station.	38 57	119 57	1895·83	—16·95	0·0	17·0	C. H. Sinclair.	C. & G. S. archives.
Cold Spring.	39 01	123 31	1891·80	—17·39	0·0	17·4	E. F. Dickins.	C. & G. S. archives.
Marysville.	39 09	121 35	1889·15	—16·42	0·0	16·4	R. A. Marr.	
Blue Canyon.	39 15	120 47	1881·27	—15·64	0·0	15·6	W. Eimbeck & R. A. Marr.	
Snow Mountain West.	39 22	122 46	1892·41	—18·00	0·0	18·0	E. F. Dickins.	C. & G. S. archives.
Mount Lassic.	40 20	123 33	1892·73	—19·65	0·0	19·7	E. F. Dickins.	C. & G. S. archives.
Cape Mendocino.	40 26	124 24	1886·27	—18·01	....	17·7	F. Morse.	
Humboldt, Red Bluff.	40 45	124 13	1854·33	—17·08	—0·9	18·0	G. Davidson & A. Tod.	
Bucksport.	40 47	124 12	1853·55	—17·11	—0·9	18·0	G. Davidson.	
Eureka.	40 48	124 10	1871·58	—18·71	—0·1	—18·8	G. Davidson.	
Group II.								
Camp Riley.	32 36	117 05	1849·5	—12·95	0·0	—13·0	W. H. Emory.	
San Isabel.	33 09	116 38	1852·5	—12·57	+0·1	12·5	W. H. Emory.	
Old Fort Tejon.	34 52	118 55	1875·5	—14·91	+0·2	14·7	G. M. Wheeler.	
Soda Lake.	35 03	115 59	1854·18	—13·85	+0·3	13·6	J. C. Ives.	
Pai-ute Creek.	35 06	114 54	1854·17	—14·28	+0·3	14·0	J. C. Ives.	
Tchachipai Valley.	35 07	118 28	1875·5	—14·20	+0·2	14·0	A. W. Whipple.	
Forks, Los Angeles and Calientes Roads.	35 08	118 09	1875·5	—14·80	+0·2	14·6	R. Birnie.	
Near Marl Springs.	35 11	115 33	1854·18	—13·98	+0·3	13·7	J. C. Ives.	
Desert Springs.	35 18	117 57	1871·5	—15·52	+0·2	15·3	D. W. Lockwood.	
Indian Well.	35 40	117 53	1875·5	—15·21	+0·2	15·0	Engineer officer.	
Saratoga Springs.	35 41	116 26	1871·5	—15·08	+0·2	—14·9	D. W. Lockwood.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

CALIFORNIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Off Santa Cruz.	35 56	121 57	1891·77	—16·25	0·0	—16·2	Z. L. Tanner.	Rep. on Fish & Fisheries, 1892.
Penamint Valley, Station A.	36 05	117 14	1875·5	—15·18	+0·2	15·0	R. Birnie.	
Wild Rose Spring.	36 16	117 12	1875·5	—15·32	+0·3	15·0	R. Birnie.	
Passmore P. O.	36 17	118 00	1875·5	—14·90	+0·2	14·7	Engineer officer.	
Furnace Creek.	36 26	116 51	1875·5	—15·69	+0·3	15·4	R. Birnie.	
Cerro Gordo Landing.	36 28	117 51	1875·5	—15·31	+0·2	15·1	R. Birnie.	
Lone Pine Camp.	36 36	118 04	1875·5	—15·33	+0·2	15·1	Engineer officer.	
Camp Independence.	36 50	118 13	1871·5	—15·56	+0·2	15·4	Engineer officer.	
Madera.	36 58	120 03	1894·93	—15·85	0·0	15·8	F. E. Smith.	Letter to Office.
New York of the Pacific.	38 03	121 49	1850·0	—15·70	—0·9	16·6	Chart, C. Ringold	
Opposite Mare Island Navy-Yard.	38 06	122 16	1888·8	—17·23	—0·1	17·3	G. F. F. Wilde.	
Suisun City.	38 11	121 37	1850·0	—15·68	—0·9	16·6	Chart, C. Ringold	
Barbers.	38 19	121 30	1850·0	—16·33	—0·9	17·2	Chart, C. Ringold.	
Fort Rumantsof or Bodega Head.	38 19	122 43	1818·7	—16·50	—2·1	18·6	V. M. Golovnin.	
Armstrong Ranch.	38 50	119 47	1877·0	—16·75	+0·4	16·4		
Yanks Ldg., Lake Tahoe.	38 56	120 03	1876·5	—15·85	+0·4	15·4		
Rowland, Lake Tahoe.	38 57	119 59	1876·5	—15·85	+0·4	15·4		
Rubicon Pt., Lake Tahoe.	39 00	120 06	1876·5	—15·62	+0·4	15·2	Eng'r officer.	
Lusks, Lake Tahoe.	39 02	120 07	1876·5	—15·62	+0·4	15·2		
Boundary Monument, North Shore, Lake Tahoe.	39 13	120 00	1876·5	—15·85	+0·4	15·4		
Hot Springs, Lake Tahoe.	39 14	120 01	1876·5	—18·02?	....	....		
Cisco.	39 19	120 33	1877·5	—17·18	+0·4	16·8	J. N. Macomb.	
Shelter Cove.	40 03	124 09	1792·30	—15·00	—3·1	18·1	G. Vancouver.	
Susanville.	40 25	120 40	1877·5	—18·35	+0·4	18·0	Eng'r officer.	
Humboldt Bay, entrance.	40 45	124 14	1895·8	—18·30	0·0	18·3	Eng'r officer.	
Trinidad.	41 07	124 16	1841·5	—16·00	—0·8	16·8	Duflot de Mofras.	
Fort Bidwell.	41 52	120 09	1877·5	—17·88	+0·4	—17·5	T. W. Symons.	

COLORADO.

Group I.								
Trinidad.	37 10	104 30	1888·86	—13·78	+0·4	—13·4	J. B. Baylor.	
West Las Animas.	38 04	103 01	1888·81	—13·00	+0·4	12·6	J. B. Baylor.	
Uncompahgre.	38 04	107 28	1895·64	—14·90	+0·2	14·7	R. L. Faris.	C. & G. S. archives.
North Pueblo.	38 18	104 37	1888·84	—13·21	+0·4	12·8	J. B. Baylor.	
Mt. Ouray.	38 25	106 14	1894·57	—14·30	+0·2	14·1	R. L. Faris.	C. & G. S. archives.
Gunnison.	38 33	106 56	1886·46	—14·72	+0·5	14·2	E. Smith.	
Arapahoe.	38 46	102 05	1892·65	—13·30	+0·3	13·0	F. W. Perkins.	C. & G. S. archives.
First View.	38 48	102 32	1892·85	—12·26	+0·3	12·0	F. W. Perkins.	C. & G. S. archives.
Colorado Springs.	38 50	104 49	1886·52	—14·39	+0·5	13·9	E. Smith.	
Pikes Peak.	38 50	105 03	1895·57	—13·92	+0·2	13·7	J. Nelson.	
Chiquita.	38 54	108 39	1895·41	—14·82	+0·2	14·6	W. Eimbeck.	
Cheyenne Wells.	38 57	102 24	1892·82	—12·65	+0·3	12·4	F. W. Perkins.	C. & G. S. archives.
Landsman.	38 57	102 35	1892·77	—12·64	+0·3	12·3	F. W. Perkins.	C. & G. S. archives.
Mt. Treasury.	39 00	107 06	1893·66	—14·37	+0·3	14·1	R. L. Faris.	C. & G. S. archives.
Monotony.	39 02	102 14	1892·66	—12·56	+0·3	12·3	F. W. Perkins.	C. & G. S. archives.
Grand Junction.	39 04	108 34	1895·38	—14·67	+0·2	—14·5	R. L. Faris.	C. & G. S. archives.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

COLORADO—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Mt. Elbert.	39 07	106 27	1894·55	—15·02	+0·2	—14·8	P. A. Welker.	C. & G. S. archives.
Tavaputs.	39 32	109 00	1891·80	—14·97	+0·3	14·7		
Denver.	39 45	105 00	1888·83	—14·10	....	13·5	J. B. Baylor.	
Greeley.	40 26	104 40	1878·69	—14·56	+0·9	—13·7		
Group II.								
La Costilla.	37 00	105 30	1872·13	—14·43	+1·1	—13·3	C. J. Moore.	
Colonas Ferry, Rio Grande.	37 05	105 45	1877·5	—11·07	+0·9	10·2	Engineer officer.	
Purgatoire River, head of North Fork.	37 18	104 19	1873·5	—14·38	+1·1	13·3	W. L. Marshall.	
San Juan River, head of East Fork.	37 23	106 46	1874·5	—14·97	+1·0	14·0		
Fort Garland.	37 26	105 26	1873·5	—14·12	+1·1	13·0		
San Juan River.	37 26	106 47	1874·5	—15·02	+1·0	14·0		
East Boundary Station 173.	37 30	102 03	1872·9	—12·50	+1·1	11·4	J. J. Major.	
Cucharas River.	37 30	105 01	1873·5	—14·01	+1·1	12·9	W. L. Marshall.	
Dolores River.	37 31	108 04	1874·5	—14·00	+1·0	13·0	A. W. Whipple.	
La Veta Creek.	37 32	105 03	1873·5	—14·12	+1·1	13·0	W. L. Marshall.	
La Loma.	37 41	106 14	1873·5	—14·88	+1·1	13·8		
Simpson Peak, Camp.	37 41	107 22	1874·5	—14·50	+1·0	13·5		
Diana Creek.	37 42	107 48	1874·5	—14·53	+1·0	13·5		
Rio Grande.	37 45	107 27	1874·5	—14·83	+1·0	13·8		
East Boundary Station 154.	37 47	102 03	1872·9	—13·00	+1·1	11·9	J. J. Major.	
Dolores River.	37 47	107 57	1874·5	—14·16	+1·0	13·2	A. W. Whipple.	
San Juan Mines.	37 50	107 35	1873·5	—14·64	+1·1	13·5	W. L. Marshall.	
La Junta, near Eclipse Station.	37 59	103 33	1878·58	—14·06	+0·9	13·2	T. E. Thorpe.	
Wet Mountain Valley.	38 02	105 25	1873·5	—14·33	+1·1	13·2	W. L. Marshall.	
Saguache, Craigs Ranch.	38 02	106 37	1873·5	—14·58	+1·1	13·5		
East Boundary Station 130.	38 08	102 03	1872·9	—13·08	+1·1	12·0	J. J. Major.	
Fort Lyon.	38 08	102 50	1866·5	—14·50	+1·3	13·2	J. Prince.	
Los Pinos, Indian Agency.	38 12	106 49	1874·5	—14·83	+1·0	13·8	W. L. Marshall.	
East Boundary Station 123.	38 15	102 03	1872·9	—13·17	+1·1	12·1	J. J. Major.	
Hayden Creek.	38 20	105 47	1874·5	—14·09	+1·0	13·1	W. L. Marshall.	
East Boundary Station 111.	38 25	102 03	1872·8	—13·50	+1·1	12·4	J. J. Major.	
Arkansas River.	38 28	105 51	1873·5	—14·68	+1·1	13·6	W. L. Marshall.	
Currant Creek.	38 40	105 30	1873·5	—14·40	+1·1	13·3		
High Creek.	38 41	105 18	1873·5	—15·01	+1·1	13·9		
Buffalo Slough.	38 48	105 42	1873·5	—14·41	+1·1	13·3		
East Boundary Station 68.	39 01	102 03	1872·8	—13·50	+1·1	12·4	J. J. Major.	
Fairplay.	39 14	106 00	1879·5	—14·43	+0·8	13·6	Eng'r officer.	
East Boundary Station 40.	39 26	102 03	1872·8	—13·58	+1·1	12·5	J. J. Major.	
East Boundary Station 7.	39 52	102 03	1872·8	—14·08	+1·1	13·0		
East Boundary Station 6.	39 54	102 03	1872·8	—14·00	+1·1	12·9		
East Boundary Station 3.	39 57	102 03	1872·8	—14·00	+1·1	12·9		
East Boundary of Colorado.	39 59	102 03	1872·8	—14·17	+1·1	13·1		
North Boundary of Colorado.	41 00	105 00	1866·5	—15·25	+1·3	—14·0	J. Prince.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

CONNECTICUT.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Stamford.	41 04	73 32	1844·70	+6·60	+3·2	+ 9·8	J. Renwick.	
Round Hill.	41 06	73 40	1833·52	+5·72	+3·5	9·2	F. R. Hassler.	
Norwalk.	41 07	73 25	1844·70	+6·82	+3·2	10·0	J. Renwick.	
Black Rock.	41 09	73 13	1845·72	+6·89	+3·6	10·5		
Bridgeport.	41 10	73 11	1845·71	+6·32	+3·6	9·9		
Millford.	41 14	73 04	1845·72	+6·64	+3·6	10·2		
Saybrook.	41 16	72 21	1845·63	+6·83	+3·6	10·4		
Tashua.	41 16	73 15	1863·69	+8·04	+2·4	10·4	G. W. Dean & S. H. Lyman.	
Sachem's Head.	41 17	72 44	1845·64	+6·25	+3·6	9·8	J. Renwick.	
Fort Wooster.	41 17	72 54	1848·64	+7·42	+3·4	10·8	J. S. Ruth.	
Oyster Point.	41 17	72 56	1855·63	+7·04	+3·0	10·0	C. A. Schott.	
New Haven.	41 18	72 55	1895·65	+9·60	....	9·9	J. B. Baylor.	
New London, Groton Pt.	41 18	72 00	1845·62	+7·49	+3·6	11·1	J. Renwick.	
Stonington.	41 20	71 54	1845·60	+7·64	+3·6	11·2		
Wooster.	41 21	73 29	1864·59	+7·63	+2·0	9·6	R. E. Halter.	
Sandford.	41 28	72 57	1862·77	+7·03	+2·4	9·4	E. Goodfellow.	
Westfield.	41 34	72 43	1891·73	+9·77	+0·4	10·2	W. C. Hodgkins.	C. & G. S. archives.
Schoolhouse Hill.	41 40	72 41	1891·73	+9·82	+0·4	10·2		
Taylor.	41 40	72 35	1891·79	+9·47	+0·4	9·9		
Hartford, Capitol Park.	41 46	72 40	1890·78	+9·02	....	10·4	J. B. Baylor.	
Box Hill.	41 48	72 27	1861·79	+8·51	+2·3	10·8	G. W. Dean & R. E. Halter.	
Ivy.	41 52	73 14	1863·58	+8·43	+2·2	10·6	G. W. Dean & S. H. Lyman.	
Bald Hill.	41 58	72 12	1861·71	+8·84	+2·3	+11·1	G. W. Dean & R. E. Halter.	
Group II.								
Toilsome Hill.	41 12	73 13	1880·5	+8·90	+1·2	+10·1	J. P. Bogart.	Letter to Office.
Double Beach.	41 14	72 51	1884·55	+9·43	+0·9	10·3	O. T. Sherman.	
South End.	41 14	72 53	1884·55	+8·77	+0·9	9·7		
Lyme.	41 18	72 17	1810·5	+4·50	+5·1	9·6	A. Miller.	
Danbury.	41 22	73 23	1810·5	+5·68	+4·9	10·6		
Centerville.	41 23	72 54	1884·59	+9·10	+0·9	10·0	O. T. Sherman.	
Hebron.	41 38	72 18	1835·5	+6·00	+4·0	10·0	G. Gillet.	
Pomfret.	41 52	71 57	1810·5	+5·08	+5·3	10·4	A. Miller.	
Above Hartford.	41 58	72 38	1875·0	+9·22	+1·4	+10·6	T. C. Ellis.	

DELAWARE.

Group I.								
Dagsboro.	38 35	75 16	1856·66	+2·68	+3·1	+5·8	C. A. Schott.	
Cape Henlopen.	38 47	75 05	1885·58	+4·99	....	6·2	J. B. Baylor.	
Pilot Town.	38 47	75 10	1846·50	+2·71	+3·8	6·5	J. Locke.	
Lewes Landing.	38 49	75 12	1846·50	+2·75	+3·8	6·6		
Bombay Hook.	39 22	75 31	1846·46	+3·31	+3·3	6·6		
Fort Delaware.	39 35	75 34	1846·45	+3·28	+3·3	6·6		
Sawyer.	39 42	75 34	1846·42	+2·80	+3·6	6·4		
Wilmington.	39 47	75 32	1875·55	+3·74	+1·6	+5·3	J. M. Poole.	
Group II.								
Delaware City.	39 35	75 36	1842·50	+3·50	+3·7	+7·2	Barnett.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

DISTRICT OF COLUMBIA.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}.	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Washington. C. & G. S. Office station.	38 53	77 00	1896·37	+4·73	....	+4·7	C. C. Yates.	C. & G. S. archives.
Causten, Georgetown Heights.	38 56	77 04	1855·77	+1·07	+2·5	+3·6	C. A. Schott.	
Group II.								
Washington Naval Obs'y, old site.	38 54	77 03	1892·50	+4·24	+0·3	+4·5		
Washington Naval Obs'y, new site.	38 55	77 04	1894·50	+3·67	+0·2	3·9		
Boundary stones of the District of Columbia. S. E. side m. s. 9	38 48	77 02	1792·0	−0·62	+4·7	4·1	Andrew Ellicott.	Inscriptions on the boundary stones of the District of Columbia. See Surveys and Maps of the District of Columbia, by Marcus Baker, National Geographic Magazine, Vol. VI, p. 152, Washington, D. C., 1894.
S. W. " " 1	38 48	77 03	"	+0·50	4·7	5·2		
S. E. " " 8	38 49	77 01	"	−0·57	4·7	4·1		
S. E. " " 7	38 49	77 00	"	−0·42	4·7	4·3		
S. E. " " 6	38 50	76 59	"	−0·30	4·7	4·4		
S. E. " " 5	38 50	76 59	"	−0·35	4·7	4·4		
S. E. " " 3	38 52	76 57	"	+0·13	4·7	4·8		
S. W. " " 7	38 52	77 08	"	−0·08	4·7	4·6		
S. E. " " 2	38 52	76 56	"	−0·07	4·7	4·6		
East corner.	38 53	76 55	"	−0·17	4·7	4·5		
N. E. side m. s. 9	38 54	76 55	"	−0·32	4·7	4·4		
N. E. " " 8	38 55	76 56	"	−0·40	4·7	4·3		
N. E. " " 7	38 55	76 57	"	−1·13	4·7	3·6		
N. W. " " 2	38 55	77 09	"	−0·58	4·7	4·1		
N. W. " " 3	38 55	77 08	"	−0·17	4·7	4·5		
N. W. " " 4	38 56	77 07	"	+0·05	4·7	4·7		
N. E. " " 6	38 56	76 58	"	−0·85	4·7	3·9		
N. E. " " 5	38 57	76 59	"	−0·37	4·7	4·3		
N. E. " " 4	38 57	76 59	"	+0·42	4·7	5·1		
N. W. " " 5	38 57	77 06	"	+0·75	4·7	5·4		
N. W. " " 7	38 58	77 05	"	−0·98	4·7	3·7		
N. E. " " 3	38 58	77 00	"	+0·30	4·7	5·0		
N. E. " " 2	38 59	77 01	"	−1·20	4·7	3·5		
N. E. " " 1	38 59	77 02	"	−1·10	4·7	3·6		
N. W. " " 8	38 59	77 04	"	−0·48	4·7	4·2		
N. W. " " 9	38 59	77 03	"	−2·00	4·7	2·7		
North corner.	39 00	77 02	1792·0	−1·42	+4·7	+3·3		

FLORIDA.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Sand Key.	24 27	81 53	1849·64	−5·48	+3·1	−2·4	J. E. Hilgard.	
Key West.	24 33	81 48	1896·12	−2·82	....	2·4	G. R. Putnam.	
Bird Key, Dry Tortugas.	24 37	82 54	1880·04	−3·71	+1·2	2·5	S. M. Ackley.	
Cape Sable Base.	25 08	81 02	1855·4	−5·38	+2·8	2·6	A. D. Bache.	
Cape Florida, Key Biscayne.	25 40	80 10	1850·15	−4·42	+3·1	1·3	J. E. Hilgard.	
Hills, Hillsboro River.	26 16	80 05	1884·06	−2·72	+0·9	1·8	B. A. Colonna.	
Punta Rasa.	26 29	82 01	1866·49	−4·02	+2·0	2·0	A. T. Mosman.	
Spencer, Lake Worth.	26 44	80 02	1884·21	−2·86	+0·9	2·0	B. A. Colonna.	
Fort Jupiter.	26 54	80 05	1880·18	−2·84	+1·2	1·6	J. B. Baylor.	
Indian River, Ho. of Refuge, No. 2.	27 12	80 10	1883·04	−2·60	+1·0	1·6	B. A. Colonna.	
Bell, Indian River.	27 28	80 20	1883·34	−2·20	+1·0	−1·2	B. A. Colonna.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

FLORIDA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Saint Lucie, Fort Capron.	27 29	80 15	1880·17	—2·42	+1·2	—1·2	J. B. Baylor.	
Tampa.	27 57	82 27	1887·08	—3·03	+0·8	2·2		
Turkey Creek.	28 04	80 35	1878·38	—3·15	+1·4	1·8	R. M. Bache.	
Eau Gallie.	28 09	80 37	1880·15	—2·00	+1·3	0·7	J. B. Baylor.	
Enterprise.	28 53	81 14	1880·13	—2·77	+1·3	1·5		
Cedar Keys, Transit of Venus station.	29 08	83 03	1887·12	—3·37	+0·9	2·5		
Saint George Island.	29 37	85 06	1853·26	—6·04	+2·9	3·1	J. G. Oltmanns.	
Gainesville.	29 38	82 19	1887·13	—3·00	+0·9	2·1	J. B. Baylor.	
Cape San Blas.	29 40	85 22	1854·08	—6·11	+2·8	3·3	J. G. Oltmanns.	
Apalachicola.	29 43	84 59	1860·09	—6·20	+2·6	3·6	G. W. Dean.	
Dog Island Light.	29 47	84 40	1853·25	—5·85	+2·9	3·0	J. G. Oltmanns.	
Saint Augustine.	29 54	81 19	1880·11	—2·42	+1·4	1·0	J. B. Baylor.	
Saint Marks Light.	30 04	84 11	1852·25	—5·49	+2·9	2·6	J. E. Hilgard.	
Hurricane Island.	30 04	85 39	1854·10	—6·20	+2·8	3·4	J. G. Oltmanns.	
Baldwin.	30 19	81 56	1887·06	—2·58	+0·9	1·7	J. B. Baylor.	
Jacksonville.	30 20	81 39	1880·09	—2·34	+1·4	0·9		
Pensacola, Navy Yard.	30 21	87 16	1895·22	—4·73	....	4·1	R. L. Faris.	
Pensacola City.	30 25	87 12	1861·02	—6·70	+2·5	4·2	G. W. Dean.	
Sand String.	30 27	87 06	1894·29	—4·84	+0·4	4·4	H. L. Stidham.	C. & G. S. archives.
Pond.	30 27	86 56	1894·24	—4·37	+0·4	4·0		
Mill Point.	30 28	86 56	1894·23	—4·44	+0·4	4·0		
Devil Point.	30 30	87 09	1894·31	—4·93	+0·4	4·5		
Lindsay.	30 30	87 03	1894·27	—4·73	+0·4	4·3		
Shield Point.	30 35	87 01	1893·14	—4·62	+0·5	4·1	P. A. Welker.	C. & G. S. archives.
Fernandina.	30 40	81 27	1879·10	—2·50	....	—1·2	S. M. Ackley.	
Group II.								
Florida Reef, off west end.	24 15	82 40	1818·5	—6·55	+4·5	—2·0	Livingston.	
Gasparilla Island Light.	26 43	82 16	1891·05	—3·12	+0·5	2·6	J. L. Brownlee.	Letter to Office.
Egmont Key, Tampa Bay.	27 36	82 46	1843·5	—5·42	+3·6	1·8	L. M. Powell.	
Titusville.	28 36	80 48	1879·68	—2·08	+1·2	0·9	J. F. Le Baron.	
Daytona.	29 08	80 58	1876·20	—3·24	+1·5	1·7	D. D. Rogers.	
Orange Springs.	29 30	81 57	1835·5	—5·42	+3·7	1·7	P. J. Latham.	Letter to Office.
St. Joseph Bay Light.	29 52	85 23	1843·5	—6·40	+3·2	3·2	L. M. Powell.	
Saint Marks.	30 08	84 11	1875·38	—4·50	+1·7	2·8	J. M Poole.	
Lake City.	30 11	82 37	1875·37	—3·34	+1·7	1·6		
Jacksonville.	30 20	81 39	1884·5	—2·33	+1·0	1·3	J. F. Le Baron.	
Tallahassee.	30 26	84 17	1875·38	—3·70	+1·7	2·0	J. M. Poole.	
Amelia Light.	30 40	81 26	1889·5	—1·95	....	—1·2	W. P. Paret.	Letter to Office.

GEORGIA.

Group I.								
Dupont or Lawton.	30 58	82 47	1880·08	—2·43	+1·2	—1·2	J. B. Baylor.	
Brunswick.	31 09	81 30	1887·15	—1·81	+0·8	1·0		
Waycross.	31 11	82 30	1887·14	—2·02	+0·8	1·2		
Butler, St. Simon's Id.	31 18	81 21	1872·20	—2·72	+1·8	0·9	A. T. Mosman.	
Jesup.	31 36	81 55	1887·17	—1·75	+0·8	—1·0	J. B. Baylor.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

GEORGIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Skiddaway N. Base.	31 56	81 02	1856·3	−3·42	+2·7	−0·7	A. W. Longfellow	
Tybee Light.	32 02	80 51	1870·38	−2·34	+1·8	0·5	C. O. Boutelle.	
Savannah, Hutchinson's Isd.	32 05	81 05	1895·41	−0·95	....	0·8	J. B. Baylor.	
Macon, Bibb Co. Academy.	32 50	83 38	1855·03	−4·61	+2·5	2·1	G. W. Dean.	
Milledgeville.	33 04	83 10	1887·19	−3·61	....	2·7	J. B. Baylor.	
Atlanta.	33 44	84 22	1896·29	−1·85	+0·2	1·6	G. R. Putnam.	C. & G. S. archives.
Peach Tree Ridge, Mid. Base.	33 54	84 17	1873·12	−3·58	+1·6	2·0	F. P. Webber.	
Lawrenceville Academy.	33 58	84 00	1874·94	−3·41	+1·5	1·9	C. O. Boutelle.	
Kenesaw.	33 59	84 35	1873·58	−4·72	+1·6	3·1	F. P. Webber.	
Carnes.	34 00	85 01	1873·97	−4·09	+1·6	2·5		
Sweat.	34 04	84 27	1873·77	−5·61	+1·6	4·0		
Cumming.	34 12	84 08	1873·86	−3·22	+1·6	1·6	H. W. Blair.	
Sawnee.	34 14	84 10	1873·83	−2·92?	+1·6	1·3	C. O. Boutelle.	
Rome.	34 15	85 08	1896·27	−2·29	+0·3	2·0	J. B. Baylor.	C. & G. S. archives.
Pine Log.	34 19	84 38	1874·61	−4·00	+1·6	2·4	F. P. Webber.	
Lavender.	34 19	85 17	1874·95	−3·98	+1·6	2·4		
Grassy.	34 29	84 20	1874·56	−3·60	+1·6	2·0		
Skitt.	34 30	83 43	1874·63	−2·59	+1·6	1·0	C. O. Boutelle.	
Currahee.	34 32	83 23	1874·80	−2·80	+1·6	1·2		
Johns.	34 37	85 06	1875·47	−3·95	+1·5	−2·4	F. P. Webber.	
Group II.								
Bainbridge.	30 55	84 46	1839·5	−5·50	+3·5	−2·0		
Darien.	31 26	81 37	1838·5	−5·08	+3·6	1·5		
Fort Gaines.	31 38	85 09	1839·5	−5·52	+3·5	2·0	State Geol. Survey.	
Liberty Court House.	31 48	81 37	1838·5	−5·08	+3·6	1·5		
Cuthbert.	31 49	85 02	1839·5	−5·50	+3·5	2·0		
Lumber City.	31 57	82 45	1875·46	−3·18	+1·6	1·6	J. M. Poole.	
BryanCourt-House.	32 02	81 32	1838·5	−5·08	+3·4	1·7		
Lumpkin.	32 09	84 55	1839·5	−5·45	+3·2	2·2		
Springfield.	32 21	81 30	1837·5	−5·08	+3·4	1·7		
Columbus.	32 28	85 01	1839·5	−5·50	+3·2	2·3	State Geol. Survey.	
Black Creek.	32 39	81 20	1837·5	−5·07	+3·4	1·7		
Swainsboro.	32 39	82 30	1838·5	−5·07	+3·1	2·0		
Birdsville.	32 48	82 13	1837·5	−5·02	+3·1	1·9		
Jacksonboro.	32 49	81 43	1837·5	−4·92	+3·1	1·8		
Millen.	32 50	81 50	1875·47	−2·62	+1·5	1·1	J. M. Poole.	
Macon.	32 50	83 37	1888·2	−2·50	+0·8	1·7	J. C. Wheeler.	
Mill Haven.	32 56	81 47	1837·5	−5·07	+3·1	2·0		
Sandersonville.	32 57	82 59	1838·5	−5·45	+2·9	2·6		
Waynesboro.	33 03	82 09	1837·5	−5·07	+3·1	2·0		
Eatonton.	33 21	83 34	1838·5	−4·53	+2·9	1·6		
Augusta.	33 26	81 58	1837·5	−5·07	+3·3	1·8	State Geol. Survey.	
Applington.	33 32	82 27	1837·5	−5·00	+3·0	2·0		
Madison.	33 34	83 40	1838·5	−4·48	+2·9	1·6		
Lincolnton.	33 46	82 38	1837·5	−5·15	+3·0	2·2		
Monroe.	33 51	83 53	1838·5	−5·17	+2·9	2·3		
Goshen.	33 52	82 40	1837·5	−5·15	+3·0	2·2		
Athens.	33 57	83 23	1837·5	−4·52	+2·9	1·6	McCay.	
Lawrenceville.	33 58	84 10	1839·5	−5·00	+2·8	2·2		
Elberton.	34 06	82 59	1837·5	−4·55	+2·9	1·6	State Geol. Survey.	
Carnesville.	34 25	83 25	1837·5	−5·02	+2·9	2·1		
Toccoa Falls.	34 36	83 20	1837·5	−5·00	+2·9	−2·1		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

IDAHO.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Lewiston.	46 28	117 05	1881·71	−21·44	+0·4	−21·0	J. S. Lawson.	
Lake Pend d'Oreille.	47 58	116 30	1881·70	−22·09	+0·4	21·7		
Siniaquoteen.	48 10	116 45	1881·67	−22·48	+0·4	−22·1		
Group II.								
St. Charles Canyon.	42 05	111 32	1877·5	−18·13	+0·5	−17·6	S. E. Tillman.	
Robbins Ford.	42 10	111 49	1877·5	−17·80	+0·5	17·3		
Malade City.	42 11	112 16	1877·5	−17·73	+0·5	17·2	R. Birnie.	
Bear River.	42 13	111 08	1877·5	−17·99	+0·5	17·5	S. E. Tillman.	
Mink Creek.	42 13	111 44	1877·5	−17·85	+0·5	17·4		
Camp 80, south of Oxford Settlement.	42 14	112 01	1877·5	−18·35	+0·5	17·8	W. Young.	
Camp 77, NW. of Oxford Peak.	42 16	112 05	1877·5	−17·83	+0·5	17·3		
Camp 78, NE. of Elkhorn Peak.	42 23	112 13	1877·5	−17·85	+0·5	17·4		
Camp 53, SE. of Mt. Sedgewick.	42 28	111 47	1877·5	−18·30	+0·5	17·8	S. E. Tillman.	
U. S. Land Survey Stations; mean position.	42 30	116 22	1867·5	−18·75	+0·4	18·4	L. F. Cartee.	
Hawkins Creek.	42 32	112 20	1877·5	−22·78	+0·5	22·3	W. Young.	
Raft Creek.	42 36	113 08	1859·59	−16·75	+0·1	16·6	J. Dixon.	
Camp 71.	42 38	112 23	1877·5	−18·62	+0·5	18·1	W. Young.	
Soda Sp'gs Village.	42 40	111 35	1877·5	−21·17	+0·5	20·7	S. E. Tillman.	
Salmon River Falls.	42 42	114 39	1859·58	−17·18	+0·1	17·1	J. Dixon.	
Shadow Lake.	42 43	113 05	1877·5	−16·07	+0·5	15·6	R. Birnie.	
Game Creek.	42 46	111 15	1877·5	−18·32	+0·5	17·8	S. E. Tillman.	
Little Canyon of Smoky Creek.	42 47	111 01	1858·68	−19·20	+0·1	19·1	W. H. Wagner.	
Magnetic Station.	42 47	111 57	1889·36	−18·05	+0·4	17·6	N. P. Anderson.	
Port Neuf River.	42 47	112 16	1877·5	−18·73	+0·5	18·2	S. E. Tillman.	
Lane's Fork.	42 55	111 18	1877·5	−18·43	+0·5	17·9		
Rattlesnake Meadows.	42 56	115 06	1859·58	−17·00	+0·1	16·9	J. Dixon.	
Little Blackfoot River.	42 57	112 00?	1877·5	−18·87	+0·5	18·4	S. E. Tillman.	
Tincup Run.	42 59	111 16	1877·5	−18·53	+0·5	18·0		
Jack Knife Creek.	43 02	111 07	1877·5	−18·45	+0·5	18·0		
Camp 41, N. E. of Mt. Pisgah.	43 07	111 15	1877·5	−18·33	+0·5	17·8		
Fort Hall.	43 09	112 12	1877·5	−18·22	+0·5	17·7	R. Birnie.	
Camp 43.	43 10	111 48	1877·5	−18·72	+0·5	18·2	S. E. Tillman.	
Highane Ranch.	43 14	112 26	1872·77	−17·83	+0·5	17·3	F. V. Hayden.	
U. S. Land Survey stations; mean position.	43 22	114 17	1867·5	−18·75	+0·3	18·4	L. F. Cartee.	
U. S. Land Survey stations; mean position.	43 22	116 30	1867·5	−18·45	+0·2	18·2		
Hot Springs.	43 23	116 18	1859·56	−17·83	+0·0	17·8	J. Dixon.	
U. S. Land Survey stations; mean position.	43 25	116 22	1867·5	−18·25	+0·2	18·0	L. F. Cartee.	
Willow Creek.	43 34	111 42	1872·77	−17·92	+0·5	17·4	F. V. Hayden.	
Camp 52.	43 35?	111 30?	1872·77	−18·00	+0·5	17·5		
Snake River, 8 miles below Canyon.	43 40	111 20	1872·76	−17·98	+0·5	17·5		
Camp 16, mouth of Fall River.	44 01	111 30	1872·55	−18·20	+0·5	−17·7		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

IDAHO—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
U. S. Land Survey stations; mean position.	44 10	116 22	1867·5	—19·12	+0·2	—18·9	L. F. Cartee.	
Henrys Fork.	44 19	111 20	1872·59	—18·42	+0·5	17·9	F. V. Hayden.	
Camp 26.	44 30?	111 20?	1872·60	—19·22	+0·5	18·7		
Camp 27, Henry Lake Valley.	44 38	111 17	1872·60	—18·73	+0·5	18·2		
U. S. Land Survey stations; mean position.	44 45	116 22	1867·5	—19·17	+0·2	19·0	L. F. Cartee.	
	45 14	116 22	1867·5	—21·17	+0·2	21·0		
	45 44	116 22	1867·5	—20·94	+0·2	20·7		
	45 50	114 40	1867·5	—19·75	+0·3	19·4		
	46 17	116 22	1867·5	—20·32	+0·2	20·1		
Fort Lapway.	46 18	116 54	1876·4	—19·75	+0·3	19·4	W. M. Miller.	
Sahon Pass.	47 27	115 43	1860·5	—20·62	0·0	20·6	J. Mullan.	
Coeur d'Alene Mission.	47 33	116 21	1860·5	—20·90	0·0	20·9		
Pack River.	48 22	116 28	1861·5	—22·85	0·0	22·8	R. W. Haig.	
Chelemta River.	48 41	116 19	1861·5	—22·18	0·0	22·2		
Boundary Station.	49 00	116 33	1860·5	—22·62	0·0	—22·6	J. S. Harris.	

ILLINOIS.

Group I.								
Cairo.	37 01	89 10	1877·91	—6·01	+1·6	—4·4	A. Braid.	
Mound City.	37 05	89 04	1865·01	—7·53	+2·4	5·1	A. T. Mosman.	
Sandoval.	38 37	89 09	1896·34	—4·81	+0·2	4·6	R. L. Faris.	C. &. G. S. archives.
Springfield.	39 50	89 39	1891·75	—4·78	+0·6	4·2	J. B. Baylor.	C. & G. S. archives.
Bloomington.	40 31	88 59	1891·74	—4·01	+0·6	3·4		
Ottawa.	41 20	88 50	1891·73	—5·04	+0·6	4·4		
Chicago, old university site.	41 50	87 37	1888·63	—4·12	....	3·1		
Chicago, near water tower.	41 54	87 37	1891·55	—3·54	+0·6	2·9	G. R. Putnam.	C. & G. S. archives.
Rockford.	42 17	89 06	1891·71	—4·00	+0·6	—3·4	J. B. Baylor.	C. & G. S. archives.
Group II.								
Golconda.	37 23	88 25	1872·46	—6·10	+2·0	—4·1	T. C. Hilgard.	
Kaskaskia.	37 57	89 55	1809·5	—7·33	+3·6	3·7	Public Surveys.	
New Athens.	38 11	89 55	1880·77	—5·82	+1·4	4·4	F. E. Nipher.	
Public Land Survey Station.	38 30	88 32	1818·5	—7·83	+4·0	3·8	Public Survey.	
Cahokia.	38 36	90 09	1810·5	—8·42	+3·6	4·8	J. Mansfield.	
Collinsville.	38 39	90 04	1880·38	—6·51	+1·4	5·1	F. E. Nipher.	
Highland.	38 45	89 41	1872·67	—6·57	+2·0	4·6	T. C. Hilgard.	
East Base.	38 52	88 02	1879·82	—5·00	+1·4	3·6	J. H. Darling.	
Alton.	38 52	90 12	1840·5	—7·75	+3·6	4·2	H. Loomis.	
Belle Air.	39 11	87 52	1879·78	—5·13	+1·4	3·7	J. H. Darling.	
Public Land Survey Station.	39 30	88 32	1821·5	—8·00	+4·0	4·0	Public Surveys.	
Macon.	39 42	89 10	1872·66	—5·36	+2·0	3·4	T. C. Hilgard.	
Jacksonville.	39 45	90 18	1833·5	—8·75	+3·5	5·2	Sturtevant.	
Palermo.	39 53	87 52	1879·72	—5·20	+1·4	3·8	J. H. Darling.	
Public Land Survey Station.	40 00	88 32	1822·5	—7·92	+4·0	3·9	Public Surveys.	
Beardstown.	40 00	90 29	1880·60	—6·72	+1·4	5·3	F. E. Nipher.	
Pilot Grove.	40 12	87 50	1879·68	—4·48	+1·4	3·1	J. H. Darling.	
Public Land Survey Stations.	40 20	88 32	1823·5	—7·67	+3·8	3·9	Public Surveys.	
	40 30	88 32	1823·5	—7·50	+3·7	3·8		
	40 50	88 32	1833·5	—7·72	+3·4	4·3		
	41 00	88 32	1838·5	—6·83	+3·4	—3·4		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

ILLINOIS—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Wenona.	41 05	89 26	1872·66	−6·10	+2·0	−4·1	T. C. Hilgard.	
Public Land Survey Stations.	41 10	88 32	1838·5	−7·42	+3·4	4·0	Public survey.	
	41 15	88 32	1821·5	−8·25	+3·5	4·8		
Rock Island.	41 31	90 34	1878·71	−6·96	+1·5	5·5	C. F. Powell.	
Willow Springs.	41 44	87 51	1879·55	−5·17	+1·4	3·8	J. H. Darling.	
Mount Forest.	41 45	87 52	1876·66	−4·59	+1·6	3·0	D. W. Lockwood.	
Fulton.	41 52	90 12	1844·08	−8·25	+3·2	5·0	Public survey.	
Winetka.	42 06	87 44	1873·5	−4·97	+1·8	3·2	H. Custer.	
Waukegan.	42 21	87 50	1873·5	−5·18	+1·8	3·4		
Galena.	42 26	90 26	1876·74	−9·14	+2·0	7·1	C. F. Powell.	
Sherwood.	42 27	90 37	1839·78	−9·00	+3·4	5·6	Surveyor of P. L.	
Dunleith.	42 28	90 40	1856·80	−8·58	+2·8	−5·8	K. Friesach.	

INDIAN TERRITORY.

Group I.								
Atoka.	34 24	96 05	1878·54	−9·19	+1·2	−8·0	J. B. Baylor.	
Eufaula.	35 16	95 33	1878·54	−9·17	+1·2	8·0		
Vinita.	36 38	95 08	1888·78	−8·80	+0·7	−8·1		
Group II.								
Wilson Rock.	35 19	94 37	1870·3	−9·33	+1·5	−7·8	S. T. Abert.	
Jack Brown's.	35 20	94 45	1870·3	−9·43	+1·5	7·9		
Canadian.	35 25	95 00	1870·3	−9·15	+1·5	7·6		
Weller Falls.	35 30	95 07	1870·3	−9·50	+1·5	8·0		
Fort Gibson.	35 48	95 20	1870·3	−9·80	+1·5	−8·3		

INDIANA.

Group I.								
New Harmony.	38 08	87 50	1880·84	−5·08	+1·5	−3·6	J. B. Baylor.	
Vincennes.	38 41	87 32	1896·33	−3·30	+0·2	3·1	R. L. Faris.	C. & G. S. archives.
Terre Haute.	39 28	87 20	1888·62	−3·74	+0·6	3·1	J. B. Baylor.	
Indianapolis.	39 47	86 08	1880·86	−2·78	+1·2	1·6		
Richmond.	39 50	84 50	1880·88	−2·88	+1·2	1·7		C. & G. S. archives.
Fort Wayne.	41 03	85 03	1891·53	−1·18	+0·5	0·7		
Michigan City.	41 43	86 54	1891·54	−2·34	....	−1·8		
Group II.								
Mouth of Wabash River.	38 00	88 00	1810·5	−7·17	+3·5	−3·7	J. Mansfield.	
Ohio River.	38 10	86 30	1810·5	−6·50	+3·5	3·0		
Falls of the Ohio River.	38 20	85 40	1810·5	−5·83	+3·5	2·3		
Madison.	38 45	85 15	1810·5	−5·42	+3·5	1·9		
South Hanover.	38 45	85 23	1837·5	−4·58	+3·4	1·2	Dunn.	
Logansport.	40 45	86 24	1836·5	−5·58	+3·3	2·3	Town map.	
Reynolds.	40 45	86 48	1874·65	−3·50	+1·6	1·9	F. E. Hilgard.	
Grand Calumet River.	41 37	87 15	1871·74	−4·50	+1·8	−2·7	L. Foote.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

IOWA.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Keokuk.	40 26	91 25	1888·69	— 6·74	+0·8	—5·9	J. B. Baylor.	C. & G. S. archives.
Ottumwa.	41 02	92 25	1888·70	— 7·82	+0·8	7·0		
Davenport.	41 30	90 38	1888·68	— 6·15	+0·8	5·4		
Des Moines.	41 36	93 36	1888·72	— 8·46	+0·8	7·7		
Sioux City.	42 27	96 27	1891·67	—10·57	+0·6	10·0		
Waterloo.	42 28	92 26	1891·69	— 7·76	+0·6	7·2		
Fort Dodge.	42 30	94 14	1891·69	— 7·93	+0·6	7·3		
Dubuque.	42 30	90 44	1891·71	— 5·99	+0·6	5·4		
Sibley.	43 24	95 50	1891·68	— 9·70	+0·6	—9·1		
Group II.								
Near Winchester.	40 50	91 56	1879·74	— 8·17	+1·7	—6·5	J. B. Kaufman.	
Glenwood, Mills Co.	41 04	95 42	1897·04	— 9·53	+0·3	9·2	S. Dean.	
Council Bluffs.	41 15	95 52	1878·66	—10·66	+1·5	9·2	T. E. Thorpe.	
Missouri River Bottom, near Long's Eng'r Cantonment, 1819.	41 24	95 44	1885·77	—10·25	+1·0	9·2	S. Dean.	
Near Atalissa.	41 38	91 14	1882·65	— 7·34	+1·4	5·9	F. E. Nipher.	
Lost Grove.	41 39	90 09	1839·73	— 8·17	+3·3	4·9		
Iowa City.	41 40	91 32	1879·50	— 8·06	+1·7	6·4		
Near Iowa City.	41 40	91 36	1880·46	— 8·83	+1·7	7·1	F. E. Nipher.	
Aikins, Cedar Co.	41 43	91 14	1882·66	— 7·81	+1·4	6·4		
Wapsipinecon River.	41 44	90 23	1839·73	— 8·42	+3·3	5·1	J. Locke.	
Iron Ore.	41 55	90 40	1839·74	— 7·71	+3·3	4·4	J. Locke and other observers.	
Elkford.	42 00	90 52	1839·74	— 9·25	+3·3	6·0		
Small Mill.	42 04	91 02	1839·75	— 9·07	+3·3	5·8	J. Locke.	
Bridge.	42 06	91 02	1839·75	— 9·33	+3·3	6·0		
Mill.	42 10	90 37	1839·75	— 9·25	+3·3	6·0		
Cheney's.	42 12	90 21	1839·76	— 9·08	+3·3	5·8		
Farmer's Creek.	42 13	90 23	1839·76	— 9·18	+3·3	5·9	J. Locke.	
Maquoketa River.	42 14	90 57	1839·75	— 8·75	+3·3	5·4		
White Water.	42 18	90 38	1839·77	— 9·17	+3·3	5·9		
North Branch, Maquoketa River.	42 23	90 52	1839·77	— 9·58	+3·3	6·3		
Little Maquoketa River.	42 31	90 31	1839·80	— 8·50	+3·3	5·2		
Sherald Mound.	42 35	90 33	1839·80	— 8·17	+3·3	4·9		
Log House.	42 38	90 43	1839·80	— 9·00	+3·3	5·7		
Turkey River.	42 42	90 48	1839·81	— 9·00	+3·3	5·7		
Cherokee Eclipse station.	42 46	95 38	1869·60	—11·53	+2·5	9·0	J. Blickensderfer.	
Ferry, opposite Prairie du Chien.	43 03	90 53	1839·82	— 9·08	+3·3	—5·8		

KANSAS.

Group I.								
Wichita, University.	37 40	97 20	1888·79	—10·16	+0·7	— 9·5	J. B. Baylor.	
Dodge City.	37 44	99 59	1888·80	—11·77	+0·7	11·1		
Humboldt.	37 49	95 26	1878·55	—10·08	+1·4	8·7		
Sargent.	38 05	101 58	1878·61	—12·74	+1·2	11·5		
Great Bend, Fort Zarah.	38 24	98 43	1878·58	—11·08	+1·4	9·7		
Emporia.	38 26	96 12	1888·77	—10·14	+0·7	— 9·4		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

KANSAS—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Lacrosse.	38 36	99 16	1892·65	−11·06	+0·5	−10·6		
Skaggs.	38 40	99 45	1893·54	−10·99	+0·4	10·6		
Fairmount.	38 41	99 00	1892·60	−11·10	+0·5	10·6	F. D. Granger.	
Schmidt.	38 42	100 03	1893·50	−11·51	+0·4	11·1		
Smoky Hill.	38 44	99 33	1893·59	−11·20	+0·4	10·8		
Allen.	38 50	98 52	1892·55	−10·34	+0·5	9·8		C. & G. S. archives.
Curlew.	38 50	101 46	1892·57	−12·62	+0·4	12·2	F. W. Perkins.	
South East Base.	38 51	98 47	1893·68	−10·56	+0·4	10·2		
North West Base.	38 54	98 50	1892·84	−10·60	+0·5	10·1		
Trego.	38 54	99 38	1893·63	−11·32	+0·4	10·9	F. D. Granger.	
Hays.	38 55	99 16	1892·70	−11·43	+0·5	10·9		
Big Creek.	38 56	99 54	1893·42	−10·99	+0·4	10·6		
Lawrence.	38 58	95 15	1877·87	− 9·86	+1·5	8·4	A. Braid.	
Blue Hill.	38 59	99 06	1892·77	−11·17	+0·5	10·7	F. D. Granger.	C. & G. S. archives.
McLane.	39 02	101 57	1892·58	−12·05	+0·4	11·6	F. W. Perkins.	
Junction City.	39 02	96 53	1888·76	−10·09	+0·7	9·4	J. B. Baylor.	
Waldo.	39 10	98 50	1892·51	−11·29	+0·5	−10·8	F. D. Granger.	C. & G. S. archives.
Group II.								
Parsons.	37 20	95 17	1879·65	− 9·55	+1·2	− 8·4	F. E. Nipher.	
Fort Larned.	38 10	98 57	1867·50	−12·00	+2·1	9·9	M. R. Brown.	
Alexander, Rush Co.	38 24	99 37	1879·7	−12·17	+1·0	11·2	J. B. Kaufman.	
Hays City.	38 52	99 25	1879·68	−12·50	+1·0	11·5		
Wallace.	38 55	101 35	1872·78	−13·30	+1·4	11·9	T. C. Hilgard.	
Ellis.	38 56	99 40	1872·77	−12·42	+1·4	11·0	T. C. Hilgard.	
New Fort Hays.	38 59	99 20	1867·5	−12·80	+1·9	10·9	M. R. Brown.	
Near Detroit, 4 miles north.	39 00	97 25	1879·71	−10·75	+1·0	9·8	J. B. Kaufman.	
Manhattan.	39 12	96 35	1872·76	−10·86	+1·8	9·1	T. C. Hilgard.	
Fort Leavenworth.	39 21	94 54	1858·5	−10·98	+2·6	8·4	J. H. Simpson.	
Stockton, magnetic station.	39 24	99 25	1890·4	−11·71	+0·4	11·3	J. T. Locke.	Letter to Office.
Salina.	39 30	97 39	1872·77	−12·80	+1·8	11·0	T. C. Hilgard.	
Goodland, Sherman Co.	39 30?	102 00?	1888·5	−12·40	+0·5	11·9	D. A. Long.	
Vermilion Creek.	39 57	96 16	1858·6	−11·58	+2·6	9·0	J. H. Simpson.	
Big Blue River.	40 00	96 35	1858·6	−14·17	+2·6	−11·6		

KENTUCKY.

Group I.								
Hickman.	36 34	89 12	1881·73	−5·79	+1·3	−4·5	J. B. Baylor.	
Mayfield.	36 45	88 41	1881·74	−5·22	+1·3	3·9		
Williamsburg.	36 45	84 10	1896·30	−0·93	+0·2	0·7	R. L. Faris.	C. & G. S. archives.
Twenty-seven Mile Island.	36 57	88 14	1865·15	−7·37	+2·4	5·0	A. T. Mosman.	
Oakland.	37 02	86 15	1871·85	−6·24	+2·0	4·2	A. T. Mosman & E. Smith.	
Patterson Landing.	37 03	88 25	1865·18	−6·73	+2·4	4·3		
Upper Point of Rocks.	37 04	88 17	1865·13	−7·42	+2·4	5·0	A. T. Mosman.	
Paducah.	37 05	88 37	1865·10	−6·75	+2·4	4·4		
Madisonville.	37 19	87 33	1881·76	−5·10	+1·2	3·9		
Livingston.	37 23	84 20	1881·80	−1·61	+1·2	0·4		
Leitchfield.	37 30	86 22	1881·77	−3·32	+1·2	2·1	J. B. Baylor.	
Stanford.	37 31	84 44	1881·79	−4·26	+1·2	3·1		
Lebanon.	37 36	85 19	1881·78	−3·73	+1·2	2·5		
Lexington.	38 04	84 30	1896·31	−0·84	+0·2	−0·6	R. L. Faris.	C. & G. S. archives.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

KENTUCKY—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Shelbyville.	38 13	85 13	1871·90	—3·04	+1·8	—1·2	A. T. Mosman & E. Smith.	
Louisville.	38 15	85 46	1896·32	—1·61	+0·2	1·4	R. L. Faris.	C. & G. S. archives.
Grayson.	38 18	82 59	1881·84	—1·46	+1·0	0·5	J. B. Baylor.	
Flemingsburg.	38 26	83 46	1881·83	—1·76	+1·0	0·8		
Cynthiana.	38 26	84 25	1881·81	—2·47	+1·0	1·5		
Falmouth, Coleman's Farm.	38 41	84 17	1872·01	—3·36	+1·6	—1·8	E. Goodfellow.	
Group II.								
Guthrie.	36 38	87 20	1875·47	—6·73	+1·8	—4·9	F. E. Hilgard.	
Crofton.	37 02	87 40	1875·48	—6·26	+1·8	4·5		
Cave City.	37 10	85 55	1875·50	—5·91	+1·7	4·2		
Central City, Muhlenberg Co.	37 20	87 15	1886·8	—3·59	+0·9	2·7	T. C. Dupont.	
Danville, Centre College.	37 37	84 52	1889·4	—2·03	+0·5	1·5	A. B. Nelson.	
Nicholasville.	37 56	84 38	1875·51	—2·80	+1·2	1·6	F. E. Hilgard.	
Portland.	38 16	85 50	1875.50	—3·63	+1·6	2·0		
Kinniconnick Creek.	38 30	83 19	1884·62	—1·68	+0·9	0·8	J. W. Rand.	Letter to Office.
Vanceburg.	38 36	83 18	1890·66	—1·98	+0·5	—1·5		
Maysville.	38 41	83 41	1875·52	—0·01	+1·5	+1·5?	F. E. Hilgard.	
Augusta.	38 50	83 50	1805·5	—5·0	+3·7	—1·3	Public surveyor.	

LOUISIANA.

Group I.								
S. W. Pass, near Stake Isd.	28 59	89 23	1872·17	— 6·09	+1·9	—4·2	T. C. Hilgard.	
Isle Derniere.	29 02	90 54	1853·14	— 8·32	+2·7	5·6	J. G. Oltmanns.	
Cubitt.	29 10	89 15	1859·95	— 7·53	+2·5	5·0		
Pass à Loutre.	29 11	89 01	1859·99	— 7·50	+2·5	5·0		
Fort Livingston.	29 16	89 57	1853·02	— 7·64	+2·7	4·9		
Magnolia Base, lower end.	29 32	89 47	1872·05	— 6·78	+1·9	4·9	T. C. Hilgard.	
Marsh Isd. Lighthouse.	29 35	92 02	1886·04	— 6·90	+1·0	5·9	J. B. Baylor.	
Morgan City.	29 40	91 15	1886·38	— 6·50	+1·0	5·5		
Cote Blanche.	29 44	91 43	1860·17	— 8·36	+2·5	5·9	J. G. Oltmanns.	
Barrel Key, Chandeleur Sound.	29 54	89 08	1857·29	— 7·60	+2·4	5·2	S. Harris.	
New Orleans, City Park.	29 56	90 08	1872·12	— 6·66	+1·9	4·8	T. C. Hilgard.	
New Orleans, Fair Grounds.	29 59	90 05	1895·55	— 5·67	....	5·2	G. R. Putnam.	
E. Base, LakePontchartrain.	30 01	90 07	1896·25	— 5·55	+0·3	5·3	C. C. Yates.	C. & G. S. archives.
Frenier.	30 06	90 25	1896·23	— 5·60	+0·3	5·3		
Donaldsonville.	30 07	90 57	1896·07	— 5·81	+0·3	5·5	J. B. Baylor.	
Kirsch.	30 10	90 26	1896·23	— 5·48	+0·3	5·2	C. C. Yates.	
Lake Charles.	30 12	93 09	1890·30	— 7·12	+0·7	6·4	J. B. Baylor.	
Mermenteau.	30 12	92 27	1890·31	— 6·82	+0·7	6·1		
North West Point.	30 14	90 21	1896·26	— 5·52	+0·3	5·2	C. C. Yates.	
Lafayette.	30 14	92 00	1890·31	— 6·76	+0·7	6·1	J. B. Baylor.	
Baton Rouge.	30 27	91 11	1896·10	— 5·99	+0·3	5·7		
Amite.	30 43	90 27	1896·11	— 5·77	+0·3	5·5		
Cheneyville.	31 01	92 15	1896·08	— 6·55	+0·3	6·3		
Shreveport.	32 30	93 45	1888·98	— 7·40	+0·8	—6·6		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

LOUISIANA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II.	° ′	° ′		°	°	°		
Balize, Pass à Loutre.	29 07	89 06	1838·5	—10·25?			A. Talcott.	
Osgood Island.	29 11	89 05	1872·18	— 6·18	+1·8	—4·4	T. C. Hilgard.	
Public Survey Station.	29 41	94 00	1840·5	— 8·68	+1·9	6·8	Boundary Com'n	
Avery Island.	29 55	91 45?	1872·20	— 7·33	+1·9	5·4	T. C. Hilgard.	
Chandeleur Lighthouse.	30 03	88 52	1896·1	— 4·97	+0·3	4·7	U. S. Engineer.	Letter to Office.
Alexandria.	31 17	92 27	1872·30	— 7·73	+1·8	5·9	T. C. Hilgard.	
Gaines Ferry.	31 28	93 45	1840·4	— 8·68	+2·5	6·2	J. D. Graham.	
Public Survey Station.	31 40	92 32	1835·5	— 8·67	+2·5	6·2	Public Surveyor.	
Public Survey Station.	31 45	92 22	1834·5	— 8·50	+2·5	6·0		
Grand Ecore.	31 48	93 07	1872·27	— 7·87	+1·8	6·1	T. C. Hilgard.	
Public Survey Station.	31 50	92 32	1834·5	— 8·50	+2·5	6·0	Public Surveyor.	
Public Survey Station.	32 25	92 32	1836·5	— 8·50	+2·5	6·0		
Monroe.	32 29	92 08	1872·32	— 7·59	+1·8	5·8	T. C. Hilgard.	
Public Survey Station.	32 50	92 22	1835·5	— 8·67	+2·5	—6·2	Public Surveyor.	

MAINE.

Group I.								
Isles of Shoals, Hog Id.	42 59	70 37	1847·62	+10·06	+3·2	+13·3	T. J. Lee.	
Kittery Pt, opposite Portsmouth, N. H.	43 05	70 43	1890·66	12·74	....	13·3	J. B. Baylor.	
Cape Neddick.	43 12	70 36	1851·66	11·15	2·9	14·0	J. E. Hilgard.	
Agamenticus.	43 13	70 42	1847·74	10·16	3·2	13·4	T. J. Lee & R. H. Fauntleroy.	
Kennebunkport.	43 21	70 28	1851·65	11·39	2·7	14·1	J. E. Hilgard.	
Fletcher Neck.	43 27	70 20	1850·69	11·29	2·8	14·1		
Richmond Isd.	43 33	70 14	1850·71	12·30	2·8	15·1		
Portland, Bramhall Hill.	43 39	70 17	1895·57	14·27	....	14·4	J. B. Baylor.	
Harpswell.	43 44	70 01	1863·55	14·42	1·9	16·3	C. A. Schott.	
Mt. Independence.	43 46	70 19	1849·77	11·77	2·8	14·6	G. Davidson.	
Cape Small.	43 47	69 51	1851·80	12·09	2·7	14·8	G. W. Dean.	
Freeport.	43 51	70 06	1863·53	14·20	1·9	16·1	C. A. Schott.	
Brunswick.	43 54	69 58	1873·70	14·30	1·2	15·5	T. C. Hilgard.	
Bath.	43 55	69 49	1863·52	12·86	1·8	14·7	C. A. Schott.	
Damariscotta.	44 02	69 32	1887·60	15·21	0·4	15·6	J. B. Baylor.	
Mt. Pleasant.	44 02	70 49	1851·64	14·53	2·7	17·2	G. W. Dean.	
Rockland.	44 06	69 06	1863·52	15·04	1·6	16·6	C. A. Schott.	
Mt. Sabattus.	44 09	70 05	1853·57	12·89	2·5	15·4	J. E. Hilgard.	
Camden Village.	44 12	69 05	1854·83	13·95	2·2	16·2	G. W. Dean & R. J. Breckinridge.	
Mount Ragged.	44 13	69 09	1854·74	14·28	2·2	16·5	G. W. Dean & S. Harris.	
South West Harbor.	44 15	68 18	1856·74	15·42	2·1	17·5	S. Harris.	
Mount Desert.	44 21	68 14	1856·77	15·24	2·1	17·3	G. W. Dean.	
Belfast.	44 26	69 01	1863·52	15·50	1·6	17·1	C. A. Schott.	
Mill Bridge.	44 32	67 54	1887·62	17·08	0·3	17·4	J. B. Baylor.	
Howard.	44 38	67 24	1859·61	+18·53	+1·5	+20·0	G. W. Dean.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

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MAINE—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Mount Saunders.	44 39	68 36	1856·82	+14·99	+2·1	+17·1	G. W. Dean & J. H. Toomer.	
Epping Base, east end.	44 40	67 50	1857·5	16·33	1·7	18·0	C. O. Boutelle.	
Mount Harris.	44 40	69 09	1855·67	14·58	2·2	16·8	G. W. Dean & T. M. McIver.	
Farmington.	44 40	70 09	1887·76	14·94	0·3	15·2	J. B. Baylor.	
Machiasport.	44 41	67 24	1887·64	17·72	0·2	17·9		
Pittsfield, Central Maine Inst.	44 46	69 29	1887·74	15·99	0·3	16·3		
Bangor, Thomas Hill.	44 48	68 47	1895·58	16·96	....	17·1		
Humpback.	44 52	68 07	1858·65	15·80	1·6	17·4	G. W. Dean & A. T. Mosman.	
Eastport, Ft. Sullivan.	44 54	66 59	1895·61	18·89	....	19·0	J. B. Baylor.	
Cooper.	44 59	67 28	1859·69	16·53	1·6	18·1	G. W. Dean.	
Calais.	45 11	67 17	1895·64	17·42	0·1	17·5	G. R. Putnam.	C. & S. archives.
Greenville.	45 28	69 43	1887·73	16·80	0·3	17·1	J. B. Baylor.	
Mattawamkeag.	45 31	68 24	1887·72	17·94	0·3	18·2		
Vanceboro.	45 34	67 27	1887·70	18·36	0·2	18·6		
Danforth.	45 40	67 58	1887·71	18·38	0·2	18·6		
Houlton.	46 07	67 53	1887·63	19·00	0·2	19·2		
Presque Isle.	46 39	68 00	1887·66	+20·06	+0·4	+20·5		
Group II.								
Hiram.	43 50	70 45	1845·18	+11·97	+3·3	+15·3	Wadsworth.	
West Thomaston.	43 56	69 05	1840·5	12·18	3·5	15·7	3*d* Geological Report.	
Raymond.	43 57	70 24	1838·5	9·75	3·7	13·4		
Greenwood.	44 20	70 45	1845·5	12·13	3·2	15·3		
Bethel.	44 27	70 51	1845·5	11·83	3·2	15·0		
Waterville.	44 28	69 32	1840·5	12·60	3·5	16·1		
North Vassalboro.	44 30	69 40	1880·5	15·58	0·7	16·3	I. E. Getchell.	
Rumford.	44 30	70 26	1840·5	11·17	3·5	14·7	3*d* Geological Report.	
Dixfield.	44 32	70 14	1840·5	12·17	3·5	15·9		
Umbagog Lake.	44 42	70 53	1838·5	13·00	3·6	16·6		
Hampden.	44 44	68 50	1840·5	13·37	3·4	16·8	N. Barker.	
Orono.	44 54	68 40	1878·5	16·67	0·7	17·4	State College.	
Mouth of St. Croix River.	45 05	67 12	1797·5	12·32	5·9	18·2	Chart.	
Greenville, near.	45 24	69 35	1838·5	11·00	3·6	14·6	3*d* Geological Report.	
Forks of Penobscot River.	45 30	68 30	1840·5	15·42	3·0	18·4	N. Barker.	
Penobscot.	45 30	68 45	1825·5	14·75	4·2	19·0	J. Herrick.	
Taschereau.	45 49	70 24	1844·5	14·12	3·5	17·6	J. D. Graham.	
Source of St. Croix River.	45 55	67 55	1817·5	14·00	4·8	18·8	J. Johnson.	
Near St. Croix River.	45 57	67 47	1840·5	16·00	3·1	19·1	J. D. Graham.	
Parks Hill.	46 07	67 47	1841·5	16·15	3·0	19·2		
Canada Boundary.	46 25	70 03	1850·5	15·75	2·4	18·2	N. Barker.	
Near Mars Hill.	46 30	67 54	1856·5	18·00	1·6	19·6		
Burgeois House and Massardis River.	46 31	68 22	1842·0	17·34	3·0	20·3	Boundary Survey.	
Blue Hill.	46 38	67 47	1841·5	17·25	3·0	20·2	Boundary Survey.	
Fort Fairfield.	46 46	67 50	1841·5	17·45	3·0	20·4		
Aroostook Hill.	46 47	67 47	1841·5	17·47	3·0	20·5		
Big Black River.	46 57	69 27	1844·5	16·48	2·7	19·2	J. D. Graham.	
Peconk Hill.	46 59	67 47	1841·5	17·72	3·0	20·7		
St. Francis River.	47 11	68 56	1842·5	+17·05	+3·2	+20·2	Boundary Survey.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MAINE—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Matwaska.	47 12	68 10	1818·5	+16·75	+5·0	+21·8	J. Johnson.	
Lake Cleveland.	47 12	68 14	1842·5	17·88	3·2	21·1	Boundary Survey.	
St. Francis River.	47 14	69 01	1843·5	17·40	3·2	20·6	Boundary Survey.	
Fort Kent.	47 15	68 35	1843·5	17·50	3·2	20·7	Me. & Mass. Survey.	
Savage Island.	47 16	68 44	1842·5	17·97	3·2	21·2	Boundary Survey.	
Mouth of Green River.	47 19	68 10	1843·5	+18·10	+3·2	+21·3	Boundary Survey.	

MARYLAND.

Group I.								
Mason's Landing.	38 14	75 15	1856·66	+2·38	+3·1	+5·5	C. A. Schott.	
Davis.	38 20	75 06	1853·73	2·55	3·3	5·8	J. E. Hilgard.	
Calvert.	38 22	76 24	1871·58	2·82	1·7	4·5	A. T. Mosman.	
Oxford.	38 41	76 10	1856·64	2·69	2·6	5·3	C. A. Schott.	
Marriott.	38 52	76 37	1849·46	2·08	3·0	5·1	J. Hewston.	
Kent Isd., South Base.	38 54	76 22	1845·42	2·40	3·3	5·7	T. J. Lee.	
Hill.	38 54	76 53	1868·83	2·85	1·7	4·6	C. O. Boutelle.	
Taylor.	39 00	76 28	1847·42	2·30	3·1	5·4	T. J. Lee.	
Kent Isd., Station 1.	39 02	76 19	1849·49	2·50	3·0	5·5	J. Hewston.	
Webb.	39 05	76 40	1868·73	2·93	1·8	4·7	C. O. Boutelle.	
Soper.	39 05	76 57	1850·57	2·12	3·0	5·1	G. W. Dean.	
Stabler.	39 07	76 59	1869·65	2·66?	1·7	4·4	C. O. Boutelle.	
Bodkin Light.	39 08	76 26	1847·31	2·03	3·2	5·2	T. J. Lee.	
North Point.	39 12	76 27	1847·32	1·66	3·2	4·9	T. J. Lee.	
Baltimore, Fort McHenry.	39 16	76 35	1895·74	5·34	....	5·4	J. B. Baylor.	
Pool's Island.	39 17	76 16	1847·48	2·49	3·2	5·7	T. J. Lee.	
Rosanne.	39 18	76 43	1845·44	2·18	3·3	5·5	T. J. Lee.	
Maryland Heights.	39 20	77 43	1870·82	2·93	1·8	4·7	C. O. Boutelle.	
Finlay.	39 24	76 32	1846·29	2·31	3·3	5·6	T. J. Lee & J. Locke.	
Osborne Ruin.	39 28	76 17	1845·47	2·54	3·3	5·8	T. J. Lee.	
Susquehanna Light.	39 32	76 05	1847·51	2·23	3·2	5·4	T. J. Lee.	
Cumberland.	39 39	78 45	1864·22	+1·53	+2·7	+4·2	A. T. Mosman.	
Group II.								
Monie Bay.	38 13	75 54	1860·60	+2·58	+2·6	+5·2	D. S. Hessey.	Letter to Office.
Vienna, Dorchester Co.	38 29	75 49	1886·63	4·83	0·8	5·6	J. W. Thompson.	
Cheltenham, House of Reformation.	38 42	76 51	1889·39	4·17	0·6	4·8	J. B. Kaufman.	
Annapolis.	38 59	76 29	1879·4	4·43	1·1	5·5	S. W. Very.	
Ashton.	39 08	77 01	1893·1	5·47	0·3	5·8	H. B. Looker.	Letter to Office.
Lonaconing.	39 34	78 58	1879·56	+3·00	+1·0	+4·0	F. E. Bracket.	

MASSACHUSETTS.

Group I.								
Nantucket Cliff.	41 17	70 06	1895·49	+12·18	....	+12·0	J. B. Baylor.	
Sampson Hill.	41 23	70 29	1846·56	8·81	+2·7	11·5	T. J. Lee.	
Indian.	41 26	70 41	1846·61	8·82	2·7	11·5	T. J. Lee.	
Vineyard Haven.	41 28	70 36	1875·72	10·57	0·9	11·5	J. M. Poole.	
Tarpaulin Cove.	41 28	70 45	1846·60	9·20	2·7	11·9	T. J. Lee.	
Fairhaven.	41 37	70 54	1845·80	+8·90	+3·0	+11·9	T. J. Lee.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MASSACHUSETTS—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Hyannis.	41 38	70 18	1846·65	+9·36	+2·7	+12·1	T. J. Lee & R. H. Fauntleroy.	
Chatham.	41 40	69 57	1860·69	11·19	1·8	13·0	C. A. Schott.	
Shootflying.	41 41	70 21	1846·66	9·67	2·7	12·4	T. J. Lee & R. H. Fauntleroy.	
Copecut.	41 43	71 04	1844·77	9·15	3·0	12·2	T. J. Lee.	
Cromeset.	41 44	70 43	1887·47	11·77	0·5	12·3	G. Bradford.	
Wellfleet.	41 56	70 02	1860·70	10·72	1·8	12·5	C. A. Schott.	
Manomet.	41 56	70 36	1867·58	10·41	1·6	12·0	C. O. Boutelle.	
Provincetown.	42 03	70 11	1895·53	12·99	....	12·9	J. B. Baylor.	
Springfield.	42 06	72 32	1859·57	8·65	2·5	11·2	C. A. Schott.	
Blue Hill.	42 13	71 07	1845·75	9·22	2·8	12·0	T. J. Lee.	
Easthampton.	42 15	72 40	1862·52	9·07	2·3	11·4	E. Goodfellow.	
Nantasket.	42 18	70 54	1847·67	9·62	2·7	12·3	T. J. Lee.	
South Boston.	42 20	71 01	1896·45	12·34	0·1	12·4	G. R. Putnam.	C. & G. S. archives.
Boston Common.	42 22	71 04	1890·68	12·09	....	12·3		
Cambridge, Harvard Coll. Observatory.	42 23	71 08	1895·54	12·37	....	12·4	J. B. Baylor.	
Chesterfield.	42 24	72 51	1859·56	8·90	2·6	11·5	C. A. Schott.	
Little Nahant.	42 26	70 56	1849·63	9·68	3·2	12·9	G. W. Keely.	
Wachusett.	42 29	71 53	1860·72	8·80	2·4	11·4	G. W. Dean & R. E. Halter.	
Coddon Hill.	42 31	70 51	1849·68	11·83	3·9	15·7	G. W. Keely.	
Baker Island.	42 32	70 47	1849·67	12·28	3·9	16·2		
Salem, Fort Lee.	42 32	70 52	1887·81	12·64	....	13·5	J. B. Baylor.	
Deerfield.	42 33	72 36	1859·56	9·42	2·6	12·0	C. A. Schott.	
Beaconhill.	42 36	70 39	1859·52	12·05	2·5	14·6		
Thompson.	42 37	70 44	1859·52	11·15	2·5	13·6		
Annisquam.	42 39	70 41	1849·66	11·61	3·3	14·9	G. W. Keely.	
Rockport.	42 40	70 37	1859·52	11·62	2·5	14·1	C. A. Schott.	
Ipswich.	42 41	70 50	1859·53	11·23	+2·5	13·7		
Newburyport, Plum Island.	42 48	70 49	1887·80	+12·20	....	+12·8	J. B. Baylor.	
Group II.								
Off Tarpaulin Cove.	41 27	70 45	1775·5	+ 9·50?				
Hyannis.	41 38	70 18	1892·5	12·88	+0·2	+13·1	C. F. Sleeper.	Letter to Office.
Plymouth.	41 58	70 39	1876·53	10·91	1·0	11·9	F. E. Hilgard.	
Kingston.	41 59	70 42	1894·65	11·67	0·2	11·9	C. W. Sherman.	Letter to Office.
Bridgewater.	42 00	70 58	1882·6	11·43	0·6	12·0	J. S. Leach.	
House Point Island.	42 03	70 04	1835·5	9·33	3·6	12·9	Gov't Survey.	
Southwest Corner of Mass.	42 03	73 32	1787·56	5·05	5·4	10·4	D. Rittenhouse.	
Southwick.	42 04	72 46	1838·5	8·25	3·9	12·2	A. Holcomb.	
Near Springfield.	42 05	72 36	1875·5	9·35	1·4	10·8	T. C. Ellis.	
Near South Hadley.	42 12	72 36	1875·5	9·47	1·4	10·9		
Pittsfield.	42 27	73 15	1886·5	10·05	0·7	10·8	A. Walker.	
Lynn.	42 28	70 56	1877·5	11·25	1·1	12·4	I. K. Harris.	
Beverly.	42 33	70 52	1781·5	7·05	7·0	14·0		
Fitchburg.	42 35	71 48	1876·55	10·73	1·2	11·9	F. E. Hilgard.	
Greenfield.	42 35	72 35	1876·57	10·34	1·4	11·7		
Lowell.	42 39	71 20	1876·55	10·80	1·1	11·9		
Near Lowell and Pine Tree Monument.	42 42	71 20	1741·2	7·40	4·3	11·7	R. Hazen.	
North Adams.	42 42	73 08	1876·57	10·51	+1·4	11·9	F. E. Hilgard.	
Williamstown.	42 43	73 13	1886·64	+10·35	....	+11·4	A. Walker & T. H. Safford.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MICHIGAN.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Ann Arbor.	42 17	83 44	1870·66	−0·34	+2·0	+1.7	J. E. Hilgard.	
Kalamazoo.	42 17	85 35	1890·5	−1·92	....	−1·0	M. Baker.	
Detroit.	42 21	83 03	1891·47	+1·00	....	+1·2	G. R. Putnam.	
Grand Haven.	43 05	86 13	1891·55	−1·65	....	−1·0	J. B. Baylor.	C. & G. S. archives.
Mackinac.	45 51	84 38	1880·57	+0·34	1·3	+1·6		
Sault de Ste. Marie.	46 30	84 20	1891·58	+1·84	....	+2·2		
Marquette.	46 33	87 22	1891·59	−2·87	0·5	−2·4		
Ontonagon.	46 52	89 20	1880·63	−4·69	+1·3	−3·4		
Group II.								
New Buffalo.	41 48	86 45	1872·5	−4·80	+2·8	−2·0	H. Custer.	
La Salle.	41 50	83 25	1877·57	−0·22	1·4	+1·2	A. C. Lamson.	
Stony Point.	41 56	83 16	1877·67	−0·30	1·4	+1·1		
Saint Joseph.	42 06	86 30	1871·6	−3·88	2·8	−1·1	H. Custer.	
Ypsilanti.	42 14	83 37	1895·50	+2·12	....	+2·2	C. S. Woodard.	Letter to Office.
7 miles N. of St. Joseph.	42 14	86 22	1871·6	−3·95	2·8	−1·2	H. Custer.	
Marshall.	42 16	84 58	1876·79	−1·70	1·9	+0·2	C. F. Powell.	
South Haven.	42 24	86 16	1871·5	−3·50	2·8	−0·7	F. U. Farquhar & H. Custer.	
Public Survey Station.	42 30	84 22	1826·5	−4·42	5·1	+0·7	Public Surveyor.	
5 miles N. of Milk River.	42 31	82 52	1868·5	−0·70	2·0	+1·3	A. Molitor.	
Plumberville.	42 32	86 14	1871·5	−2·77	2·8	0·0	H. Custer.	
Middle Pass of St. Clair River.	42 34	82 41	1856·8	−0·80	2·4	+1·6	G. W. Lamson.	
General Land Survey Station.	42 35	85 48	1826·5	−5·36	5·4	0·0	Public Surveyor.	
Do.	42 35	85 56	1830·2	−5·20	4·8	−0·4		
Do.	42 35	86 03	1831·8	−5·58	4·7	−0·9		
Algonac.	42 37	82 32	1866·96	−0·07	1·8	+1·7	O. N. Chaffee.	
Saugatuck.	42 40	86 12	1871·6	−2·37	2·8	+0·4	H. Custer.	
Black Leg Harbor.	42 46	86 12	1871·63	−2·40	2·8	+0·4	F. U. Farquhar & L. Foote.	
Public Land Survey Station.	42 50	84 22	1826·5	−4·92	5·1	+0·2	Public Surveyor.	
Stag Isd., St. Clair River.	42 53	82 27	1866·5	−0·37	1·8	+1·4	F. M. Towar.	
Grand River.	42 55	86 10	1837·5	−4·50	4·6	+0·1		
Fort Gratiot.	43 00	82 25	1873·53	+0·62	1·4	+2·0	A. N. Lee.	
Public Survey Station.	43 00	84 22	1831·5	−3·45	4·5	+1·0	Public Surveyor.	
2 miles S. of Lake Port.	43 05	82 28	1859·75	+0·25	2·2	+2·4	W. H. Hearding.	
4 miles S. of Lexington.	43 12	82 30	1859·75	+0·60	2·2	+2·8		
Muskegon.	43 13	86 19	1871·50	−4·03	2·8	−1·2	L. Foote.	
1 mile S. of Lexington.	43 15	82 31	1859·64	+1·00	2·2	+3·2	W. H. Hearding.	
1 mile N. of Lexington.	43 16	82 31	1859·66	+1·35	2·2	+3·6		
Public Survey Station.	43 19	85 59	1837·5	−6·25	4·5	−1·8	Public Surveyor.	
3 miles S. of New London Point.	43 20	82 31	1858·77	+1·23	2·2	+3·4	W. H. Hearding.	
Public Survey Station.	43 20	84 22	1832·5	−3·00	4·5	+1·5	Public Surveyor.	
Wahley.	43 22	82 32	1860·36	+1·08	2·1	+3·2	W. P. Smith.	
Whitehall.	43 22	86 25	1871·51	−4·03	2·8	−1·2	F. U. Farquhar & L. Foote.	
New London Point.	43 23	82 31	1858·76	+0·72	2·2	+2·9	W. H. Hearding.	
Saint Louis.	43 24	84 36	1876·79	−0·98	1·8	+0·8	D. W. Lockwood.	
Port Sanilac.	43 25	82 32	1858·71	+0·50	2·2	+2·7	W. H. Hearding.	
Saginaw.	43 25	83 58	1876·72	−0·39	+1·8	+1·4	D. W. Lockwood.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MICHIGAN—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Miller Creek.	43 28	82 33	1858·67	+0·72	+2·2	+2·9	W. H. Hearding.	
Cherry Creek.	43 30	82 34	1858·65	+0·70	2·2	+2·9		
Little Point aux Sables.	43 31	85 54	1837·5	−6·00	4·5	−1·5		
Benona.	43 34	86 30	1870·65	−4·93	2·9	−2·0	J. W. Cuyler.	
Elk Creek.	43 37	82 35	1858·61	+0·58	2·2	+2·8	W. H. Hearding.	
3 miles W. of Quamakissee River.	43 37	83 43	1857·73	−1·53	2·8	+1·3		
Saginaw River, mouth.	43 39	83 50	1856·5	−1·47	3·0	+1·5		
Forestville.	43 40	82 34	1873·53	+1·51	1·4	+2·9	A. N. Lee.	
4 miles NW. of Saginaw River.	43 41	83 55	1856·5	−1·47	3·0	+1·5	W. H. Hearding.	
White Rock Point.	43 43	82 36	1858·59	+0·35	2·3	+2·6		
Père Marquette River.	43 44	85 43	1837·5	−4·57	4·5	−0·1		
Public Survey Station.	43 45	84 22	1832·5	−2·92	4·0	+1·1	Public Surveyor.	
Nyahquing Point.	43 46	83 56	1856·5	−1·23	3·0	+1·8	W. H. Hearding.	
Sharpe Bay.	43 47	82 36	1858·53	+0·30	2·3	+2·6		
Pentwater.	43 47	86 26	1871·6	−4·25	2·9	−1·4	F. U. Farquhar.	
Cranes Point.	43 50	82 38	1858·53	+0·27	2·3	+2·6	W. H. Hearding.	
South of Pt. aux Barques.	43 51	82 42	1835·5	−1·63	3·8	+2·2		
20 miles W. of Pt. aux Barques.	43 51	83 06	1835·5	−2·10	3·9	+1·8		
Stony Island.	43 52	83 26	1857·49	−0·40	3·0	+2·6	W. H. Hearding.	
Forest Bay.	43 53	82 40	1858·5	−0·05	2·7	+2·6		
Sand Point.	43 55	83 23	1858·71	−0·53	2·7	+2·2	W. P. Smith.	
Stafford.	43 57	82 42	1858·5	+0·20	2·7	+2·9	W. H. Hearding.	
Père Marquette.	43 57	86 27	1871·6	−4·30	2·9	−1·4	F. U. Farquhar.	
Near Oak Point.	43 59	83 12	1857·71	−1·08	2·7	+1·6	W. H. Hearding.	
Pointe aux Gres.	43 59	83 40	1857·66	−1·50	2·7	+1·2	G. W. Lamson.	
Little Lake Sable.	43 59	86 28	1866·74	−4·20	3·3	−0·9	A. F. Chaffee.	
2 miles N. of Stafford.	44 00	82 45	1858·5	−0·13	2·6	+2·5	W. H. Hearding.	
Near Pointe aux Barques Light.	44 00	82 46	1858·5	−0·08	2·6	+2·5		
Partridge River.	44 00	83 03	1857·59	−0·13	2·7	+2·6	G. W. Lamson.	
Hat Point.	44 00	83 06	1857·70	−0·67	2·7	+2·0		
Pointe aux Barques	44 01	82 47	1857·5	+0·01	2·7	+2·7		
Willow River.	44 02	82 50	1857·43	+0·20	2·7	+2·9	W. H. Hearding.	
Gravelly Point.	44 03	83 34	1857·67	−1·42	2·7	+1·3	G. W. Lamson.	
Pointe aux Barques	44 04	82 57	1857·54	0·00	2·7	+2·7	W. H. Hearding.	
6 miles N. of White Stone Point.	44 12	83 33	1857·47	−0·57	2·7	+2·1	G. W. Lamson.	
Manistee.	44 15	86 20	1866·7	−4·00	3·3	−0·7	W. T. Casgrain.	
4 miles N. of Tawas Pt.	44 18	83 24	1856·5	−2·08	2·7	+0·6	G. W. Lamson.	
Sable River.	44 25	83 19	1856·5	−2·20	2·7	+0·5	W. H. Hearding.	
North Bar Lake.	44 29	86 15	1866·72	−3·27	3·3	0·0	O. N. Chaffee.	
Geological Station	44 31	83 50	1838·5	−2·00	3·8	+1·8		
Do.	44 31	84 28	1838·5	−2·75	3·8	+1·0		
Do.	44 31	84 56	1838·5	−2·83	3·8	+1·0		
Michigan Shore.	44 31	85 32	1838·5	−4·50	3·8	−0·7		
4 miles S. of Harrisville.	44 36	83 19	1858·65	−0·48	2·6	+2·1	H. C. Penny.	
River aux Becs Scies.	44 37	86 15	1866·48	−4·28	3·0	−1·3	A. F. Chaffee.	
Sturgeon Point.	44 43	83 14	1858·74	−1·03	2·6	+1·6	W. P. Smith.	
The Cove.	44 46	83 17	1858·69	+0·32	2·6	+2·9	H. C. Penny.	
Grand Traverse Bay.	44 46	85 30	1860·71	−1·87	3·0	+1·1	W. H. Hearding.	
Traverse City.	44 46	85 37	1860·5	−2·39	+3·0	+0·6	W. P. Smith & H. C. Penny.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

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MICHIGAN—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Grand Traverse Bay.	44 50	85 33	1860·73	—2·42	+3·0	+0·6	W. H. Hearding.	
Do.	44 51	85 27	1860·67	—1·48	3·0	+1·5	W. H. Hearding.	
Do.	44 51	85 39	1860·7	—2·77	3·0	+0·2	H. C. Penny.	
Tucker Pt., Gr. Trav. Bay.	44 53	85 34	1860·7	—2·45	3·0	+0·6	W. H. Hearding.	
Grand Traverse Bay.	44 54	85 25	1860·67	—1·75	3·0	+1·2	W. H. Hearding.	
Glen Arbor.	44 54	86 00	1860·46	—3·53	3·0	—0·5	H. C. Penny.	
Grand Traverse Bay.	44 57	85 34	1860·72	—2·10	3·0	+0·9	W. H. Hearding.	
North Unity.	44 57	85 54	1860·55	—3·53	3·0	—0·5	H. C. Penny.	
Old Mission Pt. Gr. Trav. Bay.	44 58	85 29	1860·7	—2·33	3·0	+0·7	W. H. Hearding.	
Good Harbor Leland.	44 58	85 47	1860·52	—3·52	3·0	—0·5	H. C. Penny.	
Suttons Bay, Gr. Trav. Bay.	45 00	85 36	1860·72	—3·45	3·0	—0·4	H. C. Penny.	
Thunder Bay.	45 02	83 09	1858·64	+1·23	2·6	+3·8	W. P. Smith.	
Thunder Bay, North Point.	45 02	83 16	1858·5	+1·00	2·6	+3·6	G. W. Lamson.	
South Manitou Isd., east side.	45 02	86 06	1860·69	—3·53	3·0	—0·5	D. F. Henry & W. P. Smith.	
Alpena.	45 04	83 25	1858·5	+0·60	2·6	+3·2	G. W. Lamson.	
Menomonee River.	45 05	87 35	1863·8	—6·33	2·8	—3·5	D. F. Henry.	
Near N. end of Torch Light Lake.	45 06	85 22	1860·64	—2·33	3·0	+0·7	W. H. Hearding.	
North Manitou Id., west side.	45 06	86 04	1860·5	—3·48	3·0	—0·5	D. F. Henry.	
North Manitou Id., east side.	45 07	85 59	1860·5	—4·02	3·0	—1·0	D. F. Henry.	
Grand Traverse Bay.	45 08	85 22	1860·62	—2·18	3·0	+0·8	W. H. Hearding.	
North Port.	45 08	85 36	1860·66	—2·50	3·0	+0·5	H. C. Penny.	
Middle Island.	45 12	83 19	1858·59	+1·07	2·6	+3·7	H. C. Penny.	
Near Fisherman Isd.	45 17	85 20	1860·53	—3·23	2·9	—0·3	W. H. Hearding.	
False Presque Isle.	45 18	83 37	1817·5	—2·98			H. W. Bayfield.	
Point Rochereau.	45 18	87 26	1863·8	—4·72	2·8	—1·9	A. Molitor.	
Presque Isle Harbor.	45 20	83 27	1858·46	—0·80	2·6	+1·8	H. C. Penny.	
Little Traverse Bay.	45 20	85 15	1860·53	—2·48	2·9	+0·4	W. H. Hearding.	
	45 22	85 02	1860·47	—3·45	2·9	—0·6	W. H. Hearding.	
	45 22	85 09	1860·50	—2·67	2·9	+0·2	W. H. Hearding.	
	45 23	84 55	1860·46	—3·45	2·9	—0·6	W. H. Hearding.	
South Fox Island.	45 23	85 50	1862·73	—3·57	2·8	—0·8	J. R. Mayer.	
Adams Point.	45 24	83 41	1859·51	—0·68	2·6	+1·9	H. C. Penny.	
Little Traverse Bay.	45 24	85 04	1860·45	—2·87	2·9	0·0	W. H. Hearding.	
Point opposite Lit. Trav. Bay.	45 25	84 59	1860·46	—2·42	2·9	+0·5	W. H. Hearding.	
Cedar River.	45 25	87 21	1863·5	—3·95	2·8	—1·2	H. C. Penny.	
Point northward of Little Traverse Bay.	45 26	85 03	1860·44	—2·98	2·9	—0·1	W. H. Hearding.	
Seven Mile Point.	45 28	85 05	1860·5	—2·68	2·9	+0·2	W. H. Hearding.	
East of Hammond's Bay.	45 29	83 55	1859·6	+1·18	2·6	+3·8	H. C. Penny.	
Hammond's Bay.	45 31	84 07	1859·6	—2·33	2·6	+0·3	H. C. Penny.	
Middle Village.	45 33	85 08	1860·5	—2·57	2·9	+0·3	W. H. Hearding.	
South Point, Beaver Isd.	45 34	85 29	1855·5	—4·05	3·0	—1·0	Chart.	
North of Lit. Trav. Bay.	45 35	85 06	1853·66	—2·63	+3·0	+0·4	W. F. Raynolds.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MICHIGAN—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Beaver Island, stations 34 and 40.	45 35	85 34	1855·5	—3·92	+3·0	—0·9	W. H. Hearding.	
Bark River.	45 35	87 14	1863·5	—3·62	2·4	—1·2	H. C. Penny.	
Beaver Isd., Stations 53 and 76, west side.	45 36	85 37	1855·5	—3·50	2·8	—0·7	W. H. Hearding.	
Near Duncan City.	45 37	84 07	1851·5	—1·88	2·9	+1·0	Chart.	
East of Cheboygan Lt. Ho.	45 37	84 12	1851·5	—1·90	2·9	+1·0	W. F. Raynolds.	
Beaver Isd., Station 60, west side.	45 38	85 37	1855·5	—3·60	2·8	—0·8	W. H. Hearding.	
Beaver Isd., Station M, east side.	45 39	85 29	1855·5	—3·03	2·8	—0·2		
4 miles W. of Isle aux Galet Light.	45 40	85 10	1853·5	—2·75	2·8	0·0	Chart.	
Point Detour.	45 40	86 37	1864·5	—3·43	2·3	—1·1	W. T. Casgrain.	
Beaver Isd., Station 7, east side.	45 41	85 30	1855·5	—3·37	2·8	—0·6	W. H. Hearding.	
Near Escanaba.	45 41	87 05	1863·5	—1·90	2·4	+0·5		
Gull Island.	45 42	85 50	1855·5	—4·42	2·8	—1·6	G. W. Lamson.	
Beaver Isd., Station R, west side.	45 43	85 34	1855·5	—3·15	2·8	—0·4	W. H. Hearding.	
West of Chippewa Point.	45 43	86 54	1864·5	—3·83	2·3	—1·5	A. F. Chaffee.	
South of Portage Bay.	45 44	86 32	1864·5	—3·53	2·3	—1·2	W. T. Casgrain.	
Little Bay of Noquette, east side.	45 44	86 59	1863·80	—3·95	2·4	—1·6	H. C. Penny.	
Little Bay of Noquette.	45 44	87 04	1863·69	—1·90	2·4	+0·5		
Beaver Island.	45 45	85 30	1860·75	—2·72	2·5	—0·2	W. P. Smith.	
Waugoshane Point.	45 45	84 56	1853·5	—2·22	2·8	+0·6	W. F. Raynolds.	
McGulpin Point.	45 47	84 47	1852·75	—2·32	2·9	+0·6		
Garden Island.	45 47	85 29	1854·5	—2·72	2·8	+0·1		
Saint Vital Island.	45 48	86 47	1864·5	—3·08	2·3	—0·8	A. F. Chaffee.	
Bois Blanc Isd., north side.	45 49	84 29	1849·5	—1·52	3·0	+1·5	J. N. Macomb.	
Bois Blanc Isd., west side.	45 49	84 35	1849·6	—1·98	3·0	+1·0	R. W. Burgess.	
Hat Island.	45 49	85 18	1853·5	—3·20	2·8	—0·4	W. F. Raynolds.	
Whiskey Island.	45 49	85 36	1854·5	—3·82	2·8	—1·0		
25 miles E. of Ft. Mackinac.	45 50	84 00	1851·5	—1·88	2·9	+1·0	Chart.	
Round Island.	45 50	84 37	1853·5	—2·08	2·8	+0·7	W. F. Raynolds.	
Fort Mackinac.	45 51	84 36	1888·63	+1·14	0·8	+1·9	C. S. Woodard.	
Point St. Ignace.	45 51	84 42	1849·56	—2·48	3·0	+0·5	E. P. Scammon.	
Rabbit Back Point.	45 52	84 43	1849·6	—2·15	3·0	+0·8		
Drummond Island.	45 55	83 30	1859·50	+0·85	2·6	+3·4	W. H. Hearding.	
Drummond Isd., near Harbor Island.	45 55	83 34	1859·53	+0·83	2·6	+3·4		
Seul Choix Point.	45 55	85 55	1855·7	—3·93	2·8	—1·1		
Drummond Id., south side.	45 56	83 38	1859·58	+0·43	2·6	+3·0		
Drummond Id., southwest point.	45 56	83 42	1859·60	—0·22	2·6	+2·4		
Drummond Pt., east side.	45 57	83 29	1859·48	+0·43	2·6	+3·0		
Scott Point.	45 57	85 41	1855·5	—3·10	2·8	—0·3		
Monistique River.	45 57	86 10	1864·5	—3·10	2·3	—0·8		
Point au Barque.	45 57	86 20	1864·5	—3·47	2·3	—1·2	W. T. Casgrain.	
Point Brulee, Stations D and 16.	45 58	84 32	1849·67	—1·40	3·0	+1·6	E. P. Scammon.	
Pt. Brulee, Station 17.	45 58	84 33	1849·71	—1·17	3·0	+1·8		
Isle St. Martin.	45 58	84 35	1849·64	—0·53	3·0	+2·5		
Grosse Point.	45 58	84 41	1849·60	—2·00	+3·0	+1·0		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I. results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MICHIGAN—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Point Patterson.	45 58	85 39	1854·5	--2·85	+2·8	0·0	G. W. Lamson.	
Search Bay, Station A, and Pointe St. Martin, Station 16.	45 59	84 31	1849·68	--0·80	3·0	+2·2	E. P. Scammon.	
Pointe St. Martin, Stations 12, 13.	45 59	84 32	1849·56	—0·98	3·0	+2·0		
Point Brulee, Stations E and C.	45 59	84 34	1849·70	—1·24	3·0	+1·8		
Search Bay, Station B.	46 00	84 30	1849·68	—0·67	3·0	+2·3		
Point Brulee, Stations F and G.	46 00	84 32	1849·71	—1·25	3·0	+1·8		
East of Boiling Spring Point.	46 02	84 35	1849·58	—1·53	3·0	+1·5		
Sault Island, north of Drummond Island.	46 02	83 45	1854·5	+1·38	2·8	+4·2		
Boiling Spring Point.	46 02	84 38	1849·89	—1·98	3.0	+1·0		
Pointe Epoufette.	46 04	85 07	1854·7	—2·50	2·8	+0·3	Chart.	
Twin Island, Mud Lake.	46 12	84 06	1854·5	+2·62	2·8	+5·4	E. P. Scammon.	
West Neebish Rapids.	46 18	84 12	1854·5	+2·05	2·8	+4·8		
East Neebish Rapids.	46 20	84 10	1853·5	—0·25?			Chart.	
Grand Island, south end.	46 28	86 40	1859·7	—4·22	2·6	—1·6	G. W. Lamson.	
Laughing Fish River.	46 28	86 55	1867·5	—5·00	2·1	—2·9	H. Gillman.	
Sugar Island Rapids.	46 29	84 18	1854·5	—0·28	2·8	+2·5	E. P. Scammon.	
Iroquois Point.	46 29	84 37	1867·73	—0·65	2·1	+1·4	O. B. Wheeler.	
Sugar Isd., northeast side.	46 30	84 08	1853·5	—0·67	2·9	+2·2	E. P. Scammon.	
Chocolate River.	46 30	87 20	1867·6	—5·42	2·1	—3·3	H. Gillman.	
Shot Point.	46 31	87 10	1867·6	—5·32	2·1	—3·2		
Small River.	46 32	87 10	1824·5	—7·35			H. W. Bayfield.	
Grand Island, near Lt. Ho.	46 34	86 40	1867·66	—3·10	2·1	—1·0	O. B. Wheeler.	
Little Girl Point.	46 37	90 17	1868·6	—8·00	2·0	—6·0	H. Gillman.	
Granite Point.	46 39	87 27	1866·5	—3·07	2·2	—0·9	A. Molitor.	
Black River.	46 40	90 02	1868·5	—7·83	2.0	—5·8	H. Gillman.	
Grand Marais.	46 41	85 37	1867·7	—2·03	2·1	+0·1	Chart.	
Pine Cliff.	46 42	85 53	1867·69	—2·02	2·1	+0·1	O. B. Wheeler.	
Whitefish Point.	46 46	84 57	1867·7	0·92	2·1	+1·2	A. Molitor.	
Lone Rock, near Porcupine Mount	46 48	89 49	1868·5	11·50	2·0	—9·5	J. E. Griffith.	
Point on shore.	46 48	90 01	1824·5	10·25			H.W. Bayfield.	
Little Iron River.	46 49	87 35	1866·6	4·35	2·2	2·2	A. Molitor.	
Iron River.	46 50	89 34	1868·4	6·80	2·0	4·8	J. E. Griffith.	
Keweenaw Bay.	46 52	88 28	1864·69	4·75	2·3	2·4	H. Gillman.	
Huron River.	46 55	88 07	1824·5	7·93			H.W. Bayfield.	
Portage Entry.	46 59	88 25	1863·5	4·62	2·4	·2·2	J. U. Mueller.	
Misery River.	47 00	88 59	1865·65	7·72	2·2	5·5	H. Gillman.	
Torch Bay.	47 05	88 26	1863·5	3·68	2·4	1·3	J. U. Mueller.	
Point above Elm River.	47 05	88 55	1865·6	6·68	2·2	4·5	H. Gillman.	
Dollar Bay.	47 07	88 29	1863·5	4·05	2·4	1·6	J. U. Mueller.	
Salmon Trout River.	47 09	88 45	1865·57	7·68	2·2	5·5	H. Gillman.	
2 miles N. of Traverse Pt.	47 11	88 15	1865·61	3·92	2·2	1·7	A. Molitor.	
Torch Lake.	47 12	88 24	1864·56	5·18	2·3	2·9	H. Gillman.	
Portage Lake, north end.	47 13	88 36	1863·5	—4·55	+2·4	—2·2	J. U. Mueller.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MICHIGAN—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Isabella Point.	47 21	87 56	1865·42	—4·88	+2·2	−2·7	A. Molitor.	
Gratiot River.	47 21	88 27	1865·5	7·62	2·2	5·4	H. Gillman.	
West of Eagle River.	47 23	88 21	1855·5	6·20	2·8	3·4	W. F. Raynolds.	
Eagle River.	47 25	88 17	1855·5	6·77	2·8	4·0	W. F. Raynolds.	
Copper Harbor.	47 28	87 51	1873·58	4·06	1·8	2·3	A. N. Lee.	
Agate Harbor.	47 28	88 03	1855·5	5·33	2·8	2·5	W. F. Raynolds.	
Eagle Harbor.	47 28	88 08	1855·5	2·67?			J. U. Mueller.	
South shore of Isle Royale.	47 50	89 06	1868·5	4·93	2·0	2·9	B. D. Greene.	
Washington Harbor, Isle Royale.	47 53	89 13	1868·5	6·60	2·0	4·6	A. C. Lamson.	
Siskawit Pt., Isle Royale.	47 54	88 54	1868·5	4·50	2·0	2·5	B. D. Greene.	
Wright Island, Isle Royale.	47 58	88 49	1868·5	4·27	2·0	2·3	B. D. Greene.	
Todd Harbor, Isle Royale.	48 05	88 45	1868·5	6·50	2·0	4·5	J. C. Mallery.	
Fish Island, Isle Royale.	48 09	88 37	1867·5	5·13	2·1	3·0	A. C. Lamson.	
Scoville Point, Isle Royale.	48 10	88 26	1867·5	—6·47	+2·1	—4·4	B. D. Greene.	

MINNESOTA.

Group I.								
Heron Lake.	43 48	95 24	1880·76	−10·23	+1·5	−8·7	J. B. Baylor.	
Watopa.	44 14	92 02	1893·6	7·24	0·6	6·6	W. R. Hoag.	C. & G. S. archives.
Lake City.	44 23	92 08	1893·66	7·04	0·6	6·4	W. R. Hoag.	C. & G. S. archives.
Buck Hill.	44 43	93 17	1893·47	8·29	0·6	7·7	W. R. Hoag.	C. & G. S. archives.
Marcotta.	44 49	93 03	1893·47	8·56	0·6	8·0	W. R. Hoag.	C. & G. S. archives.
Fort Snelling.	44 54	93 11	1880·74	10·23	1·7	8·5	J. B. Baylor.	
Wallace.	44 54	93 05	1893·48	10·18	0·6	9·6	W. R. Hoag.	C. & G. S. archives.
Woodbury.	44 55	92 57	1893·47	8·51	0·6	7·9	W. R. Hoag.	C. & G. S. archives.
Hopkins.	44 55	93 27	1893·45	8·20	0·6	7·6	W. R. Hoag.	C. & G. S. archives.
St. Paul.	44 58	93 05	1891·63	9·36	0·7	8·7	J. B. Baylor.	C. & G. S. archives.
Prospect Park.	44 58	93 13	1893·43	8·98	0·6	8·4	W. R. Hoag.	C. & G. S. archives.
Ramsey.	44 59	93 00	1893·46	10·00	0·6	9·4	W. R. Hoag.	C. & G. S. archives.
Minneapolis University Grounds.	44 59	93 14	1891·59	9·08	0·7	8·4	G. R. Putnam.	C. & G. S. archives.
Snelling Avenue Base.	45 00	93 10	1893·60	9·13	0·6	8·5	W. R. Hoag.	C. & G. S. archives.
Mound View.	45 06	93 10	1893·46	9·12	0·6	8·5	W. R. Hoag.	C. & G. S. archives.
Brainerd.	46 21	94 15	1880·66	9·59	1 6	8·0	J. B. Baylor.	C. & G. S. archives.
Duluth.	46 46	92 04	1891·65	12·78	0·5	12·3	J. B. Baylor.	C. & G. S. archives.
Glyndon.	46 52	96 40	1891·66	−10·54	+0·6	− 9·9	J. B. Baylor.	C. & G. S. archives.
Group II.								
Wabasha.	44 18	92 07	1876·61	− 8·07	+1·9	− 6·2	T. N. Bailey.	
Henderson.	44 32	93 56	1855·5	11·50	3·3	8·2	J. S. Allanson.	
Red Wing.	44 34	92 32	1878·77	7·83	1·7	6·1	C. F. Powell.	
Mouth of St. Peter River.	44 53	93 08	1823·5	10·48			S. H. Long.	
Princeton.	45 42	93 20	1858·61	10·22	2·9	7·3	O. E. Garrison.	
Fond du Lac.	46 39	92 15	1861·66	9·70	2·7	7·0	W. H. Hearding.	
South of Spirit Lake and Island of Spirit Lake.	46 41	92 11	1861·55	9·77	+2·7	−7·1	W. H. Hearding.	
Point on shore.	46 42	91 50	1824·5	−12·33			H. W. Bayfield.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

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MINNESOTA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Aminicon River, 5½ miles east of it.	46 43	91 45	1861·6	—10·28	+2·7	+7·6	H. C. Penny.	
Near South Base, Minnesota Point.	46 43	92 02	1861·53	10·20	2·7	7·5	W. H. Hearding.	
St. Louis Bay.	46 43	92 10	1861·61	11·73	2·7	9·0	W. H. Hearding.	
South Base, Minnesota Point.	46 44	92 03	1870·75	9·77	2·1	7·7	E. S. Wheeler.	
Point on shore.	46 48	91 30	1824·5	12·45			H. W. Bayfield.	
Lester River.	46 50	92 00	1861·5	7·65	2·4	5·2	H. C. Penny.	
Knife River.	46 57	91 46	1861·6	12·75	2·4	10·4		
Point on shore.	47 33	90 50	1824·5	10·50			H. W. Bayfield.	
Terrace Point.	47 43	90 26	1868·6	8·20	1·9	6·3	H. Gillman.	
Brulé River.	47 48	90 03	1868·6	9·50	1·9	7·6	W. E. Rogers.	
Grand Portage Isd.	47 57	89 39	1868·6	5·83	1·9	3·9		
North shore Lake Superior.	47 58	90 00	1823·5	6·35			S. H. Long.	
Pigeon Point.	48 00	89 30	1868·5	9·50	1·9	7·7	W. E. Rogers.	
Island on Rainy Lake.	48 35	92 30	1823·5	8·25			S. H. Long.	
Lake of the Woods.	49 00	94 00	1823·5	11·02				
Northwest boundary stations.	49 00	94 45	1874·08	10·92	1·5	9·4	W. J. Twining.	
	49 00	94 55	1874·07	11·08	1·5	9·6		
	49 00	95 00	1874·06	11·20	1·5	9·7		
Lake of the Woods, Buffalo Point.	49 00	95 15	1874·05	11·50	1·5	10·0		
Northwest Boundary stations.	49 00	96 10	1873·98	12·00	1·5	10·5		
	49 00	96 25	1873·96	12·42	1·5	10·9		
	49 00	96 30	1873·96	—13·17	+1·5	—11·7		

MISSISSIPPI.

Group I.								
Shieldsboro.	30 18	89 19	1896·14	—5·20	+0·3	—4·9	J. B. Baylor.	C. & G. S. archives.
East Pascagoula.	30 21	88 33	1855·07	7·15	2·3	4·8	J. E. Hilgard.	
Mississippi City.	30 23	89 02	1896·12	5·35	0·3	5·1		
Poplarville.	30 50	89 30	1896·12	5·35	0·3	5·1		
Natchez, bluff north of city.	31 34	91 24	1890·33	6·50	0·7	5·8		
Vicksburg, Castle Hill.	32 21	90 53	1890·34	6·35	0·7	5·6	J. B. Baylor.	C. & G. S. archives.
Greenville.	33 25	91 04	1890·36	6·30	0·6	5·7		
Oxford, grounds of University.	34 22	89 33	1890·39	—6·00	+0·6	—5·4		
Group II.								
Ship Island.	30 13	88 58	1841·5	—7·58	+2·7	—4·9	L. M. Powell.	
Cat Island.	30 15	89 06	1847·5	7·20	2·6	4·6	—— Barnett.	
Pascagoula.	30 21	88 33	1875·41	6·32	1·6	4·7	J. M. Poole.	
Jackson.	32 19	90 12	1872·32	7·34	1·7	5·6	T. C. Hilgard.	
Meridian.	32 20	88 44	1875·43	6·43	1·5	4·9	J. M. Poole.	
Kings Point, opposite Vicksburg.	32 20	90 56	1877 ?	7·33	1·4	5·9	Chart.	
Near boundary of Rankin and Scott counties.	32 24	89 48	1892·24	6·28	0·5	5·8	R. E. Buckley.	Letter to Office.
Scooba, Kemper Co.	32 50	88 30	1833·5	6·92	2·7	4·2		
Coopwood.	33 02	89 05	1896·6	—5·25	+0·2	—5·0	F. M. Shields.	Letter to Office.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MISSISSIPPI—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Macon.	33 08	88 38	1833·5	−7·50	+2·7	−4·8	G. W. Campbell.	
West Point.	33 33	88 38	1875·43	6·42	1·4	5·0	J. M. Poole.	
Grenada.	33 47	89 50	1872·18	6·42	1·5	4·9	T. C. Hilgard.	
Corinth.	34 56	88 35	1875·40	6·36	1·2	5·2	F. E. Hilgard.	
Triangulation Station, Nelms.	34 58	90 15	1879·15	−6·37	+1·1	−5·3	J. H. Darling.	

MISSOURI.

Group I.								
Cape Girardeau.	37 18	89 33	1865·21	−6·58	+2·4	−4·2	A. T. Mosman.	
Ironton.	37 37	90 38	1890·87	2·21	0·6	1·6?	C. H. Sinclair.	C. & G. S. archives.
Wittenberg.	37 39	89 33	1865·26	6·78	2·4	4·4	A. T. Mosman.	
Potosi.	37 56	90 47	1890·89	6·10	+0·6	5·5	C. H. Sinclair.	C. & G. S. archives.
Saint Louis.	38 38	90 16	1896·35	−5·13	....	−5·0	R. L. Faris.	
Group II.								
Gatewood.	36 32	91 03	1880·53	−7·20	+1·4	−5·8	F. E. Nipher.	
Doniphan.	36 38	90 47	1880·53	7·08	1·4	5·7	F. E. Nipher.	
Public Survey Station.	36 40	90 02	1825·5	8·00			Public Surveyor.	
Poplar Bluffs.	36 44	90 22	1880·52	6·75	1·4	5·4	F. E. Nipher.	
Public Survey Station.	36 50	90 02	1823·5	7·50			Public Surveyor.	
Charleston.	36 56	89 19	1880·52	5·72	1·4	4·3	F. E. Nipher.	
Howell County.	36 56	91 55	1880·59	7·52	1·4	6·1	F. E. Nipher.	
Public Survey Station.	37 00	90 02	1823·5	8·00			Public Surveyor.	
	37 00	90 12	1823·5	8·00			Public Surveyor.	
Piedmont.	37 08	90 41	1880·54	7·38	1·4	6·0	F. E. Nipher.	
Springfield.	37 16	93 15	1879·66	8·60	1·4	7·2	F. E. Nipher.	
Houston.	37 19	91 55	1880·58	7·58	1·4	6·2	F. E. Nipher.	
Lutesville.	37 20	89 59	1880·52	6·23	1·4	4·8	F. E. Nipher.	
Public Survey Station.	37 30	90 02	1827·5	7·50			Public Surveyor.	
Bolivar.	37 35	93 24	1881·59	8·24	1·3	6·9		
Buffalo and farm of F. Voris.	37 36	93 08	1881·58	8·13	1·3	6·8		
Pilot Knob, base.	37 37	90 37	1880·55	11·14				
Pilot Knob, top.	37 37	90 37	1880·55	3·76				
Salem.	37 39	91 31	1880·58	6·94	1·4	5·5	F. E. Nipher.	
Lebanon, old and new stations.	37 40	92 42	1880·62	7·77	1·4	6·4	F. E. Nipher.	
Arcadia.	37 46	90 41	1880·54	6·81	1·4	5·4	F. E. Nipher.	
Decaturville.	37 54	92 43	1881·58	8·94	1·3	7·6	F. E. Nipher.	
Wheatland.	37 56	93 24	1881·60	8·66	1·3	7·4	F. E. Nipher.	
Rolla.	37 58	91 45	1880·5	6·88	1·4	5·5	Emerson.	
Schell City.	38 03	94 05	1879·65	9·04	1·4	7·6		
Cuba.	38 04	91 21	1880·57	7·41	1·4	6·0		
Linn Creek.	38 04	92 47	1881·57	9·00	1·3	7·7		
De Soto.	38 07	90 35	1880·55	7·78	1·4	6·4		
Lawson Farm.	38 11	92 11	1881·55	6·90	1·3	5·6		
Vienna.	38 12	91 54	1881·54	7·25	1·3	6·0		
Tuscumbia.	38 12	92 30	1881·55	8·51	1·3	7·2		
Warsaw.	38 14	93 23	1881·60	8·85	1·3	7·6		
Soap Creek.	38 17	92 50	1881·57	8·34	1·3	7·0	F. E. Nipher.	
Canaan and Dry Fork.	38 18	91 34	1881·54	7·18	1·3	5·9		
Kimmswick.	38 20	90 26	1880·56	6·76	1·4	5·4		
Lincoln.	38 23	93 21	1881·60	9·31	1·3	8·0		
Roedersville.	38 24	91 10	1881·52	6·93	1·3	5·6		
Wulfert Farm.	38 24	91 16	1881·54	7·07	1.3	5·8		
Union.	38 25	90 59	1881·52	6·60	1·3	5·3		
Versailles.	38 25	92 53	1881·56	−8·33	+1·3	−7·0		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MISSOURI—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Pacific, formerly Franklin.	38 28	90 44	1881·52	−6·90	+1·3	−5·6		
F. Kaldeweiher's.	38 28	91 41	1882·49	7·74	1·2	6·5		
Linn, Osage Co.	38 28	91 50	1882·49	7·62	1·2	6·4		
Grays Summit.	38 29	90 49	1882·46	6·91	1·2	5·7		
Washington, old and new stations.	38 31	90 59	1881·53	6·32	1·3	5·0	F. E. Nipher.	
Windsor.	38 32	93 33	1881·60	8·72	1·3	7·4		
Newport and Goebel's.	38 35	91 06	1882·47	7·31	1·3	6·0		
Jefferson City.	38 35	92 09	1881·65	8·45	1·3	7·2		
22 Miles W. of Jefferson City.	38 35	92 30	1868·55	8·78	2·2	6·6	G. B. Nicholson.	Letter to Office.
Ten Mile House and Kirkwood.	38 37	90 24	1881·98	6·60	1·3	5·3		
Fred Bruhns.	38 37	91 29	1882·48	6·87	1·2	5·7		
California Station and Centertown.	38 38	92 34	1881·64	7·68	1·3	6·4		
Holden.	38 38	94 03	1879·63	8·93	1·4	7·5	F. E. Nipher.	
Near Clayton and St. Charles R. R.	38 41	90 20	1882·08	6·10	1·2	4·9		
E. Ruck's place.	38 41	91 20	1882·48	7·85	1·2	6·6		
G. Zimmerman's place.	38 41	93 34	1881·61	9·25	1·3	8·0		
Hermann.	38 42	91 27	1872·74	8·23	1·9	6·3	T. C. Hilgard.	
Marion.	38 42	92 25	1881·65	7·66	1·3	6·4		
Sedalia.	38 42	93 16	1879·60	8·76	1·4	7·4		
OppositeSt.Charles and Pattonsville.	38 43	90 30	1881·68	6·61	1·3	5·3		
Dardennes & Healds.	38 43	90 41	1882·15	6·66	1·3	5·4		
Little Auxvasse Creek.	38 43	92 01	1882·50	7·92	1·2	6·7		
Warrenton.	38 46	91 09	1882·63	6·56	1·2	5·4		
Florissant.	38 47	90 17	1881·68	6·58	1·3	5·3		
O'Fallon.	38 47	90 43	1880·83	6·76	1·3	5·5	F. E. Nipher.	
Wright City.	38 47	91 00	1878·53	8·23	1·5	6·7		
Providence.	38 49	92 28	1881·66	7·65	1·3	6·4		
Johnson's Farm and Prairie Home.	38 50	92 40	1881·64	7·56	1·3	6·3		
Danville.	38 51	91 32	1881·67	7·80	1·3	6·5		
Swope's or Black Water.	38 52	93 35	1881·61	8·62	1·3	7·3		
Sweet Springs.	38 55	93 29	1881·62	9·40	1·3	8·1		
Columbia, old and new stations.	38 56	92 19	1880·10	7·55	1·4	6·2		
Loomis Farm.	38 57	91 47	1881·67	7·77	1·3	6·5		
Franklin.	38 57	92 57	1819·54	11·70			S. H. Long.	
McCredie.	38 58	91 55	1881·67	7·84	1·3	6·5		
Stephen's Store.	38 58	92 05	1882·50	7·61	1·2	6·4		
Montgomery City.	39 00	91 30	1882·63	7·12	1·2	5·9	F. E. Nipher.	
Herndon.	39 00	93 21	1881·62	8·92	1·3	7·6		
Arrow Rock and Clark's Farm.	39 04	92 58	1881·63	7·90	1·3	6·6		
Kansas City.	39 07	94 38	1879·64	10·22	1·4	8·8	F. E. Nipher & J.B.Kaufman.	
Marshall.	39 08	93 17	1881·63	8·54	1·3	7·2		
Mexico.	39 11	91 52	1878·53	7·64	1·5	6·1		
Lexington.	39 12	93 53	1879·64	8·92	1·4	7·5		
Centralia.	39 13	92 05	1882·51	7·95	1·2	6·8		
Glasgow.	39 13	92 50	1879·55	8·36	1·4	7·0	F. E. Nipher.	
Carrollton.	39 21	93 33	1879·57	8·50	1·4	7·1		
Long Branch of Salt River.	39 22	91 59	1882·62	8·00	1·2	6·8		
Long Branch of Salt River.	39 24	92 10	1882·51	−8·11	+1·2	−6·9		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MISSOURI—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Cow Island.	39 25	94 00	1819·63	−11·54			S. H. Long.	
Moberly.	39 26	92 26	1882·51	7·66	+1·2	−6·5	F. E. Nipher.	
Louisiana.	39 28	91 07	1878·55	7·12	1·5	5·6		
Winkler's.	39 35	92 00	1882·62	7·74	1·2	6·5		
Wolfords.	39 38	93 45	1882·55	8·67	1·2	7·5		
Kingston & Smith's	39 40	94 08	1882·55	9·42	1·2	8·2		
Maysville.	39 43	94 24	1882·56	9·30	1·2	8·1		
Hannibal.	39 44	91 24	1878·56	7·14	1·5	5·6		
Shelbyville.	39 44	92 04	1882·62	7·78	1·2	6·6		
Macon.	39 46	92 30	1882·52	7·98	1·2	6·8		
Saint Joseph.	39 46	94 49	1879·66	8·94	1·4	7·5	F. E. Nipher & J. B. Kaufman.	
One mile west of Laclede.	39 47	93 17	1882·54	8·18	1·2	7·0	F. E. Nipher.	
Chillicothe.	39 47	93 34	1879·56	8·52	1·4	7·1		
Isaac Lewis's.	39 48	92 37	1882·52	7·98	1·2	6·8		
Linneus.	39 51	93 13	1882·54	7·93	1·2	6·7		
Harris.	39 53	92 22	1882·61	7·62	1·2	6·4		
West Branch, Yellow Creek.	39 54	93 07	1882·53	8·27	1·2	7·1		
Mercyville.	39 57	92 42	1882·53	8·28	1·2	7·1		
La Plata.	40 00	92 34	1882·61	8·15	1·2	7·0		
Johnson's.	40 01	94 23	1882·56	9·55	1·2	8·4		
Trenton.	40 03	93 39	1882·58	8·06	1·2	6·9		
Honan's & Michael's.	40 06	93 54	1882·58	8·79	1·2	7·6		
Canton.	40 09	91 36	1878·57	7·32	1·5	5·8		
Shicklerville.	40 09	92 58	1882·60	8·87	1·2	7·7		
Kirksville.	40 12	92 37	1882·61	8·28	1·2	7·1		
Milan.	40 12	93 11	1882·60	8·30	1·2	7·1		
Amick's.	40 13	93 38	1882·59	8·23	1·2	7·0		
Albany.	40 15	94 21	1882·57	8·43	1·2	7·2		
Bethany.	40 16	94 03	1882·57	8·72	1·2	7·5		
Southeast corner station.	40 16	94 17	1882·57	8·55	1·2	7·4		
Banke's.	40 19	93 07	1882·60	8·63	1·2	7·4		
Maryville.	40 21	94 58	1879·59	11·23	1·4	9·8		
Princeton.	40 24	93 39	1882·59	8·79	1·2	7·6		
Memphis.	40 27	92 13	1878·58	7·80	1·5	6·3		
Williams.	40 27	93 21	1882·59	8·65	1·2	7·4		
Ward's and Unionville.	40 28	93 06	1882·60	−8·25	+1·2	−7·0		

MONTANA.

Group I.								
Fort Ellis.	45 40	110 58	1882·66	−19·58	+0·6	−19·0	B. A. Colonna.	
Bozeman.	45 40	111 02	1896·46	18·66	0·1	18·6	R. L. Faris.	C. & G. S. archives.
Billings.	45 47	108 30	1896·45	17·48	0·1	17·4		
Forsyth.	46 15	106 40	1896·44	17·77	0·1	17·7		
Townsend.	46 19	111 31	1896·48	19·53	0·1	19·4		
Miles City.	46 24	105 53	1896·44	16·89	0·1	16·8		
Helena.	46 37	112 02	1896·48	19·23	0·1	19·1		
Glendive.	47 06	104 43	1896·43	16·73	0·1	16·6		
Cascade.	47 16	111 42	1896·49	19·50	0·1	19·4		
Fort Benton.	47 49	110 40	1896·50	20·59	0·1	20·5		
Glasgow.	48 12	106 37	1896·51	18·98	0·1	18·9		
Havre.	48 34	109 37	1896·51	−20·32	+0·1	−20·2		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MONTANA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II.	° ′	° ′		°	°	°		
Head of Gallatin.	45 15	111 00	1872·72	−19·15	+0·5	−18·6	F. V. Hayden.	
Madison River.	45 16	111 41	1860·5	19·00	0·2	18·8	W. F. Raynolds?	
Virginia City.	45 19	111 56	1872·66	19·25	0·5	18·8	F. V. Hayden.	
Powder River.	45 47	105 03	1859·5	16·90	0·6	16·3	W. F. Raynolds?	
Near Three Forks of Missouri River.	45 52	111 22	1860·5	20·48	0·2	20·3		
Yellowstone River.	45 56	108 22	1860·5	17·93	0·4	17·5		
Rosebud River.	46 03	106 23	1859·5	17·83	0·6	17·2		
Fort Sarpy.	46 18	107 04	1859·5	18·00	0·6	17·4		
Fort Owen.	46 31	113 58	1853·5	19·42	0·0	19·4	I. I. Stevens.	
Hell Gate.	46 52	113 59	1860·5	21·00	0·2	20·8	J. Mullan.	
Bitter Root.	47 19	115 04	1860·5	20·75	0·2	20·6		
Near Fort Union.	47 56	104 02	1860·5	19·93	0·6	19·3		
Fort Union.	48 03	104 00	1853·5	16·80	0·6	16·2	I. I. Stevens.	
South Crossing Kootenay.	48 22	115 21	1861·51	22·27	0·2	22·1	R. W. Haig.	
Kootenay River.	48 40	115 17	1861·51	23·40	0·2	23·2		
Camp Kootenay East.	48 59	115 12	1861·5	22·97	0·2	22·8	J. S. Harris.	
Northwest Boundary Station.	49 00	104 05	1873·7	18·42	0·8	17·6	W. J. Twining.	
Do.	49 00	104 20	1873·7	18·83	0·8	18·0		
Do.	49 00	104 30	1874·5	18·50	0·8	17·7		
Do.	49 00	104 45	1873·7	18·25	0·8	17·4		
Do.	49 00	105 10	1873·7	19·53	0·8	18·7		
Do.	49 00	105 25	1873·8	19·93	0·8	19·1		
Do.	49 00	105 30	1874·5	19·83	0·8	19·0		
Do.	49 00	105 33	1873·8	19·75	0·8	19·0		
Do.	49 00	105 45	1874·5	20·25	0·7	19·6		
Do.	49 00	105 55	1874·5	19·83	0·7	19·1		
Do.	49 00	106 05	1874·5	20·33	0·8	19·5		
Do.	49 00	106 28	1874·5	20·50	0·7	19·8		
Do.	49 00	106 30	1874·5	20·33	0·7	19·6		
Do.	49 00	106 45	1874·6	20·17	0·7	19·5		
Do.	49 00	106 50	1874·6	20·33	0·7	19·6		
Do.	49 00	106 55	1874·6	20·00	0·7	19·3		
Do.	49 00	107 10	1874·6	20·67	0·7	20·0		
Do.	49 00	107 15	1874·6	20·17	0·7	19·5		
Do.	49 00	107 30	1874·5	20·75	0·7	20·0		
Do.	49 00	107 40	1874·6	20·83	0·7	20·1		
Do.	49 00	107 50	1874·6	20·63	0·7	19·9		
Do.	49 00	109 00	1874·5	21·00	0·6	20·4		
Do.	49 00	109 40	1874·6	20·38	0·6	19·8		
Do.	49 00	110 30	1874·5	22·00	0·6	21·4		
Do.	49 00	110 45	1874·6	22·75	0·6	22·2		
Do.	49 00	111 05	1874·6	22·17	0·6	21·6		
Do.	49 00	111 28	1874·6	22·67	0·6	22·1		
Do.	49 00	111 30	1874·6	22·42	0·6	21·8		
Do.	49 00	111 35	1874·6	22·17	0·6	21·6		
Do.	49 00	112 00	1874·6	22·50	0·5	22·0		
Do.	49 00	112 35	1874·6	22·50	0·5	22·0		
Do.	49 00	112 55	1874·6	22·53	0·5	22·0		
Do.	49 00	113 00	1874·6	22·83	0·5	22·3		
Do.	49 00	113 05	1874·6	23·27	0·5	22·8		
Do.	49 00	113 20	1874·6	23·75	0·5	23·2		
NW. B'y st'n near R.M. Divide.	49 00	113 40	1874·6	23·83	0·5	23·3		
NW. B'y st'n near Divide.	49 00	114 00	1874·6	23·33	0·5	22·8		
Camp Kishenehu.	49 00	114 21	1861·5	−22·97	+0·2	−22·8	J. S. Harris.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEBRASKA.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Omaha.	41 16	95 56	1891·67	— 9·63		— 8·9	G. R. Putnam.	
Norfolk.	42 02	97 22	1896·36	10·56	+0·2	10·4	R. L. Faris.	C. & G. S. archives.
Newport.	42 36	99 21	1896·37	12·05	0·2	11·8		
Chadron.	42 50	103 00	1896·37	—13·97	+0·2	—13·8		
Group II.								
Rock Creek.	40 11	97 02	1858·6	—12·10	+2·6	— 9·5	J. H. Simpson.	
Big Sandy River.	40 12	97 12	1858·6	13·65	2·6	11·0		
Little Blue River.	40 15	98 10	1858·6	13·72	2·6	11·1		
Brownville.	40 28	95 44	1877·5	11·25	1·4	9·8	A. H. Blaisdell.	
Peru.	40 30	95 45	1888·42	10·22	0·8	9·4	H. W. Bouton.	
Elm Creek.	40 30	98 30	1858·6	12·30	2·6	9·7	J. H. Simpson.	
Fort Kearney.	40 38	98 56	1858·7	13·63	2·6	11·0		
Camp No. 20.	40 40	99 54	1858·7	13·28	2·5	10·8		
Nebraska City.	40 42	95 52	1880·5	10·22	1·3	8·9	C. R. Suter.	
Grand Island.	40 55	98 18	1878·66	12·86	1·4	11·5	T. E. Thorpe.	
Grand Island.	40 55	98 23	1872·82	13·22	1·6	11·6	T. C. Hilgard.	
Platte River.	40 58	100 35	1858·9	13·53	2·0	11·5	J. H. Simpson.	
Plattsmouth.	41 01	95 53	1877·5	11·25	1·5	9·8	A. H. Blaisdell.	
Camp No. 25.	41 03	101 50	1858·7	13·35	1·8	11·6	J. H. Simpson.	
Camp No. 22.	41 05	100 50	1858·7	11·08	2·0	9·1		
Sidney.	41 08	102 55	1872·82	14·62	1·4	13·2	T. C. Hilgard.	
North Platte.	41 11	100 45	1872·82	13·12	1·6	11·5		
North Platte.	41 23	102 15	1858·7	15·43	1·8	13·6	J. H. Simpson.	
Engineer's Cantonment.	41 25	96 00	1819·72	12·98	3·7	9·3	S. H. Long.	
North Platte.	41 58	104 00	1858·7	15·60	1·6	14·0	J. H. Simpson.	
Niobrara River.	42 34	103 57	1877·74	15·45	1·0	14·4	W. S. Stanton.	
Soldiers Creek.	42 40	103 28	1877·75	15·50	1·0	14·5		
Indian Creek.	42 59	104 03	1877·81	—16·65	+1·0	—15·6		

NEVADA.

Group I.								
T_{55}. Nev.-Cal. Boundary.	37 56	118 29	1894·86	—13·70	0·0	—13·7	C. H. Sinclair & J. H. Mather.	C. & G. S. archives.
Pioche, station.	37 59	114 03	1883·74	17·18	+0·5	16·7	W. Eimbeck & G. F. Bird.	
T_{46}, T_{48}, T_{49}, T_{50}, T_{53}.	38 05	118 41	1894·86	16·40	0·0	16·4	C. H. Sinclair & J. H. Mather.	C. & G. S. archives.
T_{39}, T_{40}, T_{43}, T_{44}, T_{45}.	38 15	118 56	1894·84	15·95	0·0	16·0		
White Pine, station.	38 19	115 30	1881·88	16·07	0·4	15·7	W. Eimbeck & R. A. Marr.	
T_{33}, T_{34}, T_{35}, T_{36}, T_{37}, T_{38}.	38 25	119 09	1894·82	16·50	0·0	16·5	C. H. Sinclair & J. H. Mather.	C. & G. S. archives.
T_{28}, T_{29}, T_{30}, T_{31}, T_{32}.	38 34	119 22	1894·78	16·55	0·0	16·6		
T_{22}, T_{23}, T_{24}, T_{25}, T_{27}.	38 42	119 33	1894·76	17·25	0·0	17·2		
T_{15}, T_{16}, T_{17}, T_{18}, T_{19}, T_{20}.	38 48	119 42	1894·71	16·33	0·0	16·3		
T_8, T_9, T_{10}, T_{11}, T_{12}, T_{13}, T_{14}.	38 51	119 47	1894·68	16·88	0·0	16·9		
Initial 1894, T_1, T_3, T_4, T_5, T_6, & T_7.	38 56	119 55	1894·65	16·47	0·0	16·5		
J. Davis.	38 59	114 19	1882·89	16·50	0·5	16·0	W. Eimbeck & R. A. Marr.	
Tres Pinos.	39 00	114 14	1882·92	16·38	0·5	15·9		
Genoa, astronomic station.	39 00	119 50	1889·59	16·74	0·0	16·7	R. A. Marr.	C. & G. S. archives.
Lehman's ranch.	39 01	114 08	1882·94	16·28	0·5	15·8	W. Eimbeck & R. A. Marr.	
Carson City.	39 10	119 46	1895·85	—16·62	+0·0	—16·6	C. H. Sinclair.	C. & G. S. archives.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEVADA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Austin.	39 29	117 04	1881·41	—16·95	+0·3	—16·6	W. Eimbeck & R. A. Marr.	
Reno.	39 30	119 49	1881·28	17·81	0·2	17·6		
Verdi, near astronomic station.	39 31	119 59	1889·53	17·44	0·2	17·2	R. A. Marr.	
Eureka, town.	39 31	115 58	1881·38	16·61	0·4	16·2	W. Eimbeck & R. A. Marr.	
Eureka, station.	39 35	115 49	1881·70	16·83	0·4	16·4		
Mount Callahan.	39 43	116 57	1881·53	17·07	0·3	16·8		
Hot Springs.	39 47	118 56	1881·29	17·44	0·2	17·2		
Mineral Hill.	40 10	116 12	1881·39	17·05	0·3	16·8		
Rye Patch.	40 26	118 18	1881·30	17·83	0·2	17·6		
Battle Mountain.	40 40	116 50	1881·31	17·58	0·3	17·3		
Elko.	40 47	115 46	1881·32	17·51	0·4	17·1		
Winnemucca.	40 59	117 44	1881·30	17·65	0·3	17·4		
Wells Station.	41 07	114 56	1881·32	17·36	0·5	16·9		
Tecoma.	41 20	114 06	1881·33	—17·47	+0·5	—17·0		
Group II.								
Nev.-Cal. Boundary. Mean of 16 stations.	35 05	114 46	1873·5	—14·87	+0·4	—14·5	A. W. Von Schmidt	Land Office records, report of survey of Cal.-Nev. Boundary.
Mean of 16 stations.	35 15	114 58	"	15·05	0·4	14·6		
" " 13 "	35 24	115 09	"	15·18	0·4	14·8		
" " 15 "	35 33	115 21	"	15·22	0·4	14·8		
" " 15 "	35 42	115 32	"	15·18	0·4	14·8		
" " 16 "	35 52	115 44	"	15·27	0·4	14·9		
" " 15 "	36 01	115 54	"	15·42	0·4	15·0		
Vegas Wash.	36 07	114 40	1869·5	16·02	0·3	15·7	G. W. Wheeler & D. W. Lockwood.	
Stone Ferry.	36 08	114 25	1875·6	14·97	0·4	14·6	E. Bergland.	
Mouth of Rio Virgin.	36 09	114 22	1869·5	15·79	0·3	15·5	G. W. Wheeler & D. W. Lockwood.	
Mean of 14 stations.	36 10	116 07	1873·5	15·42	0·4	15·0	A. W. Von Schmidt	"
Las Vegas Range.	36 11	115 03	1869·5	15·14	0·3	14·8	G. W. Wheeler & D. W. Lockwood.	
Mean of 15 stations.	36 19	116 19	1873·5	15·35	0·4	15·0	A. W. Von Schmidt	"
Saint Thomas.	36 27	114 19	1869·5	15·79	0·3	15·5	G. W. Wheeler & D. W. Lockwood.	
Mean of 15 stations.	36 28	116 31	1873·5	15·45	0·4	15·0	A. W. Von Schmidt	"
Indian Spring.	36 34	115 35	1869·5	15·69	0·3	15·4	G. W. Wheeler.	
Mean of 15 stations.	36 37	116 44	1873·5	15·48	0·4	15·1	A. W. Von Schmidt	"
West Point.	36 41	114 34	1869·5	15·32	0·3	15·0	G. W. Wheeler & D. W. Lockwood.	
Mean of 2 stations.	36 58	117 10	1873·5	15·60	0·4	15·2	A. W. Von Schmidt	"
Mud Spring.	37 11	115 35	1869·5	16·05	0·3	15·8	G. W. Wheeler & D. W. Lockwood.	
Mean of 2 stations.	37 15	117 33	1873·5	16·92	0·4	16·5	A. W. Von Schmidt	"
Mormon Canyon.	37 16	114 28	1869·5	16·58	0·3	16·3	G. W. Wheeler & D. W. Lockwood.	
Mean of 14 stations.	37 25	117 47	1873·5	16·35	0·4	16·0	A. W. Von Schmidt	"
Clover Valley.	37 30	114 14	1869·5	14·42	0·3	14·1	G. W. Wheeler & D. W. Lockwood.	
Schafer Spring.	37 34	115 27	1869·5	16·18	0·3	15·9	D. W. Lockwood.	
Mean of 14 stations.	37 34	118 00	1873·5	16·53	0·4	16·1	A. W. Von Schmidt	"
Spring below Panacea.	37 46	114 27	1869·5	16·98	0·3	16·7	G. W. Wheeler.	
Rose Valley.	37 55	114 16	1869·5	17·84	0·3	17·5	G. W. Wheeler & D. W. Lockwood.	
Pioche.	37 55	114 26	1872·5	15·97	0·3	15·7	Eng'r Officer.	
Quinn Canyon.	37 58	115 45	1869·5	16·34	0·3	16·0	G. W. Wheeler & D. W. Lockwood.	
Mean of 16 stations.	37 58	118 32	1873·5	16·65	0·4	16·2	A. W. Von Schmidt	"
Homer, Cedar Valley.	38 03	114 10	1869·5	17·67	0·3	17·4	G. W. Wheeler.	
Mean of 16 stations.	38 08	118 45	1873·5	—16·70	+0·4	—16·3	A. W. Von Schmidt	"

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEVADA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Sheep Range, Cedar Valley.	38 14	114 22	1869·5	—16·77	+0·3	—16·5	G. W. Wheeler.	
Mean of 16 stations.	38 17	118 59	1873·5	17·10	0·4	16·7	A. W. Von Schmidt	Land Office records, report of survey of Cal.-Nev. Boundary.
Wild Hop Creek.	38 23	114 30	1869·5	16·00	0·3	15·7	G. W. Wheeler.	
Mean of 16 stations.	38 27	119 12	1873·5	17·10	0·4	16·7	A. W. Von Schmidt	"
" " 16 "	38 36	119 25	1873·5	17·02	0·4	16·6		
Cave Valley.	38 39	114 49	1869·5	16·27	0·3	16·0	G. W. Wheeler & D. W. Lockwood.	
Benson Creek.	38 41	114 38	1869·5	16·40	0·3	16·1	G. W. Wheeler.	
Mean of 19 stations.	38 46	119 40	1873·5	17·48	0·4	17·1	A. W. Von Schmidt	"
Clear Creek.	38 50	114 25	1869·5	16·44	0·3	16·1	G. W. Wheeler.	
Dead Horse Well.	38 54	118 23	1876·5	16·50	0·4	16·1	Eng'r Officer.	
Mean of 8 stations.	38 56	119 55	1873·5	16·72	0·4	16·3	A. W. Von Schmidt	"
Rattlesnake Spring.	38 57	114 26	1869·5	16·30	0·3	16·0	G. W. Wheeler & D. W. Lockwood.	
McMahon Ranch.	38 59	117 28	1876·5	15·69	0·4	15·3	Eng'r Officer.	
Genoa Carson Valley.	39 00	119 40	1877·5	16·78	0·4	16·4	J. N. Macomb.	
Ice Creek.	39 02	114 49	1869·5	16·58	0·4	16·2	G. W. Wheeler & D. W. Lockwood.	
Glenbrook Wharf, Lake Tahoe.	39 05	119 56	1876·5	15·98	0·4	15·6	Eng'r Officer.	
Big Bend, Walker River.	39 09	118 56	1859·6	16·43	0·3	16·1	J. H. Simpson.	
Sacramento District.	39 10	114 23	1869·5	16·46	0·5	16·0	G. W. Wheeler.	
Monte Christo Mill.	39 13	115 35	1869·5	17·08	0·5	16·6	G. W. Wheeler & H. M. Robert.	
Murray Creek.	39 15	114 51	1869·5	16·59	0·5	16·1	G. W. Wheeler & D. W. Lockwood.	
Near Hamilton.	39 16	115 26	1869·5	16·72	0·5	16·2	G. W. Wheeler & H. M. Robert.	
Center Station, American Flat.	39 16	119 40	1876·5	16·50	0·4	16·1	Eng'r Officer.	
Meridian Boundary. Mean of 14 stations.	39 19	120 00	1872·8	16·83	0·4	16·4	A. W. Von Schmidt	G. Davidson; letter to Office.
Carson Lake.	39 24	118 30	1859·6	16·68	0·3	16·4	J. H. Simpson.	
Antelope Springs.	39 26	115 27	1869·5	17·01	0·5	16·5	G. W. Wheeler & D. W. Lockwood.	
Piermont.	39 29	114 31	1872·5	16·78	0·5	16·3	R. L. Hoxie.	
Patterson Ranch.	39 31	117 45	1876·5	16·46	0·5	16·0	Eng'r Officer.	
Mean of 13 stations.	39 31	120 00	1872·8	16·48	0·4	16·1	A. W. Von Schmidt	"
" " 15 "	39 43	120 00	1872·8	16·70	0·4	16·3		
Ko-bah Valley.	39 44	116 10	1858·9	16·23	0·4	15·8	J. H. Simpson.	
Antelope Valley.	39 47	114 12	1859·5	16·28	0·5	15·8		
Slough, Long Valley.	39 50	115 24	1869·5	17·00	0·5	16·5	G. W. Wheeler & D. W. Lockwood.	
Eagan Canyon.	39 52	114 58	1859·5	16·28	0·5	15·8	J. H. Simpson.	
Cho-keep Pass.	39 54	115 45	1858·9	16·53	0·5	16·0		
Mean of 15 stations.	39 57	120 00	1872·8	16·95	0·4	16·6	A. W. Von Schmidt	"
Huntingdon Springs.	40 01	115 19	1859·5	17·60	0·5	17·1	J. H. Simpson.	
Camp Ruby.	40 04	115 31	1869·5	17·15	0·5	16·6	G. W. Wheeler & H. M. Robert.	
Cold Spring.	40 04	115 42	1869·5	17·21	0·5	16·7	G. W. Wheeler.	
Mean of 15 stations.	40 12	120 00	1872·8	16·48	0·4	16·1	A. W. Von Schmidt	"
Pearl Creek.	40 17	115 44	1869·5	16·31	0·5	15·8	G. W. Wheeler & D. W. Lockwood.	
Mean of 15 stations.	40 25	120 00	1872·8	17·23	0·4	16·8	A. W. Von Schmidt	"
Willow Creek.	40 31	115 44	1869·5	—17·45	+0·5	—17·0	G. W. Wheeler & D. W. Lockwood.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEVADA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Mean of 15 stations.	40 38	120 00	1872·8	−18·75	+0·4	−18·4	A. W. Von Schmidt	G. Davidson; letter to Office.
Crescent Station.	40 45	115 40	1869·5	17·87	0·5	17·4	G. W. Wheeler.	
Camp Halleck.	40 49	115 20	1869·5	16·36	0·5	15·9	G. W. Wheeler & H. M. Robert.	
Mean of 15 stations.	40 51	120 00	1872·8	18·82	0·4	18·4		
15	41 04	120 00	"	17·95	0·4	17·6		
15	41 17	120 00	"	17·62	0·4	17·2	A. W. Von Schmidt	
15	41 30	120 00	"	18·32	0·4	17·9		
15	41 43	120 00	"	18·77	0·4	18·4		
15	41 55	120 00	"	−18·73	+0·4	−18·3		

NEW HAMPSHIRE.

Group I.								
Troy.	42 50	72 11	1861·61	+ 9·06	+2·2	+11·3	G. W. Dean & R. E. Halter.	
Chesterfield.	42 54	72 26	1890·71	11·21	....	11·5	J. B. Baylor.	
Unkonoonuc.	42 59	71 35	1848·77	9·07	3·0	12·1	J. S. Ruth.	
Patuccawa.	43 07	71 12	1849·63	10·71	2·9	13·6	C. O. Boutelle.	
Gunstock.	43 31	71 22	1860·54	10·90	2·4	13·3	G. W. Dean.	
Hanover, west of observatory.	43 42	72 18	1890·73	11·95	....	12·8	J. B. Baylor.	
Littleton.	44 19	71 48	1873·74	12·58	1·7	14·3	T. C. Hilgard.	
Gorham.	44 22	71 15	1873·73	+13·78	+1·7	+15·5		
Group II.								
Hinsdale.	42 46	72 17	1772·5	+ 6·00	+5·2	+11·2	— Wright.	
Concord.	43 12	71 29	1879·5	11·45	0·9	12·4	J. N. McClintock.	
Farmington.	43 23	71 04	1889·5	13·20	0·4	13·6	G. W. Fernald.	
Lebanon.	43 40	72 12	1874(?)	11·5	1·7	13·2	C. A. Downs.	
Plymouth.	43 45	71 42	1830·7	8·53	5·0	13·5	J. D. Graham.	
West Romney.	43 49	71 53	1830·7	9·63	5·0	14·6		
Warren.	43 56	71 55	1830·7	9·13	5·0	14·1		
Haverhill.	44 02	72 05	1830·7	7·53	5·0	12·5		
Lyman.	44 13	71 54	1879·5	11·55	1·0	12·6	J. N. McClintock.	
Fabyan Hotel.	44 16	71 25	1845·47	+11·53	+4·0	+15·5	J. Locke.	

NEW JERSEY.

Group I.								
Cape May.	38 56	74 56	1891·41	+5·68	....	+6·0	G. R. Putnam.	
Townbank.	38 59	74 58	1846·50	2·98	+3·4	6·4	J. Locke.	
Sea Isle City.	39 09	74 42	1884·45	5·90	0·8	6·7	J. B. Baylor.	
Egg Island Lt. Ho.	39 10	75 08	1846·48	3·05	3·4	6·4	J. Locke.	
Port Norris.	39 15	75 01	1846·48	3·07	3·4	6·5		
Atlantic City.	39 22	74 25	1860·64	4·90	2·3	7·2	C. A. Schott.	
Pine Mount.	39 25	75 20	1846·46	3·24	3·4	6·6	J. Locke.	
Hawkins.	39 26	75 17	1846·47	2·98	3·4	6·4		
Old Inlet, Tuckers Isd.	39 31	74 17	1846·86	4·46	3·4	7·9	T. J. Lee.	
Long Beach.	39 32	74 16	1860·65	5·31	2·4	7·7	C. A. Schott.	
Church Landing.	39 41	75 31	1846·43	5·82	3·9	9·7	J. Locke.	
Barnegat Lt. Ho.	39 46	74 06	1860·65	5·40	2·4	7·8	C. A. Schott.	
Chew.	39 48	75 10	1846·53	3·75	3·9	7·6	J. Locke.	
White Hill.	40 08	74 44	1846·38	4·43	3·8	8·2		
Mount Rose.	40 22	74 43	1852·62	+5·53	+3·3	+8·8	J. E. Hilgard.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW JERSEY—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Mount Mitchell.	40 24	74 00	1844·04	+5·66	+3·0	+8·7	G. M. Bache & J. Hall.	
Sandy Hook.	40 28	74 00	1895·47	8·41	....	8·8	J. B. Baylor.	
New Brunswick.	40 30	74 27	1895·67	7·78	....	7·9		
Newark.	40 45	74 10	1846·37	5·58	3·0	8·6	J. Locke.	
Bergen Neck.	40 46	74 03	1840·66	+5·88	+3·5	+9·4	S. C. Rowan.	
Group II.								
Ocean View.	39 11	74 44	1887·8	+5·67	+0·6	+6·3	J. H. Cook (in charge).	
Maurice River Lt. Ho.	39 12	75 02	1883·5	5·08	0·9	6·0		
Port Norris.	39 15	75 02	1887·8	5·40	0·6	6·0		
Atlantic City, near Lt. Ho.	39 22	74 25	1887·8	6·37	0·6	7·0		
Bridgeton, average	39 26	75 14	1887·8	5·32	0·6	5·9		
May's Landing, average.	39 27	74 44	1887·8	5·87	0·6	6·5		
Newfield.	39 32	75 01	1887·8	5·75	0·6	6·4		
Bass River.	39 35	74 27	1885·6	6·50	0·7	7·2		
Salem.	39 35	75 28	1887·8	5·70	0·6	6·3		
Tuckerton.	39 36	74 20	1887·9	6·87	0·6	7·5		
West Creek, in division line E. and W. New Jersey.	39 38	74 19	1887·5	7·17	....	7·8	H. S. Haines.	
Hammonton.	39 39	74 49	1885·9	5·88	0·7	6·6	J. H. Cook.	
Clarksboro.	39 39	75 06	1885·9	5·77	0·7	6·5		
Winslow.	39 40	74 51	1887·8	5·95	0·6	6·6		
Waterford.	39 43	74 51	1885·9	5·82	0·7	6·5		
Barnegat Village.	39 45	74 14	1887·9	6·87	0·6	7·5		
Barnegat Lt. Ho.	39 46	74 06	1880·5	6·95	1·0	8·0	A. P. Irons.	
Shamong Station.	39 49	74 32	1887·9	6·60	0·6	7·2	J. H. Cook.	
Berlin.	39 49	74 55	1885·9	5·58	0·8	6·4		
Forked River.	39 50	74 18	1876·5	6·05	1·3	7·4	C. J. Moore.	
Woodbury.	39 51	75 10	1887·8	6·03	0·9	6·9	J. H. Cook.	
Haddonfield.	39 53	75 02	1887·8	6·17	0·9	7·1		
Seaside Park.	39 55	74 05	1887·9	6·93	0·7	7·6		
Camden.	39 56	75 06	1887·8	6·17	0·9	7·1		
Whitings.	39 57	74 23	1887·9	7·15	0·7	7·8		
Browns Mills.	39 58	74 35	1885·8	6·88	0·8	7·7		
Smithville.	39 59	74 45	1885·8	6·53	1·0	7·5		
Mount Holly, average.	40 00	74 47	1890·5	7·17	0·7	7·9	H. S. Haines.	Letter to Office.
New Egypt.	40 04	74 32	1887·9	6·93	0·7	7·6	J. H. Cook.	
Columbus.	40 04	74 42	1885·8	7·25	0·7	8·0		
Ellisdale.	40 07	74 35	1885·8	6·75	0·7	7·4		
Sea Girt.	40 08	74 03	1887·9	7·15	0·7	7·8		
Bordentown.	40 09	74 43	1885·8	7·05	0·8	7·8		
Imlaystown.	40 10	74 31	1765·8	4·75	....	....		
Trenton.	40 13	74 44	1887·8	7·22	0·7	7·9		
Hamilton.	40 14	74 40	1885·8	6·97	0·8	7·8		
Freehold.	40 16	74 16	1887·9	7·25	0·7	8·0		
Hightstown.	40 16	74 32	1887·8	7·30	0·7	8·0		
Red Bank.	40 20	74 04	1887·9	7·38	0·7	8·1		
Princeton.	40 21	74 40	1887·9	7·25	0·7	8.0		
Jamesburg.	40 21	74 27	1887·5	7·42	....	8·2	H. M. Thomas.	
Seabright.	40 22	73 59	1884·7	7·20	0·8	8·0	G. H. Blakely.	
Lambertville.	40 22	74 56	1887·9	7·05	0·7	7·8	J. H. Cook.	
Morganville.	40 23	74 14	1887·9	7·58	0·7	8·3		
Blawenburg.	40 25	74 43	1887·9	7·60	0·7	8·3		
Perth Amboy.	40 30	74 16	1885·5	7·72	0·8	8·5	G. H. Blakely.	
Middlebush.	40 30	74 32	1884·9	7·22	0·8	8·0	G. H. Blakely.	
Flemington.	40 31	74 51	1887·9	7·23	0·7	7·9	J. H. Cook.	
Frenchtown.	40 32	75 04	1887·9	+7·17	+0·7	+7·9		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW JERSEY—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Cushetunk.	40 36	74 49	1883·8	+7·48	+0·9	+8·4		
Somerville.	40 37	74 34	1887·9	7·33	0·7	8·0		
Plainfield, Two Crest Station.	40 38	74 27	1887·9	8·00	0·7	8·7		
Pattenberg.	40 38	75 01	1887·8	6·88	0·7	7·6		
Lebanon.	40 39	74 49	1887·8	7·81	0·7	8·5	J. H. Cook.	
Valley Station.	40 40	75 02	1887·8	6·75	0·7	7·4		
Gillette.	40 41	74 28	1887·9	7·89	0·7	8·6		
Glen Gardner and High Bridge.	40 42	74 56	1887·8	7·64	0·7	8·3		
Phillipsburg.	40 42	75 10	1887·8	6·17	0·7	6·9		
Jersey City.	40 43	74 04	1871·4	7·92	1·6	9·5	D. E. Culver.	
Morris & Somerset Co.'s boundary line.	40 43	74 44	1893·96	8·00	0·4	8·4	E. A. Bowser.	Letter to Office.
Newark and Harrison.	40 45	74 09	1887·8	7·70	0·7	8·4		
West Hoboken.	40 46	74 02	1887·8	9·14	0·7	9·8		
Orange.	40 46	74 15	1887·9	8·05	0·7	8·8		
Secaucus.	40 47	74 03	1887·8	8·75	0·7	9·4		
Morristown.	40 47	74 29	1887·9	8·58	0·7	9·3		
Chester.	40 47	74 42	1887·8	7·93	0·7	8·6		
Cook's Bridge and Hanover.	40 48	74 22	1887·9	8·02	0·7	8·7		
Livingston.	40 48	74 19	1887·9	8·17	0·7	8·9		
Bartley, top of ridge.	40 49	74 41	1887·8	8·48	0·7	9·2	J. H. Cook.	
Schooley Mountain.	40 50	74 48	1887·8	6·42	0·7	7·1		
Belvidere.	40 50	75 05	1887·8	5·53	0·8	6·3		
Hackettstown.	40 51	74 50	1887·8	6·76	0·7	7·5		
Budd's Lake.	40 52	74 43	1880·0	6·70	1·2	7·9		
Linwood, average, top of Palisades.	40 53?	73 57?	1887·8	9·05	0·7	9·8		
Hackensack and Teaneck.	40 53	74 02	1887·8	7·98	0·7	8·7		
Paterson.	40 53	74 10	1887·8	6·62	1·8	8·4	A. A. Fonda & T. Ryerson.	
Dover.	40 53	74 34	1887·8	8·65	0·7	9·4		
Englewood, near Nordhoff.	40 54	73 58	1887·8	8·48	0·7	9·2		
Boonton.	40 54	74 24	1887·9	8·27	0·7	9·0		
Warrenville.	40 54	74 50	1881·7	6·00	1·3	7·3		
Lake Hopatcong, Bertrand and Shippenport.	40 55	74 40	1884·8	8·34	1·0	9·3	J. H. Cook.	
Allamuchy, west side of village.	40 55	74 49	1887·8	8·30	0·7	9·0		
Fairlawn & north of Hawthorn Station.	40 57	74 08	1887·8	7·98	0·7	8·7		
High Mountain, trap ridge.	40 58	74 12	1883·6	9·05	1·0	10·0	A. A. Tittsworth.	
Lake Hopatcong.	40 58	74 38	1887·8	8·20	0·7	8·9		
Prompton.	40 59	74 19	1887·8	9·27	0·7	10·0		
Andover.	40 59	74 44	1881·7	6·42	1·2	7·6	J. H. Cook.	
Blairstown.	40 59	74 58	1887·8	7·42	0·7	8·1		
Bearfort Mountain	41 01	74 24	1882·6	8·00	1·1	9·1		
Hardwick.	41 01	74 56	1886·3	7·18	0·8	8·0	A. H. Konkle.	
Newfoundland, Green Pond, and Oak Ridge.	41 03	74 28	1887·8	7·81	0·7	8·5	H. Chamberlain.	
Newton.	41 03	74 45	1887·9	7·28	0·7	8·0	A. H. Konkle.	
Darlington.	41 05	74 13	1879·6	9·67	1·2	10·9	J. H. Cook.	
Franklin Furnace.	41 06	74 33	1887·8	+7·37	+0·7	+8·1		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW JERSEY—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Mahwah.	41 07	74 10	1887·8	+8·52	+0·7	+9·2	J. H. Cook.	
Monroe.	41 07	74 38	1887·8	7·05	0·7	7·8		
Hamburg.	41 08	74 35	1882·8	7·07	1·1	8·2		
Greenwood.	41 09	74 22	1887·8	8·10	0·7	8·8		
Culver's Gap.	41 11	74 47	1887·8	7·41	0·7	8·1		
State Line.	41 12	74 21	1874·6	6·63	1·6	8·2		
Vernon.	41 12	74 30	1887·8	6·69	0·7	7·4		
Near Wawayanda Mines.	41 13	74 24	1874·6	5·15	1·6	6·8	E. A. Bowser.	
Deckertown.	41 13	74 36	1887·8	7·48	0·7	8·2	J. H. Cook.	
Layton.	41 13	74 50	1887·8	7·30	0·7	8·0		
Mount Salem.	41 19	74 37	1887·8	7·65	0·7	8·4		
High Point.	41 19	74 40	1887·8	7·83	0·7	8·5		
Montague.	41 19	74 48	1887·8	7·22	0·7	7·9		
Tri-State Rock.	41 21	74 42	1887·8	+7·83	+0·7	+8·5		

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Group I.								
Deming.	32 17	107 50	1888·90	−12·77	+0·5	−12·3	J. B. Baylor.	
Fort Craig.	33 38	107 01	1888·89	12·43	0·5	11·9		
Albuquerque.	35 04	106 39	1888·88	13·17	0.4	12·8		
Santa Fe, Fort Marcy.	35 41	105 57	1895·24	12·56	0·2	12·4	E. Smith.	C. & G. S. archives.
Fort Union.	35 54	105 01	1888·87	−13·42	+0·3	−13·1	J. B. Baylor.	
Group II.								
San Luis Springs.	31 20	108 48	1855·3	−11·75	+0·8	−11·0	W. H. Emory.	
International Boundary Station 5.	31 20	108 12	1892·5	12·05	0·3	11·8	J. F. Hayford.	C. & G. S. archives.
International Boundary Station 6.	31 20	108 38	1892·5	11·89	0·3	11·6		
International Boundary Station 7.	31 20	108 52	1892·6	12·23	0·3	11·9		
Agua del Perro.	31 21	108 20	1855·3	11·97	0·8	11·2	W. H. Emory.	
Intersection Point, boundary.	31 46	106 50	1855·7	11·67	0·8	10·9		
Initial Point of Boundary, near El Paso.	31 47	106 28	1855·1	11·92	....	11·5		
International Boundary Station 2.	31 47	107 22	1892·3	10·28	0·3	10·0	J. F. Hayford.	C. & G. S. archives.
International Boundary Station 3.	31 47	107 44	1892·3	11·94	0·3	11·6		
International Boundary Station 4.	31 47	108 12	1892·4	12·01	0·3	11·7		
Carrizalillo.	31 51	107 56	1855·2	12·03	0·8	11·2	W. H. Emory.	
Doña Aña.	32 22	106 45	1851·5	12·12	0·7	11·4		
Fort Cummings.	32 27	107 40	1873·5	12·50	0·9	11·6	S. E. Tillman.	
Fort Selden.	32 29	106 55	1870·41	12·65	0·9	11·8		
Hudson's Hot Springs, Mimbres	32 33	108 00	1878·5	12·50	0·8	11·7	Eng'r Officer.	
Apache Tejo.	32 38	108 08	1878·5	12·70	0·8	11·9		
Copper Mines.	32 48	108 04	1851·5	11·37	0·7	10·7	W. H. Emory.	
Fort Bayard, ast. monument.	32 48	108 09	1878·5	−12·93	+0·8	−12·1	Eng'r Officer.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW MEXICO—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
San Francisco River.	33 12	108 52	1873·5	−13·52	+0·9	−12·6		
Water Hole.	33 13	108 46	1873·5	13·50	0·9	12·6		
San Francisco River.	33 15	108 52	1873·5	12·86	0·9	12·0	R. L. Hoxie.	
San Francisco River.	33 26	108 55	1873·5	13·82	0·9	12·9		
Fort Stanton, flagstaff.	33 30	105 32	1878·5	12·40	0·8	11·6	Eng'r Officer.	
Tulerosa Fort.	33 53	108 30	1873·5	13·30	0·8	12·5	R. L. Hoxie.	
Oak Spring.	34 03	108 55	1873·5	12·58	0·8	11·8		
Initial Point of New Mexico meridian.	34 17	106 50	1855·3	12·75	0·8	12·0		
Fort Sumner.	34 25	104 08	1866·1	13·75	0·9	12·8	— — Shinn.	
Estancia Ranch & Spring.	34 45	106 04	1876·5	12·72	0·8	11·9	Engr. Officer.	
Antelope Spring.	34 50	106 04	1875·5	13·43	0·8	12·6		
Isleta.	34 54	106 40	1853·85	13·22	0·7	12·5	J. C. Ives.	
Topographic Camp near Ojo Caliente.	34 57	109 00	1873·5	13·97	0·8	13·2	R. L. Hoxie.	
Rio San José.	35 01	107 14	1853·86	13·77	0·7	13·1		
Cedar Forest.	35 01	108 55	1853·90	13·02	0·7	12·3		
Agua Fria.	35 02	107 58	1853·88	13·42	0·7	12·7	J. C. Ives.	
Inscription Rock.	35 03	108 14	1853·88	12·95	0·7	12·2		
Covero.	35 05	107 26	1853·87	13·82	0·7	13·1		
Hay Camp.	35 05	107 39	1853·87	13·93?	0·7	13·2		
Albuquerque, flagstaff, Plaza.	35 06	106 41	1876·5	13·75	0·8	13·0	Engr. Officer.	
Zuni River.	35 06	108 39	1853·89	13·40	0·7	12·7	J. C. Ives.	
Nutria Springs.	35 18	108 33	1873·5	14·27	0·8	13·5	R. L. Hoxie.	
Fort Bascom.	35 24	103 50	1856·5	12·83	0·8	12·0		
Fort Wingate, near flagstaff.	35 29	108 32	1873·5	14·86	0·8	14·1	R. L. Hoxie & L. Nell.	
Magnetic Station.	35 40	106 50	1855·5	13·67	0·8	12·9		
Mora River.	35 59	105 19	1874·5	14·67	0·8	13·9	C. E. Blunt.	
Coyote Creek.	36 08	105 14	1874·5	14·25	0·8	13·4		
Ocate River.	36 10	105 00	1874·5	14·25	0·8	13·4		
Embuda.	36 11	105 54	1874·5	13·25	0·8	12·4	R. Birnie.	
Abiquin.	36 12	106 19	1874·5	13·90	0·8	13·1		
Ojo Caliente Creek.	36 17	106 02	1874·5	13·25	0·8	12·4		
Wermejo Creek.	36 42	104 47	1874·5	14·50	0·8	13·7	C. E. Blunt.	
Tierra Amarilla.	36 42	106 33	1873·5	13·71	0·8	12·9		
Line, Col. and New Mex.	37 00	105 07	1873·5	−14·02	+0·8	−13·2	W. L. Marshall.	

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Group I.								
Cole, Staten Island.	40 32	74 14	1846·35	+5·62	+3·4	+9·0	J. Locke.	
Far Rockaway, Long Isd.	40 36	73 46	1875·59	7·20	1·2	8·4	J. M. Poole.	
Fire Isd. West Base.	40 38	73 13	1860·66	7·76	2·0	9·8	C. A. Schott.	
Howard.	40 38	74 05	1840·49	5·02	3·5	8·5	S. C. Rowan.	
Mount Prospect.	40 40	73 58	1860·73	6·73	2·2	8·9	C. A. Schott.	
Babylon, Long Isd.	40 42	73 20	1875·62	7·58	1·1	8·7	J. M. Poole.	
New York City.	40 43	74 00	.....	....	...	9·1		
Patchogue, Long Isd.	40 45	73 02	1875·58	8·01	1·3	9·3	J. M. Poole.	
West Hills, Long Isd.	40 49	73 26	1865·62	+7·02	+1·8	+8·8	E. Goodfellow.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW YORK—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Legget.	40 49	73 54	1847·80	+ 5·68	+2·8	+ 8·5	R.H. Fauntleroy.	
Riverside Park.	40 49	73 58	1885·79	9·00	0·9	9·9	J. B. Baylor.	
Manhattanville, Bloomingdale Asylum.	40 50	73 56	1846·33	5·16	3·0	8·2	J. Locke.	
West Hampton.	40 51	72 34	1875·64	8·67	1·1	9·8	J. M. Poole.	
Ruland, Long Isd.	40 51	73 02	1865·40	7·51	1·7	9·2	E. Goodfellow.	
Oyster Bay, Long Isd.	40 52	73 32	1844·71	6·84	2·9	9·7	J. Renwick.	
Sands Pt. Lt. Ho.	40 52	73 44	1847·77	6·16	2·7	8·9	R.H. Fauntleroy.	
New Rochelle.	40 52	73 47	1844·69	5·49	3·0	8·5	J. Renwick.	
Drowned Meadow.	40 56	73 04	1845·70	6·06	3·2	9·3	J. Renwick.	
Lloyd Harbor, Long Isd.	40 56	73 25	1844·71	6·19	3·2	9·4	J. Renwick.	
East Hampton.	40 58	72 12	1875·64	9·09	1·5	10·6	J. M. Poole.	
Sag Harbor.	41 00	72 17	1860·68	8·46	2·6	11·1	C. A. Schott.	
Port Chester.	41 00	73 40	1844·70	5·97	3·2	9·2	J. Renwick.	
Duer.	41 00	73 54	1873·62	7·62	1·5	9·1	J. H. Cook.	
Montauk Point.	41 04	71 51	1875·66	9·75	1·5	11·2	J. M. Poole.	
Greenport.	41 06	72 21	1845·63	7·24	3·6	10·8	J. Renwick.	
Buttermilk.	41 07	73 49	1833·47	3·93	3·5	7·4	F. R. Hassler.	
Bald Hill.	41 13	73 29	1833·56	5·57	4·2	9·8	F. R. Hassler.	
Carpenter's Point, Port Jarvis.	41 21	74 42	1873·47	7·08	1·5	8·6	E. Smith.	
Cold Spring.	41 25	73 58	1855·66	5·57?	2·6	8·2	C. A. Schott.	
Binghampton.	42 05	75 56	1888·50	7·82	0·8	8·6	J. B. Baylor.	
Bath, park.	42 21	77 21	1862·61	4·80	3·2	8·0	C. A. Schott.	
Oxford.	42 26	75 40	1885·73	7·72	...	8·6	J. B. Baylor.	
Ithaca, Cornell University grounds.	42 27	76 29	1890·82	6·52	...	7·5	J. B. Baylor.	
Albany, Dudley Observatory, old site.	42 40	73 45	1890·77	10·17	...	11·1	J. B. Baylor.	
Sherburne.	42 41	75 33	1875·67	7·82	1·5	9·3	J. M. Poole.	
Otsego.	42 47	74 42	1882·63	8·77	1·1	9·9	J. B. Baylor.	
Buffalo.	42 55	78 54	1885·71	5·07	...	6·0	J. B. Baylor.	
Fenner.	42 57	75 45	1882·76	7·26	1·2	8·5	J. B. Baylor.	
Howlett.	43 00	76 17	1883·66	7·78	1·1	8·9	J. B. Baylor.	
Clinton, Hamilton College.	43 03	75 24	1874·82	8·09	1·8	9·9	T. C. Hilgard.	
Clyde.	43 03	76 52	1883·72	7·07	1·1	8·2	J. B. Baylor.	
Loomis.	43 21	76 17	1882·86	8·17	1·3	9·5	J. B. Baylor.	
Pen Mount.	43 23	75 16	1882·64	8·54	1·3	9·8	J. B. Baylor.	
Prospect.	43 26	73 45	1882·60	10·85	1·1	12·0	J. B. Baylor.	
Mannsville.	43 43	76 03	1884·44	6·85	1·2	8·0	J. B. Boutelle.	
Pierrepont Manor.	43 44	76 03	1874·80	6·20	...	8·8	T. C. Hilgard.	
Potsdam.	44 37	75 00	1874·79	9·42	1·7	11·1	T. C. Hilgard.	
Rouse Point.	45 00	73 21	1879·75	+13·65	+1·3	+15·0	J. B. Baylor.	
Group II.								
Jamaica.	40 41	73 56	1835·5	+ 4·00?	...	....		
Cold Spring, L. I.	40 52	73 28	1897·2	9·44	...	+ 9·3	E. Jones.	Letter to Office.
East Hampton.	41 00	72 19	1834·84	6·13	+4·0	10·1		
Palisades, average top of trap ridge & Tappan, west foot of Palisades.	41 01	73 56	1887·8	8·49	0·7	9·2	E. A. Bowser.	
Ramapo, top of High Torn.	41 08	74 09	1883·6	9·33	1·0	10·3	A. A. Titzworth.	N. J. Geol. Survey, 1887.
Sloatsburg, boundary survey.	41 09	74 11	1874·6	7·70	1·5	9·2	E. A. Bowser.	
Liberty Corner.	41 17	74 31	1874·6	6·75	1·5	8·2	E. A. Bowser.	
Unionville.	41 18	74 34	1874·6	+ 6·05	+1·5	+ 7·6	E. A. Bowser.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

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NEW YORK—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Monroe.	41 21	74 11	1859·5	+6·63	+2·2	+ 8·8	T. B. Brooks.	
West Point.	41 25	73 56	1835·7	6·52	3·5	10·0	C. Davis.	
North Salem.	41 26	73 38	1843·5	6·00	3·1	9·1		
Travis, near Initial Pt.	42 00	75 21	1882·55	7·50	1·1	8·6	H. W. Clarke.	
Finn, near milestone 20.	42 00	75 46	1877·81	7·37	1·4	8·8		
Waverly, near milestone 60.	42 00	76 32	1877·64	5·52	1·4	6·9		
New Preemption Line, milestone 82.	42 00	76 58	1795·5	2·17	5·0	7·2	B. Ellicott.	
Pa. Line, 109½ miles W. of Del.	42 00	77 28	1787·5	1·87	4·8	6·7	S. De Witt, and other obs'rs.	
Pa. Line 136⅝ miles W. of Del.	42 00	78 05	1787·5	0·75	4·8	5·6		
Pa. Line, 195⅛ miles W. of Del.	42 00	79 09	1787·5	0·92	5·0	5·9		
Madalin.	42 03	73 54	1878·00	8·77	1·3	10·1	G. Cooke.	
Downsville.	42 03	74 59	1890·49	7·70	0·5	8·2	E. W. Lindsley.	Letter to Office.
New Preemption Line, 6 miles.	42 05	76 58	1795·5	1·58	5·0	6·6	B. Ellicott.	
Ancram.	42 06	73 37	1853·5	7·65	2·9	10·6	J. T. Hogeboom.	
Owego.	42 06	76 16	1868·5	5·37	2·4	7·8	S. Camp.	
New Preemption Line, Chemung River.	42 07	76 58	1795·5	2·08	5·0	7·1	B. Ellicott.	
Livingston.	42 10	73 52	1888·5	9·52	0·7	10·2	R. Hood.	
Holland Land Co.	42 10	78 15	1798·5	1·15	5·2	6·4	A. Porter.	
" " "	42 10	78 23	1798·5	1·02	5·2	6·2	J. Smedley.	
New Preemption Line, 14 miles.	42 12	76 58	1795·5	2·67	5·0	7·7	B. Ellicott.	
Holland Land Co.	42 13	78 09	1799·0	0·86	5·2	6·1	A. Atwater & S. Benton, jr.	
Hudson.	42 15	73 48	1888·5	9.52	0·7	10·2	R. Hood.	
Holland Land Co.	42 15	78 22	1798·5	1·20	5·2	6·4	J. Smedley.	
Delhi.	42 15	74 57	1883·95	7·51	1·0	8·5	E. W. Lindsley.	Letter to Office.
Maysville.	42 16	79 40	1874·59	+2·25	1·6	3·8	F. E. Hilgard.	
Chautauqua Lake, near Fredonia, 15 miles off.	42 16	79 30	1798·58	−0·59	5·1	4·5	Surveyor of Holland Land Co.	" " "
Ellicottville.	42 18	78 44	1841·62	+2·60	3·8	6·4	A. D. Bache.	
Holland Land Co.	42 19	79 08	1798·5	−0·75	5·1	4·4	A. Atwater.	
Lampman.	42 20	73 48	1880·7	+9·37	1·2	10·6	J. T. Gardner.	
Preemption Line, 23¼ miles.	42 20	76 58	1795·5	1·96	5·0	7·0	B. Ellicott.	
Holland Land Co.	42 20	78 40	1799·5	1·45	5·2	6·6	A. Atwater.	
Westfield.	42 20	79 36	1875·71	3·18	1·5	4·7	F. M. Towar.	
Bath.	42 21	77 21	1879·5	5·27	1·4	6·7	H. F. De Puy.	
Guilford.	42 23	75 29	1838·51	4·50	4·2	8·7		
Fredonia.	42 26	79 22	1891·5	4·20	...	4·6	E. S. Ely.	Letter to Office.
Old Kana-andoa.	42 27	78 00	1798·5	1·00	5·2	6·2	A. Porter.	
New Preemption Line, 31½ miles.	42 28	76 58	1795·5	2·17	5·0	7·2	B. Ellicott.	
Dunkirk.	42 29	79 21	1850·6	1·33	...	4·6	N. Y. & E. R. R. Eng'r.	Letter to Office.
Holland Land Co.	42 30	78 06	1798·5	+1·13	5·2	6·3	A. Atwater.	
" " "	42 31	79 03	1798·5	−0·85	5·1	4·2		
Preemption Line, 37 miles.	42 32	76 58	1795·5	+1·75	5·0	6·8	B. Ellicott.	
Cass & Clarksville.	42 34	73 58	1877·9	8·75	1·4	10·2	J. T. Gardner.	
Milo.	42 35	77 02	1878·5	7·25	1·6	8·8		
Preemption Line, 41½ miles.	42 36	76 58	1795·5	+2·33	+5·0	+ 7·3	B. Ellicott.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW YORK—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Gorham Purchase.	42 36	78 03	1798·5	+0·87	+5·2	+6·1	G. Burgess.	
Summit & Holmes.	42 37	74 33	1877·9	8·88	1·4	10·3	J. T. Gardner.	
Slingerland.	42 38	73 52	1877·9	8·75	1·4	10·2		
Helderberg.	42 38	74 01	1877·7	8·75	1·4	10·2		
Homer.	42 38	76 11	1840·81	5·08	4·2	9·3		
Gardeau Reservation.	42 38	77 51	1798·68	1·58	5·2	6·8	A. Porter.	
Holland Land Co.	42 39	78 13	1799·5	0·45	5·2	5·6	J. Dewey.	
" " "	42 39	78 23	1798·5	1·90	5·4	7·3	J. Smedley.	
Penn Yan.	42 40	77 05	1887·42	7·30	1·0	8·3	L. F. Billinger & Guy Sterling.	Letter to Office.
Preemption Line, 47¼ miles.	42 41	76 58	1795·5	2·00	5·0	7·0	B. Ellicott.	
Sears & Mann.	42 42	74 17	1877·9	9·12	1·4	10·5	J. T. Gardner.	
Knowersville & Winn.	42 43	74 02	1877·9	8·88	1·4	10·3		
Holland Land Co.	42 43	78 13	1798·5	0·62	5·4	6·0	A. Atwater.	
Hamburg.	42 43	78 49	1892·5	3·50	0·5	4·0	E. S. Nott.	Letter to Office.
Troy.	42 44	73 40	1827·5	6·08	4·7	10·8		
Freleigh and Niskayuna.	42 46	73 49	1877·9	9·62	1·4	11·0	J. T. Gardner.	
Conover, Chapman and Oak Ridge.	42 47	74 17	1879·3	9·13	1·3	10·4		
Cherry Valley.	42 48	74 47	1839·63	5·22	4·1	9·3		
Schenectady, Union College.	42 49	73 55	1859·2	7·96	2·7	10·7	T. B. Brooks.	
Hamilton.	42 49	75 34	1837·8	4·50	4·2	8·7		
Holland Land Co.	42 50	78 19	1799·5	0·35	5·4	5·8	J. Dewey.	
" " "	42 51	78 11	1799·5	1·08	5·4	6·5		
New Preemption Line, 60 miles.	42 52	76 58	1795·5	1·75	5·0	6·8	B. Ellicott.	
Geneva.	42 52	77 05	1833·75	3·82	4·6	8·4		
Cooks Point, Canandaigua Lake.	42 52?	77 17	1888·42	6·96	0·9	7·9	J. C. Dowling & J. F. Hayford.	Letter to Office.
Canajoharie.	42 53	74 35	1839·80	6·08	4·1	10·2		
Van Atten.	42 54	74 00	1877·9	10·25	1·4	11·6	J. T. Gardner.	
Fort Erie.	42 54	78 59	1839·5	1·25	4·7	6·0	Chart.	
Cazenovia.	42 55	75 51	1843·47	3·87	4·4	8·3		
Auburn.	42 55	76 28	1833·82	3·72	4·9	8·6		
Tassel.	42 56	75 19	1879·6	8·15	1·2	9·4	J. T. Gardner.	
New Preemption Line, 65 miles.	42 56	76 58	1795·5	2·08	5·6	7·7	B. Ellicott.	
Nellis, Reman & Willett.	42 57	74 38	1880·8	9·10	1·2	10·3	J. T. Gardner.	
Ostrander.	42 57	74 48	1880·7	9·10	1·2	10·3		
Hoxsie & Seeley.	42 57	76 22	1878·6	6·33	1·6	7·9		
Strawberry Island.	42 57	78 55	1875·54	4·00	1·9	5·9	F. Terry.	
Shoemaker & Yule.	42 58	74 54	1879·6	8·54	1·3	9·8	J. T. Gardner.	
Clapp & Green.	42 58	76 02	1878·6	7·09	1·6	8·7		
Johnstown.	43 00	74 23	1818·90	6·03	5·1	11·1		
Cossitt.	43 00	76 12	1878·6	6·77	1·6	8·4	J. T. Gardner.	
Grand Island.	43 00	79 01	1875·62	2·97	1·9	4·9	A. C. Lamson.	
Vedder.	43 01	74 39	1880·7	9·13	1·2	10·3	J. T. Gardner.	
Eagle.	43 01	75 55	1878·6	7·28	1·6	8·9		
Tanner.	43 01	76 34	1878·5	3·82	1·6	5·4?		
Bulger & Cranson.	43 02	75 43	1879·5	7·27	1·5	8·8		
Getman, Herkimer, & Jackson.	43 02	75 00	1879·6	8·43	1·4	9·8		
Prospect & Eaton.	43 02	75 30	1879·5	8·26	1·5	9·8		
Little Falls.	43 03	74 52	1880·7	7·35	1·4	8·8		
Merry.	43 03	75 10	1879·6	8·63	1·4	10·0		
Kirkville.	43 04	75 56	1879·5	+7·05	+1·5	+8·6		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW YORK—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Tonawanda Reservation.	43 04	78 22	1799·1	+ 1·50	+5·7	+ 7·2	J. Thompson.	
Tonawanda.	43 04	78 56	1875·57	3·83	1·9	5·7	A. C. Lamson.	
Niagara Falls.	43 04	79 04	1874·58	3·62	1·9	5·5	F. E. Hilgard.	
Allis & Canastota.	43 05	75 46	1879·5	7·52	1·5	9·0	J. T. Gardner.	
Utica.	43 06	75 13	1835·5	3·88	4·9	8·8		
Collamer.	43 06	76 04	1879·5	7·33	1·5	8·8	J. T. Gardner.	
Davison.	43 06	76 17	1878·6	6·57	1·5	8·1		
Suspension Bridge, Niagara.	43 07	79 03	1875·54	2·40	1·9	4·3	F. M. Towar.	
Barto.	43 08	74 53	1879·6	9·52	1·4	10·9	J. T. Gardner.	
Rochester.	43 08	77 39	1876·5	5·68	1·8	7·5	L. L. Nichols.	
Gorham Purchase.	43 08	78 01	1798·5	1·03	5·7	6·7	G. Burgess.	
Orleans Co.	43 09	78 16	1888·88	6·07	0·8	6·9	D. D. Waldo.	
Schuyler.	43 10	75 07	1879·6	8·93	1·4	10·3	J. T. Gardner.	
Williams.	43 10	75 13	1879·6	8·97	1·4	10·4		
New Preemption Line at Lake Ontario.	43 10	76 58	1795·5	2·17	5·5	7·7	B. Ellicott.	
Charlotte.	43 13	77 40	1875·43	4·53	1·9	6·4	F. M. Towar.	
Rome.	43 14	75 28	1879·5	7·87	1·5	9·4	J. T. Gardner.	
High Dune.	43 15	75 04	1883·55	9·45	1·3	10·8	V. Colvin.	
Vienna.	43 15	75 41	1879·5	8·40	1·5	9·9	J. T. Gardner.	
Jerseyfield Lake.	43 16	74 44	1883·52	8·84	1·3	10·1	V. Colvin.	
Service's Patent, NE. corner and Oneida Co.	43 16	75 04	1883·55	9·87	1·3	11·2		
Great Sodus.	43 16	76 58	1875·40	6·83	1·6	8·4	J. Eisenmann.	
Lyon Point.	43 16	77 26	1875·42	6·07	1·8	7·9	F. Terry.	
Holland Land Co.	43 16	78 43	1799·5	0·50	5·8	6·3	S. Benton, jr.	
Mouth of Niagara River.	43 16	79 04	1875·53	3·68	1·9	5·6	F. M. Towar.	
Luzerne.	43 17	73 50	1883·58	10·92	1·0	11·9	V. Colvin.	
Six miles west of Little Sodus.	43 18	76 49	1874·77	6·83	1·6	8·4	J. Eisenmann.	
East Porter.	43 18	78 55	1875·45	3·27	1·9	5·2		
Little Sodus.	43 19	76 43	1874·82	7·05	1·6	8·6	F. Terry.	
Morehouseville.	43 20	74 45	1883·59	8·38	1·3	9·7	V. Colvin.	
Braddock Pt. and Olcott Harbor.	43 20	78 43	1875·45	4·24	1·9	6·1	A. C. Lamson.	
At Lake Ontario.	43 21	78 01	1799·5	1·00	5·7	6·7		
Oak Orchard.	43 22	78 12	1875·52	3·77	1·8	5·6	F. Terry.	
Stony Creek Station and Station south of Thurman.	43 23	73 51	1883·58	11·34	1·0	12·3	V. Colvin.	
Piseco Lake P. O.	43 24	74 33	1883·60	11·02	1·2	12·2		
Oswego.	43 25	76 34	1797·5	3·00	5·5	8·5	S. De Witt.	
Meyer Hill.	43 26	75 04	1883·54	7·58	1·3	8·9	V. Colvin.	
Thurman Depot.	43 27	73 48	1883·58	11·33	1·0	12·3		
Near Warrensburg.	43 30	73 44	1883·60	11·00	1·0	12·0		
At the Glen.	43 33	73 51	1883·59	13·12	1·0	14·1		
Port Ontario.	43 34	76 12	1874·72	8·15	1·6	9·8	F. M. Towar.	
Johnsburg.	43 36	73 57	1883·59	10·70	1·0	11·8	V. Colvin.	
West Canada Lakes	43 36	74 36	1772·5	6·90	5·3	12·2		
Horicon and Starbuckville.	43 37	73 45	1883·60	10·53	1·0	11·5	V. Colvin.	
Gommer Hill.	43 37	75 26	1883·54	8·87	1·3	10·2		
Riverside.	43 38	73 52	1883·59	9·92	1·0	10·9		
Near outlet of Schroon Lake.	43 41	73 48	1883·59	9·77	1·0	10·8		
Sandy Creek.	43 42	76 12	1874·72	7·83	2·0	9·8	F. Terry.	
Lowville.	43 48	75 35	1821·5	4·50	6·1	10·6	J. Clark.	
Stony Creek.	43 49	76 16	1874·72	+ 8·38	+2·0	+10·4	J. Eisenmann.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NEW YORK—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.'	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
North Creek.	43 50	73 58	1883·59	+11·57	+1·1	+12·7	V. Colvin.	
Stony Island.	43 52	76 20	1874·53	6·30	2·0	8·3	J. Eisenmann.	
Snowshoe Bay.	43 53	76 14	1874·68	7·33	2·0	9·3		
Gallop Island.	43 54	76 25	1874·59	7·47	2·0	9·5		
Crown Point.	43 55	73 27	1838·5	8·78	4·2	13·0		
Sacket Harbor.	43 57	76 07	1874·49	9·77	2·0	11·8	J. Eisenmann.	
Peninsula Point.	43 58	76 16	1874·67	8·28	2·0	10·3	J. R. Mayer.	
Near the mountain.	44 01	73 50	1838·5	8·27	4·2	12·5		
Le Rayville.	44 01	75 44	1826·44	5·75	5·9	11·6		
Crown Point.	44 02	73 25	1879·5	9·62	1·1	10·7	V. Colvin.	
West Moriah & Small Pond.	44 02	73 39	1838·5	7·16	4·2	11·4		
East Moriah & Cedar Point.	44 03	73 30	1838·5	9·82	4·2	14·0		
Mount Dix.	44 05	73 47	1879·5	9·96	1·1	11·1	V. Colvin.	
Bald Peak.	44 06	73 29	1879·5	11·99	1·1	13·1		
Mount Marcy.	44 07	73 55	1879·5	10·71	1·1	11·8		
Jefferson County.	44 09	75 37	1794·60	2·67	6·8	9·5	P. Pharoux.	
Keene Valley.	44 10	73 46	1883·5	11·54	0·9	12·4	V. Colvin.	
Clear Pond.	44 10	73 57	1883·73	9·83	0·9	10·7		
Mount Hurricane.	44 14	73 42	1879·5	9·15	1·1	10·2		
Moosehead Mtn.	44 14	74 38	1883·64	9·40	1·1	10·5		
Plessis.	44 16	75 55	1858·4	7·58	3·5	11·1	J. Clark.	
Upper Saranac Lake.	44 19	74 15	1883·62	10·78	1·1	11·9	V. Colvin.	
Alexandria Bay.	44 20	75 56	1872·71	7·00	2·2	9·2	A. C. Lamson.	
Dial Mountain.	44 21	73 49	1838·5	8·34	3·7	12·0		
Wellesley Island.	44 21	76 01	1873·62	8·58	2·2	10·8	F. M. Towar.	
Whiteface Mountain.	44 22	73 54	1879·5	10·99	0·9	11·9	V. Colvin.	
Rossie.	44 22	75 43	1839·5	6·72	5·6	12·3	A. Hopkins.	
Picnic Island.	44 22	75 52	1872·76	7·93	2·4	10·3	F. M. Towar.	
Bog Mountain.	44 23	74 44	1883·64	5·95	1·0	7·0		
St. Regis Lakes & St. Regis Mountain.	44 24	74 17	1881·56	10·35	1·1	11·4	V. Colvin.	
Munger at Raquette Station.	44 25	74 45	1883·64	10·12	1·0	11·1		
Keeseville.	44 28	73 32	1838·5	8·67	3·7	12·4		
Mt. Azure.	44 28	74 28	1883·71	9·65	1·0	10·6	V. Colvin.	
Chippewa Point.	44 29	75 46	1872·63	7·70	2·4	10·1	F. M. Towar.	
Cotton Village.	44 32	74 54	1883·64	9·57	1·0	10·6	V. Colvin.	
Two miles NE. of Oak Pt.	44 32	75 43	1872·63	11·00	2·4	13·4	A. C. Lamson.	
Norway Mountain.	44 34	73 41	1879·5	12·27	1·0	13·3	V. Colvin.	
Four miles SW. of Ogdensburg.	44 40	75 33	1871·77	9·60	2·4	12·0	A. C. Lamson.	
Lyon Mountain.	44 42	73 52	1879·5	12·44	1·0	13·4	V. Colvin.	
Ragged Lake.	44 42	74 00	1883·72	14·97	0·8	15·8		
Plattsburg, NE. of breakwater.	44 45	73 24	1870·76	10·87	1·5	12·4	J. L. Gillespie.	
Rand Hill.	44 46	73 36	1879·5	11·34	1·0	12·3	V. Colvin.	
La Motte.	44 50	73 20	1879·5	13·36	1·0	14·4		
Malone, Low's Pinnacle.	44 50	74 15	1883·63	12·47	0·8	13·3		
West Chazy.	44 52	73 25	1838·5	9·35	4·9	14·2		
Goose Neck Island.	44 55	75 07	1871·45	9·65	2·5	12·2	A. C. Lamson.	
St. Regis, Indian Village.	44 59	74 39	1883·69	10·50	0·8	11·3	V. Colvin.	
Champlain, near Rouses Point.	45 00	73 26	1838·5	9·50	4·9	14·4		
Massena Pt., Polly's Gut.	45 00	74 26	1871·50	+10·62	+2·5	+13·1	A. C. Lamson.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NORTH CAROLINA.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Smithville, Fort Johnson.	33 55	78 01	1887·20	+1·13	+0·5	+1·6		
Wilmington.	34 13	77 56	1891·37	1·27	0·3	1·6		
Lake Waccamaw.	34 18	78 33	1891·36	0·69	0·3	1·0		C. & G. S. archives.
Fair Bluff.	34 19	78 58	1891·36	0·61	0·3	0·9	J. B. Baylor.	
Burgaw, Court Ho. Square.	34 31	77 53	1891·38	0·89	0·3	1·2		
Beaufort.	34 43	76 40	1880·03	1·74	0·9	2·6		
Warsaw.	34 59	77 56	1891·39	1·58	0·3	1·9		"
Portsmouth Island.	35 04	76 03	1871·25	2·37	1·4	3·8	A. T. Mosman.	
Newbern, National Cemetery.	35 07	77 03	1887·22	1·91	...	2·6		
Kinston, near College.	35 16	77 31	1891·40	1·54	0·3	1·8		"
Goldsboro.	35 23	77 52	1891·40	1·28	0·3	1·6	J. B. Baylor.	"
Washington.	35 32	76 56	1891·43	2·22	0·3	2·5		"
Wilson.	35 43	77 47	1891·42	1·70	0·3	2·0		"
Raleigh, near Capitol.	35 47	78 38	1887·23	1·30	0·5	1·8		
Bodies Island.	35 48	75 32	1846·99	1·22	2·9	4·1	C. O. Boutelle.	
Jamesville.	35 48	76 47	1891·44	2·15	0·4	2·5	J. B. Baylor.	"
Sand Island.	35 50	75 40	1876·08	2·98	1·2	4·2	E. Smith.	
Tarboro.	35 53	77 30	1891·42	2·94	0·4	3·3	J. B. Baylor.	"
Edenton, Court Ho.	36 02	76 32	1891·44	2·87	0·4	3·3		"
Poore.	36 03	81 09	1895·68	0·43	0·3	0·7	A. H. Buchanan.	"
Shellbank.	36 04	75 44	1847·24	+1·75	2·9	+4·6	C. O. Boutelle & G. Davidson.	
Roan, High Bluff.	36 06	82 09	1894·81	−0·56	0·3	−0·3	A. H. Buchanan.	"
Stevenson Point.	36 06	76 11	1847·10	+1·66	2·9	+4·6	C. O. Boutelle.	
Elizabeth City.	36 18	76 06	1891·45	3·72	0·4	4·1	J. B. Baylor.	"
Weldon.	36 27	77 25	1887·24	2·51	0·6	3·1		
Nottaway River, Riddicksville.	36 32	76 56	1887·17	2·50	0·6	3·1		
N. C. & Va. boundary, Knott Isd.	36 33	75 56	1887·06	3·55	0·6	4·2	C. H. Sinclair.	
N. C. & Va. boundary, NW.	36 33	76 12	1886·99	+2·90	+0·6	+3·5		
Group II.								
Charlotte.	35 14	80 46	1873·58	−1·06	+1·5	+0·4	F. E. Hilgard.	
Wimble Shoals.	35 34	75 24	1738·5	+4·00	2·0?	+6·0?		
Asheville.	35 35	82 30	1873·60	−1·97	1·5	−0·5		
Salisbury.	35 40	80 20	1873·58	−0·87	1·5	+0·6	F. E. Hilgard.	
Morganton.	35 47	81 30	1873·59	−1·18	1·5	+0·3		
Greensboro.	36 04	79 40	1873·57	−0·72	+1·5	+0·8		

NORTH DAKOTA.

Group I.								
Bismarck, Court-House Grounds.	46 48	100 47	1890·58	−15·25	+0·6	−14·6	R. A. Marr.	C. & G. S. archives.
Jamestown.	46 54	98 43	1896·43	12·46	0·2	12·3		
Dickinson.	46 54	102 44	1896·44	16·20	0·2	16·0		
Williston.	48 09	103 38	1896·52	16·96	0·2	16·8	R. L. Faris.	C. & G. S. archives.
Rugby.	48 22	99 56	1896·53	13·73	0·2	13·5		
Pembina.	48 58	97 14	1896·54	−11·33	+0·2	−11·1		
Group II.								
Near Fort Berthold.	47 28	101 50	1860·5	−18·97	+2·0	−17·0	W. F. Raynolds.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

NORTH DAKOTA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Northwest Boundary.	49 00	97 40	1872·5	—15·00	+1·6	—13·4	W. J. Twining.	
Northwest Boundary near Pembina Mts.	49 00	98 00	1872·5	15·17	1·5	13·7		
Northwest Boundary.	49 00	98 10	1872·5	15·50	1·5	14·0		
Northwest Boundary.	49 00	98 30	1872·5	15·54	1·4	14·1		
Northwest Boundary.	49 00	98 45	1872·5	15·25	1·4	13·8		
Northwest Boundary.	49 00	98 55	1872·5	15·67	1·3	14·4		
Northwest Boundary.	49 00	99 02	1872·5	15·83	1.3	14·5		
Northwest Boundary, near Butte.	49 00	100 28	1873·6	16·96	1·2	15·8		
Northwest Boundary.	49 00	100 40	1873·6	17·17	1·1	16·1		
Northwest Boundary.	49 00	101 10	1873·6	17·75	1·1	16·6		
Northwest Boundary.	49 00	102 00	1873·6	18·00	1·0	17·0		
Northwest Boundary.	49 00	102 15	1873·6	18·18	1·0	17·2		
Northwest Boundary, Woodend.	49 00	103 00	1873·6	18·00	0·9	17·1		
Northwest Boundary.	49 00	103 30	1873·7	—18·13	+0·9	—17·2		

OHIO.

Group I.								
South Point.	38 25	82 35	1864·14	—1·88	+2·1	+0·2	A. T. Mosman.	
Cincinnati, Obser'y on Mt. Lookout.	39 08	84 25	1888·58	—1·97	...	—1·3	J. B. Baylor.	C. & G. S. archives.
Athens.	39 20	82 02	1880·93	—0·68	...	+0·4		
Columbus, State Univ. grounds.	40 00	83 00	1891·51	+0·13	+0·5	+0·6		
Cleveland.	41 30	81 42	1891·42	+2·32	...	+2·5	H. F. Reid.	
Group II.								
Portsmouth.	38 48	82 50	1805·5	—5·0	+4·0	—1·0	Public Surveyor.	
Gallipolis.	38 53	82 07	1838·5	2·58	3·6	+1·0	J. Fletcher.	
Mouth of Miami River.	39 08	84 45	1810·5	5·17	3·7	—1·5	J. Mansfield.	
Jackson.	39 15	82 42	1838·5	3·17	3·6	+0·4	O. N. Tyson.	
Eight miles N. of Cincinnati.	39 15	84 25	1873·83	2·68	1·5	—1·2	G. B. Nicholson.	Letter to Office.
Chillicothe.	39 21	82 54	1835·5	3·25	3·8	+0·6	A. Burne.	
Marietta.	39 25	81 28	1850·5	1·42	...	+1·4		
Wilmington.	39 28	83 42	1838·5	4·08	3·4	—0·7	D. Wickersham.	
Oxford.	39 30	84 38	1845·6	4·83	3·0	—1·8	J. Locke.	
Springboro.	39 31	84 16	1838·5	4·07	3·4	—0·7	E. Baily.	
Washington.	39 34	83 21	1838·5	3·10	3·4	+0·3	J. Bell.	
Carrollton.	39 38	84 09	1845·7	4·76	3·0	—1·8	J. Locke.	
Springfield.	39 54	83 47	1835·5	4·50	3·6	—0·9	—— Dutton.	
New Madison.	39 56	84 37	1838·5	4·85	3·4	—1·4	J. Jaqua.	
Batesville.	39 58	81 11	1838·5	1·37	3·6	+2·2	M. Atkinson.	
Zanesville.	39 58	82 04	1838·5	—2·50	3·6	+1·1	J. Boyle.	
Columbus.	40 00	83 01	1893·76	+0·35	+0·3	+0·7	E. A. Kemmler.	Letter to Office.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

OHIO—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Saint Clairsville.	40 10	80 52	1838·5	−2·52	+3·6	+1·1	J. C. Moore.	
Tuscarawas.	40 24	81 50	1874·63	+0·33	1·5	+1·8	F. E. Hilgard.	
Coshocton.	40 28	81 57	1838·5	−1·50	3·6	+2·1	J. W. Sweeney.	
Dover.	40 31	81 29	1838·5	−1·83	3·6	+1·8	H. V. Beeson.	
Marion.	40 35	83 09	1838·5	−3·28	3·4	+0·1	S. Holmes.	
Carrollton.	40 36	81 09	1838·5	−0·50	3·6	+3·1	—— Van Brown.	
Sandy.	40 37	81 28	1810·5	−2·17	4·2	+2·0	E. Buckingham.	
Kenton.	40 39	83 37	1838·5	−5·28	3·3	−2·0	J. H. Ross.	
Wooster.	40 49	81 58	1840·5	−1·78	3·5	+1·7	C. W. Christmas.	
New Lisbon.	40 50	80 49	1880·5	+1·48	1·2	+2·7	J. B. Strawn.	
Forest.	40 50	83 28	1874·64	−2·30	1·4	−0·9	F. E. Hilgard.	
Ohio and Pa. State Line, 75 miles south of Lake Erie.	40 53	80 31	1880·4	+1·92	1·2	+3·1	J. B. Strawn.	
Chippewa.	40 55	81 48	1810·5	−2·60	4·2	1·6	J. Mansfield.	
Kalida.	40 59	84 14	1838·5	3·00	3·3	0·3	E. B. Fitch.	
Western Reserve, SE. corner, and Poland,	41 00	80 31	1810·5	1·35	4·1	2·8	J. Mansfield.	
Canfield.	41 00	80 50	1810·5	1·62	4·1	2·5		
Berlin.	41 00	81 03	1810·5	1·80	4·1	2·3		
Atwater.	41 00	81 21	1810·5	2·07	4·1	2·0		
Portage.	41 00	81 31	1838·5	1·25	3·4	2·2	— Mallison.	
Suffield.	41 00	81 34	1810·5	2·37	4·1	1·7	J. Mansfield.	
Coventry.	41 00	81 48	1810·5	2·32	4·1	1·8		
Norton.	41 00	81 53	1810·5	2·50	4·1	1·6		
Seneca.	41 00	83 20	1810·5	3·95	4·1	0·2		
Tallmadge.	41 06	81 28	1806·5	1·00	4·2	3·2	S. S. Ensign.	
Akron, 4 miles N. of it.	41 10	81 33	1797·54	2·03	4·2	2·2	M. Warren.	
Youngstown.	41 12	80 46	1796·6	1·45	4·2	2·8	A. Spofford.	
Brookfield.	41 14	80 37	1837·5	0·67	3·6	2·9	G. Boyse.	
Braceville.	41 14	81 03	1838·5	0·83	3·6	2·8	F. E. Stowe.	
Hudson.	41 15	81 26	1840·5	0·87	3·2	+2·3	E. Loomis.	
Defiance.	41 15	84 23	1810·5	4·50	4·2	−0·3	J. Mansfield.	
Streetsboro.	41 17	81 22	1821·4	2·08	4·0	+1·9	R. Cowles.	
Flat Rock.	41 18	84 12	1838·5	3·23	3·6	0·4	W. C. Brownell.	
Lower Sandusky.	41 21	83 09	1838·5	2·80	3·6	0·8	— De Reeves.	
Aurora, north line.	41 23	81 18	1796·66	1·37	4·2	2·8	S. Pease.	
Huron.	41 25	82 35	1877·37	0·48	1·3	0·8	F. Terry.	
Vermilion.	41 26	82 21	1876·80	0·47	1·3	0·8	F. M. Towar.	
Sandusky.	41 27	82 45	1872·42	0·92	1·6	0·7	A. C. Lamson.	
Kinsman, north line.	41 28	80 37	1796·63	1·50	4·0	2·5	S. Pease.	
Black River.	41 28	82 10	1876·82	0·28	1·3	1·0	F. Terry.	
On Pa. Line, 34 miles N.	41 29	80 31	1796·59	1·62	4·0	2·4	M. Halley.	
Mesopotamia, north line.	41 29	81 00	1796·63	2·37	4·1	1·7	S. Pease.	
South Newbury, north line.	41 29	81 18	1796·64	−1·33	4·2	2·9		
Rocky River.	41 29	81 52	1876·75	+0·18	1·2	1·4	F. M. Towar.	
Sandusky, Sand Point.	41 30	82 43	1877·41	−0·62	1·2	0·6	A. C. Lamson.	
Rapids of Maumee.	41 30	83 30	1810·5	−2·80	4·2	1·4	J. Mansfield.	
Avon Point.	41 31	82 01	1876·77	+0·60	1·2	1·8	F. M. Towar.	
Port Clinton.	41 31	82 58	1877·54	−0·78	1·2	0·4	F. Terry.	
Mayfield, SE. corner.	41 32	81 26	1796·66	−1·05	4·2	3·2	S. Pease.	
Euclid.	41 34	81 34	1876·7	+1·17	1·2	2·4	F. Terry.	
Chardon.	41 35	81 15	1838·5	−0·25	3·2	3·0	R. Cowles.	
Catawba Island.	41 35	82 50	1877·53	0·67	1·2	0·5	A. C. Lamson.	
Kelley Island.	41 36	82 44	1877·46	0·65	1·2	0·6		
Locust Point.	41 36	83 06	1877·55	−0·67	+1·2	+0·5	F. M. Towar.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

OHIO—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′	°	°	°	°		
Bass Islands.	41 39	82 44	1846·3	−2·38	+3·1	+0·7	Chart.	
Green Island.	41 39	82 52	1845·64	−2·57	3·2	0·6	J. C. Woodruff.	
Willoughby.	41 40	81 26	1876·70	+1·85	1·2	3·0	F. M. Towar.	
Toledo, meridian line.	41 40	83 34	1891·09	+0·97	0·5	1·5	— Wilhelm.	
Kirtland, NE. corner.	41 41	81 21	1796·66	−1·00	4·2	3·2	S. Pease.	
North Bass Island.	41 42	82 48	1877·40	1·22	1·2	0·0	F. M. Towar.	
Mouth of Maumee River, east side.	41 42	83 26	1862·64	1·58	2.2	0·6	W. H. Hearding.	
Bloomfield.	41 43	81 00	1796·63	2·00	4·2	2·2	S. Pease.	
Mentor.	41 43	81 22	1796·66	−1·83	4·2	2·4	M. Halley.	
Cedar Point, Maumee Bay.	41 43	83 20	1877·55	+0·17	1·2	1·4	A. C. Lamson.	
Cedar Point, Maumee Bay.	41 43	83 31	1844·5	−2·27	3·4	1·1	J. H. Simpson.	
West Sister Island.	41 44	83 06	1847·5	−2·33	3·2	0·9	Chart.	
Fairport.	41 45	81 16	1876·70	+2·00	1·2	3·2	A. C. Lamson.	
14 miles south of Lake Erie.	41 47	80 31	1796·5	−0·88	4·2	3·3	A. Porter.	
Denmark.	41 47	80 45	1796·69	1·50	4·2	2·7	M. Halley.	
East Sister Isle.	41 49	82 51	1847·5	−2·30	3·2	0·9		
Madison.	41 50	81 02	1876·47	+1·98	1·2	3·2	F. M. Towar.	
On Penna. Line, 60 miles north.	41 52	80 31	1796·60	−1·88	4·2	2·3	M. Halley.	
Red Creek.	41 53	80 51	1876·64	+2·00	1·2	3·2	A. C. Lamson.	
Ashtabula.	41 55	80 48	1876·47	+1·77	1·2	3·0	A. C. Lamson.	
North Kingsville.	41 56	80 41	1876·46	+1·27	+1·2	+2·5	F. M. Towar.	

OKLAHOMA TERRITORY.

[No Magnetic Station.]

OREGON.

Group I.	° ′	° ′		°	°	°		
Jacksonville.	42 18	122 58	1881·54	−17·41	−0·2	−17·6	J. S. Lawson.	
Ewing Harbor.	42 44	124 30	1851·89	18·50	1·3	19·8	G. Davidson.	
Canyonville.	42 54	123 18	1881·55	17·81	0·2	18·0	J. S. Lawson.	
Loggie.	43 21	124 10	1889·70	20·58	0·1	20·7		
Ross.	43 21	124 11	1889·70	20·52	0·1	20·6		
Fossil 2.	43 21	124 19	1889·88	20·27	0·1	20·4		
North Spit.	43 22	124 20	1889·87	20·18	0·1	20·3		
Pigeon 2.	43 22	124 19	1889·85	20·10	0·1	20·2		
Coos River.	43 22	124 10	1889·69	20·10	0·1	20·2		
White Point 2.	43 22	124 12	1889·79	19·12	0·1	19·2		
Marshfield Hill.	43 22	124 14	1889·78	18·10	0·1	18·2		
Crawford 2.	43 23	124 12	1889·68	19·35	0·1	19·4		
Pierce.	43 24	124 12	1889·68	17·47	0·1	17·6	E. F. Dickins.	C. & G. S. archives.
Cemetery.	43 24	124 17	1889·85	20·05	0·1	20·2		
Empire 2.	43 24	124 17	1889·85	20·02	0·1	20·1		
Pest.	43 24	124 18	1889·87	20·10	0·1	20·2		
Simpson.	43 25	124 14	1889·76	19·18	0·1	19·3		
North Bend 2.	43 25	124 14	1889·68	18·73	0·1	18·8		
Pony.	43 25	124 16	1889·85	19·75	0·1	19·8		
Hutchinson 2.	43 25	124 17	1889·86	19·98	0·1	20·1		
North Slough.	43 26	124 15	1889·85	19·62	0·1	19·7		
Mabry.	43 26	124 13	1889·65	−18·55	−0·1	−18·6		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

OREGON—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Oakland.	43 26	123 18	1881·56	—19·69	—0·2	—19·9	J. S. Lawson.	
Ten Mile Knoll.	43 53	124 09	1887·45	20·87?	0·2	21·1	E. F. Dickins.	
Cannery Hill.	44 00	124 07	1887·47	21·40?	0·2	21·6		
Eugene.	44 03	123 05	1881·56	20·80	0·4	21·2	J. S. Lawson.	
Mary Peak.	44 31	123 29	1877·79	20·86	0·6	21·5	G. Davidson.	C. & G. S. archives.
Yaquina.	44 36	124 01	1888·36	20·30	0·2	20·5	R. A. Marr.	
Albany.	44 39	123 02	1881·57	21·70	0·4	22·1	J. S. Lawson.	
Yaquina Point Lt. Ho.	44 40	124 04	1885·33	20·84	0·3	21·1	F. Morse.	
Salem.	44 56	122 58	1881·58	19·97	0·4	20·4	J. S. Lawson.	
Portland, Custom House.	45 31	122 41	1895·14	22·41	....	22·5	J. J. Gilbert.	
Three Mile Creek, near Dalles.	45 39	120 58	1881·78	21·05	0·4	21·4	J. S. Lawson.	
Blalock.	45 44	120 15	1881·77	20·35	0·2	20·6		
Saint Helen.	45 52	122 48	1881·62	19·13	—0·4	19·5		
Umatilla.	45 57	119 20	1881·76	21·54	+0·2	21·3		
Rainier.	46 05	122 56	1886·50	23·75	—0·1	23·8	G. Davidson.	
Astoria.	46 12	123 50	1881·61	—22·44	—0·2	—22·6	J. S. Lawson.	
Group II.								
Canyonville.	42 54	123 18	1885·5	—19·4	—0·2	—19·6	W. Thiel.	
Camp Harney.	43 00	119 00	1876·1	18·38	0·2	18·6	R. P. P. Wainwright.	
Cape Blanco, near and north of.	43 06	124 18	1792·31	16·0	....	....	G. Vancouver.	
Lake Watumpi.	43 16	119 15	1859·51	18·17	0·5	18·7	J. Dixon.	
Stillwater Slough.	43 25	118 48	1859·52	18·17	0·5	18·7		
Oakland.	43 26	123 18	1888·5	19·62	0·1	19·7	W. Thiel.	
Surprise Creek.	43 37	118 38	1859·52	18·42	0·5	18·9	J. Dixon.	
Ford of Owyhee River.	43 47	116 58	1859·71	18·07	0·5	18·6		
Malheur River, left bank.	43 49	117 20	1859·54	18·25	0·5	18·8		
Rock Creek Canyon.	43 56	118 07	1859·53	18·50	0·5	19·0		
Crooked River Canyon.	44 03	120 00	1859·49	18·67	0·5	19·2		
Birch Creek, Snake River.	44 16	117 26	1859·73	18·15	0·5	18·6		
Willow Creek.	44 27	120 53	1859·47	18·92	0·9	19·8		
Cape Foulweather, near.	44 42	124 07	1792·31	18·00	....	....	G. Vancouver.	
Crossing of Des Chutes.	44 47	121 00	1859·44	19·25	1·0	20·2	J. Dixon.	
Oak Grove Creek.	45 06	121 15	1859·44	19·33	1·0	20·3		
Grande Ronde Valley.	45 16	117 43	1859·75	18·33	0·5	18·8		
Grande Ronde River.	45 20	117 57	1859·75	19·00	0·5	19·5		
Near Cape Lookout.	45 20	124 00	1789·51	16·08	....	....	J. Meares.	
Lee's Encampment, Blue Mountains.	45 33	118 21	1859·75	19·33	0·5	19·8	J. Dixon.	
Three Mile Creek, near Fort Dalles.	45 34	121 06	1859·42	19·75	1·0	20·8		
Umatilla River, near McRay's Agency.	45 41	118 40	1859·77	—20·04	—0·5	—20·5		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

PENNSYLVANIA.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Philadelphia, Hospital.	39 57	75 12	1895·70	+7·18	+0·3	+7·5	J. B. Baylor.	C. & G. S. archives.
Philadelphia, Girard College.	39 58	75 10	1890·84	6·52	....	7·7		
Yard.	39 58	75 23	1854·82	6·70	3·3	10·0	J. E. Hilgard.	
Johnson Tavern.	40 00	79 48	1862·58	1·23	2·1	3·3	C. A. Schott.	
Bristol, Vanuxem.	40 07	74 53	1846·52	4·46	3·7	8·2	J. Locke.	
Harrisburg.	40 16	76 53	1895·72	6·10	....	6·0	J. B. Baylor.	
Pittsburg & Allegheny.	40 28	80 01	1885·65	2·93	0·7	3·6		
Bethlehem, Lehigh Univ.	40 37	75 23	1874·47	5·32	....	7·2	T. C. Hilgard.	
Williamsport.	41 14	77 02	1862·62	4·43	+2·9	7·3	C. A. Schott.	
Erie, Marine Hospital.	42 09	80 05	1885·70	+3·14	....	+4·2	J. B. Baylor.	
Group II.								
Warren Point.	39 43	78 02	1893·55	+4·37	+0·5	+4·9	A. S. Winger.	Letter to Office.
Pa. Boundary, ½ mile north of SW. corner.	39 44	80 31	1883·48	0·67	0·9	1·6	F. L. Hoge.	"
Irwin Mill, near Mercersburg.	39 47	77 56	1840·65	+0·91	4·2	5·1	A. D. Bache.	
Pa. Boundary, 5 miles due north of SW. corner.	39 48	80 31	1785·45	—2·05	3·5	1·4	A. Ellicott.	Copied from original notebook.
Gettysburg.	39 49	77 15	1866·6	+3·50	2·6	6·1	County Surveyors.	
2 miles south of Rock Lick.	39 52	80 31	1883·47	0·60	0·9	1·5	F. L. Hoge.	Letter to Office.
Uniontown.	39 54	79 43	1884·28	3·30	0·8	4·1	A. J. Gilmore.	
Waynesburg.	39 54	80 12	1877·8	2·17	1·2	3·4	County Surveyors.	
Pa. Boundary, 12 miles north.	39 54	80 31	1883·45	0·60	0·9	1·5	F. L. Hoge.	"
McConnellsburg.	39 55	77 59	1893·22	4·75	0·5	5·2	A. S. Winger.	"
Chambersburg, near county meridian.	39 56	77 39	1893·30	4·53	....	5·0		
Westchester.	39 57	75 40	1878·3	+5·87	1·7	7·6	County Surveyors.	
Pa. Boundary, about 16½ miles north.	39 57	80 31	1785·49	—1·50	3·5	2·0	A. Ellicott.	Copied from original notebook.
York.	39 58	76 44	1876·9	+4·90	1·4	6·3	County Surveyors.	
Pa. Boundary, 19 and 20 miles north.	39 59	80 31	1785·50	—1·31	3·5	2·2	A. Ellicott.	"
Bedford.	40 01	78 30	1883·3	+3·57	1·3	4·9	County Surveyors.	
Somerset.	40 01	79 04	1883·3	3·33	1·0	4·3		
Upper Strasburg.	40 03	77 41	1892·20	4·38	0·6	5·0	J. B. Kaufman.	Letter to Office.
Greenfield.	40 06	79 52	1874·62	+2·04	1·4	3·4	F. E. Hilgard.	
Pa. Boundary, 26 miles north.	40 06	80 31	1785·5	—1·30	3·5	2·2	A. Ellicott.	Copied from original notebook.
Norristown.	40 07	75 19	1855·29	+4·73	3·3	8·0	County Surveyors.	
Hopewell.	40 07	78 17	1876·62	+3·18	1·8	5·0		
Norritonville.	40 10	75 26	1770·5	3·13	4·5	7·6	W. Smith.	
Rices Hill, near West Alexander, 30·9 miles north of corner.	40 10	80 31	1883·44	1·18	0·9	2·1	F. L. Hoge.	Letter to Office.
Washington.	40 11	80 13	1876·9	+2·00	+1·3	+3·3	County Surveyors.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

PENNSYLVANIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Hatboro.	40 12	75 07	1850·5	+4·42	....	+8·0	E. W. Beans.	
Carlisle.	40 12	77 11	1883·77	+4·25	+1·0	5·2	County Surveyors.	
Pa. Boundary, 37 miles north.	40 15	80 31	1785·46	—1·12	3·5	2·4	A. Ellicott.	Copied from original notebook.
Doylestown.	40 18	75 10	1885·3	+7·08	1·0	8·1	County Surveyors.	G. W. Hayes, letter to Office.
Greensburg.	40 19	79 32	1884·80	3·12	0·8	3·9		
Lebanon.	40 20	76 26	1883·5	5·18	1·1	6·3		
Johnstown.	40 20	78 53	1875·68	2·33	1·5	3·8		
Gardners Hill, 44½ miles north of corner.	40 22	80 31	1883·43	+1·82	0·9	2·7	F. L. Hoge.	Letter to Office.
Pa. Boundary, 47½ miles north.	40 24	80 31	1785·4	—0·67	3·5	2·8	A. Ellicott.	Copied from original notebook.
Hollidaysburg.	40 28	78 23	1885·8	+4·00	0·9	4·9	County Surveyors.	
Pittsburg.	40 28	80 01	1887·7	+3·01	0·6	3·6	D. Carhart.	
Pa. Boundary, 51 miles north.	40 28	80 31	1785·6	—0·96	3·5	2·5	A. Ellicott.	"
Pa. Boundary, 53 miles north.	40 29	80 31	1785·6	—0·83	3·5	2·7		
Huntingdon.	40 31	78 02	1885·98	+4·63	....	5·6	County Surveyors.	
Altoona.	40 31	78 23	1874·54	+2·78	1·8	4·6	F. E. Hilgard.	"
Pa. Boundary, 57 miles north.	40 33	80 31	1785·6	—1·04	3·5	2·5	A. Ellicott.	
South Bethlehem.	40 36	75 23	1894·66	+7·05	....	7·2	M. Merriman.	Letter to Office.
Allentown.	40 36	75 28	1878·2	5·08	1·6	6·7	County Surveyors.	
Lewiston.	40 36	77 35	1876·8	3·60	1·4	5·0		
Indiana.	40 37	79 10	1857·61	1·20	2·7	3·9	W. G. Waring.	
Tyrone.	40 40	78 16	1879·21	3·80	1·4	5·2	County Surveyors.	
Beaver Co., Ohio line.	40 40	80 31	1878·6	1·37	1·4	2·8	A. D. Bache.	
Easton.	40 42	75 15	1841·56	3·63	4·1	7·7	Boundary Commission of 1878.	
Meridian Station, west boundary of State.	40 43	80 31	1879·5	1·52	1·3	2·8	County Surveyors.	
Beaver.	40 44	80 19	1883·74	1·70	....	2·8	Boundary Commission of 1878.	
Meridian Station, west boundary of State.	40 45	80 31	1879·5	1·65	1·3	3·0		
Meridian Station.	40 49	80 31	1879·5	1·90	1·3	3·2		
Sunbury.	40 52	76 50	1884·54	+5·17	0·8	6·0	County Surveyors.	
Pa. Boundary, 79 miles north.	40 52	80 31	1785·7	—0·29	3·5	3·2	A. Ellicott.	Copied from original notebook.
Bellefonte.	40 54	77 48	1855·5	+2·50	3·1	5·6	County Surveyors.	
Butler.	40 54	79 50	1885·83	2·05	0·8	2·8	B. F. Hilliard.	
Portland.	40 55	75 06	1887·8	+7·08	0·8	7·9	G. H. Cook.	
Lewisburg.	40 58	77 12	1884·8	+4·95	0·8	5·8	County Surveyors.	
Curwinsville.	40 58	78 36	1841·58	1·75	4·0	5·8	A. D. Bache.	
Water Gap House.	40 59	75 08	1887·8	6·60	0·8	7·4	G. H. Cook.	
Mountain Home.	41 00	75 30	1883·85	7·00	1·1	8·1	County Surveyors.	
New Castle.	41 01	80 19	1883·87	+1·83	1·0	2·8		
Pa. Boundary, 90 miles north.	41 01	80 31	1785·7	—0·32	3·5	3·2	A. Ellicott.	Copied from original notebook.
Morrisdale.	41 02	78 08	1870·81	+2·70	2·1	4·8	County Surveyors.	
Meridian Station, west boundary of State.	41 07	80 31	1879·5	+1·78	+1·3	+3·1	Boundary Commission of 1878.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

PENNSYLVANIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Brookville.	41 10	79 07	1885·3	+3·42	+0·9	+4·3	County Surveyors.	
Dingman.	41 13	74 52	1884·8	6·22	1·0	7·2	G. H. Cook.	
Meridian Station, west boundary of State.	41 13	80 31	1879·5	1·78	1·3	3·1	Boundary Commission of 1878.	
Clarion.	41 14	79 24	1876·5	2·33	1·5	3·8	County Surveyors.	
Mercer.	41 14	80 16	1853·95	0·92	2·9	3·8		
Williamsport.	41 15	77 03	1878·5	5·25	1·3	6·6		
Sharpsville.	41 17	80 27	1874·59	1·00	1·6	2·6	F. E. Hilgard.	
Meridian Station, west boundary of State.	41 17	80 31	1878·5	1·70	1·4	3·1	Boundary Commission of 1878.	
Milford.	41 21	74 48	1883·77	6·00	1·1	7·1	County Surveyors.	
Heiner Run.	41 21	77 48	1856·5	3·32	3·0	6·3	S. Tyndale.	
Ridgway.	41 26	78 43	1855·5	1·50	3·1	4·6	County Surveyors.	
Cameron Co.	41 27	78 12	1883·87	4·50	1·0	5·5		
Honesdale.	41 35	75 17	1876·8	6·75	1·5	8·2		
Meadville.	41 39	80 09	1884·85	3·13	0·9	4·0		
Towanda.	41 47	76 30	1855·5	4·33	3·0	7·3		
Montrose.	41 50	75 57	1877·9	7·10	1·3	8·4		
Warren.	41 50	79 12	1883·3	3·67	1·0	4·7		
Bloomfield.	41 50	79 50	1883·85	3·25	1·0	4·2		
Silver Lake.	41 57	76 02	1841·64	4·50	4·2	8·7	A. D. Bache.	
North Terminal Monument, Pa. & Ohio Line.	41 58	80 31	1878·5	2·73	1·3	4·0	Boundary Commission of 1878.	
Little Meadows; N. Y. & Pa. Line at 39½ milestone.	42 00	76 08	1883·70	7·47	1·2	8·7	H. W. Clarke.	
New York Line, Bradford Co.	42 00	76 30	1877·5	5·53	1·7	7·2	County Surveyors.	
Burt, N. Y. & Pa. Line, west of milestone 69.	42 00	76 44	1882·68	6·07	1·2	7·3	H. W. Clarke.	
N. Y. & Pa. Line, ¼ mile west of milestone 90.	42 00	77 08	1877·73	5·25	1·8	7·0		
N. Y. & Pa. Line, Tioga Co.	42 00	77 12	1876·5	5·43	1·8	7·2	County Surveyors.	
N. Y. & Pa. Line; Station near milestones 167 & 168.	42 00	78 38	1879·52	4·02	1·5	5·5	H. W. Clarke.	
Monument N. Y. & Pa. Line, near milestone 171.	42 00	78 42	1799·50	1·00	5·0	6·0	B. Ellicott.	
Meridian Boundary, N. Y. & Pa.; milestone 18 & Clark.	42 00	79 46	1885·12	3·41	0·9	4·3	H. W. Clarke.	
North Springfield.	42 00	80 29	1875·77	3·05	1·5	4·6	J. Eisenmann.	
Meridian Boundary, N. Y. & Pa.; milestones 16 & 17.	42 02	79 46	1885·55	3·38	0·9	4·3	H. W. Clarke.	
Avonia.	42 03	80 18	1875·77	2·03	1·5	3·5	F. M. Towar.	
Meridian Boundary, N. Y. & Pa.; milestones 13, 14, & 15.	42 04	79 46	1885·57	+3·54	+0·9	+4·4	H. W. Clarke.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

PENNSYLVANIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Fairview.	42 05	80 27	1838·5	+0·00	+3·9	+3·9	H. H. Sherwood.	
Meridian Boundary, N. Y. & Pa.; milestones 10, 11, & 12.	42 06	79 46	1885·57	3·48	0·9	4·4	H. W. Clarke.	
Meridian Boundary, N. Y. & Pa.; milestones 7, 8, & 9.	42 08	79 46	1885·58	3·59	0·9	4·5		
Meridian Boundary, N. Y. & Pa.; milestones 4, 5, & 6.	42 11	79 46	1885·58	3·70	0·9	4·6		
Meridian Boundary, N. Y. & Pa.; milestone 3.	42 13	79 46	1885·58	3·77	0·9	4·7		
North East.	42 15	79 50	1875·73	2·90	1·5	4·4	J. Eisenmann.	
Boundary Stone N. Y. & Pa.; at Lake Erie.	42 16	79 46	1869·71	+2·58	+1·9	+4·5	C. H. F. Peters.	

RHODE ISLAND.

Group I.								
Watch Hill.	41 19	71 51	1847·72	+7·56	+3·4	+11·0	R.H.Fauntleroy.	
Point Judith.	41 22	71 29	1847·68	9·00	3·2	12·2		
Coasters Harbor.	41 30	71 20	1896·47	11·46	0·1	11·6	G. R. Putnam.	C. & G. S. archives.
McSparran.	41 30	71 27	1844·54	8·81	3·3	12·1	A. D. Bache & T. J. Lee.	
Spencer.	41 41	71 30	1844·62	9·10	3·3	12·4	T. J. Lee.	
Providence, near Brown University.	41 50	71 24	1895·63	11·59	....	12·0	J. B. Baylor.	
Beaconpole.	42 00	71 27	1844·86	+9·45	+3·3	+12·8	T. J. Lee.	
Group II.								
Sakonnet River.	41 27	71 12	1775·5	+6·00	+5·7	+11·7		
Newport.	41 28	71 20	1832·5	+8·20	+3·8	+12·0	A. S. Wadsworth.	

SOUTH CAROLINA.

Group I.								
Graham, Hilton Head Id.	32 13	80 46	1870·20	−1·92	+1·8	−0·1	C. O. Boutelle.	
Port Royal.	32 18	80 38	1859·09	3·07	2·4	−0·7		
Beaufort.	32 26	80 40	1875·37	1·97	1·4	−0·6		
Edisto Id. East Base.	32 33	80 14	1850·26	−2·89	2·9	0·0	G. Davidson.	
Sullivan Isd., Breach Inlet.	32 46	79 49	1895·43	+0·32	0·2	+0·5	J. B. Baylor.	C. & G. S. archives.
Charleston, St. Michael's Ch.	32 47	79 56	.....	....	....	+0·5		
Allston, near Georgetown.	33 22	79 17	1853·98	−2·11	2·6	+0·5	C. O. Boutelle.	
Aiken.	33 32	81 43	1885·97	1·46	0·8	−0·7	J. B. Baylor.	
Columbia.	34 00	81 02	1854·14	−3·04	+2·6	−0·4	G. W. Dean.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

SOUTH CAROLINA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Florence.	34 09	79 43	1891·34	+0·02	+0·3	+0·3	J. B. Baylor.	C. & G. S. archives.
Marion.	34 09	79 20	1891·35	+0·37	+0·3	+0·7	J. B. Baylor.	C. & G. S. archives.
Group II.								
Robertsville.	32 36	81 12	1843·5	−3·42	+3·3	−0·1	W. T. Feay.	
Columbia.	34 00	81 02	1875·48	−1·82	+1·4	−0·4	J. M. Poole.	
Pacolet.	34 51	81 45	1886·36	−1·25	+0·8	−0·4	G. E. Ladshaw.	Letter to Office.

SOUTH DAKOTA.

Group I.								
Yankton.	42 53	97 25	1896·38	−11·18	+0·2	−11·0	R. L. Faris.	C. & G. S. archives.
Mitchell.	43 42	98 01	1896·39	11·67	0·2	11·5	"	C. & G. S. archives.
Huron.	44 21	98 14	1890·29	11·84	0·6	11·2	C. H. Sinclair.	C. & G. S. archives.
Pierre.	44 22	100 22	1896·40	12·74	0·2	12·5	R. L. Faris.	C. & G. S. archives.
Aberdeen.	45 28	98 29	1896·41	−12·30	+0·2	−12·1	"	C. & G. S. archives.
Group II.								
South Cheyenne River.	43 18	103 50	1877·80	−15·50	+1·3	−14·2	W. S. Stanton.	
White River.	43 45	99 45	1860·5	14·83	2·4	12·4	W. F. Raynolds.	
French Creek.	43 46	103 34	1877·79	15·36	1·3	14·1	W. S. Stanton.	
Spring Creek.	43 57	103 12	1877·77	16·36	1·3	15·1	W. S. Stanton.	
Cold Springs.	44 09	104 02	1877·60	15·70	1·3	14·4	W. S. Stanton.	
Fort Pierre.	44 25	100 24	1860·0	14·75	2·4	12·4	W. F. Raynolds.	
Oak Grove.	44 27	103 36	1877·77	16·06	1·3	14·8	W. S. Stanton.	
Spearfish Creek.	44 30	103 51	1877·63	15·44	1·3	14·1	W. S. Stanton.	
Cheyenne River.	44 35	101 25	1859·5	14·50	2·4	12·1	W. F. Raynolds.	
Red Earth Creek.	44 35	103 54	1859·5	17·00	2·4	14·6	W. F. Raynolds.	
Encampment on St. Peters River.	44 41	97 00	1823·5	12·35	....	....	S. H. Long.	
Little Moreau River.	45 18	101 02	1860·5	16·5	+2·4	−14·1	W. F. Raynolds.	
Columbia Fur Co., Fort.	45 39	96 34	1823·5	−12·48	....	....	S. H. Long.	

TENNESSEE.

Group I.								
Chattanooga.	35 01	85 18	1890·43	−2·06	+0·8	−1·3	J. B. Baylor.	C. & G. S. archives.
Grand Junction.	35 05	89 13	1881·69	5·98	1·2	4·8	J. B. Baylor.	"
Memphis.	35 08	90 03	1890·38	5·91	0·6	5·3	J. B. Baylor.	"
Pulaski.	35 13	87 03	1881·65	5·02	1·2	3·8	J. B. Baylor.	"
Tullahoma.	35 22	86 13	1881·59	3·52	1·4	2·1	J. B. Baylor.	"
Clifton.	35 23	88 01	1865·18	5·80	2·1	3·7	A. T. Mosman.	
Athens.	35 27	84 37	1881·55	1·74	1·4	0·3	J. B. Baylor.	
Columbia.	35 37	87 04	1881·63	4·59	1·2	3·4	J. B. Baylor.	
Jackson.	35 39	88 51	1881·71	5·83	1·2	4·6	J. B. Baylor.	
Murfreesboro.	35 53	86 25	1881·61	4·89	1·4	−3·5	J. B. Baylor.	
Knoxville.	35 58	83 55	1890·44	0·58	0·8	+0·2	J. B. Baylor.	"
Johnsonville.	36 04	88 00	1865·19	5·83	2·5	−3·3	A. T. Mosman.	
Big Butt.	36 04	82 38	1893·8	0·65	0·5	0·2	A. H. Buchanan.	"
Rutherford.	36 09	89 01	1881·72	5·99	1·3	4·7	J. B. Baylor.	
Nashville, Vanderbilt University.	36 09	86 48	1888·60	4·52	....	3·6	J. B. Baylor.	
Lebanon.	36 13	86 18	1896·10	−4·04	+0·2	−3·8	A. H. Buchanan.	"

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

TENNESSEE—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	°	° ′		°	°	°		
Caryville.	36 19	84 14	1881·53	—1·20	+1·4	+0·2	J. B. Baylor.	
Fort Henry.	36 30	88 04	1865·19	6·40	2·5	—3·9	A. T. Mosman.	
Bristol.	36 36	82 11	1890·45	—0·13	+0·7	+0·6	J. B. Baylor.	C. & G. S. archives.
Group II.								
Cleveland.	35 10	85 00	1875·46	—3·51	+1·8	—1·7	F. E. Hilgard.	
Edgefield.	36 15	86 46	1871·92	—5·03	2·0	—3·0	T. C. Hilgard.	
Rogersville.	36 25	83 03	1873·63	—1·82	1·9	+0·1	F. E. Hilgard.	
Station near Cumberland Gap.	36 30	83 55	1890·6	+0·10	+0·7	+0·8	O. A. Landreth.	Letter to Office.

TEXAS.

Group I.								
Mouth of Rio Grande, observatory.	25 57	97 09	1853·85	—9·02	+2·0	—7·0	W. H. Emory.	
Peña.	27 19	98 39	1890·08	8·51	0·4	8·1	J. B. Baylor.	C. & G. S. archives.
Laredo, Fort McIntosh.	27 30	99 31	1895·33	8·58	0·2	8·4	E. Smith.	"
Laredo.	27 32	99 31	1890·10	8·80	0·4	8·4	J. B. Baylor.	"
San Diego.	27 46	98 11	1890·08	8·40	0·5	7·9		"
Corpus Christi.	27 48	97 23	1890·05	8·42	0·6	7·8		"
Beeville.	28 23	97 41	1890·06	8·95	0·6	8·4		"
Cotulla.	28 27	99 10	1890·11	8·67	0·6	8·1		"
Port Lavaca.	28 37	96 37	1890·16	8·08	0·6	7·5		"
Eagle Pass.	28 44	100 30	1890·12	9·38	0·6	8·8		"
Jupiter.	28 55	95 21	1853·36	9·14	2·0	7·1	G. W. Dean.	
Columbia.	29 10	95 35	1890·27	7·62	0·7	6·9	J. B. Baylor.	"
Spofford.	29 11	100 25	1890·14	9·23	0·6	8·6		"
Galveston Id., E. Base.	29 13	94 56	1853·21	9·08	2·0	7·1	G. W. Dean.	
Galveston.	29 18	94 47	1895·44	7·33	....	6·9	E. Smith.	
Wharton.	29 18	96 04	1890·19	8·33	0·7	7·6	J. B. Baylor.	"
Dollar Point.	29 26	94 53	1878·41	8·29	1·3	7·0		
San Antonio, observatory.	29 27	98 28	1892·33	8·81	....	8·3	R. E. Halter & L. G. Shultz.	
Hillside Ranch, near San Antonio.	29 29	98 32	1895·07	8·73	....	8·3		
Houston.	29 42	95 20	1890·25	7·94	0·7	7·2	J. B. Baylor.	"
Langtry.	29 48	101 35	1890·14	9·56	0·5	9·1		"
La Grange.	29 53	96 48	1890·23	8·08	0·6	7·5		"
Orange.	30 03	93 43	1890·29	7·16	0·7	6·5		"
Liberty.	30 04	94 50	1890·28	7·82	0·7	7·1		"
Beaumont.	30 05	94 05	1890·29	7·51	0·7	6·8		"
Hempstead.	30 08	96 10	1878·48	8·61	1·2	7·4		
Sanderson.	30 09	102 26	1890·12	10·14	0·4	9·7		"
Austin.	30 17	97 44	1895·37	8·12	....	7·9	E. Smith.	
Sierra Blanca.	31 10	105 35	1888·93	11·30	0·5	10·8	J. B. Baylor.	
Pecos City.	31 26	103 20	1888·94	10·94	0·5	10·4		
Groesbeck.	31 33	96 30	1878·49	9·25	1·0	8·2		
El Paso, City Park.	31 46	106 29	1895·29	11·77	....	11·5	E. Smith.	
Boundary, near El Paso.	31 47	106 31	1892·33	11·89	0·3	11·6	O. B. French.	"
Colorado.	32 22	100 55	1888·94	11·00	0·4	10·6	J. B. Baylor.	
Cisco.	32 23	98 50	1888·95	9·64	0·5	9·1		
Mineola.	32 40	95 20	1888·97	8·12	0·6	7·5		
Fort Worth.	32 45	97 20	1888·96	9·12	0·6	8·5		
Sherman.	33 36	96 36	1878·52	—9·33	+1·3	—8·0		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

TEXAS—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II.	° ′	° ′		°	°	°		
Ringgold Barracks.	26 23	98 43	1853·5	—9·25	+2·0	—7·2	W. H. Emory.	
Pass Cavallo.	28 21	96 24	1879·6	8·33	1·1	7·2	U. S. Engineers.	
Matagorda.	28 41	95 58	1877·5	8·42	1·2	7·2	A. H. Bishop.	
Mouth of Sabine River, Everett's House.	29 44	93 52	1840·1	8·67	2·0	6·7	J. D. Graham.	
Boerne.	29 49	98 39	1892·38	8·93	0·4	8·5	R. K. Croskey.	Letter to Office.
Fredericksburg.	30 16	98 48	1890·2	9·22	0·6	8·6	A. Striegler.	
Willis.	30 27	95 30	1838·5	9·52	2·2	7·3	L. Burnes.	
Brazos.	30 42	96 20	1823·5	10·62	3·0	7·6		
Burnet.	30 44	98 06	1873·88	9·77	1·3	8·5	J. W. Glenn.	
Mouth of Canyon.	31 02	105 37	1852·5	12·02	0·7	11·3	W. H. Emory.	
San Saba.	31 11	98 38	1874·0	10·98	1·3	9·7	J. W. Glenn.	
Cherokee.	31 45	95 00	1835·5	9·33	2·8	6·5		
Frontera.	31 49	106 33	1859·06	12·42	....	11·5	J. H. Clark.	
Longview.	32 29	94 34	1872·29	8·63	1·6	7·0	T. C. Hilgard.	
Fork of Brazos River.	33 00	99 17	1854·5	11·20	2·0	9·2		
Sulphur Springs.	33 08	95 32	1888·4	8·80	0·6	8·2	E. A. Wells.	
West Fork of Trinity River.	33 29	98 52	1854·5	10·28	2·0	8·3	J. Pope.	
Trinity Waters.	33 34	98 15	1854·5	10·45	2·0	8·4	J. Pope.	
Elm Fork of Trinity River.	33 42	97 23	1854·5	—10·60	+2·0	—8·6	J. Pope.	

UTAH.

Group I.								
Mt. Ellen.	38 07	110 49	1891·63	—15·13	+0·3	—14·8	P. A. Welker.	C. & G. S. archives.
Beaver.	38 16	112 38	1885·74	15·50	0·4	15·1	G. F. Bird.	
Tamarac.	38 24	112 24	1885·62	15·62	0·4	15·2	G. F. Bird.	
Tushar.	38 25	112 24	1885·66	15·37	0·4	15·0	G. F. Bird.	
Milford.	38 25	113 00	1885·74	15·22	0·4	14·8	G. F. Bird.	
Mt. Waas.	38 32	109 14	1893·58	14·59	0·3	14·3	R. L. Faris.	"
Warner Ranch.	38 34	109 32	1893·61	15·18	0·3	14·9	R. L. Faris.	"
Wasatch.	39 07	111 27	1890·65	16·63	0·3	16·3	P. A. Welker.	"
Deseret, R. R. station.	39 18	112 38	1884·73	16·17	0·5	15·7	W. Eimbeck & G. F. Bird.	
Scipio.	39 24	112 12	1884·67	16·17	0·5	15·7	W. Eimbeck & G. F. Bird.	
Patmos Head.	39 30	110 19	1890·81	15·90	0·3	15·6	P. A. Welker.	"
Nephi.	39 42	111 51	1883·85	16·45	0·5	16·0	W. Eimbeck & G. F. Bird.	
Mt. Nebo.	39 48	111 46	1887·57	16·29	0·4	15·9	W. Eimbeck & J. H. Turner.	
Provo.	40 15	111 40	1883·86	16·53	0·5	16·0	W. Eimbeck & G. F. Bird.	
Mt. Guyot (Deseret).	40 27	112 37	1892·67	16·72	0·3	16·4	P. A. Welker.	"
Lake shore.	40 40	112 26	1887·79	16·64	0·4	16·2	W. Eimbeck & J. H. Turner.	
Salt Lake, Temple Block & University.	40 46	111 54	1893·43	16·37	....	16·1	R. L. Faris.	
City Creek.	40 48	111 53	1893·42	16·60	0·3	16·3	W. Eimbeck.	"
Waddoup.	40 54	111 53	1892·41	16·58	0·3	16·3	R. L. Faris.	"
Antelope.	40 58	112 13	1892·75	16·30	0·3	16·0	R. L. Faris.	"
Castle Rock.	41 08	111 10	1878·80	16·95	0·5	16·4	J. B. Baylor.	
Ogden, triangulation station.	41 12	111 53	1888·71	17·43	0·4	17·0	J. H. Turner.	
Ogden, U. S. E. Observatory.	41 13	112 00	1886·71	—17·41	+0·4	—17·0	R. A. Marr.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

UTAH—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Promontory.	41 18	112 25	1892·55	—17·12	+0·3	—16·8	P. A. Welker.	C. & G. S. archives.
Corinne.	41 33	112 06	1881·35	17·52	0·5	17·0	W. Eimbeck & R. A. Marr.	
Kelton.	41 45	113 08	1881·34	—17·76	+0·5	—17·3		
Group II.								
Kanab.	37 02	112 32	1872·5	—14·38	+0·5	—13·9	W. L. Marshall & E. P. Austin.	
Saint George.	37 07	113 35	1871·5	16·45	0·5	16·0	Eng'r officer.	
Camp on Virgin River.	37 08	113 20	1872·5	15·48	0·5	15·0	R. L. Hoxie.	
Paria.	37 11	111 53	1872·5	14·50	0·5	14·0	W. L. Marshall.	
Paria River.	37 14	111 56	1872·5	14·22	0·5	13·7	R. L. Hoxie.	
Toquerville.	37 15	113 16	1872·5	16·18	0·5	15·7	Eng'r officer.	
Pine Valley, near.	37 24	113 31	1872·5	16·00	0·5	15·5	W. L. Marshall.	
Water Pocket, near Escalante River.	37 28	111 02	1873·5	15·64	0·5	15·1	R. L. Hoxie.	
Iron City.	37 33	113 27	1872·5	18·50	0·5	18·0	W. L. Marshall.	
Welcome Creek.	37 34	111 27	1873·5	15·12	0·5	14·6	R. L. Hoxie.	
Azay Ranch.	37 34	112 32	1872·5	16·85	0·5	16·4		
Antelope Springs.	37 46	113 26	1872·5	16·33	0·5	15·8		
Desert Spring.	37 49	113 57	1872·5	16·33	0·5	15·8	W. L. Marshall.	
Paragoonah.	37 55	112 48	1872·5	19·50	0·5	19·0		
Mammoth Mill.	38 05	113 46	1873·5	15·87	0·5	15·4	R. L. Hoxie.	
Circleville.	38 10	112 24	1872·5	21·50	0·5	21·0	— Marie.	
Minersville.	38 13	112 56	1872·5	16·50	0·5	16·0	W. L. Marshall.	
Dirty Devil River.	38 16	111 11	1873·5	16·33	0·5	15·8	R. L. Hoxie.	
Dirty Devil Canyon.	38 17	111 00	1873·5	16·30	0·5	15·8		
Fort Cameron.	38 17	111 44	1873·5	16·40	0·5	15·9	G. M. Wheeler.	
Mill Spring Station.	38 17	113 30	1872·5	17·33	0·5	16·8	R. L. Hoxie.	
Rabbit Valley.	38 19	111 25	1873·5	16·33	0·5	15·8		
Hay Spring.	38 19	113 00	1872·5	16·26	0·5	15·8		
Grass Spring.	38 20	111 54	1872·5	17·75	0·5	17·2	W. L. Marshall.	
San Francisco Spring.	38 27	113 17	1872·5	16·97	0·5	16·5	R. L. Hoxie.	
Hawawat Spring.	38 30	113 30	1869·5	16·66	0·4	16·3	G. M. Wheeler & D. W. Lockwood.	
Grass Valley.	38 34	111 50	1872·5	17·75	0·5	17·2	W. L. Marshall.	
Black Rock Spring.	38 43	112 57	1872·5	16·03	0·5	15·5	R. L. Hoxie.	
Gunnison Trail.	38 48	111 30?	1873·5	16·00	0·5	15·5		
Camp near Sevier Lake.	38 50	113 15	1872·5	17·47	0·5	17·0		
Meadow Creek.	38 51	112 26	1872·5	16·18	0·5	15·7		
Fillmore.	38 57	112 17	1872·5	16·25	0·5	15·8	R. L. Hoxie, G. M. Wheeler & E. P. Austin.	
Muddy Creek.	38 59	111 09	1873·5	16·00	0·5	15·5	R. L. Hoxie.	
Fillmore City.	38 59	112 20	1857·5	15·73	0·0	15·7		
Cottonwood Creek, south.	39 05	111 07	1873·5	16·27	0·5	15·8	R. L. Hoxie.	
Cedar Springs.	39 08	113 00?	1872·5	17·15	0·5	16·6	— Marie.	
Cottonwood Creek, north.	39 14	111 03	1873·5	16·83	0·5	16·3	R. L. Hoxie.	
Joe Valley.	39 25	111 12	1873·5	17·00	0·5	16·5		
Mt. Pleasant.	39 32	111 29	1873·5	17·17	0·5	16·7		
Sevier Pass.	39 33	112 17	1872·5	17·00	0·5	16·5	W. L. Marshall.	
Sulphur.	39 41	113 46	1859·5	14·93	0·1	14·8	J. H. Simpson.	
Fish Spring.	39 52	113 21	1872·5	17·08	0·5	16·6	R. L. Hoxie.	
Eureka City.	39 58	112 07	1872·5	17·15	0·5	16·6	W. L. Marshall.	
Santaquin.	39 59	111 48	1872·5	17·43	0·5	16·9		
Simpson Spring.	40 02	112 47	1859·4	15·70	0·1	15·6	J. H. Simpson.	
Faust Station.	40 12	112 27	1872·5	16·86	0·5	16·4	R. L. Hoxie.	
Old Camp Floyd or Fairfield.	40 16	112 05	1872·5	16·99	0·5	16·5		
Salt Lake base.	40 35	111 10	1891·76	—16·83	+0·3	—16·5	N. P. Anderson.	Letter to Office.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

UTAH—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Fort Douglas, astc. monument.	40 46	111 50	1872·5	−17·02	+0·5	−16·5	G. M. Wheeler.	
Schneider Creek.	40 56	111 42	1858·9	18·92	0·1	18·8	J. H. Simpson.	
Magnetic station, near Pilot Peak.	41 01	113 59	1892·63	17·14	0·3	16·8		Letter to Office.
Magnetic station, vicinity of Morgan.	41 02	111 42	1889·68	16·32	0·4	15·9		"
Box Elder.	41 30	112 02	1884·25	17·39	0·5	16·9	N. P. Anderson.	
Bear River.	41 37	112 08	1881·70	17·50	0·5	17·0		
NE. corner of township 10, range 3 E., Salt Lake meridian.	41 38	111 34	1891·65	17·74	0·3	17·4		"
Ten miles SE. of Laketown.	41 45	111 10	1877·5	17·80	0·5	17·3		
Meadowville, near.	41 51	111 22	1877·5	18·02	0·5	17·5	S. E. Tillman.	
Logan River, east fork.	41 56	111 33	1877·5	−17·55	+0·5	−17·0		

VERMONT.

Group I.								
Rutland, city park.	43 36	72 55	1890·75	+11·54	....	+12·4	J. B. Baylor.	
Burlington, University grounds.	44 28	73 12	1890·74	+12·02	....	+12·5		
Group II.								
Pownal.	42 46	72 59	1786·5	+5·87	+5·6	+11·5	— Williams.	
Bellows Falls.	43 09	72 28	1876·58	11·11	1·3	12·4	F. E. Hilgard.	
White River Junction.	43 40	72 18	1876·59	11·09	1·6	12·7		
West Hartford.	43 42	72 22	1860·21	11·15	2·9	14·0	J. M. Clark.	
Wells River.	44 09	72 05	1876·60	11·91	1·4	13·3	F. E. Hilgard.	
Ryegate.	44 10	72 10	1801·5	7·00	6·2	13·2	J. Whitelaw.	
Montpelier.	44 17	72 36	1829·5	12·42	4·9	17·3?		
Saint Johnsbury.	44 26	71 55	1837·5	9·27	4·3	13·6	A. C. Twining.	
Essex Junction.	44 31	73 06	1849·65	9·40	2·9	12·3	J. M. Clark.	
Barton.	44 44	72 03	1837·5	10·85	3·8	14·6	A. C. Twining.	
Swanton Falls.	44 56	73 09	1850·29	11·47	3·4	14·9	J. M. Clark.	
Derby.	45 00	72 12	1876·61	+13·30	+1·1	+14·4	F. E. Hilgard.	

VIRGINIA.

Group I.								
Dismal Swamp, boundary stone.	36 33	76 23	1886·95	+3·26	+0·7	+4·0	C. H. Sinclair.	
Hines, Va. and N. C. boundary.	36 33	76 34	1887·11	3·08	0·7	3·8		
Knott Island, north end.	36 34	75 55	1873·30	2·91	1·4	4·3	A. T. Mosman.	
White Rock.	36 40	83 27	1893·54	0·31	0·3	0·6	A. H. Buchanan.	C. & G. S. archives.
Big Knob.	36 40	82 30	1893·7	0·32	0·3	0·6		
Rogers.	36 40	81 33	1894·6	0·22	0·3	0·5		
Buffalo.	36 48	80 29	1895·73	0·15	0·3	0·4		
Marion.	36 48	81 31	1881·50	0·03	1·1	1·1	J. B. Baylor.	
Norfolk, south of City Hall.	36 50	76 17	1856·69	1·56	2·4	4·0	C. A. Schott.	
Norfolk, near gas factory.	36 51	76 18	1856·69	+1·65	+2·4	+4·0		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

VIRGINIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Wytheville.	36 55	81 05	1881·48	−0·02	+1·1	+1·1	J. B. Baylor.	
Cape Henry Lighthouse.	36 56	76 00	1895·45	+3·94	....	4·0		
Old Point Comfort.	37 00	76 18	1856·69	1·24	2·4	3·6	C. A. Schott.	
Cape Charles.	37 07	75 58	1856·68	1·59	2·4	4·0		
Petersburg, Roslyn.	37 14	77 24	1871·78	1·48	1·7	3·2	A. G. McIlvaine, jr.	
Williamsburg, W. and M. College.	37 16	76 43	1887·28	3·05	....	3·9	J. B. Baylor.	
Scott.	37 20	75 54	1856·68	1·62	2·5	4·1	C. A. Schott.	
Wolftrap.	37 24	76 15	1871·36	2·82	1·7	4·5	A. T. Mosman.	
Lynchburg, on bluff.	37 25	79 09	1890·46	1·67	0·5	2·2	J. B. Baylor.	
Richmond, Mayo Isd.	37 32	77 26	1856·72	0·24?	2·7	2·9	C. A. Schott.	
Joynes.	37 42	75 37	1856·68	2·06	2·7	4·8		
Corner of Rockbridge, Alleghany and Botetourt Counties.	37 46	79 34	1884·14	1·08	0·9	2·0	J. B. Baylor.	
Tangier.	37 48	75 59	1871·47	3·05	1·9	5·0	A. T. Mosman.	
Covington.	37 48	80 00	1881·46	1·05	1·1	2·2	J. B. Baylor.	
Snead.	37 58	75 26	1856·67	2·31	2·7	5·0	C. A. Schott.	
Charlottesville.	38 02	78 29	1887·26	1·99	0·7	2·7	C. H. Sinclair.	
Greenwood.	38 02	78 47	1880·43	2·31	1·2	3·5	J. B. Baylor.	
Fredericksburg.	38 18	77 27	1856·71	1·04	2·6	3·6	C. A. Schott.	
Clark Mtn.	38 19	78 00	1871·64	1·78	1·6	3·4	C. O. Boutelle.	
Bull Run.	38 53	77 42	1871·79	4·36	1·5	5·9		
Peach Grove.	38 55	77 14	1869·84	2·91	1·6	4·5		
Strasburg.	39 00	78 22	1884·49	+2·96	+0·7	+3·7	C. H. Sinclair.	
Group II.								
South Boundary, on shore.	36 33	75 52	1728·18	+3·00	+0·5	+3·5	W. Byrd.	
Brunswick and Greensville, Va. and N. C. Line.	36 36	80 50	1824·0	−0·92	3·9	3·0	— Boye.	
Peach Bottom, Va. & N. C. Line.	36 36	81 00	1824·0	−3·83	3·9	0·1		
Danville.	36 37	79 20	1873·57	+1·27	1·3	2·6	F. E. Hilgard.	
Station in Washington Co.	36 38	81 47	1892·67	−0·13	0·5	0·4	F. D. Leffingwell.	Letter to Office.
Emory and Henry College, Washington Co.	36 40	81 46	1881·2	−1·00	1·3	0·3	J. A. Davis.	
Meadville.	36 47	78 57	1886·14	+1·50	0·8	2·3	M. French.	
Gosport Navy-Yard.	36 49	76 17	1865·83	+2·63	1·9	4·5	W. Harkness.	
Norfolk.	36 51	76 17	1880·08	+2·95	1·1	4·0	T. Bernard.	
Mount Airy.	36 52	79 06	1873·64	−0·92	1·0	0·1	F. E. Hilgard.	
Wytheville.	36 55	81 05	1882·33	−0·18	1·2	1·0	J. M. Gibboney.	
Gratton.	37 08	81 30	1896·52	+1·00	0·2	1·2	A. G. Cox.	Letter to Office.
Christiansburg.	37 11	80 18	1873·65	−0·58	1·6	1·0	F. E. Hilgard.	
Burkeville.	37 13	78 12	1873·56	+2·00	1·4	3·4		
Mobjack Bay.	37 18	76 20	1824·0	0·62	3·8	4·4	— Boye.	
Lynchburg.	37 25	79 09	1873·55	0·56	1·5	2·1	F. E. Hilgard.	
Scottsville.	37 30	77 54	1879·5	2·50	1·0	3·5	County Surveyor	
Richmond.	37 32	77 26	1874·25	2·26	1·4	3·7	W. Popp.	
Natural Bridge.	37 35	79 22	1873·65	0·08	1·6	1·7	F. E. Hilgard.	
Staunton.	38 09	79 04	1873·66	0·76	1·6	2·4		
Harrisonburg.	38 25	78 52	1873·67	1·47	1·6	3·1		
Culpeper.	38 28	78 00	1873·53	+2·35	+1·6	+4·0		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

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WASHINGTON.

Name of station.	Lat.	Long.	Date.	D	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Vancouver, near Fort Vancouver.	45 38	122 40	1895·17	—21·54	....	—21·4	J. J. Gilbert.	
Lower Cascades.	45 39	122 00	1881·80	19·49	0·0	19·5	J. S. Lawson.	
Wallawalla, near Court-House.	46 04	118 21	1887·71	21·17	....	21·1	E. Smith.	
Wallula.	46 07	118 55	1881·75	19·93	+0·3	19·6	J. S. Lawson.	
Ainsworth.	46 14	119 03	1881·64	21·41	+0·3	21·1	J. S. Lawson.	
Cape Disappointment.	46 17	124 03	1895·15	21·93	....	21·9	J. J. Gilbert.	
Pomeroy.	46 31	117 40	1881·72	21·56	+0·3	21·3	J. S. Lawson.	
Sixty Mile Well.	46 49	118 50	1881·65	22·78	+0·3	22·5	J. S. Lawson.	
Olympia.	47 02	122 54	1881·84	21·58	....	22·5	J. S. Lawson.	
Howard, near Olympia.	47 03	122 53	1894·96	22·72	....	22·5	J. J. Gilbert.	C. & G. S. archives.
Tacoma, Wrights Park.	47 16	122 27	1894·42	22·52	—0·1	22·6	G. Davidson.	C. & G. S. archives.
Sprague.	47 19	118 10	1881·65	22·92	+0·3	22·6	J. S. Lawson.	
Seattle.	47 36	122 20	1894·39	22·68	....	22·5	G. Davidson.	
Seattle, University.	47 37	122 20	1888·52	22·48	....	22·5	E. Smith.	
Spokane Falls.	47 40	117 26	1881·67	21·66	+0·3	21·4	J. S. Lawson.	
Port Townsend, Marine Hospital.	48 07	122 45	1894·88	22·85	....	22·7	J. J. Gilbert.	
Striped Peak.	48 10	123 41	1893·51	23·20	—0·1	23·3	J. J. Gilbert.	C. & G. S. archives.
Dungeness.	48 11	123 07	1892·68	23·44	—0·1	23·5	J. J. Gilbert.	"
Slip.	48 16	124 14	1893·56	23·51	—0·1	23·6	J. J. Gilbert.	"
Cape Flattery and Neah Bay.	48 22	124 38	1881·78	22·74	....	23·3	H. E. Nichols.	
Waadah.	48 23	124 36	1893·64	23·44	—0·1	23·5	J. J. Gilbert.	"
Classet.	48 24	124 40	1893·71	23·11	—0·1	23·2	J. J. Gilbert.	"
Tatoosh.	48 24	124 44	1893·72	23·75	—0·1	23·8	J. J. Gilbert.	"
Shaw Isd., San Juan Co.	48 36	122 58	1895·64	—23·73	—0·1	—23·8	F. A. Young.	"
Group II.								
Small Island, Columbia River.	45 52	119 39	1860·5	—18·00	—0·2	—18·2	S. Garfielde.	
Chequees.	45 56	121 23	1854·0	16·08	0·8	16·9	J. Pope.	
Columbia River, Township 6.	46 00	118 58	1860·5	18·83	0·2	19·0	S. Garfielde.	
Near Wallula.	46 02	119 00	1860·0	19·77	0·2	20·0	J. S. Harris.	
Old Fort Wallawalla.	46 05	118 55	1861·5	20·50	0·2	20·7	S. Garfielde.	
Monticello.	46 07	122 55	1857·5	19·83	1·0	20·8	S. Garfielde.	
Dry Creek.	46 10	118 18	1860·0	20·22	0·2	20·4	J. S. Harris.	
Near Mt. Adams.	46 12	121 03	1860·5	20·50	0·5	21·0	S. Garfielde.	
Snake River, Columbia Guide Meridian.	46 15	118 58	1860·5	20·00	0·2	20·2	S. Garfielde.	
Mouth of Strong River.	46 15	123 23	1855·5	20·00	1·2	21·2	S. Garfielde.	
Magnetic station.	46 18	117 51	1860·5	18·75	0·2	19·0	S. Garfielde.	
Grays Bay, Columbia River.	46 18	123 42	1858·5	21·62	1·1	22·7	S. Garfielde.	
Crossing, Pataha Creek.	46 23	117 34	1863·5	21·25	0·2	21·4	S. Garfielde.	
Fort Simcoe.	46 30	120 40	1865·5	21·50	0·4	21·9	S. Garfielde.	
Tucanon River.	46 32	118 00	1860·0	20·92	0·2	21·1	J. S. Harris.	
Willapa Bay, east side.	46 33	123 54	1856·5	20·50	1·4	21·9	S. Garfielde.	
Crossing, Snake River.	46 34	118 04	1860·5	19·00	0·2	19·2	S. Garfielde.	
Crossing, Columbia River.	46 34	119 18	1863·5	21·50	0·4	21·9	S. Garfielde.	
Leadbetter Point.	46 36	124 03	1859·5	21·08	1·2	22·3	S. Garfielde.	
Willapa Bay Light.	46 43	124 04	1858·5	—21·08	—1·3	—22·4	S. Garfielde.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

WASHINGTON—Continued.

Name of station.	Lat.	Long.	Date.	D	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Cow Creek.	46 53	118 10	1860·0	—21·02	—0·2	—21·2	J. S. Harris.	
Fourth Standard Parallel and Grays Harbor.	46 54	124 01	1855·5	22·00	1·4	23·4	S. Garfielde.	
Chehalis Point.	46 55	124 07	1858·5	21·50	1·3	22·8	S. Garfielde.	
Grays Harbor, Chikeeles Pt.	46 56	124 12	1841	21·38	2·2	23·6	C. Wilkes.	U. S. Exploring Expedition, Chart.
Off Grays Harbor.	47 00	123 53	1792·96	18·0	4·9	22·9	G. Vancouver.	
North Head of Grays Harbor.	47 03	124 05	1858·5	21·5	1·3	22·8	S. Garfielde.	
Nisqually.	47 07	122 38	1859·5	21·38	1·9	23·3	R. W. Haig.	
Lugenbeel Creek.	47 09	118 07	1860·0	20·92	0·2	21·1	J. S. Harris.	
Steilacoom.	47 10	122 35	1856·5	21·5	1·5	23·0	S. Garfielde.	
Intersection 5th standard parallel & Hoods Canal.	47 15	123 08	1856·5	21·58	1·5	23·1	S. Garfielde.	
Intersection 5th standard parallel & ocean.	47 15	124 12	1859·5	21·75	1·8	23·6	S. Garfielde.	
Magnetic station.	47 16	122 05	1855·5	21·0	1·2	22·2	S. Garfielde.	
Puget Sound, Narrows at Entrance.	47 18	122 31	1841	22·48	1·8	24·3	C. Wilkes.	"
Puget Sound, Case Inlet.	47 20	122 48	1841	22·48	1·8	24·3	C. Wilkes.	"
Puget Sound, Carr Inlet.	47 20	122 40	1841	22·48	1·8	24·3	C. Wilkes.	"
Head of Hoods Canal.	47 28	122 50	1856·5	21·5	1·0	22·5	S. Garfielde.	
Wenatshapaw.	47 29	120 38	1854·0	18·83	0·7	19·5	J. Pope.	
Restoration Point.	47 30	122 14	1792·40	19·60	3·4	23·0	G. Vancouver.	
Admiralty Inlet, Point Moore.	47 36	122 22	1841	21·89	1·2	23·1	C. Wilkes.	"
Magnetic Station.	47 36	121 42	1865·5	22·33	0·4	22·7	S. Garfielde.	
Seabeck, Hoods Canal.	47 39	122 49	1859·5	22·0	0·8	22·8	S. Garfielde.	
Hoods Canal, Pasisi Point.	47 40	122 51	1841	21	1·6	22·6	C. Wilkes.	"
Peon Prairie.	47 43	117 14	1860·0	21·88	0·2	22·1	J. S. Harris.	
Port Madison Mill.	47 43	122 33	1856·5	20·50	0·9	21·4	S. Garfielde.	
Mouth of Skookum Chuck.	47 45	122 40	1856·5	21·0	0·9	21·9	S. Garfielde.	
Hoods Canal, Rose Pt.	47 47	122 50	1841	21·0	1·6	22·6	C. Wilkes.	"
Admiralty Inlet, Applecove Inlet.	47 47	122 28	1841	21·18	1·6	22·8	C. Wilkes.	"
Near Spokane Ferry.	47 48	117 58	1860·0	22·12	0·2	22·3	J. S. Harris.	
Port Gamble Mill.	47 51	122 34	1859·5	20·83	0·8	21·6	S. Garfielde.	
Pilot Cove Anchorage.	47 52	122 29	1841	21·0	1·6	22·6	C. Wilkes.	"
Hoods Canal, Squamish Harbor.	47 52	122 39	1841	21·0	1·6	22·6	C. Wilkes.	"
Hoods Canal, Port Ludlow.	47 55	122 40	1841	21·0	1·6	22·6	C. Wilkes.	"
Columbia Guide Meridian.	47 55	118 58	1860·5	22·0	0·4	22·4	S. Garfielde.	
Foulweather Bluff.	47 56	122 36	1859·5	20·5	0·8	21·3	S. Garfielde.	
Point Elliott.	47 57	122 18	1855·5	21·5	0·9	22·4	S. Garfielde.	
Chemikane River.	48 00	117 45	1861·50	21·47	0·2	21·7	R. W. Haig.	
Port Gardner.	48 00	122 17	1841	20·78	1·6	22·4	C. Wilkes.	"
Port Discovery Mill.	48 01	122 51	1862·50	22·0	0·9	22·9	S. Garfielde.	
Whidby Isd., Holmes Harbor.	48 05	122 31	1841	—20·67	—1·9	—22·7	C. Wilkes.	"

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

WASHINGTON—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Admiralty Head, Whidby Island.	48 09	122 41	1857·5	—21·90	—1·1	—23·0	S. Garfielde.	
Admiralty Inlet	48 09	122 45	1841	20·45	1·9	22·4	C. Wilkes.	U. S. Exploring Expedition, Chart.
Port Wilson.								
Port Susan.	48 11	122 20	1841	20·58	1·9	22·5		
Dungeness Light.	48 11	123 06	1858·5	21·5	1·1	22·6	S. Garfielde.	
Whidby Isd., Penns Cove.	48 14	122 40	1841	20·67	1·9	22·6	C. Wilkes.	"
Clallam Bay.	48 15	124 16	1864·5	22·5	0·9	23·4	S. Garfielde.	
Straits of Fuca.	48 17	123 11	1841	20·67	1·9	22·6	C. Wilkes.	"
Deception Passage, Whidby Island.	48 24	122 39	1858·5	21·75	1·1	22·8	S. Garfielde.	
Straits of Fuca.	48 25	124 27	1841	22·5	2·2	24·7	C. Wilkes.	"
Perry Island.	48 28	122 40	1841	20·67	2·0	22·7		
Hornet Harbor.	48 32	122 32	1841	20·67	2·0	22·7		
Colville Depot.	48 33	117 52	1860·0	22·52	0·2	22·7	J. S. Harris.	
Bellingham Bay, Guide Meridian.	48 33	122 27	1859·5	22·15	1·0	23·2	S. Garfielde.	
Strawberry Bay.	48 34	122 42	1841	20·67	2·0	22·7	C. Wilkes.	"
Colville Barracks.	48 40	118 05	1861·50	21·67	0·2	21·9	R. W. Haig.	
Fort Bellingham.	48 47	122 32	1859·5	22·5	1·0	23·5	S. Garfielde.	
Birch Bay.	48 55	122 45	1841	20·67	2·0	22·7	C. Wilkes.	"
Point Roberts.	48 59	123 03	1859·07	22·63	1·0	23·6	J. S. Harris & S. Garfielde.	
Magnetic Station.	48 59	121 42	1860·0	22·78	0·8	23·6	J. S. Harris.	
"	48 59	121 57	1860·0	22·65	0·8	23·4		
"	49 00	118 44	1860·0	22·12	0·3	22·4		
"	49 00	119 35	1860·0	23·57	0·4	24·0		
"	49 00	121 23	1860·0	22·15	0·8	23·0		
Drayton Cove.	49 00	122 45	1841	—20·67	—2·0	—22·7	C. Wilkes.	"

WEST VIRGINIA.

Group I.								
Alderson.	37 45	80 40	1881·45	+0·92	+1·0	+1·9	J. B. Baylor.	
Charleston.	38 21	81 38	1881·43	1·05	1·0	2·0		
St. Albans, East Base.	38 23	81 48	1893·08	1·11	0·4	1·5	W. B. Fairfield.	C. & G. S. archives.
St. Albans, West Base.	38 23	81 50	1893·10	1·58	0·4	2·0		
Ryan.	38 24	81 48	1892·94	+1·18	0·4	1·6		
Point Pleasant.	38 50	82 09	1864·08	—1·58	2·3	0·7	A. T. Mosman.	
Parkersburg.	39 16	81 34	1881·41	+0·12	1·2	1·3	J. B. Baylor.	
Clarksburg.	39 17	80 20	1880·94	+1·76	1·2	3·0		
Grafton.	39 21	80 02	1864·03	+1·86	2·4	4·3	A. T. Mosman.	
Cameron.	39 50	80 34	1864·04	—0·40	2·2	1·8		
Wheeling.	40 03	80 44	1881·40	+0·02	+1·1	+1·1	J. B. Baylor.	
Group II.								
Dego, Kanawha Co.	38 14	81 31	1895·2	+0·57	+0·2	+0·8	O. A. Veazey.	Letter to Office.
Elk River, Randolph Co.	38 35	80 20	1787·5	—1·75	4·0	2·2	J. Haddon & E. Jackson.	A. K. White, letter to Office.
Elk River, Monongalia Co.	38 40	80 15	1784·5	—1·50	3·9	2·4	J. Friend & S. Hanway.	"
Bull Town, Braxton Co.	38 48	80 31	1824·0	—2·17	4·2	2·0	— Boye.	
North Branch of Potomac.	39 18	79 19	1824·0	—1·58	4·6	3·0	— Boye.	
Pruntytown, Taylor Co.	39 20	80 05	1883·3	+2·55	+1·0	+3·6	R. McPheeters.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

WEST VIRGINIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Martinsburg.	39 27	77 57	1873·52	+2·86	+1·7	+4·6	F. E. Hilgard.	
Cumberland Gap.	39 38	78 44	1824·0	—4·58?	5·0	0·4	— Boye.	
Observatory, 2 miles west of SW. cor. of Pa.	39 43	80 33	1785·44	—2·25	3·5	1·2	A. Ellicott.	Copied from original notebook.
Echo Point Park, 2½ miles SE. of Wheeling.	40 03	80 42	1886·7	+0·20	+0·8	+1·0	F. L. Hoge.	Letter to Office.

WISCONSIN.

Group I.								
Milwaukee, near North Point Light.	43 04	87 53	1888·65	—4·37	....	−3·6	J. B. Baylor.	
Madison, University Grounds.	43 04	89 25	1888·66	5·89	+0·7	5·2		
La Crosse.	43 49	91 15	1877·73	8·63	1·6	7·0	A. Braid.	
Alma.	44 21	91 48	1893·5	6·83	0·6	6·2	W. R. Hoag.	C. & G. S. archives.
Green Bay.	44 30	87 59	1891·60	4·02	0·7	3·3	J. B. Baylor.	"
Maxvilla.	44 32	91 58	1893·6	6·80	0·6	6·2	W. R. Hoag.	"
Maiden Rock.	44 33	92 12	1893·50	6·98	0·6	6·4		
Ellsworth.	44 43	92 29	1893·50	6·86	0·6	6·3		
Prentice.	45 32	90 28	1891·62	4·12	+0·6	3·5	J. B. Baylor.	"
Superior City and *Duluth.*	46 40	92 04	1880·64	—9·76	....	—9·5		
Group II.								
Kenosha.	42 35	87 49	1872·5	—5·00	+2·2	−2·8	H. Custer.	
Monroe.	42 37	89 41	1859·61	8·41	3·0	5·4	J. T. Dodge.	
Racine.	42 44	87 48	1872·5	4·48	2·2	2·3	H. Custer.	
Mineral Point.	42 51	89 58	1839·84	8·67	3·2	5·5	J. Locke.	
Parish.	42 58	90 10	1839·82	8·92	3·2	5·7		
Trout Brook.	42 59	90 45	1839·82	9·00	3·2	5·8		
Campbell.	43 01	89 26	1839·84	8·65	3·2	5·4		
Blue Mound.	43 01	89 38	1839·83	8·63	3·2	5·4		
Fort Crawford.	43 03	90 52	1823·5	8·82	3·4	5·4	S. H. Long.	
New Lisbon.	43 08	88 12	1884·72	4·92	1·4	3·5	W. Powrie.	
7 miles S. of Sheboygan.	43 39	87 44	1870·80	8·38	2·5	5·9	J. W. Cuyler.	
Sheboygan.	43 45	87 42	1865·6	5·25	3·0	2·2	A. W. Unthank.	
2 miles S. of Manitowoc.	44 04	87 39	1870·63	5·05	2·5	2·6	J. P. Mayer.	
Raley Point.	44 11	87 31	1866·77	6·93	2·9	4·0	H. Gillman.	
Kewaunee.	44 28	87 30	1866·66	6·20	2·9	3·3		
Green Bay, near Fort Howard.	44 31	87 54	1884·50	4·43	1·2	3·2	C. S. Woodard.	
2½ miles S. of Sable Point.	44 32	87 56	1843·5	6·43	3·4	3·0	J. H. Simpson.	
Head of Green Bay.	44 33	87 59	1865·63	5·42	2·6	2·8	O. N. Chaffee.	
Ahnepee.	44 36	87 26	1866·60	5·55	2·6	3·0	H. Gillman.	
Long Tail Pt. Light.	44 36	87 54	1845·5	6·42	3·4	3·0	Chart.	
One mile north of station Clay Banks.	44 42	87 21	1866·57	6·30	2·6	3·7	H. Gillman.	
Near Red River.	44 43	87 43	1865·75	6·13	2·6	3·5	A. C. Lamson.	
One mile N. of Sugar Creek.	44 48	87 39	1843·5	6·15	3·4	2·8	J. H. Simpson.	
Little Sturgeon Bay	44 51	87 33	1865·70	6·27	2·6	3·7	A. C. Lamson.	
Whitefish Point.	44 52	87 12	1866·5	—5·82	+2·6	−3·2	O. N. Chaffee.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

WISCONSIN—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Oconto.	44 53	87 50	1865·6	—5·35	+2·6	—2·8	A. F. Chaffee.	
Whitefish Bay.	44 54	87 12	1866·49	5·82	2·6	3·2	H. Gillman.	
Sturgeon Bay, north side.	44 54	87 24	1865·52	4·60	2·6	2·0	A. C. Lamson.	
4 miles N. of Big Sturgeon Bay.	44 58	87 22	1843·5	4·98	3·4	1·6	J. H. Simpson.	
Peshtigo.	44 59	87 38	1865·6	4·33	2·6	1·7	A. F. Chaffee.	
Egg Harbor.	45 03	87 16	1865·63	4·82	2·6	2·2	H. C. Penny.	
Green Island.	45 03	87 30	1863·8	4·53	2·7	1·8	D. F. Henry.	
Bayley's Harbor Lt. Ho.	45 04	87 05	1863·8	4·43	2·7	1·7	J. R. Mayer.	
Ephraim.	45 09	87 10	1863·58	4·70	2·7	2·0	H. Gillman.	
Chambers Island.	45 10	87 20	1864·6	3·80	2·7	1·1	A. Molitor.	
Rawley Bay.	45 12	87 03	1863·7	4·37	2·7	1·7	J. R. Mayer.	
Hedgehog Harbor.	45 17	87 02	1863·64	4·63	2·7	1·9	H. Gillman.	
Detroit Island.	45 19	86 55	1862·83	4·23	2·8	1·4	J. R. Mayer.	
Washington Harbor.	45 24	86 56	1863·69	3·63	2·7	0·9	S. W. Robinson.	
Washington Island.	45 25	86 56	1865·5	3·50	2·6	0·9		
Oronto River.	46 34	90 26	1868·60	6·97	2·4	4·6	H. Gillman.	
Bay City.	46 35	90 52	1869·5	8·17	2·4	5·8	A. C. Lamson.	
Bad River.	46 38	90 39	1869·5	7·50	2·4	5·1		
Chaquamegon Point.	46 41	90 45	1869·5	7·60	2·4	5·2		
Madeline Isd., south point.	46 45	90 55	1824·5	9·80	....	....	H. W. Bayfield.	
Magdalena Isd., north point.	46 50	90 35	1869·5	7·13	2·4	4·7	A. C. Lamson.	
Magdalena Isd., north side.	46 50	90 40	1869·5	7·63	2·4	5·2		
Little Island, NE. of Michigan Island.	46 54	90 26	1869·5	—6·35	+2·4	—4·0	A. F. Chaffee.	

WYOMING.

Group I.								
Cheyenne.	41 08	104 49	1878·70	—15·34	+1·1	—14·2	J. B. Baylor.	
Sherman.	41 08	105 24	1872·58	15·88	1·3	14·6	W. Suess.	
Laramie.	41 19	105 36	1878·73	15·12	1·1	14·0	J. B. Baylor.	
Green River.	41 32	109 29	1878·77	16·77	0·8	16·0		
Carter.	41 36	110 26	1878·78	17·10	0·8	16·3		
Point of Rocks.	41 43	108 58	1878·76	16·30	0·9	15·4		
Fort F. Steele.	41 47	106 57	1878·74	16·17	1·0	15·2		
Creston.	41 48	107 57	1878·75	16·06	1·0	15·1		
Rock Creek.	41 50	106 05	1878·73	15·76	1·1	14·7		
Yellowstone Lake.	44 33	110 24	1892·47	*18·84	0·4	18·4	G. R. Putnam.	C. & G. S. archives.
NE. corner of Wyoming.	45 00	104 03	1882·45	15·65	0·9	14·8	B. A. Colonna.	
Little Missouri River.	45 00	104 25	1882·48	16·19	0·9	15·3		
Mile post 42.	45 00	110 12	1882·63	19·52	0·8	18·7		
Mile posts 283, 284.	45 00	105 20	1882·51	16·92	0·9	16·0		
Mile post 185.	45 00	107 21	1882·54	—17·96	+0·9	—17·1		
Group II.								
Fort Sanders.	41 17	105 35	1873·5	—15·50	+1·3	—14·2	G. M. Wheeler.	
Fort Bridger.	41 20	110 24	1858·9	—16·62	+0·2	—16·4	J. H. Simpson.	

*Mean of 2 stations, both locally disturbed.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

WYOMING—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Chugwater Creek.	41 45	104 50	1877·53	−15·31	+1·1	−14·2	W. S. Stanton.	
Bear River.	41 54	111 00	1877·5	18·22	0·8	17·4	S. E. Tillman.	
Chugsprings.	41 59	104 51	1877·53	15·44	1·1	14·3	W. S. Stanton.	
Fort Laramie.	42 12	104 34	1877·73	15·41	1·0	14·4		
SE. base Laramie Peak.	42 15	105 23	1877·72	16·71	1·0	15·7		
Little Sandy Creek.	42 15	109 40	1858·8	17·73	0·2	17·5	J. H. Simpson.	
Sweetwater River.	42 30	108 35	1858·8	16·93	0·3	16·6		
Camp Aspen Hut.	42 30	108 58	1858·47	16·70	0·3	16·4	W. H. Wagner.	
Mouth of Piney Canyon.	42 32	109 58	1858·56	17·88	0·2	17·7		
La Bonté River.	42 35	105 22	1858·8	15·38	0·7	14·7	J. H. Simpson.	
Sweetwater River.	42 38	107 25	1858·8	16·68	0·5	16·2		
Greasewood Creek.	42 40	107 07	1858·8	17·40	0·5	16·9		
Smoky Creek.	42 47	111 04	1877·5	18·42	0·8	17·6	S. E. Tillman.	
West of Deer Creek.	42 53	105 57	1858·8	15·47	0·7	14·8	J. H. Simpson.	
Popo Agie River.	43 00	108 28	1860·5	15·20	0·5	14·7		
Bad Water River.	43 08	107 53	1860·5	16·00	0·5	15·5		
Lance Creek.	43 19	104 20	1877·59	15·24	1·1	14·1	W. S. Stanton.	
Deer Creek.	43 19	105 52	1859·5	16·38	0·7	15·7		
Wind River.	43 32	110 00	1860·5	19·50	0·2	19·3		
Snake River, near mouth of Gros Ventres Creek.	43 32	110 49	1872·75	17·67	1·0	16·7	F. V. Hayden.	
South Cheyenne River.	43 33	104 09	1877·60	15·67	1·0	14·7	W. S. Stanton.	
Pass no Pass.	43 33	110 23	1860·5	20·75	0·2	20·6		
Powder River.	43 38	106 33	1859·5	16·53	0·6	15·9		
A small brook.	43 39	105 52	1877·65	16·72	1·0	15·7	W. S. Stanton.	
Camp 44.	43 40	110 43	1872·74	17·63	1·0	16·6	F. V. Hayden.	
Teton Canyon, 12 miles west of Mt. Hayden.	43 46	111 00	1872·56	17·92	1·0	16·9		
Fort McKinney.	43 47	106 15	1877·66	17·01	1·0	16·0	W. S. Stanton.	
East Foot of Tetons.	43 47	110 43	1872·74	17·70	1·0	16·7	F. V. Hayden.	
A swale.	43 51	105 37	1877·64	16·33	1·0	15·3	W. S. Stanton.	
Camp 42, foot of Jackson Lake.	43 52	110 41	1872·73	17·93	1·0	16·9	F. V. Hayden.	
Beaver Creek Valley.	43 53	104 06	1877·60	15·87	1·0	14·9	W. S. Stanton.	
Mouth of Lewis Fork.	44 08	110 40	1872·71	18·13	1·0	17·1	F. V. Hayden.	
Beula Lake.	44 09	110 44	1872·71	18·92	1·0	17·9		
Belle Fourche River.	44 11	105 05	1877·64	16·15	1·0	15·2	W. S. Stanton.	
Bechler Fork of Fall River.	44 11	110 58	1872·59	18·25	1·0	17·2	F. V. Hayden.	
Lewis Fork, near Lewis Lake.	44 14	110 33	1872·70	18·22	1·0	17·2		
Shoshone Lake.	42 21	110 40	1872·68	18·25	1·0	17·2		
Gilliss Creek.	44 27	104 36	1877·64	16·19	1·0	15·2	W. S. Stanton.	
Upper Geyser Basin.	44 28	110 30	1872·63	18·48	1·0	17·5	F. V. Hayden.	
Redwater Creek.	44 32	104 06	1877·63	15·67	1·0	14·7	W. S. Stanton.	
Lower Geyser Basin.	44 34	110 30	1872·62	18·48	1·0	17·5	F. V. Hayden.	
Yellowstone Falls.	44 44	110 34	1872·58	19·00	1·0	18·0		
Tongue River.	44 53	107 14	1859·5	16·50	0·6	15·9	J. Mullan.	
Hot Springs, White Mountains.	44 58	110 43	1872·57	−19·28	+1·0	−18·3	F. V. Hayden.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BERMUDAS, WEST INDIA ISLANDS, CENTRAL AMERICA, AND MEXICO TO LONGITUDE 100° W. OF GR.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Port Escondido, Mex.	16 04	96 57	1880·88	—7·70	+1·0	—6·7	H. E. Nichols.	
Salina Cruz, Tehuantepec, Mex.	16 10	95 27	1880·87	7·29	1·0	6·3		
Acapulco, Mex.	16 49	99 56	1880·90	7·94	....	7·1	S. M. Ackley.	
Belize, British Honduras.	17 29	88 12	1879·29	5·79	1·4	4·4		
Coatzacoalcos, Mex.	18 08	94 26	1880·14	7·18	1·4	5·8		
Laguna de Terminos, Mex.	18 38	93 00	1880·17	6·66	1·4	5·3		
Vera Cruz, Mex.	19 12	96 08	1880·11	7·44	....	6·1		
City of Mexico.	19 26	99 07	1884·29	8·23	....	7·4	G. Davidson.	
Campeche, Yucatan.	19 50	90 33	1880·19	6·61	1·4	5·2	S. M. Ackley.	
Cozumel Island.	20 33	86 57	1879·32	5·20	1·2	4·0		
Mugeres Island.	21 15	86 46	1879·32	4·82	1·2	3·6		
Progresso, Yucatan.	21 17	89 40	1880·20	6·43	1·2	5·2		
Cape San Antonio, Cuba.	21 56	84 55	1879·27	4·73	1·2	3·5		
Arenas Cay, off Yucatan.	22 07	91 25	1880·08	6·55	1·2	5·4		
Perez Island, off Yucatan.	22 24	89 42	1880·06	6·32	1·2	5·1		
Bahia Honda, Cuba.	22 58	83 12	1879·24	4·06	1·0	3·1		
Matanzas, Cuba.	23 03	81 37	1879·18	3·44	1·0	2·4		
Habana, Colegio de Belen.	23 08	82 22	1879·20	3·90	....	3·0		
Water Cay, Salt Key Banks.	23 59	80 21	1879·16	2·84	1·0	1·8		
Nassau, New Providence.	25 06	77 20	1879·14	1·43	1·0	0·4		
South Bemini, Bahama Islands.	25 42	79 18	1879·15	—2·46	1·0	—1·5		
Nonsuch Isd., Bermudas.	32 21	64 39	1890·40	+8·07	+0·2	+8·3	E. D. Preston.	C. & G. S. archives.
Group II.								
Dominica.	15 18	64 33	1826·5	—1·25	....	....	Zahrtmann.	
Beacon Key.	15 48	79 51	1844·5	6·00	+2·5	—3·5	— Lawrence.	
South Key, Honduras Bay.	16 03	86 59	1844·5	7·75	2·6	5·2		
The Hobbies.	16 04	83 11	1833·5	6·00	3·0	3·0	E. Barnett.	
Salina Cruz, Mex.	16 10	95 12	1889·2	6·98	0·7	6·3	Laird, Norris Holcombe.	R. Clover, letter to office.
Acapulco, east of Fort San Diego.	16 49	99 56	1892·88	7·58	....	—7·1	L. Mottez.	Annales Hydrographiques, Vol. II, 1893.
Antigua.	17 08	61 52	1848·5	0·77	2·3	+1·5	E. Barnett.	
Saint Croix.	17 45	64 44	1853·5	1·53	2·0	+0·5	— Lang.	
Point Moran, Jamaica.	17 55	76 16	1831·5	5·22	3·0	—2·2	— Austin.	
Kingston, Port Royal.	17 56	76 51	1880·5	3·10	....	—2·1		
Coatzacoalcos, Mex.	18 09	94 25	1889·1	6·88	0·7	—6·2	Laird, Norris Holcombe.	R. Clover, letter to Office.
Anguilla Island.	18 14	63 09	1846·5	0·93	2·3	+1·4	E. Barnett.	
Saint Thomas.	18 20	64 55	1865·87	0·66	1·5	+0·8	W. Harkness.	
Cocolopam, Orizaba.	18 53	97 04	1856·65	8·47	2·5	—6·0	A. Sonntag.	
Potrero, Mex.	18 56	96 48	1856·63	8·65	2·5	6·2		
San Andres, Chalchecomula.	18 59	97 15	1856·71	8·22	2·2	6·0		
Tlamacas.	19 03	98 39	1857·07	—8·47	+1·5	—7·0		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BERMUDAS, WEST INDIA ISLANDS, CENTRAL AMERICA, AND MEXICO TO LONG. 100° W. OF GR.—Cont'd.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Vera Cruz, Mex.	19 12	96 07	1888·98	—7·21	....	—6·1	Laird, Norris Holcombe.	R. Clover, letter to Office.
Mirador, "	19 13	96 37	1856·77	8·03	+2·2	5·8	A. Sonntag.	
Chalco, "	19 18	98 51	1857·02	9·05	1·5	7·6		
City, of Mexico, astc. obs'y, Tacubaya.	19 26	99 07	1895·5	7·76	....	7·4	M. Moreno y Anda.	Boletin del observatorio astronomico Nacional de Tacubaya, Mexico, 1896.
Port Plata, San Domingo.	19 49	70 41	1889·96	0·62	0·4	0·2	C. Laird & L. M. Garrett.	U.S.Hydc.Office Publication No. 97.
Cumberland Harbor, Cuba.	19 55	75 15	1837·5	3·52	2·8	0·7	Milne.	
Saint Iago, Cuba.	20 00	76 03	1837·5	3·65	2.8	—0·8		
Cape Maysi, "	20 14	74 12	1831·5	2·45	3·0	+0·6	— Austin.	
Baraçoa, "	20 22	74 34	1831·5	3·28	3·0	—0·3	Austin & Foster.	
San Domingo Key.	21 33	75 45	1837·5	4·03	2·8	—1·2	— Milne.	
Crooked Isd., Bahama Isds.	22 07	74 24	1835·5	5·22?	2·8	—2·4	— Foster.	
Crooked Isd., Bahama Isds.	22 47	74 21	1837·5	2·57	2·9	+0·3	— Milne.	
Habana, Colegio de Belen.	23 08	82 22	1886·97	3·58	....	—3·0	B. Viñes.	
Watling Isd., Landfall of Columbus 1492.	23 57	74 25	1831·5	—2·52	3·0	+0·5	— Smith.	
St. George, Button Island, Bermuda.	32 23	64 43	1873·28	+7·25	+0·8	+8·1	Officers of the Challenger Expedition.	

MEXICO, WEST OF LONGITUDE 100° W. OF GR.

Group I.								
Isla Grande, Mex.	17 40	101 41	1880·91	— 7·44	+1·0	— 6·4		
Clarion Island.	18 20	114 42	1880·77	8·38	0·4	8·0		
Socorro Island.	18 43	110 54	1880·78	8·83	0·4	8·4		
Manzanilla, Mex.	19 03	104 20	1880·92	8·08	0·9	7·2		
San Blas, Mex.	21 32	105 18	1880·93	9·30	....	8·0		
Cape San Lucas, L. C.	22 54	109 55	1881·14	9·44	....	9·0		
San José del Cabo, L. C.	23 04	109 41	1881·13	9·73	0·6	9·1		
Mazatlan, Mex.	23 12	106 27	1881·12	9·66	0·9	8·8		
La Paz, L. C.	24 10	110 21	1881·10	10·15	0·5	9·6		
Pichilingue Bay, L. C.	24 16	110 20	1881·10	9·75	0·5	9·2		
Magdalena Bay, L. C.	24 38	112 09	1881·15	10·48	....	10·0		
Isle San Josef, L.C.	24 55	110 37	1881·09	9·79	0·5	9·3	H. E. Nichols.	
Point San Ignacio, Mex.	25 36	109 17	1880·97	10·26	0·5	9·8		
Loreto, L. C.	26 01	111 20	1881·08	10·27	0·5	9·8		
Pequeña Bay, L. C.	26 16	112 28	1881·16	10·52	0·5	10·0		
Santa Barbara Bay, Mex.	26 42	109 38	1880·98	10·81	0·5	10·3		
Point Abreojos, L. C.	26 47	113 31	1881·17	11·26	0·4	10·9		
Muleje, L. C.	26 54	111 58	1881·07	11·22	0·5	10·7		
Ascension Island, L. C.	27 06	114 18	1881·18	11·38	....	10·8		
Santa Maria Cove, L. C.	27 25	112 20	1881·06	11·10	0·4	10·7		
Guaymas, Mex.	27 55	110 53	1880·99	11·80	+0·5	11·3		
Cerros Island, L. C.	28 03	115 11	1881·19	—11·98	....	—11·2		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MEXICO, WEST OF LONGITUDE 100° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I—Cont'd.	° ′	° ′		°	°	°		
Lagoon Head, L. C.	28 14	114 06	1873·12	−11·85	+0·8	−11·0	W. Eimbeck.	
Santa Teresa Bay, L. C.	28 25	112 52	1881·05	11·70	0·6	11·1	H. E. Nichols.	
Guadaloupe Isd., L. C.	28 55	118 15	1881·21	12·91	0·6	12·3		
Tiburon Isd., Mex.	29 12	112 27	1881·00	11·99	0·6	11·4		
San Geronimo, L. C.	29 47	115 48	1881·23	12·70	0·5	12·3		
San Luis Gonzales, L. C.	29 51	114 25	1881·04	12·46	0·5	12·0		
San Martin Isd., L. C.	30 29	116 07	1881·24	12·93	0·5	12·4		
Point San Felipe, L. C.	31 02	114 50	1881·04	12·95	0·4	12·6		
Rocky Point, Mex.	31 17	113 33	1881·01	13·45	0·4	13·0		
Philippe Pt., mouth of river.	31 46	114 43	1881·02	13·10	0·3	12·8		
Todos Santos, L. C.	31 51	116 38	1881·26	−12·01	+0·3	−11·7		
Group II.								
Near Roca Partida.	19 06	112 00	1874·24	−8·35	+0·6	−7·8	C. Seymour & E. J. Young.	
Near Benedicte Island.	19 15	110 49	1874·24	9·10	0·6	8·5		
Tabo Bay.	20 24	105 40	1874·18	8·90	1·2	7·7		
Peñas Anchorage.	20 36	105 16	1874·17	8·83	1·2	7·6		
Punta Mita.	20 46	105 32	1875·34	9·06	1·1	8·0	J. E. Craig & C. Seymour.	
Isabel Island.	21 56	105 41	1874·14	9·40	1·2	8·2	C. Seymour & E. J. Young.	
Todos Santos.	23 24	110 14	1875·04	9·23	0·6	8·6	G. C. Reiter.	
Observation Point.	23 33	109 29	1875·05	9·96	0·6	9·4		
Punta Arena.	24 04	109 50	1875·06	10·10	0·6	9·5		
El Conejo Point.	24 21	111 30	1875·04	10·27	0·5	9·8	G. C. Reiter & J. E. Craig.	
Lupono Pt., Espiritu Santo Island.	24 24	110 21	1875·06	9·43	0·5	8·9		
Santa Maria Bay.	24 45	112 16	1875·03	10·76	0·5	10·3	J. E. Craig.	
San Everisto, San Josef's Channel.	24 52	110 42	1873·84	8·88	0·5	8·4	C. Seymour & E. J. Young.	
San Josef Island.	25 02	110 43	1875·10	10·08	0·5	9·6	J. E. Craig & G. C. Reiter.	
Playa Colorado.	25 12	108 24	1874·08	10·68	0·6	10·1	H. P. Tuttle & E. J. Young.	
Boca Soledad.	25 16	112 08	1875·02	11·13	0·5	10·6	G. C. Reiter.	
Navachista.	25 23	108 49	1874·08	10·34	0·6	9·7	H. P. Tuttle & E. J. Young.	
San Marcial Point.	25 29	111 02	1875·10	10·18	0·5	9·7	G. C. Reiter.	
Topolobampo.	25 34	109 10	1874·08	10·68	0·6	10·1	H. P. Tuttle & E. J. Young.	
Carmen Isd., Salinas Bay.	26 00	111 07	1873·86	11·46	0·5	11·0		
San Juanico Point.	26 03	112 40	1875·02	10·82	0·5	10·3	G. C. Reiter.	
Agiabampo.	26 17	109 18	1874·07	12·02	0·5	11·5	H. P. Tuttle & E. J. Young.	
San Domingo Point	26 19	112 42	1875·01	10·36	0·5	9·9	J. E. Craig & C. Seymour.	
Pulpito Point.	26 31	111 27	1875·11	11·56	0·5	11·1	G. C. Reiter.	
Abreojos Point. ?	26 42	113 14	1873·51	11·96	0·5	11·5	Z. L. Tanner & E. J. Young.	
San Ignacio Point.	26 46	113 16	1875·01	12·13	0·5	11·6	J. E. Craig & C. Seymour.	
Abreojos Point.	26 47	113 32	1890·04	10·97	0·3	10·7	C. F. Pond.	Notice to Mariners, No. 50.
Ciaris Island.	26 59	109 57	1874·06	−11·27	+0·5	−10·8	H. P. Tuttle & E. J. Young.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

MEXICO, WEST OF LONGITUDE 100° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Ascension Island. L. C.	27 06	114 18	1889·93	—10·98	....	—10·8	C. F. Pond.	U. S. Hydc. Office, publication, No. 101, 1892.
San Marcos Isd.	27 10	112 06	1875·12	10·63	+0·5	10·1	J. E. Craig & G. C. Reiter.	
Off Lobos Island.	27 20	110 38	1874·06	11·51	0·5	11·0	H. P. Tuttle & E. J. Young.	
Santa Rosalia, L. C.	27 20	112 18	1892·85	10·85	0·2	10·6	L. Mottez.	Annales Hydrographiques, Vol. II, 1893.
San Bartolome Bay.	27 39	114 52	1888·40	11·50	0·3	11·2	C. F. Pond.	
San Carlos Point.	28 00	112 48	1875·13	11·76	0·5	11·3	J. E. Craig & G. C. Reiter.	
San Pedro Anchorage.	28 03	111 16	1874·00	12·41	0·5	11·9	H. P. Tuttle & E. J. Young.	
Cerros Id., Morro Rodondo Bay.	28 04	115 12	1888·32	11·66	0·4	11·3	C. F. Pond.	Notice to Mariners, No. 47.
Lagoon Head, Sebastian Vizcaino Bay.	28 15	114 06	1888·05	11·52	0·3	11·2		
San Beneto Island.	28 18	115 35	1889·10	11·44	0·4	11·0		
Rosalia Bay, Sebastian Vizcaino Bay.	28 40	114 14	1888·23	9·44	0·3	9·1		
Kino Bay.	28 46	111 59	1873·99	12·55	0·5	12·0	H. P. Tuttle & E. J. Young.	
Tiburon Island.	28 46	112 22	1873·99	12·47	0·5	12·0		
Las Animas.	28 48	113 13	1873·92	12·59	0·6	12·0		
Raza Island.	28 49	113 00	1875·21	12·50	0·6	11·9	G. C. Reiter & J. E. Craig.	
La Playa, Maria Bay.	28 55	114 32	1889·40	10·36	0·4	10·0	C. F. Pond.	"
Angeles Bay.	28 57	113 35	1873·92	12·69	0·6	12·1	H. P. Tuttle & E. J. Young.	
Angel de la Gardia Id.	29 00	113 12	1875·14	12·48	0·6	11·9	J. E. Craig & G. C. Reiter.	
Remedios Bay.	29 14	113 40	1873·93	12·56	0·6	12·0	H. P. Tuttle & E. J. Young.	
Patos Island.	29 16	112 29	1873·98	13·00	0·6	12·4		
Angel de la Gardia Id.	29 32	113 30	1875·15	12·53	0·6	11·9	G. C. Reiter.	
Mejia Island.	29 33	113 35	1875·15	12·08	0·6	11·5	G. C. Reiter & C. Seymour.	
Presidio del Norte.	29 34	104 25	1852·5	10·27	0·8	9·5	W. H. Emory.	
San Geronimo Island.	29 47	115 48	1888·44	12·39	0·4	12·0	C. F. Pond.	
Libertad Bay.	29 54	112 45	1873·98	12·93	0·6	12·3	H. P. Tuttle & E. J. Young.	
San Luis Island.	29 58	114 26	1873·96	12·50	0·6	11·9		
Sepoca Bay.	30 16	112 53	1875·20	12·28	0·6	11·7	G. C. Reiter.	
San Quentin.	30 22	115 59	1873·67	13·00	0·6	12·4	Z. L. Tanner & E. J. Young.	
San Firmin.	30 25	114 40	1873·96	11·23	0·6	10·6	H. P. Tuttle & E. J. Young.	
San Martin Island.	30 29	116 06	1888·44	12·39	0·4	12·0	C. F. Pond.	
Cape Colnet.	30 58	116 17	1889·41	13·25	0·3	13·0	C. F. Pond.	"
George's Island.	31 01	113 16	1875·20	12·72	0·6	12·1	G. C. Reiter & C. Seymour.	
Espia.	31 21	107 56	1855·2	12·08	0·7	11·4	W. H. Emory.	
Adair Bay.	31 30	114 08	1873·97	13·33	0·4	12·9	H. P. Tuttle & E. J. Young.	
Santo Tomas Anchorage.	31 33	116 41	1889·42	13·77	0·2	13·6	C. F. Pond.	"
El Paso del Norte, Initial Point.	31 47	106 28	1855·01	—11·92	+0·4	—11·5	W. H. Emory.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources].

MEXICO, WEST OF LONGITUDE 100° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Mouth of Rio Colorado.	31 51	114 45	1841·5	−11·25	−0·2	−11·4	Duflot de Mofras.	
Ensinado Anchorage, Bay of Todos Santos.	31 51	116 38	1873·65	12·69	+0·4	12·3	Z. L. Tanner & E. J. Young.	
Los Coronados Islands.	32 25	117 15	1889·42	−13·16	+0·2	−13·0	C. F. Pond.	Notice to Mariners, No. 47.

BRITISH POSSESSIONS AND DOMINION OF CANADA TO LONGITUDE 75° W. OF GR.

Group I.								
Yarmouth, N. S.	43 50	66 07	1881·85	+17·82	+0·2	+18·0	S. W. Very.	
Weymouth, "	44 24	66 00	1881·86	18·72	0·2	18·9	S. W. Very.	
Halifax, "	44 40	63 35	1896·52	20·64	....	20·7	G. R. Putnam.	C. & G. S. archives.
Annapolis, "	44 44	65 31	1881·87	19·45	0·2	19·6	S. W. Very.	
Windsor, "	45 00	64 08	1881·89	20·70	0·2	20·9	S. W. Very.	
Chamcook, N. B.	45 08	67 05	1859·79	17·60	+1·2	18·8	G. W. Dean.	
Arichat, Isle Madame.	45 30	61 01	1881·82	23·43	−0·5	22·9	S. W. Very.	
Montreal.	45 30	73 35	1879·73	13·68	....	15·4	J. B. Baylor.	
Sydney, Cape Breton.	46 09	60 12	1896·53	24·89	0·2	24·7	G. R. Putnam.	C. & G. S. archives.
St. Pierre de Miquelon.	46 47	56 11	1881·78	28·35	1·2	27·2	S. W. Very.	
Quebec.	46 48	71 14	1879·72	17·23	....	17·5	J. B. Baylor.	
St. John's, N. F.	47 34	52 42	1881·74	30·62	....	29·3	S. W. Very.	
Twillingate, "	49 39	54 46	1881·53	+33·99	−1·2	+32·8	S. W. Very.	
Group II.								
Cape Sable.	43 20	65 30	1828·5	+12·00?	....	....	Chart.	
Negro Harbor.	43 33	65 25	1859·5	17·33	+1·0	+18·3	P. F. Shortland.	
Shelburn Light.	43 37	65 16	1859·5	17·78	1·0	18·8	P. F. Shortland.	
Chester Harbor.	44 36	64 10	1775·5	13·50	6·7	20·2	J. F. W. Des Barres.	
Lawrencetown.	44 42	63 22	1881·5	21·25	0·1	21·4	W. B. Dawson.	
Waverly.	44 47	63 36	1881·8	21·02	0·1	21·1	W. B. Dawson.	
Barnhart Island.	45 00	74 48	1871·5	10·37	2·6	13·0	A. C. Lamson.	
Cornwall Canal.	45 00	74 55	1869·5	9·50	2·8	12·3		
Stanstead.	45 02	72 10	1845·5	11·55	3·2	14·8	Boundary Survey.	
Black Rock, near Light.	45 10	64 46	1856·5	18·73	1·2	19·9	P. F. Shortland.	
New Brunswick, or Mispeck.	45 12	66 00	1859·5	18·27	1·2	19·5	P. F. Shortland.	
Saint John, N. B.	45 14	66 03	1866·27	19·38	0·8	20·2	J. H. Orlebar.	
Prospect Hill and Connecticut River.	45 15	71 14	1845·5	12·14	3·0	15·1	Boundary Survey.	
Highland Boundary.	45 18	71 05	1845·5	13·33	3·0	16·3	Boundary Survey.	
Saint John, near Montreal.	45 19	73 00	1842·5	11·37	3·4	14·8	J. H. Lefroy.	
Arnold River.	45 20	70 55	1845·5	13·50	3·0	16·5	Boundary Survey.	
Dead River.	45 26	70 48	1845·5	13·17	3·0	16·2	Boundary Survey.	
Highland Boundary.	45 31	70 43	1845·5	13·42	3·0	16·4	Boundary Survey.	
Isle Madame.	45 35	60 56	1848·5	22·50	0·4	22·9	G. W. Keely.	
River La Graise.	45 36	74 22	1843·5	8·43	5·5	13·9	J. H. Lefroy.	
Carillon.	45 36	74 32	1843·5	8·68	5·5	14·2	J. H. Lefroy.	
Highland Boundary.	45 37	70 37	1845·5	+13·62	+3·0	+16·6	Boundary Survey.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS AND DOMINION OF CANADA TO LONGITUDE 75° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		° ′	°	°		
Point aux Chênes.	45 37	74 55	1843·5	+ 7·47	+5·5	+13·0	J. H. Lefroy.	
Merigomish Harbor.	45 38	62 27	1842·5	20·25	1·4	21·6	H. W. Bayfield.	
Richmond Junction.	45 41	72 03	1876·63	16·99	0·8	17·8	F. E. Hilgard.	
Pictou Harbor.	45 42	62 40	1841·5	20·32	1·4	21·7	H. W. Bayfield.	
Highland Boundary.	45 42	70 28	1844·5	13·83	3·2	17·0	Boundary Survey.	
Wallace Harbor.	45 49	63 26	1840·5	19·83	1·5	21·3	H. W. Bayfield.	
Pugwash Harbor.	45 53	63 41	1840·5	19·67	1·5	21·2		
Drummondville.	45 53	72 34	1842·5	12·47	4·9	17·4	J. H. Lefroy.	
Sorel.	46 03	73 00	1842·5	11·37	4·9	16·3		
Stone Island.	46 06	73 02	1830·5	10·50	6·0	16·5	H. W. Bayfield.	
Isle de Grace.	46 06	73 07	1830·5	10·45	6·0	16·4		
Cape Tormentine.	46 10	63 50	1840·5	20·00	1·5	21·5		
Georgetown.	46 11	62 33	1843·5	21·97	1·2	23·2		
Charlotte Town.	46 14	63 27	1862·41	23·32	....	22·7	J. H. Orlebar.	
Ice, Lake St. Peter.	46 14	72 44	1828·5	11·25	5·7	17·0	J. H. Lefroy.	
Carleton Head.	46 15	63 43	1840·5	20·30	1·5	21·8	H. W. Bayfield.	
Shediac Island.	46 15	64 23	1839·5	19·98	+1·6	21·6		
Cape Breton.	46 17	60 23	1857·5	24·67	—0·2	24·5	J. H. Orlebar.	
Three Rivers.	46 19	72 36	1842·5	11·97	+4·5	16·5	J. H. Lefroy.	
River St. Maurice.	46 21	72 43	1835·5	11·53	5·3	16·8	H. W. Bayfield.	
Beçancour.	46 22	71 33	1876·63	15·72	0·8	16·5	F. E. Hilgard.	
Badeque Harbor.	46 24	63 48	1841·5	20·20	1·4	21·6	H. W. Bayfield.	
River Saint Croix.	46 25	70 03	1844·5	15·03	3·0	18·0	Boundary Survey.	
Isle Bigot & River Champlain.	46 26	72 24	1835·5	12·69	5·3	18·0	H. W. Bayfield.	
Cape Turner.	46 30	63 20	1845·5	21·68	1·0	22·7		
Richmond Bay.	46 34	63 43	1845·5	21·00	1·0	22·0		
Grondine.	46 34	72 24	1835·5	12·45	5·0	17·6		
Platon Point.	46 40	71 54	1837·5	12·87	4·7	17·6		
Richibucto River.	46 43	64 49	1839·5	19·83	2·2	22·0		
Cascumpeque.	46 48	64 03	1845·5	21·17	1·4	22·6		
Saint Thomas.	46 59	70 33	1876·65	17·84	0·2	18·0	F. E. Hilgard.	
Crane Island.	47 05	70 32	1831·5	14·47	4·4	18·9	H. W. Bayfield.	
Miramichi, Vin Island.	47 06	65 04	1857·4	21·40	0·2	21·6	J. H. Orlebar.	
Stone Pillar.	47 12	70 22	1831·5	14·82	4·4	19·2	H. W. Bayfield.	
Amherst Harbor.	47 15	61 50	1833·5	22·60	2·0	24·6		
Isle aux Coudres.	47 25	70 26	1831·5	15·28	+4·4	19·7		
Bull Island, Newfoundland.	47 26	53 47	1858·6	30·45	—1·5	29·0	— Otter.	
Duck Isd., near Cape Ray.	47 34	59 11	1856·5	27·37	0·5	26·9	J. H. Orlebar.	
Bay Roberts, Newfoundland.	47 35	53 15	1866·72	30·93	1·6	29·3		
Cape Ray, Newfoundland.	47 37	59 19	1856·5	27·62	0·5	27·1		
Timiscuata Lake.	47 38	69 00	1818·5	16·52	....	....	J. Johnson.	
Carbiniere, Newfoundland.	47 44	53 14	1866·53	31·03	—1·6	29·4	J. H. Orlebar.	
Shipfrigan Harbor.	47 45	64 43	1838·5	21·72	+1·7	23·4	H. W. Bayfield.	
Bryon Island.	47 48	61 26	1835·5	23·50	1·4	24·9		
Caraquetta Island.	47 50	64 53	1838·5	21·50	1·7	23·2		
Riviere au Loup en bas.	47 51	69 25	1876·66	20·65	0·0	20·6	F. E. Hilgard.	
Riviere du Loup.	47 51	69 35	1831·5	17·60	+3·5	21·1	H. W. Bayfield.	
Hearts Content, Newfoundland.	47 52	53 22	1866·58	31·35	—1·6	29·8	J. H. Orlebar.	
Cod Ray Island.	47 53	59 25	1835·5	25·00	+1·4	26·4	H. W. Bayfield.	
Brandy Pot Island.	47 53	69 42	1836·5	17·42	2·7	20·1		
Northeast Boundary claimed before 1842.	48 00	67 47	1859·5	+19·50	+0·7	+ 20·2	State Survey.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from the United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS AND DOMINION OF CANADA TO LONGITUDE 75° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II– Cont'd.	° ′	° ′		°	°	°		
Hunts Harbor, Newfoundland.	48 01	53 14	1866·51	+32·22	—1·6	+30·6	J. H. Orlebar.	
Miscon Harbor.	48 01	64 30	1838·5	20·58	+1·7	22·3	H. W. Bayfield.	
Passebiac.	48 01	65 35	1838·5	21·35	1·9	23·2		
Dalhousie Island.	48 04	66 23	1839·5	20·25	+1·9	22·2		
Old Perlican, Newfoundland.	48 05	53 00	1866·41	31·70	—1·6	30·1	J. H. Orlebar.	
Carleton Point.	48 05	66 08	1838·5	20·38	+1·9	22·3	H. W. Bayfield.	
Tadousac.	48 09	69 44	1829·5	17·58	3·6	21·2		
Point Maquereau.	48 12	64 47	1837·5	22·00	1·7	23·7		
Razade Inlet.	48 13	69 09	1829·5	17·57	3·6	21·2		
Bic Island.	48 25	68 49	1830·5	17·48	+3·6	21·1		
King's Cove, Newfoundland.	48 34	53 18	1866·55	32·62	—1·6	31·0	J. H. Orlebar.	
Port Neuf.	48 37	69 07	1831·5	17·60	+3·6	21·2	H. W. Bayfield.	
Bonavista, Newfoundland.	48 39	53 08	1866·43	34·09	—1·6	32·5	J. H. Orlebar.	
Gaspe Basin.	48 50	64 30	1846·0	22·82	+1·1	23·9	H. W. Bayfield.	
Bersimis Point.	48 56	68 38	1831·5	18·80	3·6	22·4		
Cape Chatte.	49 06	66 46	1830·5	21·45	3·0	24·4		
East Point Anticosti.	49 08	61 42	1830·5	25·32	2·6	27·9		
Mt. Lewis River.	49 15	65 45	1828·5	22·00	2·9	24·9		
Point de Monts.	49 19	67 23	1830·5	20·22	3·0	23·2		
Saint Nicholas Harbor.	49 19	67 48	1830·5	19·95	3·0	23·0		
Egg Inlet.	49 38	67 11	1832·5	21·58	3·0	24·6		
Cape Henry, Anticosti.	49 48	64 24	1830·0	24·37	+2·8	+27·2		
Hamilton Inlet, N. W. River, Labrador.	53 32	60 09	1860·66	39·05	....	....	J. H. Orlebar.	
Hamilton Inlet, near Rigouletta, Labrador.	54 11	58 25	1860·66	41·15	....	....		
Hamilton Inlet, Cats Islet.	54 22	57 54	1860·66	+40·65	....	....		

BRITISH POSSESSIONS AND DOMINION OF CANADA, BETWEEN LONGITUDES 75° AND 90° W. OF GR.

Group I.								
Foot of Long Portage.	47 55	84 45	1880·62	+3·23	+1·4	+4·6	S. W. Very.	
Michipicoten.	47 56	84 51	1880·60	1·34	1·4	2.7		
Big Stony Portage.	48 14	84 15	1880·57	4·20	1·4	5·6		
Sandy Beach.	48 18	84 01	1880·57	1·32	1·4	2·7		
Fairy Point.	48 21	83 44	1880·58	3·37	1·5	4·9		
Missinaibi.	48 29	83 28	1880·58	2·35	1·5	3·8		
Foot of Swampy Grounds Portage.	48 42	83 24	1880·68	0·21	1·5	1·7		
Saint Paul Rapids.	48 50	83 24	1880·68	4·17	1·5	5·7		
Moose River.	49 08	83 22	1880·67	4·34	1·6	5·9		
Twin Portage.	49 12	83 24	1880·59	4·97	1·6	6·6		
Albany Rapids.	49 22	83 30	1880·67	4·18	1·6	5·8		
Kettle Portage.	49 47	83 16	1880·60	4·25	1·6	5·8		
Storehouse Portage.	50 04	83 16	1880·66	4·91	1·7	6·6		
Near Cedar Island.	50 21	82 42	1880·63	5·24	1·7	6·9		
Moose River, near Falling Brook.	50 36	82 07	1880·61	7·95	1·7	9·6		
Long Gravel Bed.	50 44	81 48	1880·65	8·03	1·7	9·7		
Gypsum Beds.	50 50	81 15	1880·65	9·88	1·7	11·6		
Moose Factory, Hudson Bay.	51 15	80 40	1880·63	+15·46	+1·8	+17.3		

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from the United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS AND DOMINION OF CANADA, BETWEEN LONGITUDES 75° AND 90° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II.	° ′	° ′		°	°	°		
Middle Isd., Lake Erie.	41 41	82 41	1845·5	—1·90	+3·0	+1·1	J. H. Simpson.	
Pointe Pelée Id., Lake Erie.	41 49	82 41	1877·43	0·25	1·1	0·8	F. Terry.	
East Sister Id., Lake Erie.	41 49	82 51	1845·5	2·30	3·0	0·7	J. H. Simpson.	
Middle Sister Id., Lake Erie.	41 51	83 00	1845·5	2·00	3·0	1·0		
Pointe Pelée.	41 55	82 31	1877·71	—0·42	1·1	0·7	F. M. Towar.	
Pigeon Bay.	41 59	82 33	1877·71	+0·17	1·1	1·3	A. C. Lamson.	
Colchester.	42 00	82 58	1877·68	—0·52	1·1	0·6	F. M. Towar.	
Kingsville.	42 02	82 45	1877·69	0·50	1·1	0·6	F. Terry.	
Bois Blanc Island.	42 05	83 07	1874·36	0·53	1·3	0·8	A. C. Lamson.	
Amherstburg, Ontario.	42 07	83 07	1840·5	1·50	3·2	1·7	J. N. Macomb.	
Pointe aux Pines.	42 15	81 52	1845·5	1·07	3·1	2·0	J. H. Simpson.	
Rondeau Light.	42 16	81 54	1845·5	1·07	3·1	2·0	Chart.	
River aux Puces.	42 18	82 47	1868·96	1·22	1·7	0·5	J. F. Gregory.	
Mouth of Thames River.	42 19	82 27	1871·3	0·48	1·6	1·1	A. C. Lamson.	
Belle Isle.	42 20	83 00	1873·85	—0·58	1·3	0·7		
Long Point.	42 33	80 05	1845·5	+0·92	3·6	4·5	J. H. Simpson.	
"	42 33	80 09	1870·5	1·67	1·8	3·5		
"	42 34	80 11	1876·63	2·67	1·4	4·1	F. Terry.	
Mohawk Island.	42 50	79 37	1870·5	2·67	2·1	4·8		
Ridgeway.	42 52	79 04	1875·65	3·55	1·8	5·4	J. Eisenmann.	
Port Colborne.	42 53	79 14	1875·60	3·75	1·8	5·6		
Lake Wawanash, Ontario.	43 01	82 19	1859·68	0·67	2·2	2·9	H. C. Penny.	
Port Dalhousie.	43 12	79 16	1875·5	4·37	1·8	6·2	J. Eisenmann.	
Cape Ipperwash, Ontario.	43 13	82 00	1860·10	0·16	2·2	2·4	W. P. Smith and H. C. Penny.	
Toronto, Magc. Observatory.	43 39	79 23	1895·20	4·78	....	4·8	O. J. Klotz.	Letter to Office.
Goderich.	43 44	81 43	1860·5	1·70	2·3	4·0	W. P. Smith.	
Point Peter.	43 51	77 10	1869·5	6·0	2·4	8·4		
Darlington.	43 52	78 38	1869·5	3·5	2·2	5·7		
Oshaway Port.	43 52	78 48	1869·5	3·5	2·2	5·7		
Duck Island.	43 56	76 37	1874·58	5·0	2·0	7·0	C. Donovan.	
Timber Island.	43 57	76 50	1874·63	7·32	2·0	9·3	F. M. Towar.	
Point Yeo.	44 03	76 30	1818·5	2·5	6·3	8·8	W. F. W. Owen.	
Cookstown.	44 08	79 37	1880·00	4·06	1·2	5·3	H. Creswick.	
Wolfe Isd., near Garden Id.	44 11	76 29	1874·55	6·75	2·0	8·8	F. Terry.	
Amherst Isd., east end.	44 11	76 37	1874·56	7·20	2·0	9·2	F. M. Towar.	
Kingston.	44 13	76 35	1840·5	4·0	5·0	9·0		
Halliday's Point.	44 14	76 18	1873·5	7·5	2·1	9·6	H. Custer.	
Wolfe Isd., Browns Point.	44 14	76 24	1874·66	6·42	2·0	8·4	F. M. Towar.	
Gananoque.	44 18	76 12	1874·36	8·55	2·0	10·6		
Allendale.	44 20	79 41	1879·86	4·80	1·2	6·0	H. Creswick.	
Barrie, Lake Simcoe.	44 21	79 37	1878·53	4·72	1·3	6·0		
Collingwood.	44 31	80 12	1869·5	2·33	2·2	4·5		
3 miles W. of Ogdensburg.	44 42	75 34	1871·8	9·60	2·4	12·0	U. S. Lake Survey.	
2 miles above Ogdensburg.	44 44	75 32	1818·5	3·50	....	....	W. F. W. Owen.	
Penetanguishene.	44 49	80 01	1848·5	+1·47	3·2	4·7	— Typer.	
Western Isles.	45 05	80 25	1820·5	—1·42	....	....	H. W. Bayfield.	
Chin Cape.	45 07	81 25	1819·5	0·65	....	....		
Cape Hurd.	45 14	81 51	1821·5	0·35	....	....		
Cabot Head.	45 15	81 26	1819·5	— 0·40	....	....		
Cove Island.	45 20	81 43	1860·66	+ 3·98	2·6	6·6	W. P. Smith.	
Ottawa.	45 21	75 42	1875·8	+10·01	+2·0	+12·0	R. Sparks.	Letter to Office.

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS AND DOMINION OF CANADA, BETWEEN LONGITUDES 75° AND 90° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Half Moon Island.	45 27	81 35	1821·5	— 0·37	....	....	H. W. Bayfield.	
Manitoulin Island.	45 28	81 54	1821·5	— 1·22	....	....		
Point Aylmer.	45 29	75 48	1843·5	+ 6·97	+5·2	+12·2	J. H. Lefroy.	
Rattlesnake Harbor.	45 32	81 49	1821·5	— 0·83	....	....	H. W. Bayfield.	
Isles off Franklin Inlet.	45 33	80 38	1821·5	— 0·67	....	....		
Fort Portage.	45 36	76 53	1843·5	+ 5·18	5·2	10·2	J. H. Lefroy.	
Alfred Township.	45 37	75 12	1843·5	+ 6·97	5·2	12·2		
White Shingle Bank.	45 37	81 31	1821·5	— 0·35	....	....	H. W. Bayfield.	
Island off Henvey Inlet.	45 51	80 53	1821·5	— 1·55	....	....		
Islet off Grondine Point.	45 54	81 15	1821·5	+ 0·53	....	....		
Drummond Island.	45 56	83 42	1859·5	— 0·22	2·6	2·4		
Lake Huron.	45 57	81 32	1843·5	+ 0·63	3·3	3·9	J. H. Lefroy.	
Point on shore.	45 57	81 38	1821·5	+ 0·52	....	....	H. W. Bayfield.	
Saint Joseph Island.	46 04	84 09	1822·5	— 3·00	....	....		
Fort La Cloche.	46 07	82 25	1843·5	+ 1·97	3·1	5·1	J. H. Lefroy.	
Missesauga.	46 08	83 10	1843·5	0·92	3·1	4·0		
Cranberry Bay.	46 11	83 03	1845·5	0·42	3·1	3·5		
Roche Capitaine.	46 15	78 20	1843·5	4·80	4·0	8·8		
Tessalon Point.	46 16	83 31	1843·5	0·52	3·1	3·6		
Portage du Grand Vase.	46 19	79 07	1843·5	+ 3·87	4·0	7·9		
Bear Encampment.	46 20	83 56	1845·5	— 0·05	3·1	3·0		
Portlock Harbor.	46 20	84 07	1822·5	2·85	....	....	H. W. Bayfield.	
Mission Point.	46 27	84 36	1855·6	2·15	2·8	0·6	E. P. Scammon.	
Point aux Pins.	46 28	84 28	1855·5	1·40	2·8	1·4		
Point Iroquois.	46 29	84 47	1824·5	3·37	....	....	H. W. Bayfield.	
Head of Lake George.	46 32	84 20	1825·5	3·32	....	....		
Gulais Point.	46 41	84 33	1867·6	0·38	2·1	1·7	O. N. Chaffee.	
South Sandy Island, Whitefish Bay.	46 48	84 39	1867·5	0·25	2·1	1·8		
Point au Crêpe.	46 58	84 58	1843·5	2·25	3·1	0·8	J. H. Lefroy.	
Little Trout River.	47 09	88 54	1824·5	9·20	....	....	H. W. Bayfield.	
Montreal Island.	47 19	84 52	1824·5	3·47	....	....		
Gargantua.	47 35	85 11	1824·5	4·10	....	....		
Near Chicane River.	47 52	85 24	1843·5	2·37	3·1	+0·7	J. H. Lefroy.	
Le Petit Mort.	47 58	85 49	1843·5	4·98	3·1	—1·9		
Grand Portage.	47 58	89 49	1824·5	11·00	....	....	H. W. Bayfield.	
Otter Head.	48 05	86 10	1824·5	5·12	....	....		
Isle Royale.	48 07	88 49	1824·5	9·65	....	....		
Tip Top.	48 15	88 06	1871·65	0·05	2·0	+2·0	C. B. Comstock.	
Fort William.	48 24	89 23	1844·5	6·35	2·9	—3·4	J. H. Lefroy.	
Bad Portage.	48 29	89 40	1843·5	5·55	3·0	2·6		
Trembling Portage.	48 31	90 00	1857·5	6·35	2·7	—3·6	J. Palliser.	
White River.	48 33	86 27	1844·5	2·17	2·9	+0·7	J. H. Lefroy.	
Fort Pic.	48 38	86 39	1844·5	5·52	2·9	—2·6		
Peninsular Harbor.	48 44	86 28	1824·5	6·33	....	....	H. W. Bayfield.	
Point on shore.	48 44	87 00	1824·5	7·70	....	....		
Height of land.	48 45	85 05	1874·5	1·00	1·8	+0·8	W. A. Austin.	
Isle St. Ignace.	48 45	88 02	1824·5	8·25	....	....	H. W. Bayfield.	
Halting Place.	48 45	89 53	1857·5	8·90	2·7	—6·2	J. Palliser.	
St. Ignace Harbor, observatory post.	48 47	87 49	1871·68	6·43	2·0	4·4	G. A. Marr.	
Dog Lake.	48 47	89 40	1843·5	6·43	3·0	3·4	J. H. Lefroy.	
Terre Platte.	48 49	87 45	1843·5	5·67	3·0	2·7		
Halting Place.	48 55	89 54	1857·5	— 9·08	+2·7	—6·4	J. Palliser.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS, NORTHWEST TERRITORY, SOUTH OF LATITUDE 51° AND WEST OF LONGITUDE 90° W. OF GR.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group I.	° ′	° ′		°	°	°		
Beechy Head.	48 20	123 39	1892·80	—24·62	—0·1	—24·7	J. J. Gilbert.	C. & G. S. archives.
Sheringham.	48 23	123 55	1893·55	22·72	0·1	22·8	J. J. Gilbert.	C. & G. S. archives.
Esquimault, Vancouver Island.	48 25	123 26	1881·75	22·93	0·3	23·2	H. E. Nichols.	
Discovery.	48 26	123 14	1892·71	23·18	0·1	23·3	J. J. Gilbert.	"
Arch Rock.	48 28	124 12	1893·60	25·63	0·1	25·7	J. J. Gilbert.	"
Vancouver.	48 34	124 38	1893·63	23·86	0·1	24·0	J. J. Gilbert.	"
Departure Bay, Vancouver Isd.	49 13	123 57	1881·77	23·93	0·3	24·2	H. E. Nichols.	
Friendly Cove, Nootka Sound.	49 36	126 38	1881·74	23·60	....	24·0	H. E. Nichols.	
North Harbor, Brit. Col.	50 29	128 04	1881·73	24·90	0·3	25·2	H. E. Nichols.	
Anchorage Cove, Brit. Col.	50 53	126 12	1881·59	25·71	0·3	26·0	H. E. Nichols.	
Waddington Harbor, Bute Inlet.	50 54	124 50	1881·58	—25·37	—0·3	—25·7	H. E. Nichols.	
Group II.								
Second Portage.	48 15	92 27	1843·5	—10·25	....	....	J. H. Lefroy.	
Whiffen Spit, Vancouver Island.	48 22	123 44	1864·5	20·33	—0·7	—21·0	— Pender.	
Off Cape Beale, Vancouver Island.	48 22	125 30	1788·5	18·50	....	....	Meares.	
Lake à la Crosse.	48 24	92 10	1843·5	7·88	....	....	J. H. Lefroy.	
Esquimault, Vancouver Island.	48 26	123 27	1892·73	23·22	—0·15	23·4	L. Mottez.	Annales Hydrographiques, Vol. II, 1893.
Halting Place.	48 27	92 30	1857·5	9·88	....	....	J. Palliser.	
Port San Juan, Vancouver Island.	48 31	124 30	1841·5	22·50	—2·0	24·5	C. Wilkes.	
Rainy Lake.	48 32	92 56	1843·5	11·47	....	....	J. H. Lefroy.	
Perch Lake.	48 35	91 12	1857·5	8·23	....	....	J. Palliser.	
Two Rivers Portage.	48 35	91 27	1843·5	11·00	....	....	J. H. Lefroy.	
Fort Frances.	48 37	93 29	1857·5	9·52	....	....	J. Palliser.	
Entrance, Strait of Juan de Fuca.	48 37	124 54	1788·63	19·23	....	....	C. Duncan.	
Rainy River.	48 48	94 31	1843·5	13·12	....	....	J. H. Lefroy.	
Halting Lake.	48 50	93 58	1857·5	11·33	....	....	J. Palliser.	
Savannah Portage.	48 53	90 08	1857·5	6·88	....	....	J. Palliser.	
Wigwam River Station.	49 00	114 45	1861·5	23·87	+0·2	23·7	R. W. Haig.	
Inshwointum.	49 00	118 28	1860·5	20·28	—0·3	20·6	R. W. Haig.	
Osoyoos Station.	49 00	119 24	1860·5	22·23	0·4	22·6	R. W. Haig.	
Ashtnolou Station.	49 00	120 00	1860·5	22·73	0·5	23·2	R. W. Haig.	
Onchucklin Harbor.	49 00	125 00	1861·5	24·22	—1·1	25·3	— Richards.	
Akamina Station.	49 01	114 04	1861·5	23·20	+0·2	23·0	R. W. Haig.	
Magnetic Station.	49 01	121 45	1860·0	22·92	—0·8	23·7	J. S. Harris.	
Sumass Prairie.	49 01	122 12	1858·5	21·50	0·8	22·3	R. W. Haig.	
Semi-ah-moo.	49 01	122 47	1857·78	22·91	0·9	23·8	J. S. Harris.	
Schweltza Lake.	49 02	122 00	1859·5	21·62	0·9	22·5	R. W. Haig.	
Magnetic Station.	49 03	120 55	1860·0	24·32	0·7	25·0	J. S. Harris.	
Magnetic Station.	49 05	121 07	1860·0	22·38	—0·7	23·1	J. S. Harris.	
Northwest Territory Station.	49 06	113 50	1879·2	23·37	+0·5	22·9	J. C. Nelson.	
Garry Point, Fraser River.	49 07	123 11	1864·5	22·97	—1·2	24·2	— Pender.	
On Ashtnolou River.	49 08	120 00	1860·5	22·00	0·5	22·5	R. W. Haig.	
Nanaimo.	49 10	124 00	1862·5	22·95	—1·0	—24·0	— Richards.	
Ahomet.	49 12	126 12	1788·5	—19·7	....	....	C. Duncan.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS, NORTHWEST TERRITORY, SOUTH OF LATITUDE 51° AND WEST OF LONGITUDE 90° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
New Westminster.	49 13	122 53	1862·5	−22·67	−0·9	−23·6	— Richards.	
Barclay Sound.	49 14	124 50	1861·5	24·62	1·1	25·7		
Port Cox or Cliioquot.	49 14	128 40	1787·5	19·5	....	....	— Buckley.	
Hecate Bay.	49 15	125 56	1861·5	22·65	1·2	23·8	— Richards.	
Port Moody.	49 19	122 50	1881·5	22·23	−0·4	22·6	M. Smith.	
Northwest Territory Station.	49 20	113 40	1879·2	22·98	+0·5	22·5	J. C. Nelson.	
Northwest Territory Station.	49 25	113 40	1879·2	22·97	0·5	22·5		
Halting Place.	49 26	94 48	1857·5	10·28	....	....	J. Palliser.	
Lake of the Woods.	49 28	94 42	1843·5	12·88	....	....	J. H. Lefroy.	
Northwest Territory Station.	49 30	113 22	1879·2	22·60	0·4	22·2	J. C. Nelson.	
Magnetic Station.	49 32	115 35	1860·0	23·57	+0·1	23·5	J. S. Harris.	
Town of Yale.	49 34	121 25	1871·5	24·00	−0·6	24·6	J. Trutch.	
Station S, the Gap.	49 38	109 51	1880·58	21·73	+0·4	21·3	W. F. King.	
Station U.	49 39	112 18	1880·60	22·54	0·4	22·1		
Station T.	49 40	111 38	1880·60	21·86	+0·4	21·5		
Head of Howe Sound.	49 42	123 09	1873·5	23·90	−0·5	24·4	C. H. Gamsby.	
Northwest Territory Station.	49 43	112 50	1879·1	22·47	+0·4	22·1	J. C. Nelson.	
Station V, at Willow Creek.	49 45	113 24	1880·63	22·64	0·4	22·2	W. F. King.	
Upper Fort Garry.	49 53	97 02	1843·5	16·00	....	....	J. H. Lefroy.	
Northwest Territory Station.	49 53	112 30	1879·1	22·77	0·4	22·4	J. C. Nelson.	
Northwest Territory Station.	49 55	111 40	1879·1	22·40	0·5	21·9		
Station R, at Maple Creek.	50 03	108 51	1880·56	22·00	+0·5	21·5	W. F. King.	
Squirrel Cove.	50 08	124 57	1864·5	23·93	−0·8	24·7	— Pender.	
Winnipeg River.	50 10	95 09	1844·0	11·92	....	....	J. H. Lefroy.	
Pinaway Portage.	50 12	96 03	1843·5	12·80	....	....		
Northwest Territory Station.	50 12	110 30	1878·7	21·92	+0·5	21·4	J. C. Nelson.	
Mouth of Thompson River.	50 13	121 36	1871·5	25·00	−0·6	25·6	J. Trutch.	
Port Brooks.	50 18	128 13	1787·5	22·5	....	....	J. Johnstone.	
Station W.	50 22	113 49	1880·64	22·05	+0·4	21·6	W. F. King.	
Station Q, Reed Lake.	50 27	107 22	1880·55	21·58	+0·6	21·0		
Thompson River, mouth of Nicola.	50 27	121 22	1871·5	25·50	−0·6	26·1	J. Trutch.	
Lake Winnipeg.	50 28	96 35	1857·5	14·42	....	....	J. Palliser.	
Station P.	50 29	106 47	1880·55	21·31	+0·6	20·7	W. F. King.	
Northwest Territory Station.	50 30	110 20	1878·7	23·23?	+0·5	22·7	J. C. Nelson.	
Fort Alexander.	50 37	96 21	1844·0	14·23	....	....	J. H. Lefroy.	
Thompson River.	50 41	120 12	1871·5	24·00	−0·5	24·5	J. Trutch.	
Station A.	50 42	102 00	1880·39	18·84	+0·7	18·1	W. F. King.	
Thompson River, near Kamloops.	50 42	120 30	1877·5	24·25	−0·5	24·8	C. E. Perry.	
Beaver Harbor.	50 43	127 25	1866·5	24·50	−0·9	25·4	— Pender.	
Station M.	50 44	105 14	1880·53	20·36	+0·6	19·8	W. F. King.	
Station B.	50 45	101 31	1880·42	17·18	+0·7	16·5		
Station K, near Fort on Appelle.	50 46	103 48	1880·51	19·58	+0·6	19·0		
Thompson River.	50 46	121 05	1871·5	23·50	−0·5	24·0	J. Trutch.	
Station N.	50 47	105 51	1880·54	20·60	+0·6	20·0	W. F. King.	
Mouth of Hat Creek.	50 47	121 33	1873·5	27·00	−0·5	27·5	E. W. Jarvis.	
Northwest Territory Station.	50 48	113 18	1879·9	−23·00	+0·4	−22·6	J. C. Nelson.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS, NORTHWEST TERRITORY, SOUTH OF LATITUDE 51° AND WEST OF LONGITUDE 90° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Station L.	50 49	104 16	1880·53	—19·18	+0·6	—18·6	W. F. King.	
On Little Shushwap.	50 50	119 46	1871·5	24·50	—0·5	25·0	J. Trutch.	
Tracey Harbor.	50 51	126 53	1863·5	26·67	—0·8	27·5	— Pender.	
Northwest Territory Station.	50 52	114 00	1879·8	24·32	+0·4	23·9	J. C. Nelson.	
Magnetic Station.	50 55	107 29	1860·0	24·52	+0·9	23·6	J. Palliser.	
Northwest Territory Station.	50 55	110 00	1878·7	23·83	+0·5	23·3	J. C. Nelson.	
Northwest Territory Station.	50 56	114 10	1879·9	24·50	+0·4	24·1	J. C. Nelson.	
North Thompson River.	50 57	120 28	1871·5	23·88	—0·4	24·3	J. Crutch.	
Land Survey Station.	50 58	110 40	1882·59	—22·62	+0·5	—22·1	W. Ogilvie.	

BRITISH POSSESSIONS, NORTHWEST TERRITORY NORTH OF LATITUDE 51° AND WEST OF LONGITUDE 90° W. OF GR.

Group I.								
Port McLaughlin.	52 08	128 10	1881·60	—26·72	—0·8	—27·5	H. E. Nichols.	
Rose Harbor, Queen Charlotte Island.	52 09	131 15	1881·72	26·01	0·8	26·8	H. E. Nichols.	
Port Simpson.	54 34	130 26	1895·40	28·62	0·26	28·9	O. B. French.	C. and G. S. archives.
Lion Point, Portland Canal.	55 53	130 01	1895·41	—30·22	—0·26	—30·5	P. A. Welker.	
Group II.								
Station X.	51 02	114 00	1880·69	—24·22			W. F. King.	
Land Survey Station.	51 03	112 14	1882·63	23·32			W. Ogilvie.	
Lake Winnipeg.	51 04	96 45	1843·5	14·23			J. H. Lefroy.	
Station O.	51 05	106 37	1880·54	21·31			W. F. King.	
Northwest Territory Station.	51 05	115 00	1879·6	23·97			J. C. Nelson.	
Treadmill Harbor.	51 06	127 34	1864·5	24·13			— Pender.	
Station J.	51 12	103 54	1880·50	19·83			W. F. King.	
North Thompson River.	51 12	120 22	1871·5	24·12			J. Trutch.	
Station I.	51 22	104 00	1880·49	18·56			W. F. King.	
North Thompson River.	51 28	120 25	1873·5	25·33			E. W. Jarvis.	
Station H, on Pelly Trail.	51 32	103 43	1880·48	19·87			W. F. King.	
Safety Cove.	51 32	127 57	1864·5	23·63			— Pender.	
North Thompson River.	51 33	120 17	1871·5	25·50			J. Trutch.	
Lake Winnipeg.	51 36	96 42	1844·0	15·70			J. H. Lefroy.	
Station G.	51 39	103 08	1880·47	19·56			W. F. King.	
Safety Port.	51 41	128 31	1788·5	21·5			C. Duncan.	
Station F.	51 42	103 04	1880·47	19·64			W. F. King.	
Station E.	51 44	102 29	1880·46	18·93			W. F. King.	
Lake Winnipeg.	51 45	96 53	1843·5	15·95			J. H. Lefroy.	
Station D, Assiniboine River.	51 45	102 01	1880·46	20·21			W. F. King.	
Fort Pelly.	51 45	102 05	1836·9	17·0			Th. Simpson.	
Station Z.	51 52	114 00	1880·72	24·26			W. F. King.	
Station C, Swan River Bar.	51 54	101 57	1880·44	—19·62			W. F. King.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS, NORTHWEST TERRITORY NORTH OF LATITUDE 51° AND WEST OF LONGITUDE 90° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°				
Rose Harbor.	52 09	131 20	1787	—23·0			J. Johnstone.	
Clearwater River.	52 12	120 12	1873·5	24·50			E. W. Jarvis.	
Kynumft Harbor.	52 12	128 12	1866·5	26·17			—— Pender.	
Milbank Sound, Cove.	52 14	129 00	1788·5	23·0			C. Duncan.	
Lake Winnipeg.	52 15	97 07	1843·5	15·62			J. H. Lefroy.	
Saskatchewan River.	52 23	107 04	1844·5	25·35				
N. Bentinck Arm.	52 23	126 48	1864·5	24·77			— Pender.	
Etches Sound.	52 25	131 48	1788·5	23·5			C. Duncan.	
Carter Bay.	52 50	128 25	1866·5	25·98			— Pender.	
Carlton House.	52 51	106 32	1844·5	22·92			J. H. Lefroy.	
Head of Dean Inlet.	52 52	127 13	1876·5	27·00			W. S. Jennings.	
Tete Jeanne Cache.	52 58	119 50	1876·5	26·33			G. A. Keefer.	
Station a, Pipestone Creek.	53 04	113 35	1880·73	25·24			W. F. King.	
Grand Rapids, Saskatchewan.	53 08	99 27	1884·55	15·63			O. J. Klotz.	
Saskatchewan, *a*.	53 10	104 50	1884·39	21·9				
Grand Rapids, *e*.	53 12	99 30	1884·54	15·3				
Grand Rapids, j.	53 12	99 33	1884·54	16·97				
Calamity Harbor.	53 12	130 24	1787·5	23·33			J. Johnstone.	
Anchor Cove.	53 12	132 14	1866·5	24·98			— Pender.	
Hudson Bay Co., Post.	53 13	99 29	1884·54	15·7			O. J. Klotz.	
Near Fort à la Corne.	53 13	104 52	1884·39	21·83				
Forks of Saskatchewan.	53 14	105 05	1884·38	21·4				
Head of Gardner Inlet.	53 15	127 37	1875·5	26·50			C. Horetzky & C. H. Gamsby.	
Saskatchewan, b.	53 16	100 01	1884·53	18·0			O. J. Klotz.	
Jasper House.	53 16	118 10	1871·5	26·0			W. Moberly.	
Saskatchewan, Chemahawin.	53 20	100 32	1884·51	17·7			O. J. Klotz.	
Saskatchewan, Y.	53 21	104 02	1884·43	18·6				
North Saskatchewan River.	53 23	114 19	1876·5	26·5			N. Ruttan.	
Port Stepteen.	53 30	130 12	1788·5	24·2			C. Duncan.	
Saskatchewan, L.	53 31	103 49	1884·43	18·7			O. J. Klotz.	
Station b, in valley near Edmonton.	53 32	113 30?	1880·76	26·72			W. F. King.	
Station d, on 14th base line.	53 36	111 24	1880·79	25·77				
Saskatchewan, a.	53 38	103 42	1884·44	20·3			O. J. Klotz.	
Saskatchewan, h.	53 40	103 28	1884·44	20·3				
Nelson River, Warren Landing	53 43	98 05	1884·55	15·9				
Saskatchewan, N.	53 47	101 07	1884·49	18·7				
Mouth of Chilaccoh River.	53 50	123 00	1875·5	28·25			H. P. Bell.	
Saskatchewan, ξ.	53 52	103 01	1884·44	20·9			O. J. Klotz.	
Alpha Bay.	53 52	130 18	1866·5	26·57			— Pender.	
Cumberland House.	53 57	102 19	1884·46	20·2			O. J. Klotz.	
Norway House.	54 00	98 03	1884·65	15·0				
Saskatchewan, j.	54 02	101 35	1884·47	19·4				
Land Survey Station.	54 02	114 00	1882·91	26·61			W. Ogilvie.	
Nelson River, i.	54 06	97 56	1884·57	16·6			O. J. Klotz.	
Skeena River or Port Essington.	54 14	129 47	1879·5	27·33			G. A. Keefer.	
Nelson River, x.	54 15	97 49	1884·57	17·6			O. J. Klotz.	
Nelson River, j.	54 17	97 46	1884·57	—16·3				

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS, NORTHWEST TERRITORY, NORTH OF LATITUDE 51° AND WEST OF LONGITUDE 90° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°		°		
Head of Work Inlet.	54 18	129 43	1879·5	—27·50			G. A. Keefer.	
20 miles up Skeena River.	54 19	129 19	1879·5	27·33				
Fort Assiniboine.	54 20	114 28	1844·5	24·65			J. H. Lefroy.	
Nelson River, ρ.	54 21	97 49	1884·57	16·7			O. J. Klotz.	
Nelson River, χ.	54 22	97 51	1884·57	18·2				
31 miles up Skeena River.	54 22	129 00	1879·5	26·75			G. A. Keefer.	
Nelson River, p.[3]	54 25	97 53	1884·57	15·6			O. J. Klotz.	
50 miles up Skeena River.	54 30	128 35	1879·5	26·50			G. A. Keefer.	
Nelson River, k.	54 31	97 52	1884·58	14·9			O. J. Klotz.	
" " d.	54 43	97 59	1884·58	12·9				
" " o.	54 45	98 06	1884·58	15·4				
" " δ.	54 49	98 14	1884·59	20·5				
" " υ & φ.	54 55	98 09	1884·59	20·1				
" " θ.	55 00	98 00	1884·59	15·8				
Fort McLeod.	55 00	123 11	1875·5	25·33			A. Webster.	
Nelson River, N.	55 06	97 43	1884·59	21·3			O. J. Klotz.	
Land Survey Station.	55 10	114 04	1883·35	27·76			W. Ogilvie.	
Nelson River, T.	55 13	97 18	1884·60	17·4			O. J. Klotz.	
" " h.	55 19	97 08	1884·60	15·2				
" " w.	55 27	97 00	1884·61	12·5				
" " i.	55 41	96 55	1884·61	14·3				
Forks of Pine River.	55 44	121 18	1875·5	28·83			A. Webster.	
Nelson River, f.	55 54	96 47	1884·62	18·0			O. J. Klotz.	
Camp on Pearl River.	55 58	123 13	1875·5	30·17			A. Webster.	
Hudson's Hope.	56 02	121 58	1875·5	26·03				
Head of Rocky Mt. Portage.	56 03	122 15	1875·5	28·13				
Nelson River, R.	56 04	96 47	1884·62	16·9			O. J. Klotz.	
Land Survey Station.	56 10	117 47	1883·72	30·17			W. Ogilvie.	
Nelson River, E.	56 11	96 26	1884·62	14·1			O. J. Klotz.	
Fort St. John.	56 12	121 14	1875·5	26·0			A. Webster.	
Nelson River, K.	56 14	96 08	1884·63	13·2			O. J. Klotz.	
" f.	56 16	95 50	1884·63	16·6				
" a.	56 16	96 00	1884·63	14·4				
" z.	56 19	95 29	1884·64	10·1				
" Z.	56 21	94 46	1884·65	13·8				
" V.	56 21	94 53	1884·65	9·4				
" M.	56 21	95 02	1884·65	12·5				
" φ.	56 21	95 13	1884·64	9·9				
" P.	56 27	94 26	1884·66	10·3				
" zz,	56 34	94 12	1884·66	11·4				
" n.	56 49	93 59	1884·66	8·4				
" f.	56 54	93 05	1884·68	7·2				
" ψ.	56 54	93 16	1884·68	2·9?				
" N.	56 59	92 54	1884·68	7·7				
York Factory.	57 00	92 26	1884·70	6·66	....	—3·6		
Chipewyan.	58 43	111 19	1888·89	27·24			W. Ogilvie.	Exploratory Survey of part of the Lewis, Porcupine, Mackenzie, etc., rivers by W. Ogilvie, 1887–8. Ottawa, 1890.
Lake Lyndeman.	59 47	135 05	1887·48	32·28				
Marsh Lake.	60 21	134 17	1887·54	32·77				
Canyon.	60 42	135 04	1887·56	30·92				
Resolution.	61 10	113 46	1888·72	38·33				
Simpson.	61 52	121 25	1888·65	37·70				
Lewis River.	62 04	136 04	1887·60	—33·91				

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

BRITISH POSSESSIONS, NORTHWEST TERRITORY, NORTH OF LATITUDE 51° AND WEST OF LONGITUDE 90° W. OF GR.—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°	°	°		
Fort Rae.	62 39	115 44	1883·20	−40·18			H. P. Dawson.	International Polar Expedition, London, 1886.
Fort Selkirk.	62 48	137 25	1887·63	34·28			W. Ogilvie.	Exploratory Survey of part of the Lewis, Porcupine, Mackenzie, etc., rivers by W. Ogilvie, 1887–8. Ottawa, 1890.
White River.	63 12	139 38	1887·65	34·46				
Stewart River.	63 22	139 28	1887·65	33·88				
Forty Mile River.	64 26	140 32	1887·69	35·02				
Mackenzie River.	64 27	125 03	1888·59	41·58				
Boundary.	64 41	140 54	1888·15	35·78				
Norman.	64 54	125 43	1888·58	33·65				
Porcupine River.	65 43	139 40	1888·38	37·57				
Good Hope, Fort.	66 16	128 31	1888·53	41·52				
McPherson.	67 26	134 57	1888·47	46·02				
Red River.	67 27	133 36	1826·5	45·62			J. Franklin.	
Shoalwater Bay.	68 54	136 21	1837·52	49·37			Th. Simpson.	
Richardson Chain.	69 01	137 25	1826·5	46·68			J. Franklin.	
Point Kay.	69 18	138 08	1837·53	49·00			Th. Simpson.	
Herschel Island, southeast side.	69 33	138 57	1889·63	43·67	+2·07	−41·6	C. H. Stockton.	U. S. S. Thetis. Notice to Mariners No. 45, Nov., 1889.
Herschel Island.	69 36	139 42	1826·5	46·22			J. Franklin.	
Clarence Bay.	69 38	140 51	1826·5	−45·72				

WATERS ADJACENT TO ALASKA AND EASTERN SIBERIA.

Group II.								
At Sea.	45 14	159 41	1850·0	−18·75			H. Kellet.	
"	45 19	160 00	1850·0	17·77				
"	45 33	E 161 05	1849·5	4·50				
"	47 28	E 159 45	1849·5	4·00				
"	48 08	146 39	1827·5	22·58			F. P. Lütke.	
"	48 34	E 164 38	1851·5	7·17			R. Collinson.	
"	48 44	143 23	1827·5	23·02			F. P. Lütke.	
"	48 49	E 158 13	1849·5	4·38			H. Kellet.	
"	50 05	E 158 39	1848·5	2·32				
"	50 50	E 166 37	1850·5	5·90			R. Collinson.	
"	51 46	152 36	1830·5	24·08			A. Erman.	
"	51 54	E 168 38	1854·5	8·60			R. Collinson.	
"	51 55	143 33	1827·0	24·50			F. P. Lütke.	
"	53 00	149 56	1830·5	−25·55			A. Erman.	
Petropavlovsk, Kamchatka.	53 01	E 158 43	1892·5	+ 1·17	....	+0·7	—Lachton, R. N.	Document in U. S. Hydrographic Office.
Natschika, Kamchatka.	53 07	E 157 25	1829·5	— 4·00			A. Erman.	
At Sea.	53 36	143 38	1850·5	24·77			R. Collinson.	
Bering Island, Nicholski Bay.	55 10	E 166 01	1892·5	3·62	+0·4	−3·2	Z. L. Tanner.	Commissioner's Report on Fish & Fisheries 1892; Washington 1894.
Bering Island.	55 14	E 165 52	1879·6	3·93			A. Wÿkander.	
At Sea.	57 21	E 167 24	1854·5	12·67			R. Collinson.	
"	58 19	E 169 08	1849·5	9·68			H. Kellet.	
"	59 05	E 169 49	1849·5	10·28				
"	59 32	E 173 12	1849·5	10·47			R. Collinson.	
"	59 38	E 171 10	1849·5	10·90			H. Kellet.	
"	61 20	E 177 23	1850·5	−14·12			R. Collinson.	

Table of the most recent magnetic declinations observed in the United States and adjacent regions, and referred to the epoch January 1, 1900—Continued.

[Group I, results from United States Coast and Geodetic Survey; Group II, results from all other sources.]

WATERS ADJACENT TO ALASKA AND EASTERN SIBERIA—Continued.

Name of station.	Lat.	Long.	Date.	D.	Δ D.	D_{1900}	Observer or authority.	Reference.
Group II—Cont'd.	° ′	° ′		°		°		
Plover Bay, Siberia.	64 22	173 22	1880·66	—18·42			W. H. Dall & M. Baker.	
At Sea.	64 47	171 35	1881·43	23·17			C. L. Hooper.	
Konyam Bay.	64 50	172 57	1879·6	17·87			A. Wÿkander.	
Holy Cross Bay, Siberia.	65 28	178 32	1828·5	21·07			F. P. Lütke.	
Saint Laurence Bay.	65 35	170 44	1879·5	20·38			A. Wÿkander.	
At Sea.	65 35	170 45	1881·43	23·42			C. L. Hooper.	
Bay of St. Laurence.	65 38	170 46	1828·5	24·07			F. P. Lütke.	
Big Diomede Island.	65 45	169 04	1880·69	21·82			W. H. Dall & M. Baker.	
At Sea.	65 47	168 55	1881·41	22·83			C. L. Hooper.	
At Sea.	66 07	169 17	1881·43	23·67				
At Sea.	66 16	161 46	1881·69	27·05				
At Sea, Arctic Ocean.	66 42	170 46	1881·42	24·00				
Pitlekai.	67 05	173 30	1878·7	19·72			A. Wÿkander.	
At Sea, Arctic Ocean.	67 17	171 45	1881·41	22·50			C. L. Hooper.	
Koliuchin Isd., Siberia.	67 27	175 35	1823·5	23·43			F. v. Wrangell.	
Wankarem River, Siberia.	67 43	176 27	1823·5	23·0				
At Sea, off Koliuchin Bay.	67 52	175 18	1881·60	19·82			C. L. Hooper.	
At Sea, off Koliuchin Bay.	67 58	175 14	1881·42	23·50				
At Sea, off Cape Lisburne.	68 50	165 10	1881·57	32·07				
Irkaipi.	68 50	180 00	1878·7	17·90			A. Wÿkander.	
North Cape, Siberia.	68 55	E 179 56	1823·5	21·67			F. v. Wrangell.	
East of Cape Jakan.	69 36	E 176 58	1823·5	21·50				
Werkon River, Siberia.	69 53	E 173 32	1823·5	18·95				
At Sea, Arctic Ocean.	69 58	162 38	1881·57	31·92			C. L. Hooper.	
Kosmin Rock.	70 01	E 171 55	1823·5	18·00			F. v. Wrangell.	
Cape Schelagskoi.	70 03	E 171 03	1823·5	18·05				
At Sea, off Icy Cape.	70 05	162 06	1881·56	32·23			C. L. Hooper.	
At Sea, off Icy Cape.	70 15	161 55	1881·55	32·20				
Magnetic Station, Siberia.	70 20	E 174 13	1823·5	21·50			F. v. Wrangell.	
At Sea, off Herald Isd.	70 49	174 32	1881·58	24·78			C. L. Hooper.	
At Sea, off Herald Isd.	70 51	175 40	1881·58	23·43				
Wrangell Island, south coast.	70 57	178 10	1881·65	19·92			R. M. Berry & — Putnam.	
Wrangell Island, east coast.	71 04	177 40	1881·61	23·43			C. L. Hooper.	
Off Point Barrow.	71 20	156 15	1881·63	37·30	....	—32·5		
On ice, Arctic Ocean.	71 34	162 00	1849·57	37·0			H. Kellet.	
On ice, Arctic Ocean.	72 50	164 40	1849·56	—42·15				

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UNITED STATES COAST AND GEODETIC SURVEY

W. W. Duffield Superintendent

ISOGONIC CHART OF THE UNITED STATES FOR THE EPOCH JANUARY 1900

Report for 1896 App. No. 1. Chart No. 1

U. S. Coast and Geodetic Survey

W. W. Duffield, Superintendent

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1:7000000

1896

Statute Miles

Kilometres

The isogonic curves or lines of equal magnetic declination (variation of compass) are drawn for each degree; a + sign to the index number indicating that much west declination; a − sign that much east declination, broken lines indicate uncertain position. — The magnetic needle will point due north at all places through which the agonic or zero line passes as indicated on the chart. August, 1896. C. A. Schott, Assistant.

U.S. COAST AND GEODETIC SURVEY

W. W. Duffield, Superintendent

ANNUAL CHANGE OF MAGNETIC DECLINATION FOR PERIOD 1895-1900

East decln a maximum
Annual change zero

West decln a maximum
Annual change zero

Agonic for epoch 1900

Decln East

Decln West

Note: The annual change in declination is given in minutes; a + sign signifies increasing west, or decreasing east, declination, a − sign the reverse motion. Stations to the right of the agonic curve have west declination, and those to the left east declination.

C.A.S.
Oct. 1896.

U.S. Coast and Geodetic Survey

BASE MAP OF THE UNITED STATES

(Projected on intersecting cone)

Scale 1/10 000 000

1896

Statute Miles

Kilometres

West from Greenwich

Report for 1896 App. No. 1. Chart No. 3.

U. S. COAST AND GEODETIC SURVEY

W. W. Duffield Superintendent

ISOGONIC CHART FOR THE EPOCH JAN. 1900

No. 3.

APPENDIX No. 2—1896.

RESULTING HEIGHTS FROM SPIRIT LEVELING BETWEEN OLD POINT COMFORT AND RICHMOND, VA., FROM OBSERVATIONS MADE BY J. B. WEIR, SUBASSISTANT, BETWEEN SEPTEMBER AND NOVEMBER, 1884, AND BY I. WINSTON, ASSISTANT, BETWEEN DECEMBER, 1891, AND FEBRUARY, 1892.*

Submitted by the chief of the computing division for publication April 29, 1896.

I have the honor to submit herewith the results of the line of spirit levels between Old Point Comfort and Richmond, Va., as revised by Mr. O. B. French in February last.

The line was leveled in 1884 by Subassistant J. B. Weir, and releveled in 1891–92 by Assistant I. Winston. Field and office reductions were made in due time. The releveling became necessary in consequence of too great a discrepancy in the levels between Hagerstown, Md., as determined from Sandy Hook, N. J., and from Old Point Comfort, Va.

At Old Point Comfort Light-House, the starting point of the levels, no lesss than three primary bench marks (and at least one subsidiary one) were established. The one to which the tidal observations were referred is known as the "Old Tidal bench mark." It was established by Lieut. W. R. Palmer in August, 1852, and is an irregularly shaped cut, about one-fourth of an inch deep, in the southwest face of the light-house, and about 1½ feet from the ground. The spirit levels are referred to the primary mark "U," a copper bolt leaded in a stone of the southwest side of the light-house. Its center defines the starting level. It was established in 1884 by Subassistant Weir. The other marks need not concern us here. According to Weir, bench mark "U" is 0·2478^{m} or 0·813 foot *below* the Old Tidal bench mark. The two marks were found undisturbed by Assistant Winston in December, 1891.

Connection of the line of levels with the average or half-tide level of the bay (and which is taken as identical with that of the ocean outside). The average sea level was ascertained from observations of high and low waters between the years 1853 and 1878. The following results for one-half (H + L) were obtained by the tidal division of the Office.† For the period 1853–1869 the reduction is by J. Downes; for the period 1870–1878 certain corrections were applied by J. B. Boutelle for changes in the relation of the pencil of the tide gauges with reference to the mark on the light-house.

* With diagram showing route line and position of bench marks.

† Rereduced and communicated by L. P. Shidy.

Date.	Old bench mark above average level.
1853	9·67 ft.
4	9·73
5	9·70
6	9·84
7	9·64
8	9·25
9	9·24
1860	9·37
1	9·51
2	10·02
3	9·65
4	9·37
5	9·40
6	9·46
7	9·03
8	9·14
9	9·56
1870	9·74
1	9·67
2	9·81
3	9·71
4	9·71
5	9·83
6	10·29
7	10·13
8	9·80
Mean.	9·63 ± 0·04
or	2·9353 *m* ± 0·012 *m*.

Hence bench mark "U" above the half tide level, 2·6875 *m* ± 0·012 *m*.

As a rough verification of the relation of this average level with the Old Tidal mark in 1888 (Sept.), we have reading of average level 9·43 ft., and again in 1891 (Aug.) the reading 9·50 ft.

In December, 1891, the marks on the light-house were found undisturbed.

The primary reference bench marks established at Richmond, Va., in 1884, are the following:

"O" on the granite doorsill of the freight depot of the Richmond, Fredericksburg and Potomac Railroad.

"P" on the granite doorsill of the east front of Richmond College.

A third mark was established in 1891 by Mr. Winston at the new city hall to the left of the steps at the western entrance. It was made at the request of the city engineer and for special preservation. The mark "P" is 4·5516 m. above and the city hall mark 8·1541 m. below the mark "O."

The line of levels follows the Chesapeake and Ohio Railroad, and all the bench marks on the line determined in 1884 that could be found were included in the verification work of 1891-92, thus furnishing the means for the computation of the probable error for the heights of the terminal marks at Richmond. The condition of the line was not favorable, since a great part of the road-bed was made ground, with underlying swamp.

The Weir line from September to November, 1884, was run with spirit level No. 1 as a simultaneous double line.* This, as experience has shown, can count only for a single line, since the physical and instrumental conditions for the two lines were essentially the same. The collar inequality for level No. 1 was object end smaller 2″·30; the angular value for the telemeter threads was 34′ 04″·7. The lengths of the metric brass scales of the rods E and F at given temperatures, as well as their index errors, are given in Appendix No. 7, Coast and Geodetic Survey, Report for 1887 (p. 186).

The Winston line of December, 1891, to February, 1892, was run with spirit levels Nos. 5 and 6, as a single line in parts where the result agreed with that of the older measure, but with a repetition of the measure, using the other instrument in cases of discord with Weir's result. The

* For explanation of method and description of instrument Appendix No. 10, Coast and Geodetic Survey Report for 1888, and No. 9, Report for 1887, may be consulted. The former gives an account of levels run in 1884, the latter in 1885-86, by the same observer and with the same instrument.

instrumental constants for Nos. 5 and 6 are given in Appendix No. 3, Report for 1892, also in Appendix No. 4 for the same year. No. 6 was supplied with a new level of 1 div'n = 2″·33 at 41°·3 c. and 2″·58 at 6°·9 c. Inequality of collar for No. 5, object end smaller 0″·89 February, 1891, and 2″·61 October, 1892; and for No. 6, object end smaller 0″·01 February, 1891, and larger 0″·88, October, 1892, the respective mean values were used in the reduction; angular value of telemeter threads 18′ 58″·5 and 18′ 50″·6, respectively: 100 divisions of micrometer = 312″·0 for both instruments. Length of rods *I* and *K* at temperature of 22°·7 c.

	Rod I.	Rod K.	
First metre mark	1·000 007 m.	1·000 014 m.	Observations by Weir in Nov., 1888.
Second " "	2·000 031	2·000 124	
Third " "	3·000 044	3·000 174	

The index correction to rod *I* is —0·4 mm., and to rod *K* —0·2 mm.

The length of the line from the initial to the terminal bench mark is 140½ km. or 87¼ statute miles. The following table of results exhibits the values of the two measures, separately, also their difference upon which the probable error of the height of the terminal bench mark is founded.

Results of geodetic spirit leveling from Old Point Comfort, Va., to Richmond, Va., 1884.

Bench marks. From	To	Distance between successive marks.	Distance from Old Point Comfort.	Difference of height. Rod E.	Rod F.	Mean.	Discrepancy. Partial E—F.	Total accumulated.	Height above average level of bay and ocean at Old Point Comfort.
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
	U								2·6875
U	T	0·003	0·003	— 0·2603	— 0·2600	— 0·2601	—0·3	— 0·3	2·4274
T	Light-house.	0·003	0·006	+ 0·5063	+ 0·5060	+ 0·5061	+0·3	0·0	2·9335
T	327	0·469	0·472	+ 0·0657	+ 0·0650	+ 0·0653	+0·7	+ 0·4	2·4927
327	Fort.	0·146	0·618	+ 0·8764	+ 0·8762	+ 0·8763	+0·2	+ 0·6	3·3690
327	326	1·283	1·755	— 0·6735	— 0·6746	— 0·6740	+1·1	+ 1·5	1·8187
326	325	0·744	2·499	+ 1·6595	+ 1·6607	+ 1·6601	—1·2	+ 0·3	3·4788
325	324	0·844	3·343	+ 0·1679	+ 0·1705	+ 0·1692	—2·6	— 2·3	3·6480
324	V	1·674	5·017	+ 0·7276	+ 0·7254	+ 0·7265	+2·2	— 0·1	4·3745
324	323	1·090	4·433	— 1·0304	— 1·0280	— 1·0292	—2·4	— 4·7	2·6188
323	322	1·593	6·026	— 1·1570	— 1·1546	— 1·1558	—2·4	— 7·1	1·4630
322	321	1·069	7·095	+ 2·2714	+ 2·2669	+ 2·2691	+4·5	— 2·6	3·7321
321	320	1·050	8·145	+ 0·3776	+ 0·3765	+ 0·3771	+1·1	— 1·5	4·1092
320	319	1·104	9·249	+ 0·9063	+ 0·9089	+ 0·9076	—2·6	— 4·1	5·0168
319	318	1·578	10·827	— 0·3321	— 0·3370	— 0·3345	+4·9	+ 0·8	4·6823
318	317	1·054	11·881	— 0·2161	— 0·2136	— 0·2148	—2·5	— 1·7	4·4675
317	316	1·107	12·988	— 0·6261	— 0·6246	— 0·6253	—1·5	— 3·2	3·8422
316	315	1·143	14·131	+ 1·6104	+ 1·6081	+ 1·6092	+2·3	— 0·9	5·4514
315	XXIV	1·100	15·231	+ 0·3852	+ 0·3880	+ 0·3866	—2·8	— 3·7	5·8380
XXIV	S	1·241	16·472	+ 0·9770	+ 0·9732	+ 0·9751	+3·8	+ 0·1	6·8131
	Eng.								
S	Bulkhead.	1·233	17·705	— 4·4725	— 4·4801	— 4·4763	+7·6	+ 7·7	2·3368
XXIV	301	1·153	16·384	+ 0·5537	+ 0·5522	+ 0·5530	+1·5	— 2·2	6·3910
301	302	1·086	17·470	+ 1·3384	+ 1·3364	+ 1·3374	+2·0	— 0·2	7·7284
302	303	1·062	18·532	— 0·4921*	— 0·4913*	— 0·4917	—0·8	— 1·0	7·2367
303	304	1·529	20·061	+ 1·6156	+ 1·6176	+ 1·6166	—2·0	— 3·0	8·8533
304	305	1·080	21·141	— 1·0594	— 1·0622	— 1·0608	+2·8	— 0·2	7·7925
305	306	1·027	22·168	+ 1·2380	+ 1·2389	+ 1·2384	—0·9	— 1·1	9·0309
306	307	1·004	23·172	+ 0·1314	+ 0·1315	+ 0·1315	—0·1	— 1·2	9·1624
307	308	1·604	24·776	— 0·9143	— 0·9153	— 0·9148	+1·0	— 0·2	8·2476
308	309	1·185	25·961	+ 1·9367	+ 1·9364	+ 1·9365	+ 0·3	+ 0·1	10·1841
309	310	1·076	27·037	+ 1·1779	+ 1·1784	+ 1·1781	— 0·5	— 0·4	11·3622
310	311	1·029	28·066	— 0·1778	— 0·1772	— 0·1775	— 0·6	— 1·0	11·1847
311	312	1·593	29·659	— 0·5090	— 0·5093	— 0·5091	+ 0·3	— 0·7	10·6756

* Mean of two measures.

Results of geodetic spirit leveling from Old Point Comfort, Va., to Richmond, Va., 1884—Continued.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Rod E.	Rod F.	Mean.	Partial E−F	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
312	313	1·073	30·732	— 1·8333	— 1·8345	— 1·8339	+ 1·2	+ 0·5	8·8417
313	314	1·268	32·000	— 0·3385	— 0·3403	— 0·3394	+ 1·8	+ 2·3	8·5023
314	XXIII	1·130	33·130	+ 0·4081	+ 0·4089	+ 0·4085	— 0·8	+ 1·5	8·9108
XXIII	300	1·648	34·778	— 1·8684	— 1·8682	— 1·8683	— 0·2	+ 1·3	7 0425
300	299	1·078	35·856	+ 1·6690	+ 1·6692	+ 1·6691	— 0·2	+ 1·1	8·7116
299	298	1·078	36·934	+ 2·6728	+ 2·6702	+ 2·6715	+ 2·6	+ 3·7	11·3831
298	297	1·134	38·068	— 3·6872	— 3·6854	— 3·6863	— 1·8	+ 1·9	7·6968
297	296	0·935	39·003	+ 1·6520	+ 1·6503	+ 1·6512	+ 1·7	+ 3·6	9·3480
296	295	1·402	40·405	+ 0·4528	+ 0·4539	+ 0·4533	— 1·1	+ 2·5	9·8013
295	294	1·173	41·578	+ 2·6171	+ 2·6187	+ 2·6179	— 1·6	+ 0·9	12·4192
294	293	2·287	43·865	— 0·6536	— 0·6572	— 0·6554	+ 3·6	+ 4·5	11·7638
293	292	1·449	45·314	+10·5756	+10·5755	+10·5755	+ 0·1	+ 4·6	22·3393
292	291	1·184	46·498	— 1·1028	— 1·1083	— 1·1056	+ 5·5	+10·1	21·2337
291	290	1·677	48·175	+ 4·7258	+ 4·7287	+ 4·7272	— 2·9	+ 7·2	25·9609
290	289	1·402	49·577	+ 1·2316	+ 1·2322	+ 1·2319	— 0·6	+ 6·6	27·1928
289	288	1·191	50·768	— 1·7571	— 1·7592	— 1·7581	+ 2·1	+ 8·7	25·4347
288	286	1·874	52·642	+ 0·1215	+ 0·1229	+ 0·1222	— 1·4	+ 7.3	25·5569
286	285	1·160	53·802	— 0·5053	— 0·5046	— 0·5050	— 0·7	+ 6·6	25·0519
285	284	1·156	54·958	— 1·2745	— 1·2733	— 1·2739	— 1·2	+ 5·4	23·7780
284	XXII	1·155	56·113	— 2·9148	— 2·9129	— 2·9138	— 1·9	+ 3·5	20·8642
XXII	R	0·668	56·781	+ 6·2348	+ 6·2403	+ 6·2393			27·1035
XXII	275	1·165	57·278	+ 2·7383	+ 2·7396	+ 2·7389	— 1·3	+ 2·2	23·6031
275	276	1·141	58·419	+ 6·2662	+ 6·2651	+ 6·2656	+ 1·1	+ 3·3	29·8687
276	277	1·085	59·504	— 0·3057	— 0·3065	— 0·3061	+ 0·8	+ 4·1	29·5626
277	278	1·074	60·578	— 2·1700	— 2·1675	— 2·1687	— 2·5	+ 1·6	27·3939
278	279	1·371	61·949	+ 5·8666	+ 5·8664	+ 5·8665	+ 0·2	+ 1·8	33·2604
279	280	1·136	63·085	— 3·8634	— 3·8654	— 3·8644	+ 2·0	+ 3·8	29·3960
280	281	1·051	64·136	+ 0·4146	+ 0·4144	+ 0·4145	+ 0·2	+ 4·0	29·8105
281	282	1·149	65·285	+ 7·3106	+ 7·3131	+ 7·3119	— 2·5	+ 1·5	37·1224
282	283	1·400	66·685	— 5·0405	— 5·0422	— 5·0413	+ 1·7	+ 3·2	32·0811
283	288	1·156	67·841	— 2·5294	— 2·5282	— 2·5288	— 1·2	+ 2·0	29·5523
288	XXI	1·127	68·968	+ 3·5658	+ 3·5648	+ 3·5653	+ 1·0	+ 3·0	33·1176
XXI	274	1·513	70·481	+ 0·3529	+ 0.3493	+ 0·3511	+ 3·6	+ 6·6	33·4687
274	273	1·020	71·501	— 2·9044	— 2·9040	— 2·9042	— 0·4	+ 6·2	30·5645
273	272	1·057	72·558	+ 0·3728	+ 0·3730	+ 0·3729	— 0·2	+ 6·0	30·9374
272	271	1·109	73·667	— 0·9504	— 0·9520	— 0·9512	+ 1·6	+ 7·6	29·9862
271	270	1·627	75·294	— 3·8436	— 3·8445	— 3·8440	+ 0·9	+ 8·5	26·1422
270	269	1·027	76·321	— 3·8654	— 3·8677	— 3·8665	+ 2·3	+10·8	22·2757
269	268	1·117	77·438	— 5·6412	— 5·6385	— 5·6399	— 2·7	+ 8·1	16·6358
268	267	1·183	78·621	— 5·3616	— 5·3599	— 5·3607	— 1·7	+ 6·4	11·2751
267	266	1·428	80·049	— 0·7651	— 0·7626	— 0·7639	— 2·5	+ 3·9	10·5112
266	265	1·111	81·160	— 4·8236	— 4·8233	— 4·8234	— 0·3	+ 3·6	5·6878
265	264	1·104	82·264	+ 0·3698	+ 0·3723	+ 0·3711	— 2·5	+ 1·1	6·0589
264	263	1·589	83·853	— 1·2190	— 1·2172	— 1·2181	— 1·8	— 0·7	4·8408
263	262	1·313	85·166	+ 0·2099	+ 0·2088	+ 0·2093	+ 1·1	+ 0·4	5·0501
262	261	1·004	86·170	+ 7·1770	+ 7·1775	+ 7·1772	— 0·5	— 0·1	12·2273
261	260	1·826	87·996	— 2·2989	— 2·2946	— 2·2967	— 4·3	— 4·4	9·9306
260	259	0·993	88·989	— 1·7211	— 1·7251	— 1·7231	+ 4·0	— 0·4	8·2075
259	258	1·115	90·104	+ 1·9009	+ 1·9007	+ 1·9008	+ 0·2	— 0·2	10·1083
258	257	1·108	91·212	+ 0·3829	+ 0·3833	+ 0·3831	— 0·4	— 0·6	10·4914
257	256	2·374	93·586	— 0·4908	— 0·4960	— 0·4934	+ 5·2	+ 4·6	9·9980
256	255	1·107	94·693	— 1·5891	— 1·5882	— 1·5886	— 0·9	+ 3·7	8·4094
255	254	1·416	96·109	— 0·1716	— 0·1690	— 0·1703	— 2·6	+ 1·1	8·2391
254	Q	0·143	96·252	+1·5615	+ 1·5614	+1·5614	+ 0·1	+ 1·2	9·8005
254	253	0·700	96·809	+ 0·0285	+ 0·0278	+ 0·0282	+ 0·7	+ 1·8	8·2673
253	252	1·122	97·931	+ 1·4769	+ 1·4754	+ 1·4761	+ 1·5	+ 3·3	9·7434
252	251	1·594	99·525	+ 1·2680	+ 1·2642	+ 1·2661	+ 3·8	+ 7·1	11·0095
251	250	1·105	100·630	+ 0·8422	+ 0·8413	+ 0·8418	+ 0·9	+ 8·0	11·8513
250	249	1·059	101·689	— 0·3927	— 0·3914	— 0·3920	— 1·3	+ 6·7	11·4593
249	XIX	1·038	102·727	—*3·4854	—*3·4845	— 3·4850	— 0·9	+ 5·8	7·9743
XIX	221	1·441	104·168	+ 2·0655	+ 2·0649	+ 2·0652	+ 0·6	+ 6·4	10·0395

* Mean of three or more measures.

Results of geodetic spirit leveling from Old Point Comfort, Va., to Richmond, Va., 1884—Continued.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Rod E.	Rod F.	Mean.	Partial E—F	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
221	222	1·108	105·276	+ 1·2736	+ 1·2728	+ 1·2732	+0·8	+ 7·2	11·3127
222	223	1·114	106·390	+ 1·1480	+ 1·1509	+ 1·1494	—2·9	+ 4·3	12·4621
223	XX	0·892	107·282	+ 0·2061	+ 0·2024	+ 0·2042	+3·7	+ 8·0	12·6663
XX	233	1·150	108·432	+ 3·2290	+ 3·2294	+ 3·2292	—0·4	+ 7·6	15·8955
233	234	1·048	109·480	+ 1·0094	+ 1·0109	+ 1·0101	—1·5	+ 6·1	16·9056
234	235	1·111	110·591	+ 0.5337	+ 0.5277	+ 0·5307	+6·0	+12·1	17·4363
235	236	1·820	112·411	+ 5·0610	+ 5·0564	+ 5·0587	+4·6	+16·7	22·4950
236	237	1·202	113·613	+ 4·0697	+ 4·0724	+ 4·0710	—2·7	+14·0	26·5660
237	238	1·187	114·800	+*1·3476	+*1·3496	+ 1·3486	—2·0	+12·0	27·9146
238	239	1·372	116·172	+ 4·0728	+ 4·0782	+ 4·0755	—5·4	+ 6·6	31·9901
239	XVIII	1·520	117·692	+ 5·1913	+ 5·1952	+ 5·1932	—3·9	+ 2·7	37·1833
XVIII	218	1·115	118·807	+ 5·1329	+ 5·1342	+ 5·1336	—1·3	+ 1·4	42·3169
218	219	1·105	119·912	+ 3·5581	+ 3·5608	+ 3·5594	—2·7	— 1·3	45·8763
219	220	0·887	120·799	+ 1·6033	+ 1·6002	+ 1·6017	+3·1	+ 1·8	47·4780
220	224	1·135	121·934	— 0·8072	— 0·8047	— 0·8060	—2·5	— 0·7	46·6720
224	225	1·127	123·061	+ 2·3742	+ 2·3709	+ 2·3725	+3·3	+ 2·6	49·0445
225	226	1·108	124·169	+ 1·5619	+ 1·5605	+ 1·5612	+1·4	+ 4·0	50·6057
226	227	1·128	125·297	— 2·8049	— 2·7972	— 2·8010	—7·7	— 3·7	47·8047
227	228	1·134	126·431	— 3·8237	— 3·8205	— 3·8221	—3·2	— 6·9	43·9826
228	229	1·144	127·575	— 7·3065	— 7·3074	— 7·3070	+0·9	— 6·0	36·6756
229	230	1·423	128·998	— 9·3315	— 9·3317	— 9·3316	+0·2	— 5·8	27·3440
230	231	1·106	130·104	—*6·2556	—*6·2541	— 6·2548	—1·5	— 7·3	21·0892
231	232	1·775	131·879	—10·4299	—10·4251	—10·4275	—4·8	—12·1	10.6617
232	240	0·775	132·654	— 3·2959	— 3·2951	— 3·2955	—0·8	—12·9	7·3662
240	241	1·081	133·735	— 1·9030	— 1·9007	— 1·9018	—2·3	—15·2	5·4644
241	242	0·700	134·435	+ 3·5470	+ 3·5483	+ 3·5476	—1·3	—16·5	9·0120
242	243	1·242	135·677	+ 5·5594	+ 5·5598	+ 5·5596	—0·4	—16·9	14·5716
243	244	0·744	136·421	+ 6·0779	+ 6·0734	+ 6·0756	+4·5	—12·4	20·6472
244	245	0·268	136·689	+ 8·4580	+ 8·4579	+ 8·4580	+0·1	—12·3	29·1052
245	246	0·513	137·202	+13·6690	+13·6667	+13·6679	+2·3	—10·0	42·7731
246	247	0·754	137·956	+ 7·0112	+ 7·0119	+ 7·0115	—0·7	—10·7	49·7846
247	248	0·975	138·931	+ 2·4128	+ 2·4123	+ 2·4125	+0·5	—10·2	52·1971
248	O	0·957	139·888	+ 5·9793	+ 5·9745	+ 5·9769	+4·8	— 5·4	58·1740
O	P	0·392	140·280	+ 4·5497	+ 4·5495	+ 4·5496	+0·2	— 5·2	62·7236

Results of geodetic spirit leveling from Old Point Comfort to Richmond, Va., 1891–92.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Forward.	Backward.	Mean.	Partial F—B	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
	U								2·6875
U	Fort	0·500	0·500	+0·6792					3·3667
Fort	1	0·672	1·172	—1·1400					2·2267
1	2	1·844	3·016	+0·9957					3·2224
2	3	1·390	4·406	—0·5265					2·6959
3	4	0·760	5·166	—1·0536					1·6423
4	5	1·170	6·336	+1·7244					3·3667
5	6	1·127	7·463	+0·8246					4·1913
6	7	1·113	8·576	+0·3301					4·5214
7	8	1·511	10·087	—0·2615					4·2599
8	9	1·594	11·681	—0·6228					3·6371
9	10	1·085	12·766	+0·7637					4·4007
10	11	1·002	13·768	+1·2512					5·6519
11	12	0·669	14·437	+0·2499					5·9018
12	S	1·482	15·919	+0·9141					6·8159
S	14	3·195	19·114	*+0·5943	*+0·5821	+0·5882	+12·2	+12·2	7·4041
14	15	1·185	20·299	—0·2955	—0·2923	—0·2939	— 3·2	+ 9·0	7·1102
15	16	1·121	21·420	*+0·5348	*+0·5291	+0·5320	+ 5·7	+14·7	7·6422
16	17	0·998	22·418	+0·7665	+0·7724	+0·7694	— 5·9	+ 8·8	8·4116

*Mean of two measures.

Results of geodetic spirit leveling from Old Point Comfort to Richmond, Va., 1891–92—Continued.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Forward.	Backward.	Mean,	Partial F—B	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
17	18	1·046	23·464	+0·2354	+0·2330	+0·2342	+ 2·4	+11·2	8·6458
18	19	1·012	24·476	+1·0653	+1·0659	+1·0656	— 0·6	+10·6	9·7114
19	R. R. Sta.	0·717	25·193	—0·5510					9·1604
19	20	0·788	25·264	—0·8594	—0·8617	—0·8606	+ 2·3	+12·9	8·8508
20	R_3	0·094	25·358	+1·0209	+1·0209	+1·0209	0·0	+12·9	9·8717
20	22	1·866	27·130	—0·0487	—0·0536	—0·0512	+ 4·9	+17·8	8·7996
22	23	1·045	28·175	+1·8915	+1·8904	+1·8910	+ 1·1	+18·9	10·6906
23	24	1·126	29·301	+0·5569	+0·5553	+0·5561	+ 1·6	+20·5	11·2467
24	25	1·137	30·438	—1·6155	—1·6199	—1·6177	+ 4·4	+24·9	9·6290
25	26	1·250	31·688	*+0·3117	*+0·3058	+0·3088	+ 5·9	+30·8	9·9378
26	28	2·294	33·982	—1·3678	—1·3669	—1·3674	— 0·9	+29·9	8·5704
28	29	1·238	35·220	—0·2810	—0·2760	—0·2785	— 5·0	+24·9	8·2919
29	30	1·295	36·515	—1·2987	—1·3030	—1·3008	+ 4·3	+29·2	6·9911
30	31	0·983	37·498	*+1·6564	*+1·6525	+1·6544	+ 3·9	+33·1	8·6455
31	32	0·956	38·454	*+2·4748	*+2·4652	+2·4700	+ 9·6	+42·7	11·1155
32	33	0·949	39·403	—1·9236	—1·9182	—1·9209	— 5·4	+37·3	9·1946
33	34	1·247	40·650	+0·6619	+0·6649	+0·6634	— 3·0	+34·3	9·8580
34	37	3·176	43·826	+7·3466	+7·3309	+7·3388	+15·7	+50·0	17·1968
37	R_2	0·051	43·877	+2·2798	+2·2799	+2·2798	— 0·1	+49·9	19·4766
36	R. R. Sta.	0·128	43·109	+0·5281					
37	38	0·967	44·793	—2·4209	—2·4196	—2·4202	— 1·3	+48·7	14·7766
38	39	1·031	45·824	—1·9327	—1·9350	—1·9338	+ 2·3	+51·0	12·8428
39	40	1·002	46·826	+8·2385	+8·2351	+8·2368	+ 3·4	+54·4	21·0796
40	41	1·178	48·004	+1·1139	+1·1119	+1·1129	+ 2·0	+56·4	22·1925
41	R. R. Sta.	0·512	48·516	—1·702					
41	42	1·112	49·116	—1·1800	—1·1744	—1·1772	— 5·6	+50·8	21·0153
42	43	0·997	50·113	+5·0161	+5·0156	+5·0158	+ 0·5	+51·3	26·0311
43	44	1·213	51·326	*+1·1115	*+1·1058	+1·1086	+ 5·7	+57·0	27·1397
44	46	2·392	53·718	*+0·1729	*+0·1673	+0·1701	+ 5·6	+62·6	27·3098
46	47	1·095	54·813	*—4·0549	*—4·0644	—4·0596	+ 9·5	+72·1	23·2502
47	48	1·122	55·935	+1·9480	+1·9425	+1·9452	+ 5·5	+77·6	25·1954
48	49	1·116	57·051	*—1·8534	*—1·8577	—1·8556	+ 4·3	+81·9	23·3398
49	50	1·129	58·180	—2·6922					20·6476
49	R.	1·386	58·437	*+3·7451	*+3·7376	+3·7414	+ 7·5	+89.4	27·0812
50	R. R. Sta.	0·148	58·328	+0·265					
50	51	1·166	59·346	+5·3258					25·9734
51	52	1·039	60·385	+5·3933					31·3667
52	53	1·094	61·479	—3·3099					28·0568
53	54	1·238	62·717	+0·5755					28·6323
54	55	1·170	63·887	+4·5031					33·1354
55	R. R. Sta.	0·453	64·340	—1·5113					31·6241
55	56	1·099	64·986	—4·8931					28·2423
56	57	1·268	66·254	+5·1152					33·3575
57	58	0·839	67·093	+3·2406					36·5981
58	R. R. Sta.	0·365	67·458	—1·1473					35·4508
58	59	0·927	68·020	—3·3569					33·2412
59	60	0·944	68·964	—2·8463					30·3949
60	61	1·249	70·213	+2·0888					32·4837
61	62	0·940	71·153	+0·5447					33·0284
62	63	0·924	72·077	+0·7066					33·7350
63	64	1·092	73·169	—3·1646					30·5704
64	65	1·066	74·235	+0·2859					30·8563

* Mean of two measures.

Results of geodetic spirit leveling from Old Point Comfort to Richmond, Va., 1891–92—Continued.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Forward.	Backward.	Mean.	Partial F—B	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
65	Q_4	0·038	74·273	−0·0345	−0·0347	−0·0346	+ 0·2		30·8217
65	R. R. Sta.	0·100	74·335	+0·343					31·199
65	66	1·038	75·273	−0·7854					30·0709
66	67	1·049	76·322	−1·9010					28·1699
67	68	1·081	77·403	−4·2177					23·9522
68	69	0·900	78·303	−3·5941					20·3581
69	70	1·182	79·485	−5·7177					14·6404
70	71	1·325	80·810	−3·4544					11·1860
71	Q_3	0·176	80·986	+2·3514	+2·3512	+2·3513	+ 0·2		13·5374
71	R. R. Sta.	0·208	81·018	+1·051					12·237
71	72	1·034	81·844	−1·3388					9·8472
72	73	1·305	83·149	−4·6420					5·2052
73	74	1·561	84·710	+2·7078					7·9130
74	R. R. Sta.	0·290	85·000	−1·178					9·091
74	Q_2	0·673	85·383	−5·5775					2·3355
Q_2	75	1·151	86·534	+2·6434					4·9789
75	76	0·986	87·520	+3·7069					8·6858
76	77	1·011	88·531	+2·9201					11·6059
77	78	1·262	89·793	−1·4818					10·1241
78	79	1·217	91·010	−1·8761					8·2480
79	80	1·054	92·064	+2·4960					10·7440
80	81	1·090	93·154	−0·2677					10·4763
81	82	1·259	94·413	−0·0407					10·4356
82	83	0·970	95·383	−0·3442					10·0914
83	84	1·006	96·389	−1·5232					8·5682
84	85	0·951	97·340	+0·0773					8·6455
85	R. R. Sta.	0·099	97·439	+ 0·243					8·888
85	86	0·390	97·930	− 0·3038					8·3417
86	Q	0·418	98·148	+ 1·4546					9·7963
Q	87	0·779	98·927	− 1·4382	− 1·4376	− 1·4379	− 0·6	− 0·6	8·3584
87	88	1·295	100·222	+ 1·5236	+ 1·5249	+ 1·5242	− 1·3	− 1·9	9·8826
88	89	1·087	101·309	+ 0·9694	+ 0·9735	+ 0·9714	− 4·1	− 6·0	10·8540
89	90	1·131	102·440	− 0·0314	− 0·0249	− 0·0282	− 6·5	−12·5	10·8258
90	91	1·140	103·580	+ 1·3724	+ 1·3791	+ 1·3758	− 6·7	−19·2	12·2016
91	92	1·119	104·699	− 4·2687	− 4·2829	− 4·2758	+14·2	− 5·0	7·9258
92	93	1·019	105·718	+ 0·7709	+ 0·7691	+ 0·7700	+ 1·8	− 3·2	8·6958
93	R. R. Sta.	1·370	107·088	+ 1·906					
93	94	1·434	107·152	+ 1·7082	+ 1·7110	+ 1·7096	− 2·8	− 6·0	10·4054
94	P_5	0·419	107·571	+ 2·6535	+ 2·6529	+ 2·6532	+ 0·6	− 5·4	13·0586
94	95	1·090	108·242	*+1·3475	*+1·3426	+ 1·3450	+ 4·9	− 1·1	11·7504
95	96	1·128	109·370	*+1·3403	*+1·3310	+ 1·3356	+ 9·3	+ 8·2	13·0860
96	98	2·200	111·570	*+3·9936	*+3·9768	+ 3·9852	+16·8	+25·0	17·0712
98	99	1·106	112·676	+ 0·5876	+ 0.5905	+ 0·5890	− 2·9	+22·1	17·6602
99	100	1·186	113·862	*+3·1424	*+3·1482	+ 3·1453	− 5·8	+16·3	20·8055
100	R. R. Sta.	0·292	114·154	+ 1·480					22·286
100	101	1·163	115·025	+ 2·4506	+ 2·4559	+ 2·4532	− 5·3	+11·0	23·2587
101	102	1·145	116·170	+ 3·6692	+ 3·6754	+ 3·6723	− 6·2	+ 4·8	26·9310
102	103	1·189	117·359	+ 2·2010	+ 2·2045	+ 2·2028	− 3·5	+ 1·3	29·1338
103	104	1·089	118·448	+ 2·8823	+ 2·8886	+ 2·8854	− 6·3	− 5·0	32·0192
104	105	1·143	119·591	+ 4·0947	+ 4·1025	+ 4·0986	− 7·8	−12·8	36·1178
105	106	1·153	120·744	+ 6·6004	+ 6·5962	+ 6·5983	+ 4·2	− 8·6	42·7161
106	107	1·172	121·916	+ 3·3280	+ 3·3318	+ 3·3299	− 3·8	−12·4	46·0460
107	109	2·116	124·032	+ 1·0329	+ 1·0352	+ 1·0340	− 2·3	−14·7	47·0800
109	110	1·076	125·108	*+2·1490	*+2·1531	+ 2·1510	− 4·1	−18·8	49·2310

*Mean of two measures.

Results of geodetic spirit leveling from Old Point Comfort to Richmond, Va., 1891–92—Continued.

Bench marks. From	To	Distance between successive marks.	Distance from Old Point Comfort.	Difference of height. Forward.	Backward.	Mean.	Discrepancy. Partial F—B	Total accumulated.	Height above average level of bay and ocean at Old Point Comfort.
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
110	111	0·974	126·082	+ 1·3367	+ 1·3433	+ 1·3400	— 6·6	—25·4	50·5710
111	112	1·143	127·225	— 2·7149	— 2·7139	— 2·7144	— 1·0	—26·4	47·8566
112	113	1·192	128·417	— 4·3818	— 4·3846	— 4·3832	+ 2·8	—23·6	43·4734
113	P_4	1·322	129·739	— 9·1935	— 9·1970	— 9·1952	+ 3·5	—20·1	34·2782
P_4	114	0·956	130·695	— 5·5437	— 5·5385	— 5·5411	— 5·2	—25·3	28·7371
114	115	1·216	131·911	— 6·9466	— 6·9529	— 6·9498	+ 6·3	—19·0	21·7873
115	116	1·219	133·130	*—6·8102	*—6·8192	— 6·8147	+ 9·0	—10·0	14·9726
116	117	0·823	133·953	— 5·9270	— 5·9283	— 5·9276	+ 1·3	— 8·7	9·0450
117	City B. M.	0·692	134·645	— 1·2573	— 1·2565	— 1·2569	— 0·8	— 9·5	7·7881
City B. M.	118	1·173	135·818	— 2·2566	— 2·2625	— 2·2596	+ 5·9	— 3·6	5·5285
118	P_3	0·281	136·099	+ 0·4753	+ 0·4737	+ 0·4745	+ 1·6	— 2·0	6·0030
P_3	119	0·889	136·988	+ 2·9640	+ 2·9621	+ 2·9630	+ 1·9	— 0·1	8·9660
119	120	0·742	137·730	*+40·6488	*+40·6478	+40·6483	+ 1·0	+ 0·9	49·6143
120	121	1·124	138·854	+ 3·1597	+ 3·1594	+ 3·1596	+ 0·3	+ 1·2	52·7739
121	O	1·300	140·154	+ 5·4468	+ 5·4441	+ 5·4454	+ 2·7	+ 3·9	58·2193
O	P	0·382	140·536	+ 4·5526	+ 4·5544	+ 4·5535	— 1·8	+ 2·1	62·7728
P_3	P_2	0·073	136·172	+ 0·7440	+ 0·7437	+ 0·7438	+ 0·3	— 1·7	6·7468
120	City Hall, B. M.	0·069	137·799	+ 0·4508	+ 0·4510	+ 0·4509	— 0·2	+ 0·7	50·0652

* Mean of two measures.

Summary of results of spirit leveling between Old Point Comfort and Richmond, Va.

Bench marks.		Distance in km. 1884.	Distance in km. 1891–92.	Difference of heights. 1884.	Difference of heights. 1891–92.	Difference of results. 1884 — 1891–92.
				m.	*m.*	*m.*
U	to Fort	0·326	0·500	0·6815	0·6792	+0·0023
Fort	" S	13·664	15·419	3·4441	3·4492	—0·0051
S	" R	41·455	42·518	20·2904	20·2637	+0·0267
R	" Q	40·521	39·711	—17·3030	—17·2849	—0·0181
Q	" P	43·530	42·388	52·9231	52·9765	—0·0534
P	" O	0·392	0·382	— 4·5496	— 4·5535	+0·0039

Mean resulting heights above sea level.

	m.	*Ft.*
Average tide-water level of Chesapeake Bay or of ocean	0·0000 or ±0·012	0·000 ±0·04
Mark U, copper bolt on Old Point Comfort Light-House	2·6875	8·817
Old tidal mark (of 1852) at light-house	2·9353	9·630
Mark on Fort Monroe	3·3679	11·050
Mark S, Lafayette House, Newport News	6·8145	22·357
" R_3, bolt on Jones' house at Morrison	9·870	32·382
" R_2, bolt on Madison's outhouse at Lee Hall	19·487	63·933
" R, bolt at Williamsburg	27·0915	88·883
" Q_4, on brick foundation of Toano water tank	30·832	101·155
" Q_3, bolt on dwelling at Diascond	13·538	44.416
" Q_2, on brick culvert above Lanexa	2·337	7·667
" Q, bolt at Providence Forge	9·7975	32·144
" P_5, bolt on Walker's house at Roxbury	13·060	42·848
" P_4, on brick culvert near milepost 81	34·253	112·378
Engineers or city bench mark on post intersection of Poplar and Ash streets, Richmond	7·763	25·469
Mark P_3, on brick building corner of Winston alley and 17th streets, Richmond	5·978	19·613
" P_2, on brick building 17th and Dock streets, Richmond	6·721	22·050
" P, on Richmond College	62·7473	205·863
City hall, mark at west entrance of new city hall	50·0416	164·178
Mark O, on freight depot of R., F. and P. Railroad, Richmond	58·1957	190·930

For the probable error from double leveling of height of any of the Richmond stations we find:

$r_{//}=0{\cdot}675\sqrt{\frac{[d\,d]}{4}}=\pm 21{\cdot}2^{mm}$, hence the

total probable error $\pm 21{\cdot}2^{mm} \pm 12{\cdot}0^{mm}=\pm 24{\cdot}3^{mm}$ or nearly 1 inch.

Also the probable error of leveling of 1 km. (double measure) $\pm 1{\cdot}8^{mm}$, a value which is quite satisfactory.

LOCATION AND DESCRIPTION OF BENCH MARKS ON LINE OF LEVELS BETWEEN OLD POINT COMFORT AND RICHMOND, VA.

Old Tidal B. M.—Old Point Comfort Light-House, Virginia. It is on the southwest side of the light-house at Fort Monroe—a figure, thus U.S.C.S., cut in the stone about 1½ feet from the ground. The reference point is the middle of the lower horizontal edge of the indenture, which is 11 feet above mean low water, and 9·63 feet above mean sea level. The cut in the stone has the following dimensions: Top 0·161 metres long, bottom 0·185 m., height at centre 0·0675 m., and height at ends, respectively, 0·0675 m. north and 0·060 m. south. This mark was established in August, 1852, and was originally "a *line* cut in the wall."

Primary B. M. U.—Old Point Comfort, Va. It is on the southwest side of the light-house at Fort Monroe—a copper bolt leaded horizontally into the stone, directly beneath the "Old Tidal B. M.", and 0·215 m. above the ground. The bolt is 0·0125 m. in diameter and 0·055 m. in length. It is 8·817 feet above mean sea level. The centre of the bolt is the reference point. J. B. W., 1884.

[N. B.—There is also a bench mark at the door sill on the west side of the light-house, made by J. B. W. in 1884, and known as T, and another one, lozenge shaped, established by Lieut. M. L. Wood in 1888.]

Secondary B. M. Fort.—Fort Monroe, Va. It is on the outer wall of the fort, close to and on the right-hand side of the Postern Gate. It is a cross (+) cut in the second granite block from the gate, being in the eleventh course of stone. J. B. W., 1884.

Primary B. M. S.—Newport News, Va. It is on the stone door sill on the south side of the "Lafayette House," near the middle of the house, being marked by a square hole cut in the stone, thus □, at a distance of 0·055 m. from the south edge of the sill, and 0 1663 m. from the extreme west edge. The bottom of the hole is the reference level. J. B. W., 1884.

Primary B. M. R_3.—Morrison, Warwick County, Va. A copper bolt leaded into the brick chimney of a one-story frame house in the yard of D. H. Jones' residence. The bolt is in the tenth course from the ground, on the north side of the chimney, and in the second brick from the outer or northeast corner; it has a cross (+) cut on its end to mark the reference point. I. W., 1891.

Primary B. M. R_2.—Lee Hall, Warwick County, Va. A copper bolt leaded in the west wall of a two-story brick outhouse in the yard of E. C. Madison's residence. The bolt is in the seventh course above the ground and in the third brick from the southwest corner, on the west side of the house; it has a cross (+) cut on its end to mark the reference point. I. W., 1891.

Primary B. M. R.—Williamsburg, Va. A copper bolt 0·058 m. long and 0·0125 m. in diameter, leaded horizontally in the north side of the court-house, near the east end. The bolt is in the eleventh layer of bricks above the watershed of the building, and in the third brick from the corner of the north wing; its centre is the reference point. J. B. W., 1884.

Primary B. M. Q_4.—Toano, James City County, Va. A square hole cut in the top of the brick foundation under the railroad water tank. It is in the top of the third sill from the track, 3½ inches from the west end and 2 inches from the north side of the foundation; its bottom is the reference level. I. W., 1891.

Primary B. M. Q_3.—Diascond, James City County, Va. A copper bolt leaded in the brick chimney of the frame dwelling house owned by John Gordon and occupied by J. C. Glasebrook. The bolt is in the east side of the chimney, in the eleventh course of bricks above ground, and in the third brick from the northeast corner; it has a cross (+) cut on its end to mark the reference point. I. W., 1891.

Primary B. M. Q_2.—Near Lanexa, New Kent County, Va. A square hole cut in the top of the raised portion of the brick culvert under the C. and O. Railway, just above the station. It is at the north end of the culvert and 0·5 m. from its west side. It is roughly lettered thus, U. S. ■ B. M.; the bottom of the hole is the reference level. I. W., 1891.

Primary B. M. Q.—Providence Forge, New Kent County, Va. A copper bolt 0·058 m. long and 0·0125 m. in diameter, leaded horizontally in the north side of the chimney at the north end of Mr. Townsend's dwelling house. The bolt is in the eighth course of bricks from the ground, and in the eighth brick from the north end of the chimney; its centre is the reference point. J. B. W., 1884.

Primary B. M. P_3.—Roxbury, Charles City County, Va. A copper bolt leaded in the brick chimney at the west end of T. L. Walker's residence. The bolt is in the tenth course of bricks from the ground and in the third brick from the west side of the chimney; a cross (+) cut on its end marks the reference point. I. W., 1891.

Primary B. M. P_4.—One and a half miles easterly from Richmond, Va. A square hole cut in the top of the stone coping to the brick culvert under the C. and O. Railroad, 140 metres east of milepost 81. It is on the south end of the culvert, and on the eastern or largest stone of the coping on the raised part of the culvert at this end. It is roughly lettered thus, U. S. ■ B. M.; the bottom of the hole is the reference level. I. W., 1891.

Primary B. M. P_5.—Richmond, Va., corner of Seventeenth street and Winston alley. A square hole cut in the top of the stone door and window sill (on which the iron columns in front of the building rest) of the brick building owned by Davenport & Morris, and occupied by the Union Brokerage, Commission and Warehouse Company. It is at the northeast corner of the building and is nearly on a level with the pavement; it is lettered thus, U. S. / C. & G. S. / ■ / B. M.; the bottom of the hole is the reference point. I. W., 1892.

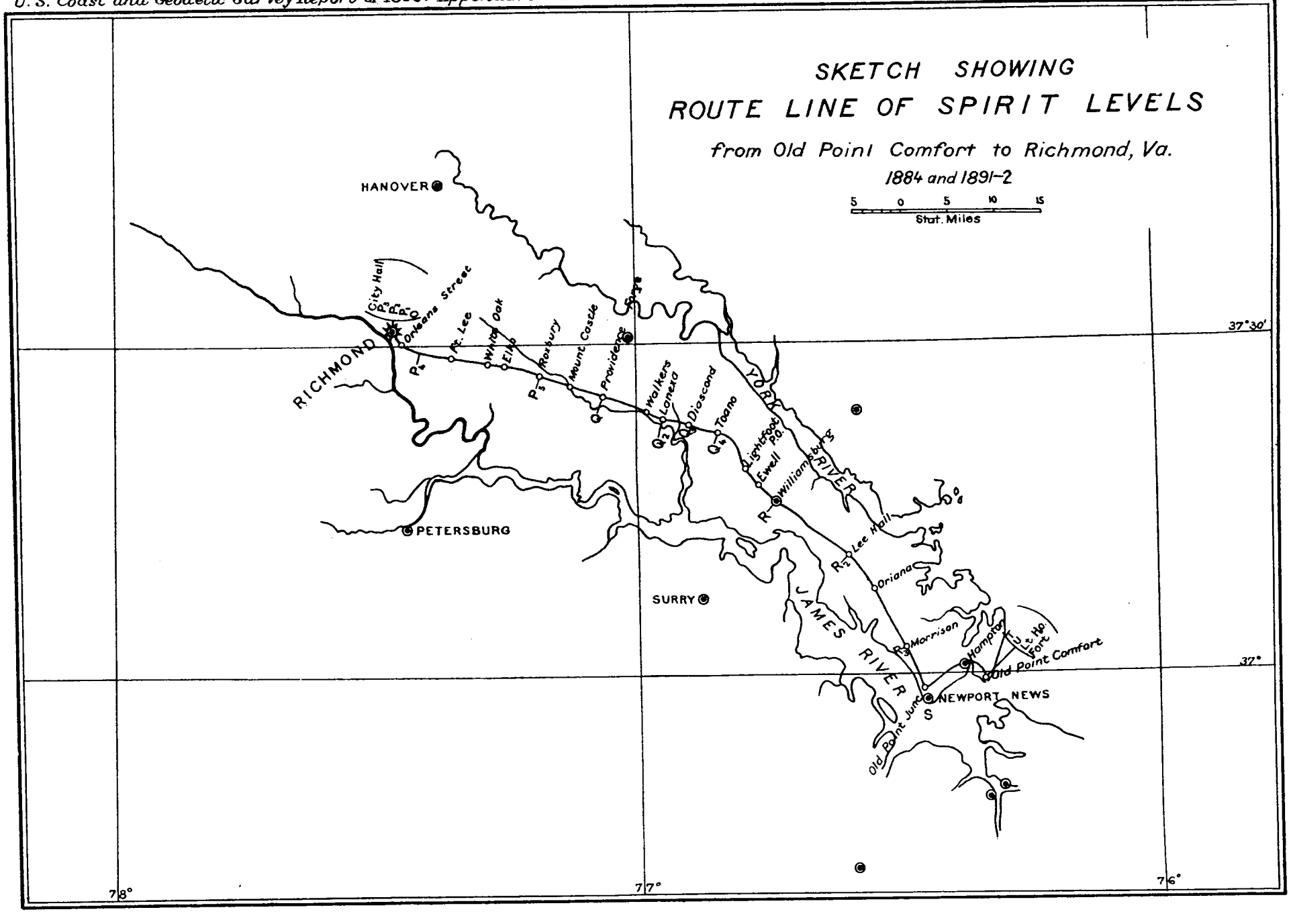
Primary B. M. P_2.—Richmond, Va., corner of Seventeenth and Dock streets. A cross (+) cut in the granite window sill of the window at the right-hand corner (as one faces the front of the building), on the front of the brick building owned and occupied by Davenport & Morris. It is lettered thus: U. S. / C. & G. S. / + / B. M. I. W., 1892.

Primary B. M. New City Hall.—Richmond, Va. The bench is the flat surface of an offset on the granite base to the lamp-post on the left of the steps leading to the west entrance to the new city hall. No marks were made. The stone is 30 by 30 inches; the reference point is the centre of the square offset, size 2½ by 2½ inches, on the corner nearest the entrance and inside toward the steps. The city engineer's department knows and preserves the point. I. W., 1892.

Primary B. M. O.—Richmond, Va.; freight depot of the Richmond, Fredericksburg and Potomac Railroad. A square hole cut in the granite door (window ?) sill of the second door on the west side of the depot, near the north end. It is 0·15 m. from the extreme west edge of the door and 0·654 m. from the north side of the door; its bottom is the reference level. J. B. W., 1884.

Primary B. M. P.—Richmond, Va.; Richmond College, at the head of Grace street. A square hole cut in the granite sill of the east front door of the college, near the south end of the sill. It is 0·142 m. from the extreme east edge of the sill and 0·174 m. from the south edge of the door; its bottom (center) is the reference point. J. B. W., 1884.

Richmond City B. M.—A stone post about 15 by 15 inches, planted at the intersection of Poplar and Ash streets, Richmond. An iron plate is set in the side of the post facing the river and is inscribed as follows: "High-water line, 24 ft. 1·8 inch. above ordinary high tide, Oct. 1, 1870." The mark is the middle line of a raised horizontal arrow on the plate (⟸⟹). Assistant Weir, when using it in 1886, called it the Engineer's B. M.


SKETCH SHOWING
ROUTE LINE OF SPIRIT LEVELS
from Old Point Comfort to Richmond, Va.
1884 and 1891-2
5 0 5 10 15
Stat. Miles
HANOVER
RICHMOND
City Hall
Orleans Street
Ft. Lee
White Oak
Elko
Roxbury
Mount Castle
Providence
Walkers
Lonaza
Diascond
Toano
Lightfoot P.O.
Ewell
Williamsburg
YORK RIVER
PETERSBURG
SURRY
Lee Hall
Oriana
JAMES RIVER
Morrison
Hampton
U.S. Ho. Fort
Old Point Comfort
NEWPORT NEWS
Old Point Junc.
37°30'
37°
78°
77°
76°

APPENDIX No. 3.—1896.

RESULTING HEIGHTS FROM SPIRIT LEVELING BETWEEN RICHMOND, VA., AND WASHINGTON, D. C., FROM OBSERVATIONS MADE BY J. B. WEIR, SUBASSISTANT, IN SEPTEMBER AND OCTOBER, 1883, AND SEPTEMBER AND OCTOBER, 1884, WITH RELEVELING BY J. B. WEIR BETWEEN RICHMOND AND FREDERICKSBURG, VA., IN MAY AND JUNE, 1886, AND VERIFICATION LEVELING BETWEEN THE TWO CITIES BY I. WINSTON, ASSISTANT, BETWEEN APRIL AND JUNE, 1895.*

Submitted for publication by Charles A. Schott, Assistant, in charge of Computing Division, September 17, 1896.

The following report on the resulting heights from spirit leveling between Richmond, Va., and Washington, D. C., is herewith respectfully submitted. The heights are taken up from the bench mark at the freight depot of the Richmond, Fredericksburg and Potomac Railroad, and known as bench mark "O," which is the starting point of the line. The height of this mark above the average level of the ocean became known by spirit leveling from Old Point Comfort to Richmond and from tidal observations carried on for many years on Chesapeake Bay near Fort Monroe. Its height is 58·1957 m., or 190·930 feet. (See preceding appendix in this volume.) The line was first run in 1883-84 by Subassistant J. B. Weir, and repeated by him in 1886 over about one-half of the distance, i. e., from Richmond to Fredericksburg. As will be seen from the result when compared with the average level of the Potomac at Washington, D. C., the operation did not prove as satisfactory as was expected, and Assistant I. Winston was directed in 1895 to rerun the whole line with the view of securing a result which should be physically true and be within acceptable limits of accuracy.

The results are thus presented in three abstracts; the computations were made in duplicate, one by the observers, the other mainly by the office computers, A. S. Christie and J. Nelson. The abstracts themselves are due to Mr. Winston.

Route line.—It follows the track of the Richmond, Fredericksburg and Potomac Railroad via Ashland, Bowling Green, Fredericksburg, and Alexandria, Va., whence it enters the District of Columbia. (See accompanying diagram.) Total development of line 185·6 kilometres, or 115·3 statute miles.

Observers and dates.—The first leveling was executed by J. B. Weir between September 11 and October 29, 1883, and resumed September 26 and completed October 4, 1884. The same observer ran over the southern half of the line between May 28 and June 23, 1886. I. Winston following the same tracks and tying on to all of the former bench marks that had remained undisturbed, leveled over the line between April 6 and June 22, 1895.

Instruments.—Spirit level No. 1 and Rods E and F were used in 1883–84. Spirit level No. 3

* With diagram showing route line and position of bench marks.

with same rods in 1886, and spirit level No. 5 with rods P and Q were used in 1895. The following table contains the instrumental constants for these instruments:

Micrometer spirit level.	No. 1.	No. 3.	No. 5.
Aperture of telescope.	3·5 cm.	4·3 cm.	2·9 cm.
Focal length of telescope.	40·7 cm.	41·0 cm.	34·8 cm.
Magnifying power of same.	26	37	28
One division of striding level.	5″·6 (July 23, 1883)	3″·9 (May 24, 1886)	2″·08 (two mm. space)
Collar inequality { + object end larger.	—2″·828 —3″·405*	—0″·78 May 24, 1886	—0″·595 Apr. 2, 1895.
Collar inequality { — " " smaller.	—2·09 —2·50†		—1·362 Jan. 14, 1896.
Value 100 divisions of micrometer or 1 turn.	442″·9	257″·5	312″·0
Angular value of telemeter threads.	34′ 05″·4	18′ 40″·6	18′ 54″·5

*Observations on July 23 and October 7, 1883. †Observations on September 22 and December 4, 1884.

The metric graduations of the brass scales on rods E and F are correct at the temperatures 16°·7 C. and 18°·9 C., respectively, and their index corrections or projections beyond the zero line are 6·33 cm. (May 6 and November 17, 1884) and 6·06 cm. (May 6 and November 17, 1884), respectively. P and Q are wooden rods, made at the office in 1894–95; they are saturated with paraffin; the metric graduations are marked by brass pins. These rods require no temperature correction, their length being almost invariable; for a full description of them see Appendix No. 8, Report for 1895. All rods are provided with movable targets. Micrometer spirit level No. 1 is described in Appendix No. 11, Report for 1880 (illustrated on plates Nos. 46 and 47), micrometer spirit level No. 3 is described in Appendix No. 15, Report for 1879 (illustrated on plate No. 52); micrometer spirit level No. 5 was constructed at the Survey Office in 1888 and differs only in some unessential details from No. 1.

The method of observing.—It was as follows: In 1883–84 two parallel lines were run simultaneously and in the same direction, but with alternate *sections* (from 10 to 15 miles) run in opposite directions. On one of the lines rod E was used, on the other rod F, the rods being placed at different distances from the instrument; the long sights were observed first during one day and the short sights during the next day. In the verification work of 1886 only a single line was run, but with its alternate sections (7 to 15 miles long) in opposite directions. In 1895 a simultaneous double line was run in one direction. The length of the sight line (instrument to rod) varies, ordinarily, between 75 and 125 m. for Weir observer, and extends to a somewhat greater distance for Winston observer.

Results of geodetic spirit leveling, Richmond, Va., to Washington, D. C., 1883–84.

Bench marks. From	Bench marks. To	Distance between successive marks.	Distance from Old Point Comfort, Va.	Difference of height. Rod E.	Rod F.	Mean.	Discrepancy. Partial E—F.	Total accumulated.	Height above average level of bay and ocean at Old Point Comfort.
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
	O		140·021						58·1957
O	204	0·883	140·904	**+ 1·3310	**+ 1·3329	+ 1·3320	—1·9	— 1·9	59·5277
204	205	1·048	141·952	— 2·2566	— 2·2522	— 2·2544	—4·4	— 6·3	57·2733
205	206	1·126	143·078	+ 1·8035	+ 1·8094	+ 1·8064	—5·9	—12·2	59·0797
206	207	1·369	144·447	— 5·1867	— 5·1862	— 5·1864	—0·5	—12·7	53·8933
207	208	1·414	145·861	+ 3·8114	+ 3·8142	+ 3·8129	—2·8	—15·5	57·7062
208	209	1·120	146·981	+ 3·0761	+ 3·0714	+ 3·0737	+4·7	—10·8	60·7799
209	210	2·041	149·022	+ 1·4229	+ 1·4186	+ 1·4207	+4·3	— 6·5	62·2006
210	211	1·143	150·165	+ 2·1687	+ 2·1683	+ 2·1685	+0·4	— 6·1	64·3691
211	Eng. 300	0·604	150·769	+ 0·8059	+ 0·8043	+ 0·8051	+1·6	— 4·5	65·1742

** Mean of three or more measures.

Results of geodetic spirit leveling, Richmond, Va., to Washington, D. C. 1883–84—Continued.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort, Va.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Rod E.	Rod F.	Mean.	Partial E—F	Total accumulated.	
		km.	*km.*	*m*	*m*	*m.*	*mm.*	*mm.*	*m.*
211	212	1·115	151·280	— 0·1007	— 0·0988	— 0·0997	—1·9	— 8·0	64·2694
212	213	1·077	152·357	*— 2·8331	*— 2·8275	— 2·8303	—5·6	—13·6	61·4391
213	214	1·108	153·465	— 3·0149	— 3·0166	— 3·0157	+1·7	—11·9	58·4234
214	215	1·167	154·632	+ 1·9053	+ 1·9073	+ 1·9063	—2·0	—13·9	60·3297
215	216	1·126	155·758	+ 3·0405	+ 3·0383	+ 3·0394	+2·2	—11·7	63·3691
216	217	1·390	157·148	— 2·9707	— 2·9712	— 2·9710	+0·5	—11·2	60·3981
217	XVII	1·439	158·587	— 0·4143	— 0·4107	— 0·4125	—3·6	—14·8	59·9856
XVII	203	1·270	159·857	+ 4·0008	+ 4·0012	+ 4·0010	—0·4	—15·2	63·9866
203	202	1·352	161·209	+ 0·2340	+ 0·2379	+ 0·2359	—3·9	—19·1	64·2225
202	201	1·340	162·549	— 2·2404	— 2·2428	— 2·2416	+2·4	—16·7	61·9809
201	200	0·849	163·398	+ 2·6965	+ 2·6963	+ 2·6964	+0·2	—16·5	64·6773
200	199	0·624	164·022	*+ 1·4942	+ 1·4917	+ 1·4930	+2·5	—14·0	66·1703
199	N	0·919	164·941	*+ 1·1502	+ 1·1511	+ 1·1506	—0·9	—14·9	67·3209
N	198	1·221	166·162	— 4·3203	— 4·3194	— 4·3198	—0·9	—15·8	63·0011
198	197	1·361	167·523	— 7·3416	— 7·3436	— 7·3426	+2·0	—13·8	55·6585
197	196	1·366	168·889	— 6·9656	— 6·9661	— 6·9658	+0·5	—13·3	48·6927
196	195	1·433	170·322	— 8·7278	— 8·7287	— 8·7283	+0·9	—12·4	39·9644
195	194	0·921	171·243	— 5·4900	— 5·4890	— 5·4895	—1·0	—13·4	34·4749
194	193	0·442	171·685	+ 0·0401	+ 0·0396	+ 0·0398	+0·5	—12·9	34·5147
193	192	1·734	173·419	— 0·1218	— 0·1196	— 0·1207	—2·2	—15·1	34·3940
192	191	1·835	175·254	+10·3404	+10·3401	+10·3402	+0·3	—14·8	44·7342
191	M	0·186	175·440	— 0·1724	— 0·1724	— 0·1724	0·0	—14·8	44·5618
191	177	1·610	176·864	— 4·2588	— 4·2592	— 4·2590	+0·4	—14·4	40·4752
177	178	1·350	178·214	— 2·5033	— 2·5023	— 2·5028	—1·0	—15·4	37·9724
178	L	1·730	179·944	— 8·9649	— 8·9642	— 8·9646	—0·7	—16·1	29·0078
L	179	1·378	181·322	+ 7·4462	+ 7·4443	+ 7·4452	+1·9	—14·2	36·4530
179	180	1·662	182·984	+11·7527	+11·7516	+11·7521	+1·1	—13·1	48·2051
180	181	0·897	183·881	+ 5·4637	+ 5·4594	+ 5·4615	+4·3	— 8·8	53·6666
181	182	1·576	185·457	+ 7·4318	+ 7·4331	+ 7·4324	—1·3	—10·1	61·0990
182	183	1·885	187·342	— 1·5114	— 1·5118	— 1·5116	+0·4	— 9·7	59·5874
183	184	1·711	189·053	—11·2272	—11·2265	—11·2268	—0·7	—10·4	48·3606
184	185	1·666	190·719	—11·1833	—11·1826	—11·1830	—0·7	—11·1	37·1776
185	186	1·518	192·237	— 6·8176	— 6·8171	— 6·8174	—0·5	—11·6	30·3602
186	187	1·880	194·117	— 3·0290	— 3·0311	— 3·0300	+2·1	— 9·5	27·3302
187	188	1·593	195·710	+ 2·1840	+ 2·1804	+ 2·1822	+3·6	— 5·9	29·5124
188	189	1·930	197·640	— 2·0638	— 2·0632	— 2·0635	—0·6	— 6·5	27·4489
189	190	1·653	199·293	— 0·9791	— 0·9801	— 0·9796	+1·0	— 5·5	26·4693
190	XVI	2·136	201·429	+ 1·6750	+ 1·6732	+ 1·6741	+1·8	— 3·7	28·1434
XVI	176	1·405	202·834	+ 1·1417	+ 1·1400	+ 1·1408	+1·7	— 2·0	29·2842
176	K	0·351	203·185	+ 2·0284	+ 2·0262	+ 2·0273	+2·2	+ 0·2	31·3115
176	175	1·154	203·988	— 0·7488	— 0·7541	— 0·7514	+5·3	+ 3·3	28·5328
175	174	1·847	205·835	+ 1·0883	+ 1·0909	+ 1·0896	—2·6	+ 0·7	29·6224
174	173	1·478	207·313	+ 2·6128	+ 2·6124	+ 2·6126	+0·4	+ 1·1	32·2350
173	172	1·451	208·764	+ 1·6063	+ 1·6104	+ 1·6083	—4·1	— 3·0	33·8433
172	171	1·393	210·157	— 1·1386	— 1·1366	— 1·1376	—2·0	— 5·0	32·7057
171	170	1·559	211·716	+ 2·0749	+ 2·0748	+ 2·0748	+0·1	— 4·9	34·7805
170	169	1·920	213·636	+ 2·1258	+ 2·1290	+ 2·1274	—3·2	— 8·1	36·9079
169	168	1·394	215·030	+ 2·6804	+ 2·6752	+ 2·6778	+5·2	— 2·9	39·5857
168	167	1·123	216·153	+ 0·4414	+ 0·4436	+ 0·4425	—2·2	— 5·1	40·0282
167	166	1·368	217·521	— 0·1048	— 0·1013	— 0·1030	—3·5	— 8·6	39·9252
166	165	2·193	219·714	+ 6·9683	+ 6·9676	+ 6·9680	+0·7	— 7·9	46·8932
165	164	1·428	221·142	+ 4·2702	+ 4·2772	+ 4·2737	—7·0	—14·9	51·1669
164	163	1·215	222·357	+ 4·5883	+ 4·5874	+ 4·5878	+0·9	—14·0	55·7547
163	162	1·410	223·767	+ 8·0809	+ 8·0808	+ 8·0808	+0·1	—13·9	63·8355
162	161	1·498	225·265	— 5·2973	— 5·2965	— 5·2969	—0·8	—14·7	58·5386
161	160	1·061	226·326	— 9·3759	— 9·3735	— 9·3747	—2·4	—17·1	49·1639
160	159	1·306	227·632	—11·1445	—11·1442	—11·1443	—0·3	—17·4	38·0196
159	158	1·493	229·125	—12·6711	—12·6735	—12·6723	+2·4	—15·0	25·3473
158	157	1·550	230·675	— 1·6048	— 1·6024	— 1·6036	—2·4	—17·4	23·7437
157	156	1·359	232·034	— 0·3719	— 0·3704	— 0·3711	—1·5	—18·9	23·3726
156	145	1·149	233·183	— 1·2575	— 1·2618	— 1·2596	+4·3	—14·6	22·1130
145	144	1·422	234·605	+ 1·3726	+ 1·3691	+ 1·3708	+3·5	—11·1	23·4838
144	143	1·408	236·013	— 3·9074	— 3·9076	— 3·9075	+0·2	—10·9	19·5763
143	XV	1·419	237·432	— 6·2590	— 6·2547	— 6·2568	—4·3	—15·2	13·3195

* Mean of two measures.

Results of geodetic spirit leveling, Richmond, Va., to Washington, D. C., 1883–84—Continued.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort, Va.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Rod E.	Rod F.	Mean.	Partial E—F.	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
XV	I	0·586	238·018	+ 7·4001	+ 7·4021	+ 7·4011	—2·0	—17·2	20·7206
XV	H	0·101	237·533	— 0·5165	— 0·5169	— 0·5167	+0·4	—14·8	12·8028
XV	129	1·819	239·251	+ 6·5224	+ 6·5218	+ 6·5221	+0·6	—14·6	19·8416
129	130	1·186	240·437	+ 6·0138	+ 6·0152	+ 6·0145	—1·4	—16·0	25·8561
130	131	1·485	241·922	+10·3583	+10·3594	+10·3588	—1·1	—17·1	36·2149
131	132	1·643	243·565	+12·9974	+12·9975	+12·9974	—0·1	—17·2	49·2123
132	133	2·045	245·610	—15·1634	—15·1617	—15·1625	—1·7	—18·9	34·0498
133	134	1·344	246·954	— 8·3020	— 8·3029	— 8·3024	+0·9	—18·0	25·7474
134	135	1·330	248·284	*+ 0·5509	*+ 0·5531	+ 0·5520	—2·2	—20·2	26·2994
135	136	1·573	249·857	*+ 5·8526	*+ 5·8551	+ 5·8538	—2·5	—22·7	32·1532
136	137	1·842	251·699	—11·0014	—11·0007	—11·0010	—0·7	—23·4	21·1522
137	138	1·967	253·666	+ 2·9198	+ 2·9161	+ 2·9179	+3·7	—19·7	24·0701
138	139	1·259	254·925	—12·3958	—12·4022	—12·3990	+6·4	—13·3	11·6711
139	140	0·991	255·916	— 7·4422	— 7·4417	— 7·4420	—0·5	—13·8	4·2291
140	141	0·619	256·535	— 0·1206	— 0·1192	— 0·1199	—1·4	—15·2	4·1092
141	142	1·617	258·152	+ 5·0386	+ 5·0422	+ 5·0404	—3·6	—18·8	9·1496
142	146	0·917	259·069	+ 0·3292	+ 0·3288	+ 0·3290	+0·4	—18·4	9·4786
146	147	1·366	260·435	— 1·9320	— 1·9334	— 1·9327	+1·4	—17·0	7·5459
147	148	1·101	261·536	— 5·3547	— 5·3554	— 5·3550	+0·7	—16·3	2·1909
148	149	1·900	263·436	+ 3·5609	+ 3·5621	+ 3·5615	—1·2	—17·5	5·7524
149	150	1·132	264·568	+ 0·4792	+ 0·4784	+ 0·4788	+0·8	—16·7	6·2312
150	151	1·355	265·923	— 4·1415	— 4·1435	— 4·1425	+2·0	—14·7	2·0887
151	152	1·359	267·282	+ 2·9233	+ 2·9244	+ 2·9238	—1·1	—15·8	5·0125
152	153	2·036	269·318	+ 0·0808	+ 0·0761	+ 0·0784	+4·7	—11·1	5·0909
153	155	0·834	270·152	— 1·6167	— 1·6143	— 1·6155	—2·4	—13·5	3·4754
155	154	1·550	271·702	+ 4·4670	+ 4·4651	+ 4·4660	+1·9	—11·6	7·9414
154	XIV	1·293	272·995	— 1·5036	— 1·5045	— 1·5040	+0·9	—10·7	6·4374
XIV	128	2·201	275·196	— 4·7075	— 4·7077	— 4·7076	+0·2	—10·5	1·7298
128	127	1·602	276·798	+ 0·7924	+ 0·7956	+ 0·7940	—3·2	—13·7	2·5238
127	126	0·439	277·237	+ 3·2829	+ 3·2811	+ 3·2820	+1·8	—11·9	5·8058
126	125	1·660	278·897	+ 3·8216	+ 3·8201	+ 3·8208	+1·5	—10·4	9·6266
125	124	0·197	279·094	— 4·3640	— 4·3635	— 4·3638	—0·5	—10·9	5·2628
124	123	0·805	279·899	*— 3·1598	*— 3·1604	— 3·1601	+0·6	—10·3	2·1027
123	122	1·596	281·495	— 1·3183	— 1·3167	— 1·3175	—1·6	—11·9	0·7852
122	121	1·896	283·391	+ 2·2765	+ 2·2770	+ 2·2767	—0·5	—12·4	3·0619
121	120	1·798	285·189	+ 2·0012	+ 2·0052	+ 2·0032	—4·0	—16·4	5·0651
120	119	1·509	286·698	+15·1004	+15·1031	+15·1017	—2·7	—19·1	20·1668
119	118	1·236	287·934	+ 1·2767	+ 1·2770	+ 1·2768	—0·3	—19·4	21·4436
118	117	2·274	290·208	— 0·2599	— 0·2605	— 0·2602	+0·6	—18·8	21·1834
117	116	1·170	291·378	+ 6·2732	+ 6·2738	+ 6·2735	—0·6	—19·4	27·4569
116	115	1·481	292·859	— 7·4157	— 7·4201	— 7·4179	+4·4	—15·0	20·0390
115	114	1·502	294·361	— 1·2647	— 1·2614	— 1·2630	—3·3	—18·3	18·7760
114	113	1·942	296·303	+ 4·6472	+ 4·6514	+ 4·6493	—4·2	—22·5	23·4253
113	112	1·481	297·784	+ 7·9159	+ 7·9154	+ 7·9156	+0·5	—22·0	31·3409
112	111	1·601	299·385	+12·2895	+12·2886	+12·2890	+0·9	—21·1	43·6299
111	110	2·021	301·406	+16·8150	+16·8154	+16·8152	—0·4	—21·5	60·4451
110	109	1·353	302·759	+ 7·0522	+ 7·0543	+ 7·0532	—2·1	—23·6	67·4983
109	108	1·515	304·274	—15·3198	—15·3211	—15·3204	+1·3	—22·3	52·1779
108	107	0·794	305·068	— 7·9106	— 7·9098	— 7·9102	—0·8	—23·1	44·2677
107	106	1·298	306·366	—13·2727	—13·2716	—13·2721	—1·1	—24·2	30·9956
106	105	1·382	307·748	—12·9205	—12·9220	—12·9212	+1·5	—22·7	18·0744
105	104	2·060	309·808	— 7·9672	— 7·9672	— 7·9672	0·0	—22·7	10·1072
104	103	1·264	311·072	— 1·2679	— 1·2689	— 1·2684	+1·0	—21·7	8·8388
103	102	1·269	312·341	+ 1·0007	+ 1·0006	+ 1·0007	+0·1	—21·6	9·8395
102	101	1·150	313·491	+ 0·5155	+ 0·5165	+ 0·5160	—1·0	—22·6	10·3555
101	100	0·673	314·164	+ 2·8350	+ 2·8348	+ 2·8349	+0·2	—22·4	13·1904
100	G	0·609	314·773	*+ 0·4665	*+ 0·4673	+ 0·4669	—0·8	23·2	13·6573
100	XIII	1·038	315·202	— 2·1941	— 2·1951	— 2·1946	+1·0	—21·4	10·9958
XIII	95	1·690	316·892	+ 0·1168	+ 0·1167	+ 0·1168	+0·1	—21·3	11·1126
95	96	1·947	318·839	— 0·1487	— 0·1514	— 0·1501	+2·7	—18·6	10·9625
96	97	1·477	320·316	+ 1·1242	+ 1·1236	+ 1·1239	+0·6	—18·0	12·0864
97	98	1·336	321·652	— 0·5389	— 0·5340	— 0·5364	—4·9	—22·9	11·5500
98	99	1·117	322·769	— 0·4026	— 0·4073	— 0·4050	+4·7	—18·2	11·1450
99	XII	2·543	325·312	— 0·1479	— 0·1438	— 0·1458	—4·1	—22·3	10·9992
XII	94	0·238	325·550	— 1·7877	— 1·7885	— 1·7881	+0·8	—21·5	9·2111
94	XI	0·371	325·921	*— 0·1728	*— 0·1721	— 0·1725	—0·7	—22·2	9·0386

* Mean of two measures.

Branch line leveling in Washington, D. C., in November and December, 1884, and navy-yard connection in 1892.

Bench marks. From	To	Distance between successive marks.	Distance from Old Point Comfort, Va.	Difference of height. Rod E.	Rod F.	Mean.	Discrepancy. Partial E—F.	Total accumulated.	Height above average level of bay and ocean at Old Point Comfort.
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
XI	6	0·342	326·263	— 5·0780	— 5·0776	— 5·0778	—0·4	—22·6	3·9608
6	5	0·858	327·121	— 1·0418	— 1·0404	— 1·0411	—1·4	—24·0	2·9197
5	4	0·928	328·049	+ 2·8723	+ 2·8710	+ 2·8716	+1·3	—22·7	5·7913
4	3	1·764	329·813	— 3·7267	— 3·7314	— 3·7290	+4·7	—18·0	2·0623
3	2	0·868	330·681	+ 6·0026	+ 6·0041	+ 6·0033	—1·5	—19·5	8·0656
2	9	0·278	330·959	— 1·5058	— 1·5045	— 1·5051	—1·3	—20·8	6·5605
9	α	0·206	331·165	+ 0·1343	+ 0·1348	+ 0·1345	—0·5	—21·3	6·6950
α	β	0·242	331·407	+ 5·0331	+ 5·0305	+ 5·0318	+2·6	—18·7	11·7268
β	γ	0·060	331·467	— 1·0667	— 1·0671	— 1·0669	+0·4	—18·3	10·6599
9	δ	0·228	331·187	— 0·3221	— 0·3230	— 0·3226	+0·9	—19·9	6·2379
2	μ	0·698	331·379	+ 0·3960	+ 0·3947	+ 0·3954	+1·3	—18·2	8·4610
μ	σ	0·083	331·462	+ 0·5383	+ 0·5383	+ 0·5383	0·0	—18·2	8·9993
μ	1	1·284	332·683	— 5·6624	— 5·6646	— 5·6635	+2·2	—16·0	2·7975
1	7	0·395	333·058	+12·4251	+12·4248	+12·4249	+0·3	—15·7	15·2224
7	8	0·268	333·326	+ 7·7092	+ 7·7087	+ 7·7090	+0·5	—15·2	22·9314
8	Capitol B. M.	0·276	333·602	+ 4·1125	+ 4·1099	+ 4·1112	+2·6	—12·6	27·0426
Capitol B. M.	23	0·531	334·133	— 2·3582	— 2.3618	— 2·3600	+3·6		24·6826
* 23	24	1·916	336·049	—10·7941	—10·8014	—10·7977	+7·3		13·8849
* 24	Ordnance.	0·274	336·323	— 9·4835	— 9·4830	— 9·4832	—0·5		4·4017
* Ordnance	C	0·231	336·554	— 2·1225	— 2·1229	— 2·1227	+0·4		2·2790

β or Washington Monument bench mark.
μ or National Museum bench mark.
C or navy-yard bench mark of 1892.
* This line was run by I. Winston and F. A. Young in September, 1892.

Results of geodetic spirit leveling, Richmond, Va., to Fredericksburg, Va., 1886.

Bench marks. From	To	Distance between successive marks.	Distance from Old Point Comfort, Va.	Difference of height. Rods E and F.			Height above average level of bay and ocean at Old Point Comfort.
		km.	*km.*	*m.*	*m.*	*m.*	*m.*
	O		140·021				58·1957
O	204	0·834	140·855	+ 1·6190			59·8147
204	205	1·057	141·912	— 2·6525			57·1622
205	206	1·197	143·109	+ 1·9959			59·1581
206	207	1·265	144·374	— 5·2179			53·9402
207	208	1·428	145·802	+ 4·0967			58·0369
208	209	0·624	146·426	+ 0·1343			58·1712
209	209½	1·298	147·724	+ 5·6705			63·8417
209½	210	1·209	148·933	— 1·8111			62·0306
210	211	1·207	150·140	+ 2·9653			64·9959
211	212	1·018	151·158	— 0·2848			64·7111
212	213	1·066	152·224	— 2·9766			61·7345
213	214	1·087	153·311	— 2·6879			59·0466
214	215	1·206	154·517	+ 1·7037			60·7503
215	216	1·097	155·614	+ 2·7849			63·5352
216	217	1·359	156·973	— 3·0342			60·5010
217	XVII	1·421	158·394	— 0·3546			60·1464
XVII	203	1·248	159·642	+ 4·3496			64·4960
203	202	1·415	161·057	+ 0·0616			64·5576
202	201	1·215	162·272	— 2·5136			62·0440
201	200	0·881	163·153	+ 2·3429			64·3869
200	199	0·645	163·798	+ 2·0761			66·4630
199	N	0·830	164·628	+ 0·9622			67·4252

Results of geodetic spirit leveling, Richmond, Va., to Fredericksburg, Va., 1886—Continued.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort, Va.	Difference of height.			Height above average level of bay and ocean at Old Point Comfort.
From	To			Rods E and F.			
		km.	*km.*	*m.*	*m.*	*m.*	*m.*
N	197	2·626	167·254	—11·6794			55·7458
197	196	1·485	168·739	— 7·5725			48·1733
196	195	1·273	170·012	— 7·7493			40·4240
195	194	0·826	170·838	— 5·1248			35·2992
194	193	0·541	171·379	— 0·2777			35·0215
193	192	1·090	172·469	— 2·5971			32·4244
192	M	2·216	174·685	+12·2771	+12·2751	+12·2761	44·7005
M	177	1·631	176·316	— 4·0394	—4·0387	—4·0390	40·6615
177	178	1·470	177·786	— 3·3886			37·2729
178	L	1·577	179·363	— 8·1266			29·1463
L	179	1·464	180·827	+ 8·1987			37·3450
179	180	1·528	182·355	+10·7731			48·1181
180	181	1·305	183·660	+ 8·2505			56·3686
181	182	1·153	184·813	+ 4·9097			61·2783
182	182½	1·002	185·815	+ 3·8841			65·1624
182½	183	1·220	187·035	— 8·1571			57·0053
183	184	1·665	188·700	—10·5978			46·4075
184	185	1·372	190·072	— 9·0891			37·3184
185	186	1·384	191·456	— 6·7212			30·5972
186	186½	0·869	192·325	— 2·0919			28·5053
186½	187	1·228	193·553	— 0·4208			28·0845
187	188	1·767	195·320	— 0·0237			28·0608
188	189	1·457	196·777	— 1·0818			26·9790
189	190	2·102	198·879	+ 0·3293			27·3083
190	XVI	1·715	200·594	+ 1·5191			28·8274
XVI	K	1·108	201·702	+ 2·6722			31·4996
K	175	1·555	203·257	— 2·7266			28·7730
175	174	1·890	205·147	+ 1·2415			30·0145
174	173	1·508	206·655	+ 2·4597			32·4742
173	172	1·154	207·809	+ 1·3970			33·8712
172	171	1·505	209·314	— 0·9840			32·8872
171	170	1·360	210·674	+ 1·5739			34·4611
170	169	0·975	211·649	+ 1·5661			36·0272
169	168½	1·078	212·727	+ 1·4837			37·5109
168½	168	0·819	213·546	+ 1·1100			38·6209
168	167	1·365	214·911	+ 0·8363			39·4572
167	166½	0·802	215·713	— 1·3085			38·1487
166½	166	2·034	217·747	+ 5·8794			44·0281
166	165	1·146	218·893	+ 3·1006			47·1287
165	164½	0·784	219·677	+ 1·8509			48·9796
164½	164	0·560	220·237	+ 2·6460			51·6256
164	163	1·060	221·297	+ 4·2182			55·8438
163	162	1·336	222·633	+ 7·1096			62·9534
162	161	1·540	224·173	— 3·1103			59·8431
161	160	1·556	225·729	—14·0982			45·7449
160	159	1·050	226·779	— 8·9671			36·7778
159	158	1·480	228·259	—12·7966			23·9812
158	157	1·581	229·840	+ 0·4389			24·4201
157	156	1·141	230·981	— 0·7683			23·6518
156	145	1·144	232·125	— 1·2480			22·4038
145	144½	0·545	232·670	— 0·5939			21·8099
144½	144	1·071	233·741	+ 1·1668			22·9767
144	143	1·599	235·340	— 6·3478			16·6289
143	H	1·091	236·431	— 3·5284			13·1005
H	4·5 ft. mark on Tide gauge.	0·578	237·009	—12·2804			0·8201

Results of geodetic spirit leveling, Richmond, Va., to Washington, D. C., 1895.

Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Rod P.	Rod Q.	Mean.	Partial P—Q	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
	O		140·021						58·1957
O	P	0·440	140·461	*+ 4·5694	*+ 4·5686	+ 4·5690	+0·8	+ 0·8	62·7647
P	1	0·947	141·408	— 1·1082	— 1·1099	— 1·1090	+1·7	+ 2·5	61·6557
1	2	1·076	142·484	— 0·7714	— 0·7696	— 0·7705	—1·8	+ 0·7	60·8852
2	3	1·209	143·693	— 0·1191	— 0·1228	— 0·1209	+3·7	+ 4·4	60·7643
3	4	1·046	144·739	— 4·5019	— 4·4998	— 4·5009	—2·1	+ 2·3	56·2634
4	5	1·071	145·810	— 2·4808	— 2·4788	— 2·4798	—2·0	+ 0·3	53·7836
5	6	1·106	146·916	+ 3·3253	+ 3·3272	+ 3·3263	—1·9	— 1·6	57·1099
6	7	1·084	148·000	+ 5·1636	+ 5·1643	+ 5·1640	—0·7	— 2·3	62·2739
7	8	1·111	149·111	+ 1·0620	+ 1·0655	+ 1·0638	—3·5	— 5·8	63·3377
8	9	1·174	150·285	— 0·6446	— 0·6434	— 0·6440	—1·2	— 7·0	62·6937
9	10	1·014	151·299	+ 2·2980	+ 2·2981	+ 2·2980	—0·1	— 7·1	64·9917
10	11	0·823	152·122	— 0·0949	— 0·0956	— 0·0953	+0·7	— 6·4	64·8964
11	N_1	0·378	152·500	+ 1·9593	+ 1·9591	+ 1·9592	+0·2	— 6·2	66·8556
11	12	1·162	153·284	— 3·6601	— 3·6610	— 3·6606	+0·9	— 5·5	61·2358
12	13	1·087	154·371	— 1·9660	— 1·9606	— 1·9633	—5·4	—10·9	59·2725
13	14	1·198	155·569	+ 1·6132	+ 1·6120	+ 1·6126	+1·2	— 9·7	60·8851
14	15	1·166	156·735	+ 3·1252	+ 3·1207	+ 3·1230	+4·5	— 5·2	64·0081
15	16	1·080	157·815	— 3·0937	— 3·0922	— 3·0930	—1·5	— 6·7	60·9151
16	17	0·988	158·803	— 3·8633	— 3·8644	— 3·8638	+1·1	— 5·6	57·0513
17	18	1·236	160·039	+ 7·8241	+ 7·8184	+ 7·8212	+5·7	+ 0·1	64·8725
18	19	1·072	161·111	+ 0·7045	+ 0·7042	+ 0·7043	+0·3	+ 0·4	65·5768
19	20	1·193	162·304	*— 1·4997	— 1·4975	— 1·4986	—2·2	— 1·8	64·0782
20	21	1·098	163·402	— 1·5760	— 1·5757	— 1·5759	—0·3	— 2·1	62·5023
21	22	0·997	164·399	+ 4·2351	+ 4·2307	+ 4·2329	+4·4	+ 2·3	66·7352
22	N	1·174	165·573	+ 0·6553	+ 0·6586	+ 0·6569	—3·3	— 1·0	67·3921
N	23	1·108	166·681	— 3·2414	— 3·2431	— 3·2423	+1·7	+ 0·7	64·1498
23	24	0·941	167·622	— 5·6087	— 5·6050	— 5·6069	—3·7	— 3·0	58·5429
24	25	1·122	168·744	— 5·8603	— 5·8600	— 5·8601	—0·3	— 3·3	52·6828
25	26	1·194	169·938	— 6·1706	— 6·1710	— 6·1708	+0·4	— 2·9	46·5120
26	27	1·044	170·982	— 6·3148	— 6·3148	— 6·3148	0·0	— 2·9	40·1972
27	28	1·316	172·298	— 5·5447	— 5·5499	— 5·5473	+5·2	+ 2·3	34·6499
28	29	1·201	173·499	— 1·4489	— 1·4506	— 1·4497	+1·7	+ 4·0	33·2002
29	30	1·055	174·554	+ 5·9143	+ 5·9111	+ 5·9126	+3·2	+ 7·2	39·1128
30	M	1·232	175·786	+ 5·5145	+ 5·5110	+ 5·5128	+3·5	+10·7	44·6256
M	31	1·022	176·808	— 3·1539	— 3·1495	— 3·1517	—4·4	+ 6·3	41·4739
31	32	1·187	177·995	+ 0·2976	+ 0·3004	+ 0·2990	—2·8	+ 3·5	41·7729
32	33	1·150	179·145	— 5·9221	— 5·9243	— 5·9232	+2·2	+ 5·7	35·8497
33	34	1·184	180·329	— 6·3401	— 6·3394	— 6·3398	—0·7	+ 5·0	29·5099
34	35	1·049	181·378	+ 4·9680	+ 4·9674	+ 4·9677	+0·6	+ 5·6	34·4776
35	36	1·108	182·486	+ 6·6389	+ 6·6430	+ 6·6409	—4·1	+ 1·5	41·1185
36	37	0·972	183·458	+ 7·0427	+ 7·0394	+ 7·0410	+3·3	+ 4·8	48·1595
37	38	1·102	184·560	+ 6·7248	+ 6·7292	+ 6·7270	—4·4	+ 0·4	54·8865
38	39	1·064	185·624	+ 6·9044	+ 6·9056	+ 6·9050	—1·2	— 0·8	61·7915
39	K_3	0·048	185·672	+ 0·6745	+ 0·6748	+ 0·6746	—0·3	— 1·1	62·4661
39	40	1·108	186·732	+ 2·2977	+ 2·2953	+ 2·2965	+2·4	+ 1·6	64·0880
40	41	1·032	187·764	— 4·3656	— 4·3704	— 4·3680	+4·8	+ 6·4	59·7200
41	42	1·193	188·957	— 7·5907	— 7·5936	— 7·5921	+2·9	+ 9·3	52·1279
42	43	1·032	189·989	— 7·0038	— 7·0064	— 7·0051	+2·6	+11·9	45·1228
43	44	1·177	191·166	— 8·1877	— 8·1907	— 8·1892	+3·0	+14·9	36·9336
44	45	1·282	192·448	— 6·4760	— 6·4794	— 6·4777	+3·4	+18·3	30·4559
45	46	1·066	193·514	— 1·8837	— 1·8840	— 1·8838	+0·3	+18·6	28·5721
46	47	1·064	194·578	— 1·0080	— 1·0088	— 1·0084	+0·8	+19·4	27·5637
47	48	0·484	195·062	+ 1·1547	+ 1·1518	+ 1·1533	+2·9	+22·3	28·7170
48	K_2	0·032	195·094	+ 0·9302	+ 0·9299	+ 0·9300	+0·3	+22·6	29·6470
48	49	0·974	196·036	+ 1·1130	+ 1·1114	+ 1·1122	+1·6	+23·9	29·8292
49	50	1·046	197·082	— 3·0349	— 3·0361	— 3·0355	+1·2	+25·1	26·7937
50	51	1·001	198·083	—·0·0130	— 0·0137	— 0·0134	+0·7	+25·8	26·7803
51	52	1·144	199·227	— 1·2504	— 1·2556	— 1·2530	+5·2	+31·0	25·5273
52	53	0·973	200·200	+ 2·1695	+ 2·1670	+ 2·1682	+2·5	+33·5	27·6955
53	54	1·092	201·292	+ 0·6328	+ 0·6319	+ 0·6324	+0·9	+34·4	28·3279

* Mean of two measures.

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Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Rod P.	Rod Q.	Mean.	Partial P—Q.	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
54	55	1·088	202·380	+ 0·9236	+ 0·9247	+ 0·9241	—1·1	+33·3	29·2520
55	56	0·480	202·860	+ 0·8904	+ 0·8893	+ 0·8899	+1·1	+34·4	30·1419
56	K_1	0·042	202·902	+ 0·9726	+ 0·9729	+ 0·9728	—0·3	+34·1	31·1147
56	57	1·086	203·946	— 1·4276	— 1·4295	— 1·4286	+1·9	+36·3	28·7133
57	58	1·084	205·030	+ 1·7172	+ 1·7150	+ 1·7161	+2·2	+38·5	30·4294
58	59	1·087	206·117	— 0·7529	— 0·7515	— 0·7522	—1·4	+37·1	29·6772
59	60	1·154	207·271	+ 2·3891	+ 2·3832	+ 2·3862	+5·9	+43·0	32·0634
60	61	1·087	208·358	+ 0·7720	+ 0·7717	+ 0·7718	+0·3	+43·3	32·8352
61	62	1·048	209·406	— 0·0760	— 0·0772	— 0·0766	+1·2	+44·5	32·7586
62	63	1·028	210·434	— 0·0661	— 0·0636	— 0·0649	—2·5	+42·0	32·6937
63	64	0·976	211·410	+ 0·2250	+ 0·2231	+ 0·2240	+1·9	+43·9	32·9177
64	65	0·820	212·230	+ 3·2114	+ 3·2091	+ 3·2102	+2·3	+46·2	36·1279
65	66	1·008	213·238	+ 0·5576	+ 0·5559	+ 0·5567	+1·7	+47·9	36·6846
66	67	1·087	214·325	+ 1·9742	+ 1·9762	+ 1·9752	—2·0	+45·9	38·6598
67	68	1·018	215·343	+ 1·7174	+ 1·7155	+ 1·7165	+1·9	+47·8	40·3763
68	I_2	0·752	216·095	— 1·7867	— 1·7874	— 1·7870	+0·7	+48·5	38·5893
I_2	69	1·120	217·215	— 1·4386	— 1·4427	— 1·4406	+4·1	+52·6	37·1487
69	70	1·091	218·306	+ 4·4490	+ 4·4486	+ 4·4488	+0·4	+53·0	41·5975
70	71	1·085	219·391	+ 4·5527	+ 4·5532	+ 4·5530	—0·5	+52·5	46·1505
71	72	1·160	220·551	+ 1·4768	+ 1·4752	+ 1·4760	+1·6	+54·1	47·6265
72	73	1·074	221·625	+ 4·7193	+ 4·7223	+ 4·7208	—3·0	+51·1	52·3473
73	74	1·195	222·820	+ 4·8753	+ 4·8694	+ 4·8724	+5·9	+57·0	57·2197
74	I_1	0·928	223·748	+ 3·5101	+ 3·5079	+ 3·5090	+2·2	+59·2	60·7287
I_1	75	1·050	224·798	+ 3·1743	+ 3·1753	+ 3·1748	—1·0	+58·2	63·9035
75	76	1·122	225·920	— 9·2337	— 9·2343	— 9·2340	+0·6	+58·8	54·6695
76	77	1·052	226·972	— 9·5246	— 9·5271	— 9·5258	+2·5	+61·3	45·1437
77	78	1·193	228·165	—10·1758	—10·1797	—10·1777	+3·9	+65·2	34·9660
78	79	1·082	229·247	— 9·1318	— 9·1283	— 9·1300	—3·5	+61·7	25·8360
79	80	1·066	230·313	— 0·6009	— 0·6024	— 0·6016	+1·5	+63·2	25·2344
80	81	0·976	231·289	— 0·5983	— 0·6029	— 0·6006	+4·6	+67·8	24·6338
81	82	1·058	232·347	— 0·8213	— 0·8216	— 0·8214	+0·3	+68·1	23·8124
82	83	1·064	233·411	— 1·1962	— 1·1937	— 1·1949	—2·5	+65·6	22·6175
83	84	1·034	234·445	+ 1·2611	+ 1·2609	+ 1·2610	+0·2	+65·8	23·8785
84	85	1·312	235·757	— 1·3633	— 1·3602	— 1·3618	—3·1	+62·7	22·5167
85	86	1·072	236·829	— 7·8717	— 7·8700	— 7·8708	—1·7	+61·0	14·6459
86	87	0·711	237·540	— 1·4370	— 1·4368	— 1·4369	—0·2	+60·8	13·2090
87	H	0·097	237·637	— 0·1909	— 0·1904	— 0·1907	—0·5	+60·3	13·0183
87	I	0·622	238·162	+ 7·7365	+ 7·7349	+ 7·7357	+1·6	+62·4	20·9447
87	88	1·010	238·550	+ 1·1288	+ 1·1299	+ 1·1293	—1·1	+59·7	14·3383
88	89	1·178	239·728	+ 6·1587	+ 6·1558	+ 6 1572	+2·9	+62·6	20·4955
89	90	1·238	240·966	+ 8·1489	+ 8·1507	+ 8·1498	—1·8	+60·8	28·6453
90	91	1·194	242·160	+ 9·1296	+ 9·1332	+ 9·1314	—3·6	+57·2	37·7767
91	92	1·175	243·335	+ 9·1300	+ 9·1326	+ 9·1313	—2·6	+54·6	46·9080
92	93	1·102	244·437	— 0·6569	— 0·6516	— 0·6543	—5·3	+49·3	46·2537
93	94	1·199	245·636	—11·6912	—11·6924	—11·6918	+1·2	+50·5	34·5619
94	95	1·040	246·676	— 8·0393	— 8·0402	— 8·0398	+0·9	+51·4	26·5221
95	96	0·646	247·322	— 0·7730	— 0·7746	— 0·7738	+1·6	+53·0	25·7483
96	G_8	0·119	247·441	+ 0·0388	+ 0·0388	+ 0·0388	0·0	+53·0	25·7871
96	97	1·499	248·821	+ 4·8062	+ 4·8033	+ 4·8048	+2·9	+55·9	30·5531
97	98	1·033	249·854	+ 2·0794	+ 2·0744	+ 2·0769	+5·0	+60·9	32·6300
98	99	1·138	250·992	— 9·8277	— 9·8285	— 9·8281	+0·8	+61·7	22·8019
99	100	0·464	251·456	— 2·1052	— 2·1067	— 2·1060	+1·5	+63·2	20·6959
100	G_7	0·020	251·476	— 2·8606	— 2·8606	— 2·8606	0·0	+63·2	17·8353
100	101	1·014	252·470	+ 7·7509	+ 7·7459	+ 7·7484	+5·0	+68·2	28·4443
101	102	1·004	253·474	— 2·5260	— 2·5235	— 2·5247	—2·5	+65·7	25·9196
102	103	1·178	254·652	—11·8581	—11·8528	—11·8555	—5·3	+60·4	14·0641
103	104	1·206	255·858	— 9·5268	— 9·5297	— 9·5282	+2·9	+63·3	4·5359
104	105	1·128	256·986	+ 1·5236	+ 1·5226	+ 1·5231	+1·0	+64·3	6·0590
105	106	1·050	258·036	+ 3·2666	+ 3·2671	+ 3·2668	—0·5	+63·8	9·3258
106	107	1·164	259·200	— 0·4914	— 0·4906	— 0·4910	—0·8	+63·0	8·8348
107	108	1·132	260·332	— 0·8619	— 0·8601	— 0·8610	—1·8	+61·2	7·9738
108	109	0·964	261·296	— 5·0097	— 5·0133	— 5·0115	+3·6	+64·8	2·9623
109	G_6	0·112	261·408	— 0·8490	— 0·8491	— 0·8490	+0·1	+64·9	2·1133

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Bench marks.		Distance between successive marks.	Distance from Old Point Comfort.	Difference of height.			Discrepancy.		Height above average level of bay and ocean at Old Point Comfort.
From	To			Rod P.	Rod Q.	Mean.	Partial P—Q.	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
109	110	1·132	262·428	+ 4·6233	+ 4·6283	+ 4·6258	—5·0	+59·8	7·5881
110	111	1·158	263·586	— 0·3268	— 0·3259	— 0·3263	—0·9	+58·9	7·2618
111	112	1·263	264·849	— 0·5186	— 0·5208	— 0·5197	+2·2	+61·1	6·7421
112	113	1·150	265·999	— 5·0612	— 5·0590	— 5·0601	—2·2	+58·9	1·6820
113	114	1·092	267·091	+ 3·7397	+ 3·7364	+ 3·7381	+3·3	+62·2	5·4201
114	115	1·020	268·111	+ 2·3760	+ 2·3767	+ 2·3763	—0·7	+61·5	7·7964
115	116	0·631	268·742	+ 1·8409	+ 1·8407	+ 1·8408	+0·2	+61·7	9·6372
116	G_6	0·054	268·796	+ 0·9566	+ 0·9565	+ 0·9566	+0·1	+61·8	10·5938
116	117	0·552	269·294	— 5·2603	— 5·2614	— 5·2609	+1·1	+62·8	4·3763
117	118	0·682	269·976	*— 1·0896	*— 1·0906	— 1·0901	+1·0	+63·8	3·2862
118	119	0·902	270·878	+ 5·1862	+ 5·1842	+ 5·1852	+2·0	+65·8	8·4714
119	120	1·031	271·909	— 0·1738	— 0·1768	— 0·1753	+3·0	+68·8	8·2961
120	121	1·176	273·085	— 2·9574	— 2·9563	— 2·9568	—1·1	+67·7	5·3393
121	122	0·915	274·000	— 2·2595	— 2·2615	— 2·2605	+2·0	+69·7	3·0788
122	123	1·004	275·004	— 1·0116	— 1·0146	— 1·0131	+3·0	+72·7	2·0657
123	124	1·074	276·078	+ 0·1788	+ 0·1778	+ 0·1783	+1·0	+73·7	2·2440
124	125	0·606	276·684	+ 0·7111	+ 0·7107	+ 0·7109	+0·4	+74·1	2·9549
125	126	0·362	277·046	+ 3·9797	+ 3·9761	+ 3·9779	+3·6	+77·7	6·9328
126	127	1·222	278·268	+ 8·7969	+ 8·7974	+ 8·7972	—0·5	+77·2	15·7300
127	128	0·678	278·946	— 8·3239	— 8·3245	— 8·3242	+0·6	+77·8	7·4058
128	129	0·539	279·485	— 5·4581	— 5·4585	— 5·4583	+0·4	+78·2	1·9475
129	130	1·402	280·887	+ 1·4424	+ 1·4419	+ 1·4422	+0·5	+78·7	3·3897
130	131	1·089	281·976	— 2·0909	— 2·0905	— 2·0907	—0·4	+78·3	1·2990
131	132	1·050	283·026	+ 2·6277	+ 2·6313	+ 2·6295	—3·6	+74·7	3·9285
132	133	1·086	284·112	— 0·4695	— 0·4710	— 0·4703	+1·5	+76·2	3·4582
133	134	1·102	285·214	+ 4·1177	+ 4·1206	+ 4·1192	—2·9	+73·3	7·5774
134	135	1·180	286·394	+12·1320	+12·1302	+12·1311	+1·8	+75·1	19·7085
135	G_4	0·926	287·320	+ 1·0836	+ 1·0834	+ 1·0835	+0·2	+75·3	20·7920
G_4	136	1·102	288·422	+ 1·5071	+ 1·5051	+ 1·5061	+2·0	+77·3	22·2981
136	137	1·140	289·562	*— 1·3168	*— 1·3184	— 1·3176	+1·6	+78·9	20·9805
137	138	1·087	290·649	*+ 3·9987	*+ 3·9943	+ 3·9965	+4·4	+83·3	24·9770
138	139	1·333	291·982	— 1·8048	— 1·8055	— 1·8051	+0·7	+84·0	23·1719
139	G_3	0·886	292·868	— 3·8860	— 3·8839	— 3·8850	—2·1	+81·9	19·2869
G_3	140	1·157	294·025	+ 3·2483	+ 3·2429	+ 3·2456	+5·4	+87·3	22·5325
140	141	1·048	295·073	— 3·6750	— 3·6744	— 3·6747	—0·6	+86·7	18·8578
141	142	1·228	296·301	+ 5·0596	+ 5·0633	+ 5·0614	—3·7	+83·0	23·9192
142	G_2	0·942	297·243	+ 0·9403	+ 0·9403	+ 0·9403	0·0	+83·0	24·8595
G_2	143	1·198	298·441	+10·9971	+10·9995	+10·9983	—2·4	+80·6	35·8578
143	144	1·164	299·605	+ 7·8811	+ 7·8766	+ 7·8789	+4·5	+85·1	43·7367
144	145	1·251	300·856	+11·5420	+11·5410	+11·5415	+1·0	+86·1	55·2782
145	146	1·228	302·084	+ 9·9712	+ 9·9713	+ 9·9712	—0·1	+86·0	65·2494
146	147	1·142	303·226	+ 0·2873	+ 0·2848	+ 0·2860	+2·5	+88·5	65·5354
147	148	1·270	304·496	—12·7892	—12·7878	—12·7885	—1·4	+ 87·1	52·7469
148	149	1·292	305·788	—13·5190	—13·5196	—13·5193	+0·6	+ 87·7	39·2276
149	150	1·270	307·058	—12·6325	—12·6361	—12·6343	+3·6	+ 91·3	26·5933
150	G_1	1·432	308·490	—11·0895	—11·0944	—11·0919	+4·9	+ 96·2	15·5014
G_1	151	1·072	309·562	— 3·6451	— 3·6496	— 3·6474	+4·5	+100·7	11·8540
151	152	1·106	310·668	— 2·2203	— 2·2213	— 2·2208	+1·0	+101·7	9·6332
152	153	1·086	311·754	+ 2·7191	+ 2·7221	+ 2·7206	—3·0	+ 98·7	12·3538
153	154	1·050	312·804	— 5·1488	— 5·1525	— 5·1506	+3·7	+102·4	7·2032
154	155	0·728	313·532	+ 2·9889	+ 2·9915	+ 2·9902	—2·6	+ 99·8	10·1934
155	G	0·558	314·090	+ 3·8643	+ 3·8638	+ 3·8640	+0·7	+100·5	14·0574
155	156	1·430	314·962	+ 3·4793	+ 3·4782	+ 3·4788	+1·1	+100·9	13·6722
156	157	1·165	316·127	— 2·9686	— 2·9718	— 2·9702	+3·2	+104·1	10·7020
157	158	1·606	317·733	+ 0·3805	+ 0·3813	+ 0·3809	—0·8	+103·3	11·0829
158	159	0·906	318·639	+ 0·2157	+ 0·2161	+ 0·2159	—0·4	+102·9	11·2988
159	160	1·309	319·948	+ 0·3349	+ 0·3320	+ 0·3334	+2·9	+105·8	11·6322
160	161	0·989	320·937	— 0·0323	— 0·0321	— 0·0322	—0·2	+105·6	11·6000
161	162	1·482	322·419	— 1·4088	— 1·4060	— 1·4074	—2·8	+102·8	10·1926
162	163	1·164	323·583	+ 0·6252	+ 0·6238	+ 0·6245	+1·4	+104·2	10·8171
163	164	1·024	324·607	+ 3·4530	+ 3·4557	+ 3·4544	—2·7	+101·5	14·2715
164	165	0·278	324·885	— 6·0697	— 6·0696	— 6·0696	—0·1	+101·4	8·2019
165	XI	0·449	325·334	+ 1·2288	+ 1·2284	+ 1·2286	+0·4	+101·8	9·4305

* Means of two measures.

Recapitulation of the preceding results for heights of bench marks above the average level of the ocean at the entrance of Chesapeake Bay:

Year.	1883–84.	1886.	1895.
	m.	*m.*	*m.*
Starting B. M. at Richmond, O at freight depot.	58·1957	58·1957	58·1957
B. M. at Fredericksburg, H at bridge.	12·8028	13·1005	13·0183
B. M. at Alexandria, G at custom-house.	13·6573	.....	14·0574
B. M. at West Washington or Georgetown, XI at Aqueduct.	9·0386	.....	9·4305
B. M. at Washington, at Senate wing of Capitol.	27·0428	.....	.....

Now the following considerations show that the results of 1883–84 can not possibly be correct and that they are affected by a cumulative error. In the first place we would remark that the width of the entrance of Chesapeake Bay of nearly 11 statute miles makes it safe to assume its half tide or average level to be identical with that of the adjacent ocean, and the same may be said of the bay up to its head; further, it is apparent that the ascending slope of the Potomac can not be great and may even be difficult to measure directly; the mouth of the river is 6½ miles in width and the aspect of its course resembles more that of a branch of the bay than that of a steady flowing river. For comparison, we may cite the slope of the Mississippi River during 333 statute miles of its lower course (mouth of the Red River to the gulf), and during a time when at its *lowest stage*, the difference in height of the river level and gulf was found to be 5·2 feet, which gives an ascending slope of 0·2 inch per mile very nearly; if we take for the Potomac slope one-half of this, the difference in height at the bay and at Washington, a distance of 100 miles nearly, would amount to but 10 inches or 0·254 m. Now by direct tidal observations, extending over five years (August, 1891, to August, 1896), at the navy-yard at Washington, and by spirit leveling thence to the Capitol bench mark, the height of this mark above the half-tide level of the Potomac at the yard becomes * 27·612 ± 0·015 m., and this is the *minimum* height above the sea level it could have, but adding to this for assumed slope of the river 0·254 m., or if this is deemed too much, say 0·160 m., we get for the height of the Capitol B. M. 27·772 m. This result is corroborated by the line of levels from Annapolis, Md., of 1875, F. W. Perkins, observer, and extended in 1880 and 1884 by J. B. Weir,† which gives for the *minimum* height above the sea level 27·618 m. ± 0·035 m. Taking a mean value, as most probable, we may adopt 27·70 m. ± 0·07 m. where the probable error is estimated. Comparing this with the value found in 1883–84 (viz, 27·043 m.) we find that the line of 1883–84 requires a correction here of + 0·66 m.

A similar comparison between the mean tidal level and the results of spirit levels at Fredericksburg leads to the following result: Reading of half-tide level on staff of United States engineers, 1·5 feet, and bench mark H above staff reading 4·5 feet, 12·281 m.; hence minimum height of H above sea level 12·281 m. + 0·914 m. = 13·195 m.

Comparing this with the value found in 1883–84 (viz, 12·803 m.), the correction to the line here amounts to + 0·392 m. Now, Fredericksburg is approximately midway between Richmond and Washington, and we may expect the correction to be about one-half of what was deduced for Washington. This is found to be so, roughly speaking, and proves the correctness of the statement that the levels of 1883–84 between Richmond and Washington developed a cumulative error and need proportional corrections. Looking at the James and Rappahannock rivers when at a low stage,

*According to a communication from Mr. L. P. Shidy, acting chief of the tidal division of the office, dated September 12, 1896, we have the following particulars: Tidal observations from August 1, 1891, to August 31, 1896; mean of 3 458 high waters on tide staff, 5·891 feet; mean of 3 462 low waters 2·987 feet; half-tide level on staff, 4·439 ± 0·037 feet. Ordnance B. M. in the navy-yard above zero of tide staff, 20·747 feet, and by spirit leveling Capitol B. M. (Senate wing) above Ordnance B. M. 74·281 feet; hence Capitol B. M. (Senate wing) above the half-tide level of the Potomac at the navy-yard 90·589 feet, or 27·612 m. The reference to the B. M. at the navy-yard introduced, as stated by Mr. Shidy, an additional uncertainty of 0·032 feet; hence total probable error ±0·049 feet, or ±0·015 m.

†C. & G. Survey Report for 1889, Appendix No. 15, p. 463. The results of this line, therefore, also require a small increase, proportional to distance from Annapolis, the correction at Washington being +0·08 m.

their windings and narrow beds in their upper courses must have the effect of raising the mean or half-tide level at Richmond and at Fredericksburg somewhat above that of the ocean. Indeed, at Richmond we possess the following information: Adopted height of bench mark "O," 58·196 m; United States engineers' city bench mark below "O," 50·433 m; half-tide water, James River, below city bench mark, 7·670 m.; hence, half-tide level at Richmond below B. M. "O," 58·103 m., or river level apparently above ocean level, 0·093 m., which may be an admissible quantity.

We may add here the observed values of mean rise and fall of the tides at the several localities referred to in this report. They are:

	Feet.
At the capes of the Chesapeake Bay.	2·8
At Old Point Comfort	2·5
At Richmond	3·6
At Fredericksburg	2·8
At Washington	2·9
At Annapolis	0·8

The last value probably the smallest range anywhere *on* the bay.

Resulting height of bench marks between Richmond, Va., and Washington, D. C.:

	m.
Mean height of B. M. "H" at Fredericksburg, levelings of 1886 and 1895	13·0594
B. M. "G" at Alexandria, above "H," levels of 1895	1·0391
Height of B. M. "G"	14·0985
B. M. "XI" at West Washington, below "G," levels of 1883–84 and of 1895 {4·6187 m. / 4·6269 m.} mean..	4·6228
Height of B. M. "XI"	9·4757
B. M. at Washington, Capitol, above B. M. "XI," leveling of 1883–84	18·0042
Height of B. M. at Capitol (Senate wing)	27·4799

This value is the best deducible from the spirit levelings, but we have seen from what precedes that this height can not be less than 27·62 m., and is probably not far from 27·70 m., hence

The correction to heights of "G" and "XI" +0·22 m.

Table of resulting heights of B. M.'s of the 1895 line, corrected for error accumulated between Richmond and Fredericksburg at the rate of +1·81 mm. per km., and between Fredericksburg and Washington at the rate of +1·01 mm. per km.

Name and location of bench mark.	Height above average level of the ocean.	
	Metres.	*Feet.*
O—at freight depot, Richmond, Va.	58·196	190·93
N_1—at Reform School, Laurel, Henrico Co., Va.	66·878	219·42
N—at Duncan Memorial Chapel, Ashland.	67·438	221·25
M—at bridge, south of Doswell.	44·690	146·62
K_3—at Rutherglen, Caroline Co., Va.	62·549	205·21
K_2—at Penola, Caroline Co., Va.	29·747	97·59
K_1—at Milford, Caroline Co., Va.	31·228	102·45
I_2—at culvert, south of Guinea, Caroline Co., Va.	38·727	127·06
I_3—at culvert, south of Summit, Spottsylvania Co., Va.	60·880	199·74
I—at court-house, Fredericksburg, Va.	21·122	69·30
H—at bridge, Fredericksburg, Va.	13·195	43·29
G_8—near Potomac Run Station, Stafford Co., Va.	25·974	85·22
G_7—at Brooke, Stafford Co., Va.	18·026	59·14
G_6—vicinity of Widewater, Stafford Co., Va.	2·314	7·59
G_5—at Quantico, Prince William Co., Va.	10·801	35·44
G_4—vicinity of Woodbridge, Prince William Co., Va.	21·018	68·96
G_3—at Pohick Creek, Fairfax Co., Va.	19·519	64·04
G_2—vicinity of Accotink, Fairfax Co., Va.	25·096	82·34
G_1—at Cameron Run, south of Alexandria, Va.	15·749	51·67
G—at custom-house, Alexandria, Va.	14·311	46·95
XI—at Aqueduct Bridge, West Washington, D. C.	9·696	31·81
B. M.—at Capitol, Senate wing, Washington, D. C.	27·700	90·88
B. M. (β)—at base of Washington Monument, Washington, D. C.	12·384	40·63
B. M. (μ)—at National Museum, Smithsonian grounds, Washington, D. C.	9·118	29·91
B. M. (C)—at Navy-Yard, commandant's building, Washington, D. C.	2·936	9·63

In consequence of the earth's rotation, two adjacent equipotential surfaces widen out as we proceed southward, since gravity diminishes and the law $h_1 g_1 = h_2 g_2$ must be satisfied. Suppose the leveling profile projected on a meridian plane passing between two cities, and let the average ordinate be h = 30 metres; also take the latitude of Washington, = 38° 52′, and that of Richmond, 37° 32′, hence $\Delta \varphi = 1° 20'$, and the effect due to the divergence will be

$$\Delta h = -0{\cdot}0054\ h.\ \Delta \varphi \sin. 2\varphi = -0{\cdot}0035\ m,$$ or about $3\frac{1}{2}$ mm.

This is so small a quantity, particularly when compared with the corrections that had to be applied to our results, that we may dispense with any further consideration of it. The same may be said of the difference in the course of the level surface which depends on the *inequality* of the ascending and descending slopes, since the elevations along the profile are too insignificant to produce any sensible effect.

DESCRIPTIONS OF BENCH MARKS ON THE LINE OF LEVELS BETWEEN RICHMOND, VA., AND WASHINGTON, D. C.

Primary B. M.—O.—At Richmond, on freight depot of the Richmond, Fredericksburg and Potomac Railroad. It is on the granite door sill of the second door on the west side and near the north end of the depot. The mark is a square hole cut in the granite sill (thus □); it is 0·150 m. from the extreme west edge of the door and 0·654 m. from the north side of it to the center of the mark. The bottom of the hole is the reference level. J. B. W., 1884.

[N. B.—There are several bench marks at Richmond, for which see preceding appendix of this report, "Resulting heights from spirit leveling between Old Point Comfort and Richmond," etc.]

Primary B. M.—N_1.—Laurel, Henrico County, Va. The bottom of a square hole cut in the granite door sill of the south door on the east side of the brick workshop of the Reform School. It is on the upper (outer) edge of the sill, 0·15 m. from the south end. I. W., 1895.

Primary B. M.—N.—Ashland, Va. The bottom of a square hole cut in the sill of the southeast door of the Duncan Memorial Chapel adjoining Randolph-Macon College. It is marked thus ⊹, and is 0·15 m. from the south edge of the sill, 0·155 m. from the east side of the brick wall, and 0·184 m. from the door jamb. J. B. W., 1883.

Primary B. M.—M.—One and one-fourth miles south of Doswell, Va., at bridge No. 37 of the Richmond, Fredericksburg and Potomac Railroad, about $1\frac{1}{4}$ miles below the Chesapeake and Ohio junction. It is the bottom of a square hole cut in the southwest corner of the south abutment of the wooden bridge. The center of the hole is 0·17 m. from the extreme north edge of the rock in which it is cut, and is 0·46 m. from the extreme west edge. J. B. W., 1883.

Primary B. M.—K_3.—Rutherglen, Caroline County, Va. A copper bolt leaded in the west wall of the brick railroad section house. It is in the twelfth course from the ground and in the third brick from the northwest corner, in the right side of the wall as one enters the door; the center of a cross cut on the end of the bolt being the reference point. I. W., 1895.

Primary B. M.—K_2.—Penola, Caroline County, Va. A copper bolt leaded in the west face of the brick chimney at the back of the house and store owned by Mrs. A. B. De Jarnett and facing the railroad track. It is in the seventeenth course above the brick foundation to the house and in the second brick from the northwest corner. The bolt has a cross cut on its end marking the reference point. I. W., 1895.

Primary B. M.—K_1.—Milford, Caroline County, Va. A copper bolt leaded in the front of the brick section hands house of the Richmond, Fredericksburg and Potomac Railroad, about 100 yards north of the railroad station. It is in the ninth course above the ground and in the fifth brick north of the front or east door. It has a cross cut on its end to mark the reference point. I. W., 1895.

Primary B. M.—I_2.—One mile south of Guinea, Caroline County, Va. The bottom of a roughly cut square hole in the stone retaining wall to a brick culvert 100 metres north of milepost 48. It is on the west side of the track and north side of the culvert, on the third step from the top and near the center of the exposed portion of the stone. I. W., 1895.

Primary B. M.—I_1.—One-half mile south of Summit, Spottsylvania County, Va. The bottom

of a square hole cut in the sandstone coping at the end of the brick culvert 200 metres south of milepost 53. It is on the east side of the track and the north stone of the coping, being lettered as follows: U S / B M . I. W., 1895.

Primary B. M.—I.—Fredericksburg, Va. The bottom of a square hole cut in the door sill of the Princess Anne street door to the library in the court-house, being near the northwest corner of the building. It is 0·051 m. from the extreme east edge of the sill and 0·11 m. from the south side of the door. J. B. W., 1883.

Primary B. M.—H.—Fredericksburg, Va. The bridge of the Richmond, Fredericksburg and Potomac Railroad over the Rappahannock River. The bottom of a square hole cut in the northwest corner of the stone coping of the west abutment of the bridge. It is below the top of the abutment and 0·181 m. from the extreme east edge of the stone in which it is cut, 0·056 m. from the extreme north edge, and 0·084 m. from the abutment wall. J. B. W., 1883.

Primary B. M.—G_8.—Near Potomac Run Station, Stafford County, Va. The bottom of a square hole cut in the stone abutment of the iron railroad bridge over Potomac Run. It is on the north side of the run, west of the track, and at the end of the ironwork of the bridge. I. W., 1895.

Primary B. M.—G_7.—Brooke, Stafford County, Va. The bottom of a square hole cut in the top of the sandstone coping to the retaining wall of a brick culvert under the railroad. It is east of the track near the south end of the wall, above the arch, and is lettered thus, U S / B M . The culvert is a short distance south of the railroad station. I. W., 1895.

Primary B. M.—G_6.—One-half mile south of Widewater, Stafford County, Va. The bottom of a square hole cut in the top of the retaining wall to a brick culvert under the railroad. It is east of the track and near the north end of the wall, above the arch; it is marked thus, U S / B M . I. W., 1895.

Primary B. M.—G_5.—Quantico, Prince William County, Va. A copper bolt leaded in the side wall of a brick building owned by Max Lansburgh, opposite to the railroad station, being east of the track. It is in the twelfth course above the ground and in the third brick from the northwest corner. A cross cut on its end marks the reference point. I. W., 1895.

Primary B. M.—G_4.—One-half mile north of Woodbridge, Prince William County, Va. The bottom of a square hole roughly cut in the top of a large granite block set in the red sandstone of the first pier from the north end of the bridge over Occoquan River. The stone is under the end of the iron superstructure; it is east of the track and the mark is at the northwest corner of the granite stone. I. W., 1895.

Primary B. M.—G_3.—Pohick Creek, Fairfax County, Va. The surface of an offset cut in the edge of the capstone to the north abutment of the iron bridge of the Richmond, Fredericksburg and Potomac Railroad. It is east of the track and on the southeast corner of the abutment. I. W., 1895.

Primary B. M.—G_2.—One-fourth mile north of Accotink, Fairfax County, Va. The bottom of a square hole cut in the north abutment to the small wooden railroad bridge No. 20. It is west of the track, on the offset below the top, on which the end of the bridge rests. I. W., 1895.

Primary B. M.—G_1.—Cameron Run, 3 miles south of Alexandria, Va. The bottom of a square hole cut in the top of the third step (down) of the granite abutment to the iron railroad bridge of the Baltimore and Potomac, over Cameron Run. It is east of the track, on the north abutment, and is lettered thus U S / B M . I. W., 1895.

Primary B. M.—G.—Alexandria, Va. A mark, thus (□), near the middle of the sill of the northwest window of the custom-house. It is 0·12 m. from the extreme west edge of the sill and 0·115 m. from the extreme east edge. J. B. W., 1883.

Primary B. M.—XI.—West Washington, D. C. (Georgetown). The bottom of a square hole cut in the northwest coping stone of the north abutment of the "Aqueduct Bridge" over the Potomac River. It is marked thus (⊠). J. B. W., 1883.

N. B.—There are a number of bench marks within the limits of Washington, but of these

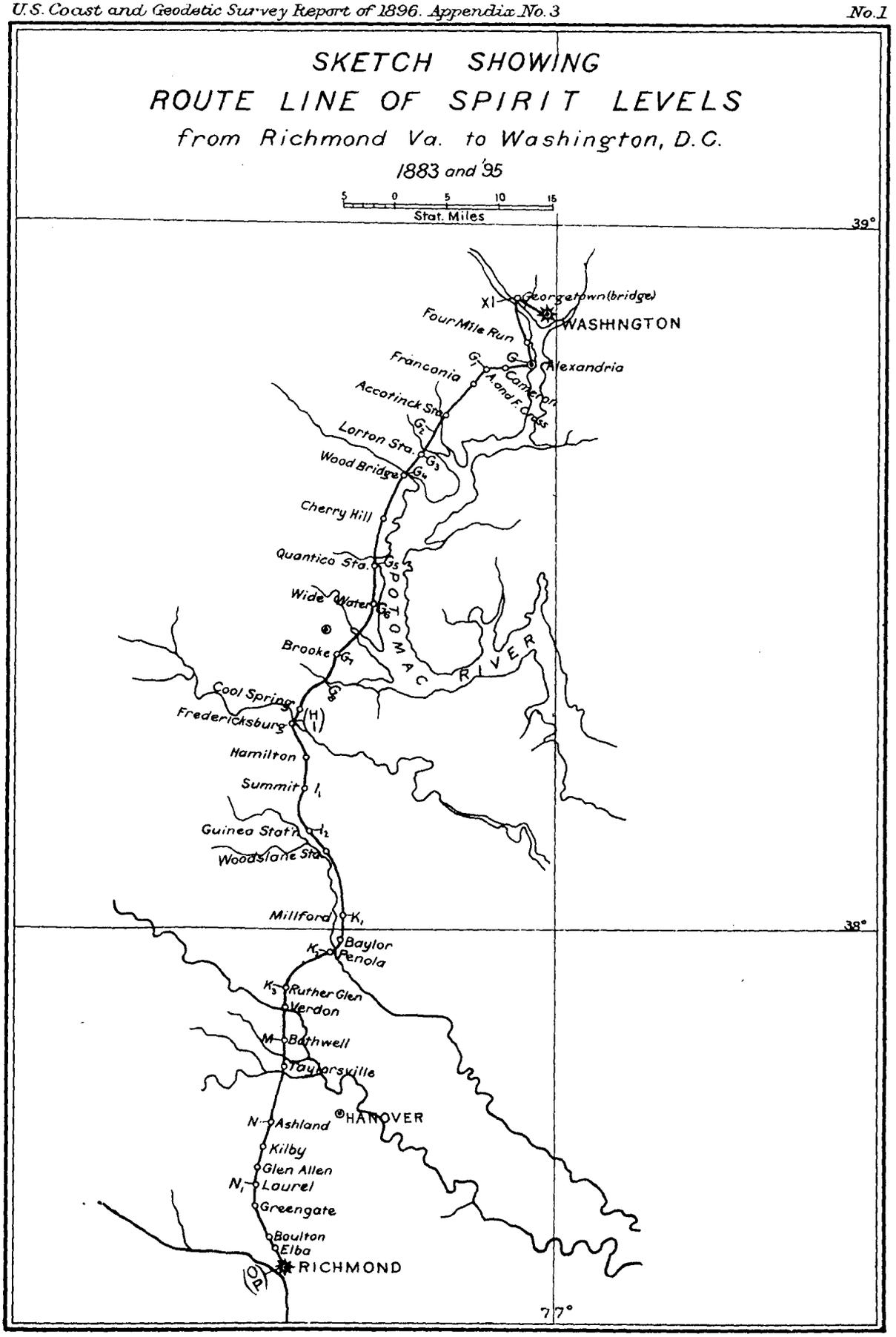
only the following ones are of importance in connection with the line of levels at present under consideration:

Monument B. M.—Washington, D. C. The top of a brass bolt, marked O, placed vertically in a stone on the southwest corner of the top layer of the foundation of the monument. It was established and used by the Army Engineers in the erection of the monument. The aluminum point of the pyramidion is said to be 555 feet 4½ inches above this bolt.

National Museum B. M.—Washington, D. C. The center of a cross cut on the granite sill of the outer door of the main entrance, north side, to the main building. It is 5 feet from the east and the same from the west side of the door, 10½ inches from the north edge of the sill, and about 10 feet from the inner door leading to the Museum. J. B. W., 1884.

Capitol B. M.—Washington, D. C. The top of a bronze bolt, in the middle of a bronze plate 5 inches square, placed vertically in the granite water table under the first window west of the southeast corner of the Senate wing of the Capitol. The plate was placed in position June, 1884, under the direction of Assistant C. O. Boutelle, and is inscribed "Capitol Bench Mark, U. S. Coast and Geodetic Survey, 1884."

Navy-Yard B. M.—C.—Washington, D. C. On the southwest corner of the upper surface of the iron plate of the brick column under the southwest corner of the porch around the commandant's office. A. S. C. 1892.


SKETCH SHOWING
ROUTE LINE OF SPIRIT LEVELS
from Richmond Va. to Washington, D.C.
1883 and '95
5 0 5 10 15
Stat. Miles
39°
38°
77°
XI
Georgetown (bridge)
WASHINGTON
Four Mile Run
Alexandria
Franconia
Cameron
A and F. Cross
Accotinck Sta.
Lorton Sta.
Wood Bridge
Cherry Hill
Quantico Sta.
Wide Water
Brooke
POTOMAC RIVER
Cool Spring
Fredericksburg
Hamilton
Summit
Guinea Station
Woodslane Sta.
Millford
Baylor
Penola
Ruther Glen
Verdon
Bathwell
Taylorsville
HANOVER
Ashland
Kilby
Glen Allen
Laurel
Greengate
Boulton
Elba
RICHMOND

APPENDIX No. 4—1896.

RESULTING HEIGHTS FROM SPIRIT LEVELING BETWEEN WASHINGTON, D. C., AND HAGERSTOWN, MD., FROM OBSERVATIONS MADE BY J. B. WEIR, SUB-ASSISTANT, BETWEEN JULY AND SEPTEMBER, 1883.*

Submitted for publication by Charles A. Schott, Assistant in charge Computing Division, September 18, 1896.

The following report on the resulting heights from spirit leveling between Washington, D. C., and Hagerstown, Md., is herewith respectfully submitted. The line connects with tide water at Old Point Comfort, at Washington, and at Annapolis (see preceding Appendices Nos. 2 and 3), whence was obtained the height of the West Washington (Georgetown) bench mark at the Aqueduct Bridge, the starting point of the present line. At Hagerstown a junction is made with the line of levels brought over from Sandy Hook, N. J., via Easton and Harrisburg, Pa., of which an account is given in Appendix No. 11, Report for 1882.† The length of this loop is, between Sandy Hook and Hagerstown court-house, 441·37 km., thence to Washington, Capitol, 129·92; total, 571·3 km. A necessary check on the height of the Hagerstown bench mark is thus secured; from this place, however, to St. Louis, Mo., no check lines have as yet been provided. The computation was made in duplicate, one by the observer and the other by A. S. Christie, office computer; the final abstract is due to Assistant I. Winston.

Route line.—From West Washington the line follows the towpath of the Chesapeake and Ohio Canal as far as Weverton, Md.; thence it follows the branch of the Baltimore and Ohio Railroad to Hagerstown.

Observer and dates.—The observations are by Sub-assistant J. B. Weir, and they comprise the period July 24 to September 10, 1883.

Instrument.—Spirit level No. 1 and metric rods A and B were used. The constants for this instrument are given in the preceding appendix, but the collar inequality adopted, $-3''\cdot12$, is the mean of the observations of July and October, 1883. The wooden rods with brass scales are 3 m. in length, and the scales are of standard value at a temperature of 65° F., nearly. The abutting ends of the rods project 7·83 cm. below the zero of graduation.

Method of observing.—It was the same as stated in the preceding appendix on the Richmond-Washington branch of levels, viz, two parallel lines run simultaneously and in the same direction, one by rod A and the other by rod B, placed at different distances from the instrument. The long sight was observed first during one day, but the short sight on the second day. Adjacent sections of the line were run in opposite directions. On the average the length of the sight line is less than 100 m.

* With diagram showing route line and position of bench marks.

† The line was run by A. Braid, Assistant, between July and December, 1881.

Results of geodetic spirit leveling between Washington, D. C., and Hagerstown, Md., 1883.

Bench marks.		Distance between successive marks.	Distance from navy-yard, Washington, D. C.	Difference in height.			Discrepancy.		Height above average level of the ocean.†
From—	To—			Rod A.	Rod B.	Mean.	Partial A—B	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
	XI		10·633						9·6960
XI	X	1·892	12·525	+ 2·0349	+ 2·0349	+ 2·0349	±0·0	0·0	11·7309
X	'93	1·426	13·951	+ 0·2824	+ 0·2845	+ 0·2835	—2·1	— 2·1	12·0144
93	92	0·965	14·916	— 0·6937	— 0·6882	— 0·6910	—5·5	— 7·6	11·3234
92	91	0·848	15·764	— 0·0749	— 0·0761	— 0·0755	+1·2	— 6·4	11·2479
91	90	1·278	17·042	+ 2·6707	+ 2·6740	+ 2·6724	—3·3	— 9·7	13·9203
90	89	0·978	18·020	+ 3·0711	+ 3·0690	+ 3·0700	+2·1	— 7·6	16·9903
89	88	1·168	19·188	— 0·8224	— 0·8212	— 0·8218	—1·2	— 8·8	16·1685
88	87	0·984	20·172	+ 1·6449	+ 1·6472	+ 1·6461	—2·3	—11·1	17·8146
87	IX	1·008	21·180	+ 0·9247	+ 0·9244	+ 0·9245	+0·3	—10·8	18·7391
IX	86	1·266	22·446	+ 2·5966	+ 2·5992	+ 2·5979	—2·6	—13·4	21·3370
86	VIII	1·412	23·858	+ 9·6714	+ 9·6716	+ 9·6715	—0·2	—13·6	31·0085
VIII	85	0·637	24·495	+ 4·7492	+ 4·7500	+ 4·7496	—0·8	—14·4	35·7581
85	84	1·324	25·819	+ 0·3130	+ 0·3098	+ 0·3114	+3·2	—11·2	36·0695
84	83	1·020	26·839	— 0·2614	— 0·2582	— 0·2598	—3·2	—14·4	35·8097
83	82	1·080	27·919	+ 1·0000	+ 1·0021	+ 1·0011	—2·1	—16·5	36·8108
82	81	1·949	29·868	+ 0·2826	+ 0·2854	+ 0·2840	—2·8	—19·3	37·0948
81	80	1·116	30·984	+ 4·2612	+ 4·2556	+ 4·2584	+5·6	—13·7	41·3532
80	F	0·886	31·870	+ 9·4489	+ 9·4468	+ 9·4478	+2·1	—11·6	50·8010
F	75	1·234	33·104	+ 0·1226	+ 0·1203	+ 0·1215	+2·3	— 9·3	50·9225
75	76	2·118	35·222	+ 0·3324	+ 0·3328	+ 0·3326	—0·4	— 9·7	51·2551
76	76½	1·288	36·510	+ 2·2180	+ 2·2164	+ 2·2172	+1·6	— 8·1	53·4723
76½	77	0·772	37·282	+*0·1329	+*0·1252	+ 0·1290	+7·7	— 0·4	53·6013
77	78	1·395	38·677	— 0·2401	— 0·2404	— 0·2402	+0·3	— 0·1	53·3611
78	79	1·084	39·761	+ 0·1660	+ 0·1685	+ 0·1672	—2·5	— 2·6	53·5283
79	VII	1·078	40·839	+ 2·0193	+ 2·0149	+ 2·0171	+4·4	+ 1·8	55·5454
VII	74	1·355	42·194	— 0·1379	— 0·1341	— 0·1360	—3·8	— 2·0	55·4094
74	73	1·161	43·355	+ 0·7709	+ 0·7701	+ 0·7705	+0·8	— 1·2	56·1799
73	72	1·008	44·363	+ 1·3270	+ 1·3296	+ 1·3283	—2·6	— 3·8	57·5082
72	E	1·246	45·609	+ 2·9659	+ 2·9709	+ 2·9684	—5·0	— 8·8	60·4766
E	68	2·984	48·593	+ 0·3244	+ 0·3279	+ 0·3262	—3·5	—12·3	60·8028
68	69	1·340	49·933	— 0·2348	— 0·2351	— 0·2350	+0·3	—12·0	60·5678
69	70	1·802	51·735	+ 0·3263	+ 0·3286	+ 0·3275	—2·3	—14·3	60·8953
70	71	1·612	53·347	+ 0·3205	+ 0·3193	+ 0·3199	+1·2	—13·1	61·2152
71	VI	2·463	55·810	— 0·2086	— 0·2086	— 0·2086	0·0	—13·1	61·0066
VI	67	1·546	57·356	+ 0·0718	+ 0·0710	+ 0·0714	+0·8	—12·3	61·0780
67	66	0·960	58·316	— 0·0237	— 0·0194	— 0·0216	—4·3	—16·6	61·0564
66	65	1·804	60·120	+ 2·4836	+ 2·4808	+ 2·4822	+2·8	—13·8	63·5386
65	64	1·148	61·268	— 0·3822	— 0·3821	— 0·3821	—0·1	—13·9	63·1565
64	63	1·408	62·676	+ 0·0132	+ 0·0091	+ 0·0111	+4·1	— 9·8	63·1676
63	62	1·031	63·707	+ 0·0350	+ 0·0363	+ 0·0357	—1·3	—11·1	63·2033
62	61	1·496	65·203	+ 0·3559	+ 0·3623	+ 0·3591	—6·4	—17·5	63·5624
61	V	1·127	66·330	— 0·4122	— 0·4129	— 0·4126	+0·7	—16·8	63·1498
V	55	1·486	67·816	+ 0·2716	+ 0·2714	+ 0·2715	+0·2	—16·6	63·4213
55	56	1·352	69·168	+ 0·1335	+ 0·1342	+ 0·1339	—0·7	—17·3	63·5552
56	57	0·874	70·042	— 0·2261	— 0·2223	— 0·2242	—3·8	—21·1	63·3310
57	58	0·670	70·712	— 0·0434	— 0·0433	— 0·0434	—0·1	—21·2	63·2876
58	59	1·344	72·356	+ 0·6165	+ 0·6169	+ 0·6167	—0·4	—21·6	63·9043
59	60	1·030	73·086	+ 1·5668	+ 1·5641	+ 1·5655	+2·7	—18·9	65·4698
60	IV	1·355	74·441	+ 0·1765	+ 0·1779	+ 0·1772	—1·4	—20·3	65·6470
IV	54	2·388	76·829	+ 2·3807	+ 2·3767	+ 2·3787	+4·0	—16·3	68·0257
54	53	0·929	77·758	—*0·0930	—*0·0950	— 0·0940	+2·0	—14·3	67·9317
53	52	1·262	79·020	+*0·4053	+*0·4038	+ 0·4045	+1·5	—12·8	68·3362
52	51	1·398	80·418	— 0·5384	— 0·5358	— 0·5371	—2·6	—15·4	67·7991
51	50	1·802	82·220	+ 0·4830	+ 0·4814	+ 0·4822	+1·6	—13·8	68·2813
50	49	1·774	83·994	— 0·2073	— 0·2058	— 0·2065	—1·5	—15·3	68·0748
49	48	1·180	85·174	— 0·3167	— 0·3151	— 0·3159	—1·6	—16·9	67·7589
48	D	1·299	86·473	+ 0·5062	+ 0·5090	+ 0·5076	—2·8	—19·7	68·2665
D	42	1·202	87·675	+ 0·3822	+ 0·3887	+ 0·3854	—6·5	—26·2	68·6519
42	43	1·410	89·085	+ 1·1451	+ 1·1458	+ 1·1455	—0·7	—26·9	69·7974
43	44	1·374	90·459	+ 0·1082	+ 0·1125	+ 0·1103	—4·3	—31·2	69·9077
44	45	1·264	91·723	+ 2·0107	+ 2·0096	+ 2·0102	+1·1	—30·1	71·9179
45	46	1·294	93·017	+ 0·0866	+ 0·0884	+ 0·0875	—1·8	—31·9	72·0054
46	47	1·522	94·539	— 0·2454	— 0·2503	— 0·2479	+4·9	—27·0	71·7575
47	III	0·804	95·343	+ 0·4392	+ 0·4388	+ 0·4390	+0·4	—26·6	72·1965
III	41	1·351	96·694	— 0·2430	— 0·2410	— 0·2420	—2·0	—28·6	71·9545

* Mean of two measures.

† As taken up in the bay at Old Point Comfort and at Annapolis and from the Potomac River at Washington, D. C.

Results of geodetic spirit leveling between Washington, D. C., and Hagerstown, Md., 1883—Cont'd.

Bench marks.		Distance between successive marks.	Distance from navy-yard, Washington, D. C.	Difference in height.			Discrepancy.		Height above average level of the ocean.†
From—	To—			Rod A.	Rod B.	Mean.	Partial A—B	Total accumulated.	
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
41	40	1·026	97·720	+ 2·1164	+ 2·1131	+ 2·1148	+3·3	—25·3	74·0693
40	39	1·365	99·085	+ 0·2010	+ 0·1984	+ 0·1997	+2·6	—22·7	74·2690
39	38	1·314	100·399	+ 0·0369	+ 0·0396	+ 0·0382	—2·7	—25·4	74·3072
38	37	1·066	101·465	+ 0·1759	+ 0·1795	+ 0·1777	—3·6	—29·0	74·4849
37	C	0·848	102·313	+ 2·2667	+ 2·2684	+ 2·2676	—1·7	—30·7	76·7525
C	23	0·866	103·179	+ 15·3076	+ 15·3114	+15·3095	—3·8	—34·5	92·0620
23	24	0·549	103·728	+ 9·3469	+ 9·3454	+ 9·3461	+1·5	—33·0	101·4081
24	25	0·862	104·590	+ 8·9342	+ 8·9367	+ 8·9355	—2·5	—35·5	110·3436
25	26	0·830	105·420	+ 9·7946	+ 9·7971	+ 9·7958	—2·5	—38·0	120·1394
26	27	1·225	106·645	+ 12·7590	+ 12·7600	+12·7595	—1·0	—39·0	132·8989
27	28	0·754	107·399	+ 10·2290	+ 10·2271	+10·2281	+1·9	—37·1	143·1270
28	29	0·758	108·157	+ 4·5029	+ 4·4992	+ 4·5010	+3·7	—33·4	147·6280
29	30	1·050	109·207	+ 10·3457	+ 10·3480	+10·3469	—2·3	—35·7	157·9749
30	31	0·857	110·064	+*12·6704	+*12·6747	+12·6725	—4·3	—40·0	170·6474
31	32	0·516	110·580	+ 7·8732	+ 7·8776	+ 7·8754	—4·4	—44·4	178·5228
32	33	0·932	111·512	+ 10·3969	+ 10·3997	+10·3983	—2·8	—47·2	188·9211
33	34	0·542	112·054	+ 8·4485	+ 8·4455	+ 8·4470	+3·0	—44·2	197·3681
34	35	0·948	113·002	+ 12·4785	+ 12·4772	+12·4779	+1·3	—42·9	209·8460
35	36	0·844	113·846	— 11·3727	— 11·3713	—11·3720	—1·4	—44·3	198·4740
36	II	0·676	114·522	— 9·0787	— 9·0796	— 9·0792	+0·9	—43·4	189·3948
II	22	0·748	115·270	— 6·7174	— 6·7177	— 6·7175	+0·3	—43·1	182·6773
22	21	1·082	116·352	— 4·9623	— 4·9588	— 4·9606	—3·5	—46·6	177·7167
21	20	0·933	117·285	— 11·0516	— 11·0524	—11·0520	+0·8	—45·8	166·6647
20	19	1·096	118·381	— 17·4025	— 17·4060	—17·4042	+3·5	—42·3	149·2605
19	18	0·680	119·061	— 11·4503	— 11·4493	—11·4498	—1·0	—43·3	137·8107
18	17	1·028	120·089	— 12·1851	— 12·1879	—12·1865	+2·8	—40·5	125·6242
17	B	1·584	121·673	— 6·3610	— 6·3631	— 6·3621	+2·1	—38·4	119·2621
B	I	0·932	122·605	+ 4·6520	+ 4·6557	+ 4·6539	—3·7	—42·1	123·9160
I	14	0·990	123·595	+ 7·3419	+ 7·3476	+ 7·3447	—5·7	—47·8	131·2607
14	15	1·194	124·789	— 4·5421	— 4·5428	— 4·5424	+0·7	—47·1	126·7183
15	16	1·020	125·809	+ 14·5207	+ 14·5172	+14·5189	+3·5	—43·6	141·2372
16	13	0·920	126·729	— 4·8360	— 4·8378	— 4·8369	+1·8	—41·8	136·4003
13	12	0·942	127·671	+ 2·8832	+ 2·8851	+ 2·8842	—1·9	—43·7	139·2845
12	11	1·189	128·860	+ 6·8547	+ 6·8561	+ 6·8554	—1·4	—45·1	146·1399
11	10	1·186	130·046	— 0·0251	— 0·0211	— 0·0231	—4·0	—49·1	146·1168
10	9	1·080	131·126	+ 4·5397	+ 4·5381	+ 4·5389	+1·6	—47·5	150·6557
9	8	1·450	132·576	+ 9·4353	+ 9·4346	+ 9·4349	+0·7	—46·8	160·0906
8	7	0·954	133·530	— 2·2929	— 2·2914	— 2·2921	—1·5	—48·3	157·7985
7	6	0·924	134·454	— *1·7390	— *1·7380	— 1·7385	—1·0	—49·3	156·0600
6	5	1·489	135·943	— 4·7966	— 4·8001	— 4·7984	+3·5	—45·8	151·2616
5	4	1·260	137·203	+ 10·2626	+ 10·2626	+10·2626	0·0	—45·8	161·5242
4	3	1·177	138·380	+ *6·9542	+ *6·9509	+ 6·9526	+3·3	—42·5	168·4768
3	2	0·649	139·029	— 4·7441	— 4·7443	— 4·7442	+0·2	—42·3	163·7326
2	1	1·012	140·041	— 1·2715	— 1·2715	— 1·2715	0·0	—42·3	162·4611
1	A	0·408	140·449	+ *5·6879	+ *5·6905	+ 5·6892	—2·6	—44·9	168·1503

* Mean of two measures.

† As taken up in the bay at Old Point Comfort and at Annapolis and from the Potomac River at Washington, D. C.

To estimate the probable error of the resulting height of the bench mark at Hagerstown we have to allow for the fact that simultaneous lines give but partial differences, and we must adopt, as before, the factor 1·6 for Σdd, hence we have:

For the line B. M. at Capitol to B. M XI, $\Sigma s =$ 7·68 km. and 1·6 $\Sigma dd =$ 67
and B. M. XI to Hagerstown, $\Sigma s =$ 129·82 " 1·6 $\Sigma dd =$ 1364

Adding the respective numbers, we get the probable error of leveling of 1 km. from one line $r_{,} = 0{\cdot}675\sqrt{\frac{[dd]}{2[s]}} = \pm$ 1·54 mm. and for mean of two lines $r_{,,} = \pm$ 1·08 mm.*, also the probable error of leveling for the whole line $1{\cdot}08\sqrt{137{\cdot}5} = \pm$ 12·8 mm.

* For a comparative table of values of r, see Appendix No. 3, Report for 1892, Part II, p. 190. We have also for the Washington-Hagerstown line the mean error of leveling one kilometre ±2·28 mm., which is a fair value.

The assumed probable error of the sea level, produced, at Washington is ± 70 mm. Similarly, we have from the Sandy Hook line, after increasing the value given in Appendix No. 11, Report for 1882, p. 522, by 25 per cent, the probable error of B. M. "A" ± 28·5 mm.

	m.	m.
We have the resulting height of "A" from Washington line,	168·15	± 0·07
and the same from Sandy Hook line (App. No. 11, Report of 1882),	168·34	± 0·03
hence the final height of "A,"	168·31	± 0·03

The correction to the heights of the Washington-Hagerstown line is therefore +1·23 mm. per km. The final heights are as follows:

	m.	feet.
B. M. at Capitol, Senate wing, Washington.	27·700 or	90·88
B. M. XI—at Aqueduct Bridge, West Washington.	9·696	31·81
B. M. F—at Great Falls, Md.	50·827	166·75
B. M. E—at aqueduct bridge, Seneca, Md.	60·520	198·56
B. M. V—at Whites Ferry, Montgomery County, Md.	63·218	207·41
B. M. D—at Point of Rocks, Md.	68·360	224·28
B. M. C—at Weverton, Washington County, Md.	76·865	252·18
B. M. B—at bridge near Keedysville, Washington County, Md.	119·399	391·73
B. M. A—at court-house, Hagerstown, Md.	168·310	552·20

The error of closing the circuit of levels from Sandy Hook, N. J., via Hagerstown, Md., to Washington, D. C., is but 0·19 m. or 0·62 feet, with a development of length of 441·4+140·5 km., or 582 km.=361½ statute miles.

The Sandy Hook line also requires a small correction at the rate of −0·077 mm. per km., commencing with bench mark F at Raritan, N. J., which is 387 km. from Hagerstown.

Primary B. M. on Capitol at Washington, D. C.—For description of this mark at the Senate wing of the Capitol, see preceding appendix.

Primary B. M.—XI.—West Washington (Georgetown), D. C. The bottom of a square hole cut in the northwest coping stone of the north abutment of the Aqueduct Bridge over the Potomac River. It is marked thus: ⊠. J. B. W., 1883.

Primary B. M.—F.—Great Falls, Md. The bottom of a square hole marked thus ⊹ cut on the capstone of the south wall, near its west end, of Lock 20, C. and O. Canal. It is 0·200 m. from extreme north and 0·450 m. from extreme east edge, and 1·65 m. from west gate of lock. J. B. W., 1883.

Primary B. M.—E.—Seneca, Md. The bottom of a square hole marked thus ⊠ cut on the southeast side of capstone on southwest end of the aqueduct bridge. It is 0·165 m. from the iron guard rail, 0·397 m. from extreme east edge of capstone, and 0·06 m. from end of lower wooden beam of guard rail crossing the bridge. J. B. W., 1883.

Primary B. M.—V.—Whites Ferry, Montgomery County, Md. A square hole cut on the south edge of capstone of culvert under C. and O. Canal, about 20 metres east of the bridge crossing the canal. It is on the south bank, and 0·178 m. from extreme south edge of capstone. J. B. W., 1883.

Primary B. M.—D.—Point of Rocks, Md. The bottom of a square hole marked thus ⊹ cut on the foundation of the north abutment of the bridge crossing the C. and O. Canal. It is 0·047 m. from extreme south edge of stone. J. B. W., 1883.

Primary B. M.—C.—Weverton, Md. A square hole marked thus ⊹ cut on northeast corner of southwest capstone on south wall of lock No. 31, C. and O. Canal. It is 0·355 m. from extreme east and 0·335 from extreme north edge. J. B. W., 1883.

Primary B. M.—B.—One-half mile south of Keedysville, Washington County, Md. A cross cut on northwest corner of west capstone on south abutment of bridge No. 26 of Baltimore and Ohio Railroad. J. B. W., 1883.

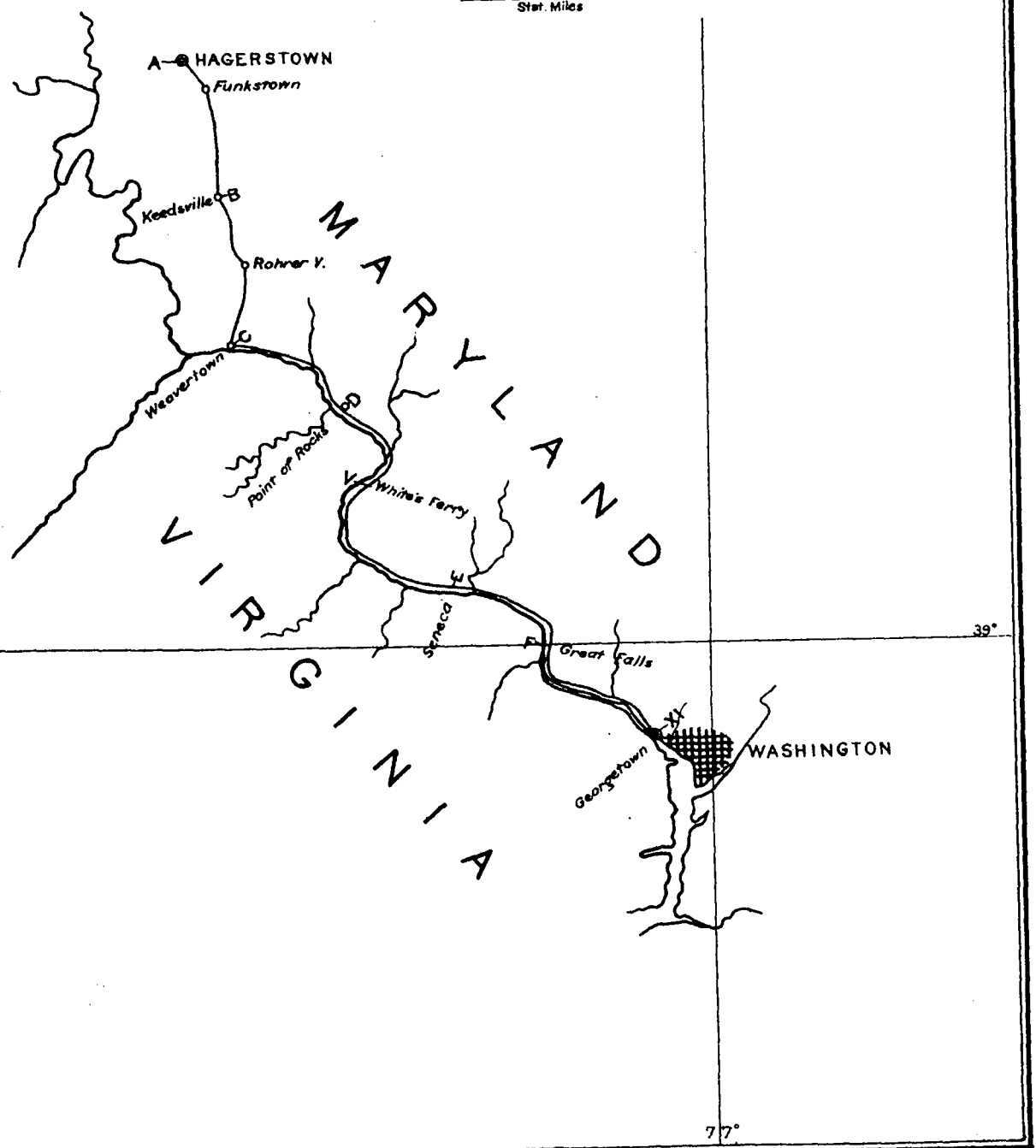
Primary B. M.—A.—Hagerstown, Md. Cut on the water table of the court-house, which stands at the corner of Washington and Jonathan streets. The bench mark is on the Jonathan street side. It is marked thus: A / B □ M. / U. S. C. S. / Oct. 1877. E. S., 1877.

SKETCH SHOWING ROUTE LINE OF SPIRIT LEVELS

from Hagerstown Md. to Washington, D. C.

1883

3 0 3 6 9
Stat. Miles



APPENDIX No. 5.—1896.

RESULTING HEIGHTS FROM SPIRIT LEVELING BETWEEN JEFFERSON CITY, MO., AND HOLLIDAY, KANS., FROM OBSERVATIONS BY I. WINSTON, ASSISTANT, AND F. A. YOUNG, AID, BETWEEN APRIL 21 AND OCTOBER 13, 1891.*

Submitted for publication by Chas. A. Schott, Assistant in charge of Computing Division, October 1, 1896.

I have the honor to submit herewith a report on the resulting heights from spirit leveling of a line commencing 8 kilometres (5 statute miles) east of Jefferson City, Mo., and extending to Holliday, Kans., about 22 kilometres (14 statute miles) westerly of Kansas City, Mo. It is a continuation of the line of levels which starts from the bench mark on the bridge across the Mississippi at St. Louis, known as bench mark K_3, and is published as Appendix No. 2, Report for 1893, part 2, pages 19–36. In that appendix the resulting levels are carried as far as the vicinity of Jefferson City; in the present report the distances and heights relative to K_3 will be continued. This mark is on the same level as the so-called "City Directrix" at St. Louis, and was used as reference mark by the Missouri River Commission in its leveling between that city and Kansas City and beyond.† The line was run twice, one observer leveling in a forward direction, the other in the opposite direction, and each observer using his own instrument, but the same rods.

Route line.—The line follows the Missouri Pacific Railway as far as Kansas City, whence it follows the Atchison, Topeka and Santa Fe Railway to Holliday, Kans.

Observers and dates of leveling.—The observers were I. Winston and F. A. Young. They worked at alternate periods attending to observing and computing. The leveling was done between April 21 and October 13, 1891.

Instruments and rods.—The micrometer spirit levels Nos. 5 and 6 were constructed at the Survey Office in 1888, after the pattern of spirit level No. 1, for which see Appendix No. 11, Report for 1880. They differ from No. 1 only in some minor details; one of these is the perfect balancing of the weight of the telescope resting on the two collars during observation, i. e., when the focal adjustment is made and when the shade cover is in place.

The instrumental constants are as follows:

Instrument.	No. 5.	No. 6.
Aperture of telescope.	2·9 cm.	2·9 cm.
Focal length of telescope.	34·8 cm.	34·8 cm.
Magnifying power.	28	28
Value of 1 division of striding level.	2″·10	2″·53
As determined in.	Sept. 26, 1888, & Apr. 8, 1890	May 23, 1888, & Apr. 8, 1890
Inequality of collars, + when object end larger than eye end.	−0″·89, Feb. 13, 1890 −2·61, Oct. 1892	−0″·01, Feb. 9–13, 1891 +0·88, Oct., 1892
Weighted mean used (first value having double weight).	−1·46	+0·29
Value of 100 divisions = 1 turn of micrometer screw.	312″·0	312″·0
As determined in.	Sept., 1888, & July, 1889	June & July, 1889
Angular value of telemeter threads.	18′ 58″·5	18′ 50″·6
As determined.	July 22, 1889	July 22, 1889

*With diagram showing route line and position of bench marks.

†See Description and Elevation of Bench Marks on the Missouri River; publication by the Missouri River Commission, May, 1888.

The index corrections to the metric rods are as follows:

Rod I	—0·2 mm. (letter of Oct. 30, 1890) and	—0·4 mm. on Apr. 27, 1892;	weighted mean used	—0·3 mm.
Rod K	—0·1 mm. " " " " "	—0·2 mm. " " " "	—0·1 mm.
Rod N	—0·4 mm., Feb., 1891,	—0·5 mm. on June 10, 1892;	" " "	—0·4 mm.
Rod O	—0·4 mm. "	—1·0 mm. " " " "	—0·6 mm.

These rods are of standard length at the following temperatures, the coefficient of expansion of the brass scales being taken as 0·00001 for the Fahrenheit scale.

Rod I at 22°·1 C.	The rods I and K were standardized in Nov., 1888, at 72°·8 F, viz.			
K at 20 ·4		I	K	
N at 21 ·7	0 to 1st m.	1·000 007 m.	1·000 014 m.	The standard temperature refers to the graduations about the second metre as most frequently used.
O at 21 ·7	0 to 2d m.	2·000 031	2·000 124	
	0 to 3d m.	3·000 044	3·000 174	

Method of observing.—The method adopted this season was the same as that followed on the preceding part of the line between Etlah and Jefferson City (Appendix No. 2, Report for 1893, part 2, p. 22), viz, two independent measures are made, one in the forward or westerly direction by one of the observers and the other in the opposite or easterly direction by the second observer, but on different days, and each observer using his own instrument, Winston, No. 5, and Young, No. 6, but the same rods, N and O, and toward the end of the season Rods I and K. The line was divided off in convenient stretches of about 10 km. in length, the observers being engaged alternately in field work and in computing work; in case their two measures of such a subdivision when compared proved not quite satisfactory, a third measure was made. The average distance between the instrument and the rod was about 95 m.

Computations.—The field computation is by the observers, the office computation by H. F. Flynn, aided by L. Pike and H. G. Ogden; the comparison and final results are due to Mr. Winston.

Results.—The resulting heights of the bench marks are contained in the following tabular statement of the individual measures; they are relative, and give the difference between each bench mark and that of the City Directrix (so called) at St. Louis. The absolute heights above the Gulf of Mexico can not yet be given; approximately the mark K_3 is 125·8 metres, or 412·7 feet, above that level. As the result of the leveling we find the height of B. M. LXIII at Holliday, Kans., above B. M. K_3 at St. Louis 106·665 m., and distant from B. M. XXV, near Jefferson City, measured along the route, 481·65 — 194·91 = 286·74 km. We find also by squaring the numbers in the column "Partial discrepancy F — B" the value of $[dd]=5475$, hence the mean error m_1 of a single leveling of 1 km.

$$m_1=\sqrt{\frac{[dd]}{2[s]}}=\pm 3{\cdot}09 \text{ mm.}$$

Also the probable error r_{11} of a double measure of 1 km.

$$r_{11}=0{\cdot}675\sqrt{\frac{[dd]}{4[s]}}=\pm 1{\cdot}47 \text{ mm.}$$

and the probable error r for the whole line between B. M. XXV and B. M. LXIII

$$r=0{\cdot}675\sqrt{\frac{[dd]}{4}}=\pm 25{\cdot}0 \text{ mm.}$$

The probable error of the height of XXV is given as ±11·2 mm. ±9·1 mm. (see App. No. 2, Rept. for 1893, part 2, p. 36), hence we have for the probable error developed in the leveling from St. Louis (K_3) to Holliday (LXIII), a distance of 481·65 km., or 299·3 statute miles, ±11·2 ±9·1 ±25·0 = ±28·9 mm.

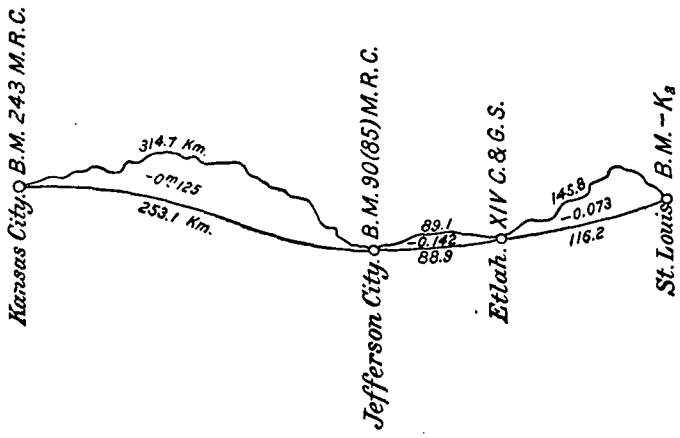
Comparison of results for heights determined at or in the vicinity of Kansas City, Mo., by the Mississippi River Commission. (See publication of May, 1888, and Annual Report of Chief of Engineers, U. S. Army, 1893, App. ZZ, pp. 3986–4062; see also part 4, 1888, pp. 2329–2340.)

Mo. Riv. Com. B. M.	Locality.	U. S. C. & G. Survey.	Mo. Riv. Com.	Difference.
		m.	*m.*	*m.*
73 / I	50 ft. east of shore pier of Kansas City bridge.	102·366	102·706	—0·340
243	In south abutment of Kansas City bridge.	103·875	104·215	—0·340
244	On first pier of abutment of Kansas City bridge.	103·715	104·056	—0·341
			Mean	—0·340

The distance from the St. Louis mark to the Kansas City marks along the line of levels of 1882, 1888, and 1891, via Jefferson City and Sedalia, is about 458 km. This line, with that of the Missouri River Commission, which in general followed the course of the river, forms a loop of levels with a periphery of 458 + 550, or 1 008 km., of which the closing error is the above small quantity, 0·340 m. A smaller loop between St. Louis, Mo., and Jefferson City, Mo., 205·1 km. by the route of the Coast and Geodetic Survey and 234·9 km. by that of the Missouri River Commission (following the river), leads to the following comparison: Height of B. M. 90 (85) by Coast and Geodetic Survey, 43·606 m.; same by Missouri River Commission, 43·821 m.; hence closing error — 0·215 m.

There is another loop which branches off our line at Pleasant Hill B. M. No. 41 and connects again at Holliday B. M. LXIII. These and several other loops will be adjusted as soon as all the measures shall have been completed, and it may be remarked here that these closing errors furnish the means of forming a more accurate and true estimate of the accuracy of leveling results than can be had from line measures alone. As an illustration, we may contrast here the value of $r = \pm 25$ mm. with half the closing error of the large loop, or 170 mm. In fact, as is well known, leveling errors are composed of accidental errors and of systematic errors, the latter largely predominating. This is also shown by the numbers in the column of accumulated errors. After some small oscillations of + and — sign there is a gradual rise up to —104 mm., with a final descent to —43 mm., and we notice that on the shorter line, St. Louis to Jefferson City, the comparison between the results from the two lines of levels shows a difference of —0·215 m. at a distance of 205 km., which rose to —0·340 m. at the distance of 458 km.; that is, the discrepancy nearly reached two-thirds of the whole at about half the distance.

No. 1.



We also have the following closing error in the first loop, St. Louis to Etlah, viz, B. M. XIV (App. 2, Rept. for 1893, part 2, pp. 25-28), height 29·082 m.; same by the levels of the Missouri River Commission (Rept. for 1893, App. ZZ, p. 4062), 29·155 m.; hence closing error, 0·073 m. Distance by Coast and Geodetic Survey line 116·2 km. and by the Missouri River Commission line 145·8 km.; total circuit, 262·0 km.

The separate loops are shown on the above diagram, which gives also the separate closing errors and distances.

Results of geodetic spirit leveling, from Jefferson City, Mo., to Holliday, Kans.

Bench mark. From—	Bench mark. To—	Distance between successive marks.	Distance from initial mark K₃.	Difference in height between marks. Forward.	Backward.	Mean.	Discrepancy. Partial F—B.	Total accumulated.	Height above K₃. (St. Louis.)
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
	XXV		† 194·906						† 43·5847
XXV	1	1·129	196·035	*+ 3·3228	*+ 3·3280	+ 3·3254	— 5·2	— 5·2	46·9101
1	2	1·086	197·121	+ 3·0138	+ 3·0153	+ 3·0146	— 1·5	— 6·7	49·9247
2	3	1·077	198·198	*+ 0·7169	*+ 0·7108	+ 0·7138	+ 6·1	— 0·6	50·6385
3	4	0·922	199·120	*— 2·7264	*— 2·7238	— 2·7251	— 2·6	— 3·2	47·9134
4	5	1·188	200·308	— 3·0820	— 3·0835	— 3·0828	+ 1·5	— 1·7	44·8306
5	6	1·176	201·484	— 1·7238	— 1·7250	— 1·7244	+ 1·2	— 0·5	43·1062
6	7	1·266	202·750	*+ 0·1921	*+ 0·1984	+ 0·1952	— 6·3	— 6·8	43·3014
7	8	1·242	203·992	+ 0·2581	+ 0·2545	+ 0·2563	+ 3·6	— 3·2	43·5577
8	9	0·897	204·889	*— 1·7128	*— 1·7093	— 1·7110	— 3·5	— 6·7	41·8467
9	90 (85) M. R. C.	0·194	205·083	+ 1·7591	+ 1·7591	+ 1·7591	0·0	— 6·7	43·6058
9	XXVII	0·378	205·267	+16·6280	+16·6288	+16·6284	— 0·8	— 7·5	58·4751
XXVII	XXVIII	0·189	205·456	+ 6·8091	+ 6·8096	+ 6·8094	— 0·5	— 8·0	65·2845
9	R. R. S. 1	0·333	205·222	+ 1·1805					43·0272
9	10	0·920	205·809	+ 1·8678	+ 1·8646	+ 1·8662	+ 3·2	— 3·5	43·7129
10	12	2·380	208·189	+ 0·5023	+ 0·4976	+ 0·5000	+ 4·7	+ 1·2	44·2129
12	13	0·952	209·141	+ 0·1826	+ 0·1763	+ 0·1794	+ 6·3	+ 7·5	44·3923
13	14	0·901	210·042	+ 0·0093	+ 0·0057	+ 0·0075	+ 3·6	+11·1	44·3998
14	XXIX	0·940	210·982	— 0·9689	— 0·9746	— 0·9718	+ 5·7	+16·8	43·4280
XXIX	15	1·151	212·133	*+ 3·1894	*+ 3·1957	+ 3·1926	— 6·3	+10·5	46·6206
XXIX	× Road 2	0·392	211·374	+ 2·6367					46·0647
15	16	1·340	213·473	*+ 4·0988	*+ 4·1050	+ 4·1019	— 6·2	+ 4·3	50·7225
16	17	1·143	214·616	+ 0·3433	*+ 0·3430	+ 0·3432	+ 0·3	+ 4·6	51·0657
17	XXX	1·283	215·899	— 0·3141	*— 0·3164	— 0·3152	+ 2·3	+ 6·9	50·7505
XXX	R. R. S. 3	0·109	216·008	+ 2·3248					53·0753
XXX	18	1·144	217·043	+ 3·6904	+ 3·6941	+ 3·6922	— 3·7	+ 3·2	54·4427
18	19	1·134	218·177	*+ 7·7400	*+ 7·7452	+ 7·7426	— 5·2	— 2·0	62·1853
19	20	1·146	219·323	+10·4985	+10·5053	+10·5019	— 6·8	— 8·8	72·6872
20	21	1·162	220·485	+ 9·7544	+ 9·7569	+ 9·7556	— 2·5	—11·3	82·4428
21	XXXI	0·100	220·585	+ 4·3729	+ 4·3722	+ 4·3726	+ 0·7	—10·6	86·8154
21	× Road 4	1·128	221·613	+ 8·1349					90·5777
21	R. R. S. 5	0·138	220·623	+ 0·3473					82·7901
21	22	1·146	221·631	*+ 9·3176	*+ 9·3172	+ 9·3174	+ 0·4	—10·9	91·7602
22	23	1·158	222·789	*+ 9·7382	*+ 9·7415	+ 9·7398	— 3·3	—14·2	101·5000
23	24	1·137	223·926	*+11·1725	*+11·1730	+11·1728	— 0·5	—14·7	112·6728
24	25	1·130	225·056	*+10·1719	*+10·1644	+10·1682	+ 7·5	— 7·2	122·8410
25	26	1·230	226·286	*+11·8785	*+11·8684	+11·8734	+10·1	+ 2·9	134·7144
26	× Road 6	0·157	226·443	+ 1·6786					136·3930
26	27	0·946	227·232	— 2·8762	— 2·8742	— 2·8752	— 2·0	+ 0·9	131·8392
27	28	1·402	228·634	*+ 0·2984	*+ 0·3062	+ 0·3023	— 7·8	— 6·9	132·1415
28	XXXII	0·063	228·697	+ 2·6982	+ 2·6984	+ 2·6983	— 0·2	— 7·1	134·8398
28	M. P. R. R. B. M. 114	0·074	228·708	+ 0·5009	+ 0·5009	+ 0·5009	0·0	— 6·9	132·6424
28	R. R. S. 7	0·039	228·673	+ 0·6151					132·7566
28	29	1·038	229·672	— 1·9252	— 1·9265	— 1·9258	+ 1·3	— 5·6	130·2157
29	30	1·067	230·739	*— 0·1464	*— 0·1395	— 0·1430	— 6·9	—12·5	130·0727
30	31	1·115	231·854	*+ 1·4582	*+ 1·4645	+ 1·4614	— 6·3	—18·8	131·5341
31	32	1·189	233·043	+ 6·1185	+ 6·1228	+ 6·1206	— 4·3	—23·1	137·6547
32	33	1·034	234·077	+ 6·6389	+ 6·6418	+ 6·6404	— 2·9	—26·0	144·2951
33	× Road 8	0·897	234·974	— 1·3397					142·9554
33	34	1·108	235·185	— 0·8526	— 0·8580	— 0·8553	+ 5·4	—20·6	143·4398

* Mean of two or more results.

† See Appendix No. 2, Report for 1893.

Results of geodetic spirit leveling, from Jefferson City, Mo., to Holliday, Kans.—Continued.

Bench mark. From—	To—	Distance between successive marks.	Distance from initial mark K_3.	Difference in height between marks. Forward.	Backward.	Mean.	Discrepancy. Partial F—B.	Total accumulated.	Height above K_3. (St. Louis.)
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
34	× Road 9	0·782	235·967	+ 0·8566					144·2964
34	35	1·136	236·321	— 4·2226	— 4·2263	— 4·2244	+ 3·7	—16·9	139·2154
35	36	1·052	237·373	+ 0·1731	+ 0·1675	+ 0·1703	+ 5·6	—11·3	139·3857
36	37	1·041	238·414	*+ 3·4718	*+ 3·4700	+ 3·4709	+ 1·8	— 9·5	142·8566
37	× Road 10	0·280	238·694	+ 1·9212					144·7778
37	38	1·097	239·511	+ 3·8349	+ 3·8321	+ 3·8335	+ 2·8	— 6·7	146·6901
38	39	0·968	240·479	*— 2·1912	*— 2·1859	— 2·1886	— 5·3	—12·0	144·5015
39	× Road 11	0·755	241·234	— 1·0646					143·4369
39	40	1·035	241·514	— 0·8411	— 0·8408	— 0·8410	— 0·3	—12·3	143·6605
40	41	0·940	242·454	+ 1·2134	+ 1·2127	+ 1·2130	+ 0·7	—11·6	144·8735
41	× Road 12	0·659	243·113	+ 4·9563					149·8298
41	42	0·929	243·383	*+ 2·9912	*+ 2·9870	+ 2·9891	+ 4·2	— 7·4	147·8626
42	43	1·189	244·572	*— 4·1091	*— 4·1126	— 4·1108	+ 3·5	— 3·9	143·7518
43	XXXIII M. P. R. R.	1·156	245·728	— 2·9643	— 2·9620	— 2·9632	— 2·3	— 6·2	140·7886
43	B. M. 122	0·226	244·798	+ 1·0461	+ 1·0466	+ 1·0464	— 0·5	— 4·4	144·7982
43	R. R. S. 13	0·345	244·917	+ 1·2119					144·9637
43	44	1·234	245·806	*— 2·5434	*— 2·5482	— 2·5458	+ 4·8	+ 0·9	141·2060
44	45	0·911	246·717	*— 1·1660	*— 1·1668	— 1·1664	+ 0·8	+ 1·7	140·0396
45	46	1·164	247·881	— 0·3937	— 0·3958	— 0·3948	+ 2·1	+ 3·8	139·6448
46	47	1·148	249·029	*+ 3·8886	*+ 3·8835	+ 3·8860	+ 5·1	+ 8·9	143·5308
47	× Road 14	0·494	249·523	+ 3·2212					146·7520
47	48	1·136	250·165	+ 4·0244	+ 4·0217	+ 4·0230	+ 2·7	+11·6	147·5538
48	49	1·207	251·372	*— 4·6851	*— 4·6837	— 4·6844	— 1·4	+10·2	142·8694
49	50	1·224	252·596	+ 6·6985	+ 6·6969	+ 6·6977	+ 1·6	+11·8	149·5671
50	51	1·085	253·681	— 1·9092	— 1·9066	— 1·9079	— 2·6	+ 9·2	147·6592
51	52	1·196	254·877	*+ 0·1655	*+ 0·1727	+ 0·1691	— 7·2	+ 2·0	147·8283
52	XXXIV	0·033	254·910	+ 1·5999	+ 1·6003	+ 1·6001	— 0·4	+ 1·6	149·4284
52	53	1·141	256·018	— 3·2427	— 3·2453	— 3·2440	+ 2·6	+ 4·6	144·5843
53	54	1·098	257·116	*+ 7·2267	*+ 7·2220	+ 7·2244	+ 4·7	+ 9·3	151·8087
54	55	1·138	258·254	*+ 5·0046	*+ 5·0003	+ 5·0024	+ 4·3	+13·6	156·8111
55	× Road 15	0·961	259·215	— 5·1174					151·6937
55	56	1·137	259·391	— 5·6231	— 5·6229	— 5·6230	— 0·2	+13·4	151·1881
56	57	0·924	260·315	+ 0·6867	+ 0·6824	+ 0·6846	+ 4·3	+17·7	151·8727
57	58	1·254	261·569	*+ 2·5268	*+ 2·5260	+ 2·5264	+ 0·8	+18·5	154·3991
58	59	1·150	262·719	*+ 0·8726	*+ 0·8773	+ 0·8750	— 4·7	+13·8	155·2741
59	60	1·074	263·793	*+ 2·2583	*+ 2·2648	+ 2·2616	— 6·5	+ 7·3	157·5357
60	R. R. S. 16	1·168	264·961	— 2·5652					154·9705
60	61	1·346	265·139	— 2·5886	— 2·5835	— 2·5860	— 5·1	+ 2·2	154·9497
61	× Road 17	0·297	265·436	+ 1·0700					156·0197
61	XXXV	0·326	265·465	+ 0·7995	+ 0·7982	+ 0·7988	+ 1·3	+ 3·5	155·7485
61	62	1·018	266·157	+ 4·3654	+ 4·3664	+ 4·3659	— 1·0	+ 1·2	159·3156
62	63	1·097	267·254	+ 1·6928	+ 1·6844	+ 1·6886	+ 8·4	+ 9·6	161·0042
63	64	1·178	268·432	+ 0·4845	+ 0·4818	+ 0·4832	+ 2·7	+12·3	161·4874
64	× Road 18	0·193	268·625	+ 1·1815					162·6689

* Mean of two or more measures.

Results of geodetic spirit leveling, from Jefferson City, Mo., to Holliday, Kans.—Continued.

Bench mark. From—	To—	Distance between successive marks.	Distance from initial mark K_3.	Difference in height between marks. Forward.	Backward.	Mean.	Discrepancy. Partial F—B.	Total accumulated.	Height above K_3. (St. Louis.)
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
64	65	0·781	269·213	+ 2·8112	+ 2·8090	+ 2·8101	+ 2·2	+14·5	164·2975
65	66	0·892	270·105	— 0·8519	— 0·8526	— 0·8522	+ 0·7	+15·2	163·4453
66	67	0·831	270·936	*— 2·4335	*— 2·4310	— 2·4322	— 2·5	+12·7	161·0131
67	68	0·804	271·740	*— 2·6234	*— 2·6211	— 2·6222	— 2·3	+10·4	158·3909
68	69	0·795	272·535	*+ 1·1112	*+ 1·1093	+ 1·1102	+ 1·9	+12·3	159·5011
69	R. R. S. 19	0·827	273·362	— 6·7777					152·7234
69	70	0·864	273·399	*— 7·5226	*— 7·5276	— 7·5251	+ 5·0	+17·3	151·9760
70	XXXVI	0·071	273·470	+ 3·4258	+ 3·4247	+ 3·4252	+ 1·1	+18·4	155·4012
70	71	1·269	274·668	*— 9·8576	*— 9·8524	— 9·8550	— 5·2	+12·1	142·1210
71	72	0·972	275·640	— 7·5934	— 7·5929	— 7·5932	— 0·5	+11·6	134·5278
72	73	1·149	276·789	— 4·1979	— 4·1988	— 4·1984	— 0·9	+12·5	130·3294
23	× Road 20	0·253	277·042	+ 0·4979					130·8273
73	74	0·987	277·776	*— 4·3560	*— 4·3518	— 4·3539	— 4·2	+ 8·3	125·9755
74	75	0·881	278·657	— 7·8125	— 7·8038	— 7·8082	— 8·7	— 0·4	118·1673
75	76	1·154	279·811	— 8·9695	— 8·9659	— 8·9677	— 3·6	— 4·0	109·1996
76	77	1·162	280·973	— 7·9901	— 7·9846	— 7·9874	— 5·5	— 9·5	101·2122
77	78	1·100	282·073	— 9·7530	— 9·7570	— 9·7550	+ 4·0	— 5·5	91·4572
78	79	1·197	283·270	— 8·3246	— 8·3311	— 8·3278	+ 6·5	+ 1·0	83·1294
79	80	0·982	284·252	*— 0·7236	*— 0·7188	— 0·7212	— 4·8	— 3·8	82·4082
80	R. R. S. 21	1·324	285·576	+ 9·6248					92·0330
80	81	1·333	285·585	*+ 9·5003	*+ 9·5108	+ 9·5056	—10·5	—14·3	91·9138
81	XXXVII	0·116	285·701	+ 5·2929	+ 5·2930	+ 5·2930	— 0·1	—14·4	97·2068
81	M. P. R. R. B. M. 143	0·293	285·878	+ 1·0482					92·9620
81	82	1·076	286·661	*+10·2667	*+10·2752	+10·2710	— 8·5	—22·8	102·1848
82	83	1·115	287·776	*+11·0819	*+11·0836	+11·0828	— 1·7	—24·5	113·2676
83	× Road 22	0·524	288·300	+ 4·9916					118·2592
83	84	1·153	288·929	*+12·8050	*+12·8079	+12·8064	— 2·9	—27·4	126·0740
84	85	1·144	290·073	+ 3·3303	+ 3·3321	+ 3·3312	— 1·8	—29·2	129·4052
85	86	1·238	291·311	+ 4·6955	+ 4·6970	+ 4·6962	— 1·5	—30·7	134·1014
86	87	0·840	292·151	+ 5·9458	+ 5·9511	+ 5·9484	— 5·3	—36·0	140·0498
87	× Road 23	0·542	292·693	— 0·0985					139·9513
87	88	1·139	293·290	*+ 1·2250	*+ 1·2308	+ 1·2279	— 5·8	—41·8	141·2777
88	R. R. S. 24	1·017	294·307	+ 3·3452					144·6229
88	89	1·036	294·326	+ 2·9706	+ 2·9744	+ 2·9725	— 3·8	—45·6	144·2502
89	XXXVIII	0·078	294·404	— 1·2985	— 1·2981	— 1·2983	— 0·4	—46·0	142·9519
89	90	0·774	295·100	+ 0·3659	+ 0·3650	+ 0·3654	+ 0·9	—44·7	144·6156
90	91	1·015	296·115	+ 1·8275	+ 1·8270	+ 1·8272	+ 0·5	—44·2	146·4428
91	× Road 25	1·171	297·286	— 2·3454					144·0974
91	92	1·206	297·321	*— 2·7535	*— 2·7483	— 2·7509	— 5·2	—49·4	143·6919
92	93	0·960	298·281	+ 4·8494	+ 4·8579	+ 4·8536	— 8·5	—57·9	148·5455
93	94	0·914	299·195	— 0·6347	— 0·6356	— 0·6352	+ 0·9	—57·0	147·9103
94	95	0·958	300·153	+ 1·5932	+ 1·5890	+ 1·5911	+ 4·2	—52·8	149·5014
95	96	1·196	301·349	*— 0·4887	*— 0·4825	— 0·4856	— 6·2	—59·0	149·0158
96	× Roads 26	0·852	302·201	+ 4·0514					153·0672

* Mean of two or more results.

Results of geodetic spirit leveling, from Jefferson City, Mo., to Holliday, Kans.—Continued.

Bench mark. From—	To—	Distance between successive marks.	Distance from initial mark K_3.	Difference in height between marks. Forward.	Backward.	Mean.	Discrepancy. Partial F—B.	Total accumulated.	Height above K_3. (St. Louis.)
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
96	97	1·114	302·463	*+ 2·4152	*+ 2·4244	+ 2·4198	— 9·2	—68·2	151·4356
97	98	1·048	303·511	*— 2·6328	*— 2·6234	— 2·6281	— 9·4	—77·6	148·8075
98	99	1·072	304·583	+ 2·2672	+ 2·2726	+ 2·2699	— 5·4	—83·0	151·0774
99	M. P. R. R. B. M. 152	0·824	305·407	— 0·7983					150·2791
99	100	1·094	305·677	*— 1·4980	*— 1·4985	— 1·4982	+ 0·5	—82·5	149·5792
100	101	1·053	306·730	— 4·3228	— 4·3245	— 4·3236	+ 1·7	—80·8	145·2556
101	R. R. S. 27	0·157	306·887	— 0·3445					144·9111
101	XXXIX	0·533	307·263	+ 5·8579	+ 5·8592	+ 5·8586	— 1·3	—82·1	151·1142
101	102	1·124	307·854	—10·6027	—10·6054	—10·6040	+ 2·7	—78·1	134·6516
102	103	1·050	308·904	—11·4248	—11·4187	—11·4218	— 6·1	—84·2	123·2298
103	105	2·048	310·952	— 5·6560	— 5·6537	— 5·6548	— 2·3	—86·5	117·5750
105	106	0·892	311·844	*— 7·0928	*— 7·0961	— 7·0944	+ 3·3	—83·2	110·4806
106	× Road 28	0·339	312·183	— 3·8650					106·6156
106	107	0·911	312·755	— 8·9270	— 8·9282	— 8·9276	+ 1·2	—82·0	101·5530
107	XL	0·079	312·834	— 1·5506	— 1·5506	— 1·5506	0·0	—82·0	100·0024
107	108	1·065	313·820	*+12·8398	*+12·8458	+12·8428	— 6·0	—88·0	114·3958
108	109	1·010	314·830	+ 9·9189	+ 9·9195	+ 9·9192	— 0·6	—88·6	124·3150
109	110	0·970	315·800	— 3·7439	— 3·7404	— 3·7422	— 3·5	—92·1	120·5728
110	111	0·891	316·691	*+ 2·1368	*+ 2·1332	+ 2·1350	+ 3·6	—88·5	122·7078
111	112	0·953	317·644	*+ 1·2562	*+ 1·2505	+ 1·2534	+ 5·7	—82·8	123·9612
112	R. R. S. 29	0·146	317·790	+ 0·3498					124·3110
112	113	1·051	318·695	+ 3·4189	+ 3·4140	+ 3·4164	+ 4·9	—77·9	127·3776
113	114	1·054	319·749	+ 0·6819	+ 0·6855	+ 0·6837	— 3·6	—81·5	128·0613
114	115	0·968	320·717	— 0·7744	— 0·7736	— 0·7740	— 0·8	—82·3	127·2873
115	× Road 30	0·627	321·344	+ 5·9749					133·2622
115	116	1·037	321·754	+ 6·7166	+ 6·7221	+ 6·7194	— 5·5	—87·8	134·0067
116	117	1·086	322·840	*+ 2·4483	*+ 2·4533	+ 2·4508	— 5·0	—92·8	136·4575
117	118	1·140	323·980	*+ 1·9152	*+ 1·9150	+ 1·9151	+ 0·2	—92·6	138·3726
118	119	1·233	325·213	— 0·4340	— 0·4309	— 0·4324	— 3·1	—95·7	137·9402
119	120	0·828	326·041	*— 1·5158	*— 1·5219	— 1·5188	+ 6·1	—89·6	136·4214
120	XLI	0·111	326·152	+ 1·7043	+ 1·7041	+ 1·7042	+ 0·2	—89·4	138·1256
120	121	1·218	327·259	*— 5·8992	*— 5·8989	— 5·8990	— 0·3	—89·9	130·5224
121	122	0·946	328·205	*+ 3·4026	*+ 3·4025	+ 3·4026	+ 0·1	—89·8	133·9250
122	123	1·060	329·265	— 2·8845	— 2·8900	— 2·8872	+ 5·5	—84·3	131·0378
123	× Road 31	0·117	329·382	— 0·2722					130·7656
123	124	1·246	330·511	— 3·0443	— 3·0479	— 3·0461	+ 3·6	—80·7	127·9917
124	125	1·193	331·704	+ 1·3338	+ 1·3311	+ 1·3324	+ 2·7	—78·0	129·3241
125	126	1·110	332·814	*— 3·9100	*— 3·9131	— 3·9116	+ 3·1	—74·9	125·4125
126	127	1·173	333·987	—13·8219	—13·8228	—13·8224	+ 0·9	—74·0	111·5901
127	× Road 32	0·581	334·568	+ 3·4273					115·0174
127	128	1·203	335·190	+ 5·8145	+ 5·8194	+ 5·8170	— 4·9	—78·9	117·4071
128	129	1·280	336·470	*+ 8·6580	*+ 8·6596	+ 8·6588	— 1·6	—80·5	126·0659
129	R. R. S. 33	1·188	337·658	—10·6969					115·3690
129	130	1·195	337·665	— 11·6882	—11·6893	—11·6888	+ 1·1	—79·4	114·3771

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Bench mark. From—	Bench mark. To—	Distance between successive marks.	Distance from initial mark K_3.	Difference in height between marks. Forward.	Backward.	Mean.	Discrepancy. Partial F—B.	Total accumulated.	Height above K_3. (St. Louis.)
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
130	XLII	0·172	337·837	+ 6·2496	+ 6·2543	+ 6·2520	— 4·7	—84·1	120·6291
130	M. P. R. R. B. M. 169	1·209	338·874	—13·8175					100·5596
130	131	1·214	338·879	—14·4769	—14·4757	—14·4763	— 1·2	—80·6	99·9008
131	132	1·162	340·041	— 5·0447	— 5·0525	— 5·0486	+ 7·8	—72·8	94·8522
132	133	1·158	341·199	*+ 4·1534	*+ 4·1487	+ 4·1510	+ 4·7	—68·1	99·0032
133	× Roads 34	0·723	341·922	+ 7·6115					106·6147
133	134	1·149	342·348	+ 9·9057	+ 9·9037	+ 9·9047	+ 2·0	—66·1	108·9079
134	135	0·904	343·252	+ 8·5978	+ 8·5971	+ 8·5974	+ 0·7	—65·4	117·5053
135	XLIII	0·047	343·299	— 0·3713	— 0·3710	— 0·3712	— 0·3	—65·7	117·1341
135	R. R. S. 35	0·197	343·449	+ 0·2828					117·7881
135	136	1·296	344·548	*— 0·2038	*— 0·2086	— 0·2062	+ 4·8	—60·6	117·2991
136	× Road 36	1·111	345·659	—10·3227					106·9764
136	137	1·184	345·732	—11·3748	—11·3782	—11·3765	+ 3·4	—57·2	105·9226
137	138	1·179	346·911	*— 8·4853	*— 8·4752	— 8·4802	—10·1	—67·3	97·4424
138	139	1·274	348·185	*— 5·1564	*— 5·1534	— 5·1549	— 3·0	—70·3	92·2875
139	140	1·284	349·469	*+ 1·4859	*+ 1·4811	+ 1·4835	+ 4·8	—65·5	93·7710
140	141	0·924	350·393	+ 6·2510	+ 6·2487	+ 6·2498	+ 2·3	—63·2	100·0208
141	× Road 37	1·080	351·473	+13·8066					113·8274
141	142	1·160	351·553	*+14·3874	*+14·3999	+14·3936	—12·5	—75·7	114·4144
142	143	1·034	352·587	*+ 8·6624	*+ 8·6735	+ 8·6680	—11·1	—86·8	123·0824
143	144	1·063	353·650	*+ 7·7802	*+ 7·7860	+ 7·7831	— 5·8	— 92·6	130·8655
144	145	0·350	354·000	*— 3·4918	*— 3·4936	— 3·4927	+ 1·8	— 90·8	127·3728
145	R. R. S. 38	0·101	354·101	— 0·5827					126·7901
145	XLIV	0·666	354·666	+14·1533	+14·1545	+14·1539	— 1·2	— 92·0	141·5267
XLIV	XLV	0·055	354·721	+ 1·7863	+ 1·7865	+ 1·7864	— 0·2	— 92·2	143·3131
145	146	1·005	355·005	*—12·6878	*—12·6862	—12·6870	— 1·6	— 92·4	114·6858
146	147	1·039	356·044	*—13·7852	*—13·7932	—13·7892	+ 8·0	— 84·4	100·8966
147	× Road 39	0·269	356·313	— 3·1629					97·7337
147	148	1·082	357·126	*— 7·1462	*— 7·1521	— 7·1492	+5·9	— 78·5	93·7474
148	149	1·180	358·306	+ 0·6864	+ 0·6848	+ 0·6856	+1·6	— 76·9	94·4330
149	150	1·089	359·395	*+ 9·4962	*+ 9·5020	+ 9·4991	—5·8	— 82·7	103·9321
150	151	1·001	360·396	*+10·3048	*+10·3086	+10·3067	—3·8	— 86·5	114·2388
151	× Road 40	0·764	361·160	+ 7·4341					121·6729
151	152	0·944	361·340	+ 9·2837	+ 9·2792	+ 9·2814	+ 4·5	— 82·0	123·5202
152	153	0·973	362·313	*+ 9·3102	*+ 9·3072	+ 9·3087	+ 3·0	— 79·0	132·8289
153	154	1·021	363·334	*+ 4·9401	*+ 4·9374	+ 4·9388	+ 2·7	— 76·3	137·7677
154	R. R. S. 41	0·444	363·778	+ 1·5009					139·2686
154	155	0·524	363·858	+ 1·2146	+ 1·2110	+ 1·2128	+3·6	— 72·7	138·9805
155	XLVI	0·042	363·900	+ 0·7562	+ 0·7566	+ 0·7564	—0·4	— 73·1	139·7369
155	156	1·162	365·020	*— 3·9778	*— 3·9730	— 3·9754	— 4·8	— 77·5	135·0051
156	157	1·606	366·626	+ 2·6375	+ 2·6367	+ 2·6371	+ 0·8	— 76·7	137·6422
157	× Road 42	0·167	366·793	+ 0·1199					137·7621
157	158	1·002	367·628	*— 1·2601	*— 1·2653	— 1·2627	+ 5·2	— 71·5	136·3795
158	159	0·976	368·604	*— 2·9298	*— 2·9322	— 2·9310	+ 2·4	— 69·1	133·4485

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		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
159	160	1·034	369·638	*+ 9·5795	*+ 9·5835	+ 9·5815	— 4·0	— 73·1	143·0300
160	161	1·106	370·744	*—11·1132	*+11·1063	—11·1098	— 6·9	— 80·0	131·9202
161	162	0·855	371·599	*+ 0·7012	*+ 0·6946	+ 0·6979	+ 6·6	— 73·4	132·6181
162	× Road 43	1·059	372·658	+ 9·2492					141·8673
162	163	1·300	372·899	*+ 4·6867	*+ 4·6842	+ 4·6854	+ 2·5	— 70·9	137·3035
163	164	1·187	374·086	—12·2935	—12·2885	—12·2910	— 5·0	— 75·9	125·0125
164	165	1·062	375·148	*+ 8·4056	*+ 8·4072	+ 8·4064	— 1·6	— 77·5	133·4189
165	166	1·050	376·198	+ 0·9080	+ 0·9086	+ 0·9083	— 0·6	— 78·1	134·3272
166	R. R. S. 44	1·042	377·240	— 1·3619					132·9653
166	167	1·125	377·323	*— 1·1342	*— 1·1379	— 1·1360	+ 3·7	— 74·4	133·1912
167	XLVII	0·097	377·420	+ 0·8917	+ 0·8926	+ 0·8922	— 0·9	— 75·3	134·0834
167	168	1·159	378·482	*—11·7453	*—11·7488	—11·7470	+ 3·5	— 70·9	121·4442
168	XLVIII	0·334	378·816	— 3·3126	— 3·3123	— 3·3124	— 0·3	— 71·2	118·1318
XLVIII	169	0·926	379·742	*+ 6·8984	*+ 6·8986	+ 6·8985	— 0·2	— 71·4	125·0303
169	170	0·946	380·688	+ 1·8330	+ 1·8330	+ 1·8330	0·0	— 71·4	126·8633
170	171	1·034	381·722	+ 4·7312	+ 4·7336	+ 4·7324	— 2·4	— 73·8	131·5957
171	172	1·138	382·860	+ 9·5467	+ 9·5468	+ 9·5468	— 0·1	— 73·9	141·1425
172	173	1·209	384·069	*+ 0·4836	*+ 0·4846	+ 0·4841	— 1·0	— 74·9	141·6266
173	R. R. S. 45	0·751	384·820	+ 9·1593					150·7859
173	174	0·779	384·848	+ 9·1585	+ 9·1628	+ 9·1606	— 4·3	— 79·2	150·7872
174	XLIX	0·065	384·913	+ 2·7697	+ 2·7696	+ 2·7697	+ 0·1	— 79·1	153·5569
174	175	0·645	385·493	*+ 3·5889	*+ 3·5904	+ 3·5896	— 1·5	— 80·7	154·3768
175	176	0·973	386·466	*— 7·2081	*— 7·1924	— 7·2002	—15·7	— 96·4	147·1766
176	177	1·198	387·664	*— 2·9082	*— 2·9000	— 2·9041	— 8·2	—104·6	144·2725
177	178	1·198	388·862	*— 4·9573	*— 4·9630	— 4·9602	+ 5·7	— 98·9	139·3123
178	179	0·830	389·692	*+ 5·5071	*+ 5·4997	+ 5·5034	+ 7·4	— 91·5	144·8157
179	180	0·896	390·588	*— 3·2160	*— 3·2204	— 3·2182	+ 4·4	— 87·1	141·5975
180	181	0·916	391·504	*— 3·3002	*— 3·3063	— 3·3032	+ 6·1	— 81·0	138·2943
181	× Road 46	0·093	391·597	— 0·3243					137·9700
181	182	1·118	392·622	— 9·0389	— 9·0373	— 9·0381	— 1·6	— 82·6	129·2562
182	L	0·588	393·210	*— 0·0642	*— 0·0616	— 0·0629	— 2·6	— 85·2	129·1933
L	R. R. S. 47	0·691	393·901	+ 2·8963					132·0896
L	183	1·590	394·800	+ 9·8849	+ 9·8898	+ 9·8874	— 4·9	— 90·1	139·0807
183	184	0·915	395·715	*+ 8·4208	*+ 8·4148	+ 8·4178	+ 6·0	— 84·1	147·4985
184	185	0·983	396·698	+ 4·3329	+ 4·3316	+ 4·3322	+ 1·3	— 82·8	151·8307
185	186	0·892	397·590	*— 5·1977	*— 5·2038	— 5·2008	+ 6·1	— 76·7	146·6299
186	× Road 48	0·325	397·915	— 0·6425					145·9874
186	187	1·112	398·702	— 2·1262	— 2·1277	— 2·1270	+ 1·5	— 75·2	144·5029
187	188	1·068	399·770	— 7·9663	— 7·9680	— 7·9672	+ 1·7	— 73·5	136·5357
188	189	1·125	400·895	*+ 5·0886	*+ 5·0876	+ 5·0881	+ 1·0	— 72·5	141·6238
189	190	1·228	402·123	*— 4·4674	*— 4·4766	— 4·4720	+ 9·2	— 63·3	137·1518
190	191	1·384	403·507	*— 3·6879	*— 3·6884	— 3·6882	+ 0·5	— 62·8	133·4636
191	R. R. S. 49	0·097	403·604	+ 1·0977					134·5613
191	LI	0·018	403·525	+ 1·4901	+ 1·4884	+ 1·4892	+ 1·7	— 61·1	134·9528
191	M. P. R. R. B. M. 201	0·540	404·047		+ 0·9112				134·3748
191	LII	1·152	404·659	*+ 0·2804	*+ 0·2853	+ 0·2828	— 4·9	— 67·7	133·7464
LII	192	1·006	405·665	*+ 2·3922	*+ 2·3928	+ 2·3925	— 0·6	— 68·3	136·1389

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		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
192	193	0·950	406·615	*+ 2·0474	*+ 2·0518	+ 2·0496	— 4·4	— 72·7	138·1885
193	194	1·075	407·690	*+ 7·8063	*+ 7·8024	+ 7·8044	+ 3·9	— 68·8	145·9929
194	195	1·260	408·950	— 3·9524	— 3·9560	— 3·9542	+ 3·6	— 65·2	142·0387
195	196	0·969	409·919	+ 1·5045	+ 1·5021	+ 1·5033	+ 2·4	— 62·8	143·5420
196	197	0·455	410·374	— 1·9118	— 1·9110	— 1·9114	— 0·8	— 63·6	141·6306
197	198	0·919	411·293	+ 1·5806	+ 1·5819	+ 1·5812	— 1·3	— 64·9	143·2118
198	199	0·916	412·209	+ 0·8801	+ 0·8678	+ 0·8740	+12·3	— 52·6	144·0858
199	200	0·962	413·171	+ 7·4478	+ 7·4451	+ 7·4464	+ 2·7	— 49·9	151·5322
200	M. P. R. R. / B. M. 206	0·757	413·928	+ 2·4353					153·9675
200	LIII	0·758	413·929	*+ 2·4304	*+ 2·4253	+ 2·4278	+ 5·1	— 44·8	153·9600
LIII	201	1·208	415·137	+ 6·2436	+ 6·2477	+ 6·2456	— 4·1	— 48·9	160·2056
201	202	1·368	416·505	*+12·1477	*+12·1554	+12·1516	— 7·7	— 56·6	172·3572
202	203	0·993	417·498	+ 9·3421	+ 9·3470	+ 9·3446	— 4·9	— 61·5	181·7018
203	204	1·039	418·537	*+ 7·3226	*+ 7·3214	+ 7·3220	+ 1·2	— 60·3	189·0238
204	205	1·049	419·586	*+ 2·8513	*+ 2·8431	+ 2·8472	+ 8·2	— 52·1	191·8710
205	206	1·249	420·835	— 0·6135	— 0·6151	— 0·6143	+ 1·6	— 50·5	191·2567
206	LIV	0·066	420·901	— 1·8064	— 1·8064	— 1·8064	0·0	— 50·5	189·4503
206	R. R. S. 50	0·072	420·907	+ 0·1861					191·4428
206	207	1·186	422·021	—10·6699	—10·6718	—10·6708	+ 1·9	— 48·6	180·5859
207	208	1·108	423·129	*—12·8122	*—12·8162	—12·8142	+ 4·0	— 44·6	167·7717
208	209	0·940	424·069	—10·6697	—10·6678	—10·6688	— 1·9	— 46·5	157·1029
209	× Road 51	0·151	424·220	— 1·3628					155·7401
209	210	0·934	425·003	—10·5127	—10·5091	—10·5109	— 3·6	— 50·1	146·5920
210	211	1·246	426·249	—17·1972	—17·1950	—17·1961	— 2·2	— 52·3	129·3959
211	212	1·109	427·358	— 7·4832	— 7·4788	— 7·4810	— 4·4	— 56·7	121·9149
212	213	1·191	428·549	— 5·4916	— 5·4878	— 5·4897	— 3·8	— 60·5	116·4252
213	214	0·645	429·194	— 0·8438	— 0·8485	— 0·8462	+ 4·7	— 55·8	115·5790
214	215	1·161	430·355	— 1·2885	— 1·2831	— 1·2858	— 5·4	— 61·2	114·2932
215	R. R. S. 52	0·173	430·528	+ 0·4544					114·7476
215	LV	0·188	430·543	— 0·4592	— 0·4591	— 0·4592	— 0·1	— 61·3	113·8340
215	216	1·042	431·397	— 0·4507	— 0·4533	— 0·4520	+ 2·6	— 58·6	113·8412
216	217	1·037	432·434	*+ 3·3416	*+ 3·3436	+ 3·3426	—2·0	—60·6	117·1838
217	218	1·044	433·478	+14·0747	+14·0769	+14·0758	—2·2	—62·8	131·2596
218	219	1·135	434·613	+ 8·0308	+ 8·0260	+ 8·0284	+4·8	—58·0	139·2880
219	× Road 53	0·525	435·138	+ 7·3989					146·6869
219	220	1·149	435·762	*+15·1669	*+15·1575	+15·1622	+9·4	—48·6	154·4502
220	221	1·128	436·890	+15·6822	+15·6813	+15·6818	+0·9	—47·7	170·1320
221	222	1·156	438·046	*+ 4·2780	*+ 4·2826	+ 4·2803	—4·6	—52·3	174·4123
222	× Road 54	0·803	438·849	+ 9·3540					183·7663
222	223	1·029	439·075	+10·2633	+10·2630	+10·2632	+0·3	—52·0	184·6755
223	LVI	0·570	439·645	— 0·9052	— 0·9044	— 0·9048	—0·8	—52·8	183·7707
LVI	224	1·467	441·112	*— 7·9986	*— 8·0040	— 8·0013	+5·4	—47·4	175·7694
224	225	1·365	442·477	—12·9524	—12·9531	—12·9528	+0·7	—46·7	162·8166
225	R. R. S. 55	0·190	442·667	+ 0·4825					163·2991
225	A	1·160	443·637	+12·8669	+12·8606	+12·8638	+6·3	—40·4	175·6804
A	LVII	0·560	444·197	+18·5376	+18·5345	+18·5360	+3·1	—37·3	194·2164
LVII	I. C. D.	0·030	444·227	— 0·5159	— 0·5160	— 0·5160	+0·1	—37·2	193·7004
225	226	1·124	443·601	*—10·7844	*—10·7863	—10·7854	+1·9	—44·8	152·0312
226	227	1·062	444·663	—10·8196	—10·8221	—10·8208	+2·5	—42·3	141·2104
227	228	1·071	445·734	*—13·6418	*—13·6464	—13·6441	+4·6	—37·7	127·5663
228	× Road 56	1·008	446·742	—13·0610					114·5053

* Mean of two or more results.

Results of geodetic spirit leveling, from Jefferson City, Mo., to Holliday, Kans.—Continued.

Bench mark. From—	Bench mark. To—	Distance between successive marks.	Distance from initial mark K_s.	Difference in height between marks. Forward.	Backward.	Mean.	Discrepancy. Partial F—B.	Total accumulated.	Height above K_s. (St. Louis.)
		km.	*km.*	*m.*	*m.*	*m.*	*mm.*	*mm.*	*m.*
228	229	1·083	446·817	—14·5597	—14·5598	—14·5598	+0·1	—37·6	113·0065
229	230	1·179	447·996	—12·8421	—12·8423	—12·8422	+0·2	—37·4	100·1643
230	LVIII	1·531	449·527	+ 1·5755	+ 1·5757	+ 1·5756	—0·2	—37·6	101·7399
LVIII	× Road 57	0·666	450·193	— 1·3124					100·4275
LVIII	231	1·097	450·624	— 1·5682	— 1·5684	— 1·5683	+0·2	—37·4	100·1716
231	232	1·047	451·671	+ 0·0223	+ 0·0181	+ 0·0202	+4·2	—33·2	100·1918
232	233	1·131	452·802	— 0·2233	— 0·2275	— 0·2254	+4·2	—29·0	99·9664
233	234	1·183	453·985	+ 0·0847	+ 0·0853	+ 0·0850	—0·6	—29·6	100·0514
234	235	1·245	455·230	+ 1·0987	+ 1·0986	+ 1·0986	+0·1	—29·5	101·1500
235	236	0·948	456·178	— 0·2660	— 0·2644	— 0·2652	—1·6	—31·1	100·8848
236	237	0·507	456·685	+ 0·1485	+ 0·1456	+ 0·1470	+2·9	—28·2	101·0318
237	M. R. C. / B. M. 241	0·233	456·918	+ 0·7923	+ 0·7933	+ 0·7928	—1·0	—29·2	101·8246
237	238	1·131	457·816	+ 0·7174	+ 0·7197	+ 0·7186	—2·3	—30·5	101·7504
238	M. R. C. / B. M. 1^3	0·355	458·171	+ 0·6155	+ 0·6157	+ 0·6156	—0·2	—30·7	102·3660
M. R. C. / B. M. 1^3	M. R. C. / B. M. 244	0·028	458·199	+ 1·3493	+ 1·3491	+ 1·3492	+0·2	—30·5	103·7152
M. R. C. / B. M. 1^3	M. R. C. / B. M. 243	0·031	458·202	+ 1·5089	+ 1·5081	+ 1·5085	+0·8	—29·9	103·8745
M. R. C. / B. M. 1^3	239	0·866	459·037	+ 1·5930	+ 1·5901	+ 1·5916	+2·9	—27·8	103·9576
239	M. R. C. / B. M. 245	0·408	459·445	— 2·8635	— 2·8639	— 2·8637	+0·4	—27·4	101·0939
239	R. R. S. 58	0·366	459·403	— 1·4165					102·5411
239	240	0·712	459·749	— 1·8578	— 1·8534	— 1·8556	—4·4	—32·2	102·1020
240	241	0·743	460·492	+ 0·4387	+ 0·4442	+ 0·4414	—5·5	—37·7	102·5434
241	242	1·337	461·829	+ 0·7019	+ 0·7042	+ 0·7030	—2·3	—40·0	103·2464
242	LIX	0·950	462·779	— 1·3012	— 1·2996	— 1·3004	—1·6	—41·6	101·9460
LIX	243	1·025	463·804	*+ 0·2798	*+ 0·2804	+ 0·2801	—0·6	—42·2	102·2261
243	244	1·018	464·822	*+ 2·9388	*+ 2·9323	+ 2·9355	+6·5	—35·7	105·1616
244	245	1·006	465·828	— 0·1465	— 0·1441	— 0·1453	—2·4	—38·1	105·0163
245	R. R. S. 59	0·873	466·701	— 2·1720					102·8443
245	246	1·124	466·952	— 2·4211	— 2·4206	— 2·4208	—0·5	—38·6	102·5955
246	LX	0·094	467·046	+ 0·2548	+ 0·2550	+ 0·2549	—0·2	—38·8	102·8504
246	247	1·632	468·584	*+ 2·9966	*+ 2·9909	+ 2·9938	+5·7	—32·9	105·5893
247	248	0·900	469·484	*+ 0·2661	*+ 0·2628	+ 0·2644	+3·3	—29·6	105·8537
248	249	1·076	470·560	*+ 1·4740	*+ 1·4689	+ 1·4715	+5·1	—24·5	107·3252
249	R. R. S. 60	0·284	470·844	+ 0·0276					107·3528
249	250	0·994	471·554	— 0·1473	— 0·1465	— 0·1469	—0·8	—25·3	107·1783
250	251	0·894	472·448	— 2·4782	— 2·4773	— 2·4778	—0·9	—26·2	104·7005
251	252	1·155	473·603	*— 0·3164	*— 0·3149	— 0·3156	—1·5	—27·7	104·3849
252	253	1·032	474·635	*+ 1·5526	*+ 1·5584	+ 1·5555	—5·8	—33·5	105·9404
253	254	1·014	475·649	+ 0·8250	+ 0·8263	+ 0·8256	—1·3	—34·8	106·7660
254	R. R. S. 61	0·298	475·947	+ 0·4298					107·1958
254	255	1·173	476·822	+ 0·8393	+ 0·8407	+ 0·8400	—1·4	—36·2	107·6060
255	256	0·886	477·708	+ 1·2641	+ 1·2621	+ 1·2631	+2·0	—34·2	108·8691
256	257	0·927	478·635	— 0·1026	— 0·1013	— 0·1020	—1·3	—35·5	108·7671
257	258	1·169	479·804	— 1·8507	— 1·8500	— 1·8504	—0·7	—36·2	106·9167
258	259	0·706	480·510	— 1·1128	— 1·1125	— 1·1126	—0·3	—36·5	105·8041
259	LXI	0·044	480·554	— 0·3454	— 0·3431	— 0·3442	—2·3	—38·8	105·4599
259	R. R. S. 62	0·519	481·029	— 0·0258					105·7783
259	LXII	0·950	481·460	*+ 0·8365	*+ 0·8436	+ 0·8401	—7·1	—43·6	106·6442
LXII	LXIII	0·188	481·648	+ 0·0209	+ 0·0203	+ 0·0206	+0·6	—43·0	106·6648

* Mean of two or more results.

DESCRIPTION OF BENCH MARKS ON THE LINE OF LEVELS BETWEEN JEFFERSON CITY, MO., AND HOLLIDAY, KANS., WITH YEAR WHEN ESTABLISHED.

B. M. XXV.—1888 AND 1891.

Established by Assistant G. Bradford, in 1888. See his description of bench marks, New Haven, Mo., to Jefferson City, Mo., 1888.

When visited in April, 1891, the B. M. was found undisturbed. It is on the abutment to the first trestle *east* of mile post 119, instead of *west*, as stated in the description, and is on the end of the wing wall to the *west* abutment, south of the track. It is very indistinctly marked.

B. M. XXVI.—1888 AND 1891.

Established by Assistant G. Bradford, in 1888. See his description of bench marks, New Haven, Mo., to Jefferson City, Mo., 1888.

When visited in April, 1891, the bottom of the square hole was found so uneven that it was not used in the work.

B. M. 90 (85).

Established by the Missouri River Commission. The pamphlet published by them in May, 1888, entitled "Descriptions and Elevations of Bench Marks on the Missouri River," gives the following description: "Horizontal furrow in head of copper bolt, leaded into rock of riverward cut face of Capitol Hill, Jefferson City, Mo."

The hill on the north side has been cut away to permit the construction of the Missouri Pacific Railroad and presents about 30 feet of rock above the B. M. The bolt is about 3½ feet above the ground and 35 paces west of east end of rock cut. It projects 1 inch outside the face of the bluff, and is bent slightly downward. It is not firmly fixed in position, as it can be moved a little up and down with the fingers. The connection is certainly made within half an inch. Two and a half feet above and a little to the left of the B. M., the smooth surface of the rock is marked as follows:

U S B M
185

B. M. XXVII.—1891.

A square hole cut in the coping to the stone wall around the Capitol grounds at Jefferson City, Mo. It is a short distance north of the east entrance to the grounds. The wall is level on top north of the entrance as far as the B. M. and then descends the side of the hill by slopes and benches. The smooth bottom of the hole (one-fourth inch deep) is the B. M. It is marked as follows:

U S
C & G S
B M

B. M. XXVIII.—1891.

Two lines forming a cross cut in the face of the east wall of the Capitol building at Jefferson City, Mo. The B. M. is on the east or front wall of the building at its northeast corner, about 8 inches south of the corner and 2 feet above the ground. The intersection of the two lines forming the cross (+) is the B. M. The stone on which it is cut is the corner stone of the building. There is an offset in the wall a few inches below the B. M., and on the upper surface of this offset letters were cut as follows:

\+
U. S. C. & G. S. B. M.

B. M. XXIX.—1891.

A square hole cut in the top of the stone abutment to the iron railroad bridge over Gray's Creek near Cole Station, Missouri Pacific Railroad. The B. M. is on the abutment on the east bank of the creek and is south of the track. It is on the stone on which the end of the iron truss rests, just inside the southeast corner of the truss. It is about 1 mile from south end of abutment and about the middle east and west. The bottom of the square hole is the B. M. It was roughly lettered as follows:

U S
B M

B. M. XXX.—1891.

A square hole cut in the stone abutment to the iron railroad bridge over Gray's Creek at Scott Station, Missouri Pacific Railroad. The B. M. is on the abutment on the west bank of the creek, and is south of the track on the stone on which the end of the iron truss rests. It is 1½ metres from south end of abutment, and 0·3 metre from its inner face on line with south face of highest part of the abutment. The bottom of the square hole is the B. M. The stone was roughly lettered as follows: U S / B M

B. M. XXXI.—1891.

A square hole cut in the top of stone foundation to the brick residence of George Elston at Elston Station, Cole County, Mo. The B. M. is at an angle in the wall just outside the south end of the porch on the front or west side of the house. The bottom of the square hole is the B. M.

B. M. XXXII.—1891.

A square hole cut in the top of the stone foundation to the brick store at Center Town, Cole County, Mo. (owned by W. S. Freshoar). The store is south of the railroad and west of the railroad station. The B. M. is in the opening for the north window in the front of the store and is near the north side of this opening. The bottom of the square hole is the B. M. It was marked as follows: U S / B M

B. M. XXXIII.—1891.

Two lines forming a cross (+) cut in the face of the raised stonework at the west end of the stone steps to the brick court-house at California, Moniteau County, Mo. The intersection of the lines forming the cross is the B. M. The steps lead to the entrance on the south side of the building. The B. M. was lettered as follows: U S + B M.

B. M. XXXIV.—1891.

A copper bolt leaded in the front of a one-story brick building at Clarksburg post-office (Moniteau railroad station). The building is owned by Mr. G. L. Fowler and occupied by him as a drug store. It is next door to the bank and nearly opposite the railroad station, north of the track. The bolt is in the fourth course above the iron door and window sill, and in the middle brick of the east side wall of the building (□□□•□□). Two lines were cut in the end of the bolt forming a cross (+) at its center, and the intersection of these lines is the B. M.

B. M. XXXV.—1891.

A square hole cut in the stone window sill to the city drug store at Tipton, Moniteau County, Mo. The drug store is in the corner room of the city hotel, a three-story brick building, south of the track and nearly opposite the railroad station, owned by Mr. Redmond, the proprietor of the drug store. The B. M. is on the sill of the window east of the east door to the drug store, about in the middle of the exposed portion of the stone window sill. The bottom of the square hole is the B. M. The following letters were roughly cut: U S ■ B M

B. M. XXXVI.—1891.

Four lines forming a square cut on the iron door and window sill to the brick building at Syracuse, Morgan County, Mo. The building is owned by D. Crowe and is south of the track, nearly opposite the railroad station. It is rented and occupied as a store by A. S. Thomson. The B. M. is on the sill of the west window about 6 inches east of the west side of this window near the northwest corner of the building. The surface of the iron in the center of the square formed by the four lines is the B. M.

B. M. XXXVII.—1891.

A copper bolt leaded in the front wall of the brick drug store at Otterville, Mo., owned by J. H. Potter. Mr. Potter's son, R. E. Potter, is the proprietor of the store. The bolt is in the fourth course above the sidewalk and in the third brick from the south side of the window south of the front entrance. Two lines were cut in the end of the bolt, forming a cross at its center, and the intersection of these lines is the B. M.

B. M. XXXVIII.—1891.

A square hole cut in the top of the stone foundation to the brick store at Smithton, Mo., occupied by Hair & White. The building is south of the railroad and nearly opposite the railroad station. The foundation projects outside the brick wall, and the B. M. is on top of this projection on the east side of the building, near the northeast corner. The bottom of the square hole is the B. M.

B. M. XXXIX.—1891.

A square hole cut in the top of the coping to the stone wall around the basement entrance to the court-house at Sedalia, Pettis County, Mo. It is north of the west entrance to the court-house (the basement entrance being immediately under the entrance to first floor) and near the wall of the main building. The bottom of the square hole is the B. M. It is lettered as follows: U S C & G S / B M

B. M. XL.—1891.

A square hole cut in the top of the stone pier on the west bank of Mud Creek (Pettis County, Mo.) which supports the iron railroad bridge (Missouri Pacific Railroad). The end of the bridge north of the track rests on the stone in which the hole is cut, this portion of the pier being smaller and about 3 feet higher than the main pier. The B. M. is near the northwest corner of this raised portion. The bottom of the hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. XLI.—1891.

A copper bolt leaded in the front wall of the brick block at Lamonte, Mo., owned by White & Bramley. It is in the eighth course above the foundation, and in the second brick from the northwest corner, in the front or west wall of the building. The building is near the railroad track just east of the railroad station. Two lines were cut in the end of the bolt, forming a cross (+) at its center, and the intersection of these lines is the B. M.

B. M. XLII.—1891.

A square hole cut in the top of the stone doorsill to the side entrance of the private office back of the Bank of Knobnoster, owned by C. B. Littlefield, at Knobnoster, Mo. The bottom of the hole is the B. M. It was lettered as follows: U S B M. The steps have been removed from this door, and it is not used as an entrance.

B. M. XLIII.—1891.

Missouri Pacific Railroad B. M. 171 was used for this B. M. It is a cross cut in the top of one of the stones of the west abutment to the small wooden railroad bridge 500 feet east of the railroad station at Montserrat. It is north of the track. The rod was held on the intersection of the two lines forming the cross (+). It is lettered as follows: B+M.

B. M. XLIV.—1891.

The center reference stone for the triangulation station "Normal" was used for this B. M. It is situated in the grounds of the Missouri State Normal School, at Warrensburg, Johnson County, Mo., near the southeast corner of the extension to the main building. It is a sandstone post

6 inches square, with two lines cut in the top, forming a ⊞ at its center, and the intersection of these lines is the B. M. Two other sandstone posts are placed 5 feet from this center stone, one north and one south. The center stone is marked as follows, and its top is nearly even with the ground: U S / C S

B. M. XLV.—1891.

A copper bolt leaded in one of the stones of the basement story of the State Normal School at Warrensburg, Mo. The bolt is on the south side of the main building, near the southeast corner, just to the left of a blind window. Two lines were cut in the end of the bolt, forming a cross (+) at its center, and the intersection of these lines is the B. M. The basement story is built of sandstone. No letters were cut, as the stone is very brittle.

B. M. XLVI.—1891.

A mark made on top of the sandstone pillar under the northwest corner of the corrugated-iron warehouse at Center View, Johnson County, Mo. The top edge of this pillar is beveled, and this bevel was cut so as to form a flat bench at the northwest corner of the pillar, and the surface of this bench is the B. M. The warehouse is owned by Porter & Delany. It is south of the track and west of the railroad station.

B. M. XLVII—1891.

Established at Holden, Mo. This B. M. was destroyed.

B. M. XLVIII—1891.

Missouri Pacific Railroad B. M. 188 was used for this B. M., marked thus B + M, 1 foot west of the northwest bridge seat over Little Pine Oak Creek 1 mile west of Holden Station. The line forming the west side of the cross was found broken, and a square hole was cut in the top of the stone bridge pier at this point for the B. M. The B. M. is on the pier on the west bank of the creek, and is north of the track. The bottom of the square hole is the B. M.

B. M. XLIX—1891.

A copper bolt leaded in the front wall of the brick building at Kingsville, Mo., known as "Isley's Hall." The building is owned by B. F. Metzler. Two lines were cut in the end of the bolt, forming a cross (+), and the intersection of these lines is the B. M. The bolt is in the fourth course above the iron window sill, and in the third brick from the northwest corner.

B. M. L.—1891.

A square hole cut in the top of the stone pier (on east bank of creek) to the iron railroad bridge about 500 meters east of Strasburg, Mo. It is on the pier on east bank of the creek, and is north of the track, near northwest corner of the pier. The bottom of the square hole is the B. M. It was roughly lettered, as follows: U S / B M

B. M. LI.—1891.

A copper bolt leaded in the face of the south wall to the Atlantic Hotel, at Pleasant Hill, Cass County, Mo. It is below and about halfway between the second and third windows from the southeast corner of the building, in the eighth course above the porch and in the fifth brick from the west side of the first recess in the wall from the southeast corner. Two lines were cut in the end of the bolt forming a cross at its center, and the intersection of these lines is the B. M.

B. M. LII.—1891.

A square hole cut in the top of the stone pier under the east end of the iron railroad bridge, three-fourths of a mile west of Pleasant Hill, Mo. The B. M. is south of the track and quite near the end of the iron superstructure of the bridge. The bottom of the hole is the B. M. It was roughy lettered as follows: U S / B M

B. M. LIII.—1891.

A square hole cut in the stone pier under the east end of the iron railroad bridge (No. 63) a half mile west of Greenwood, Mo. It is north of the track and near the northeast corner of the pier. A railroad B. M. is quite near it, marked B + M. The bottom of the hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. LIV.—1891.

A square hole cut in the top of the stone foundation to the brick building at Lees Summit, Jackson County, Mo., owned by W. B. Howard. The corner store is occupied by J. R. Spencer as a drug store. The building is at the northeast corner of the intersection of the street parallel to the railroad and the first street south of the railroad station. The B. M. is near the southwest corner of the building, on the front, where there is an entrance to the basement. The bottom of the hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. LV.—1891.

A square hole cut in the top of the stone pier under the north end of the iron railroad bridge over Little Blue Creek, about one-fourth mile south of Little Blue Station, Jackson County, Mo. It is near the southeast corner of the large stone which supports the bridge, on the east side of the track. The bottom of the hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. LVI.—1891.

A square hole cut in the stone abutment to the Missouri Pacific Railroad bridge at the Chicago & Alton Railroad crossing. It is east of the Missouri Pacific track and on the north side of the Chicago & Alton track. The bottom of the hole is the B. M. An attempt was made to cut letters but the stone chipped too much to allow success. This crossing is about 2 miles south of Independence, Mo.

B. M. LVII.—1891.

A square hole cut in the top of the stone coping to the paved entrance to the court-house at Independence, Jackson County, Mo. This entrance is on the south side of the old building, and the B. M. is between the last column on the left as you enter the building, and the corner of the building itself on the left of the entrance. The stone forms a portion of the building. The bottom of the hole is the B. M. It was lettered as follows: U S / C & G S / B M

INDEPENDENCE CITY DIRECTRIX.

This B. M. is the top of a granite post buried in the court-house yard near the southwest corner of the court-house (new building) at Independence, Jackson County, Mo. The top of the post is cut in the form of a sphere and polished. The B. M. is the highest point of the sphere. The city levels in Independence are based on this B. M. It is marked "Elevation $326\frac{4}{10}$ ft.," and the city engineer informed me that this is its elevation above the Kansas City datum point.

B. M. LVIII.—1891.

A square hole cut in the top of the abutment to Missouri Pacific Railroad bridge over Big Blue Creek. The end of the bridge rests on a bench several feet below. The B. M. is south of the track and east of the creek. It is near the southwest (upper) corner of the east abutment. The bottom of the hole is the B. M. It was roughly lettered as follows: U S / B M

M. R. C. B. M. 241.

The pamphlet published by the Missouri River Commission in 1888 gives the following description of this B. M.: "Cross (+) cut into top of stone foundation at northeast corner of four-story brick grist mill, called 'Zenith Mills,' 1 mile below Kansas City Bridge." The cross is very faintly cut and there are not any letters near it. A two-story extension to the Zenith Mills has been built since the B. M. was established. The rod was held on the surface of the stone at the cross.

M. R. C. B. M. 243.

The pamphlet of 1888 gives the following description: "Horizontal furrow in head of copper bolt leaded into north face, near east end, of south abutment of Kansas City Bridge."

M. R. C. B. M. 244.

The pamphlet of 1888 gives the following description: "Equals B. M. 24½ of 1878—point of arrowhead engraved on south side of first pier north of south abutment of Kansas City Bridge, and marked (erroneously) 'High water of 1844.'" The face of one of the stones in the pier is dressed and cut and lettered as follows: High Water 1844

M. R. C. B. M. $\frac{1a}{1}$.

The pamphlet of 1888 gives the following description: "On right bank at Kansas City, Mo., 50 ft. east of shore pier of Kansas City railroad bridge, and 10 ft. from river bank." An iron pipe is driven in the ground and an iron cap is secured on top of it by a bolt. The upper surface of the knob in the center of the upper surface of this cap is the B. M. referred to in the Coast and Geodetic Survey records. The cap is lettered as follows: Missouri River Commission / U S B M.

The M. R. C. B. M. is the head of a copper bolt set in a stone under this pipe; it is 4·02 ft. or 1·225 m. below the cap on pipe.

M. R. C. B. M. 245.

The pamphlet of 1888 gives the following description: "Equals B. M. 23 of 1878—cross (+) cut into top of foundation at northwest corner of Union Elevator, Kansas City, Mo."

B. M. LIX.—1891.

A square hole cut in the top of the stone abutment to the Atchison, Topeka and Santa Fe R. R. bridge No. 2 about 2 miles west of Kansas City, Mo. The bridge is a small one in Johnson County, Kansas, and is about one-half mile east of the first wagon bridge across the Kansas River above Kansas City. The B. M. is on the east abutment and is north of the track. The bottom of the hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. LX.—1891.

A square hole cut in the top of the stone foundation to one of the iron columns supporting the road bridge over the Atchison, Topeka and Santa Fe Railroad yard at Argentine, Johnson County, Kans. The bridge is a short distance west of the railroad station at Argentine, and the B. M. is on the foundation to the first column south of the main track on the west side of the bridge. The bottom of the square hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. LXI.—1891.

A square hole cut in the top of the coping to the stone culvert under the Atchison, Topeka, and Santa Fe Railroad about one-half mile east of Holliday, Johnson County, Kans. The B. M. is south of the track and near the southeast corner of the culvert. It is the second culvert east of the railroad station at Holliday and just outside the end of the switches. The bottom of the hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. LXII.—1891.

A square hole cut in the top of the stone pier under the east end of the iron railroad bridge over Mill Creek about one-half mile west of Holliday, Johnson County, Kans. It is north of the track and near the northeast corner of the pier. The bottom of the square hole is the B. M. It was roughly lettered as follows: U S / B M

B. M. LXIII.—1891.

A square hole cut in the top of the stone pier under the west end of the iron railroad bridge over Mill Creek about one-half mile west of Holliday, Johnson County, Kans. It is north of the track near the north end of the pier. The bottom of the square hole is the B. M. It was roughly lettered as follows: U S / B M

RAILROAD BENCH MARKS BETWEEN JEFFERSON CITY, MO., AND HOLLIDAY, KANS.*

The following are descriptions of bench marks established by the Missouri Pacific Railroad Company, with which connections were made:

B. M. No. 114.—Marked thus: B + M. On top of the foundation stone at the southwest corner of the water tank at Center Town Station. Elevation, 435·43 feet.

B. M. No. 122.—Marked thus: B + M. On top of foundation on north side of water tank 200 feet east of California Station. Elevation, 475·25 feet.

B. M. No. 143.—Marked thus: B + M. On top of second course of masonry from the top, at the northeast corner of bridge, 900 feet west of Otterville Station. Elevation, 304·88 feet.

B. M. No. 152.—Marked thus: B + M. On top of the northwest corner of basement entrance on north side of railroad office building, about 1 mile east of Sedalia Station. This B. M. is almost flush with the surface of the ground. Elevation, 492·96 feet.

B. M. No. 169.—Marked thus: B + M. On top of stone at northwest corner of culvert, 3 600 feet west of Knobnoster Station. B. M. is 8 feet north of north rail. Elevation, 330·64 feet.

B. M. No. 171.—Same as B. M. XLIII (1891). Elevation, 384·87 feet.

B. M. No. 188.—Same as B. M. XLVIII (1891). Elevation, 388·01 feet.

B. M. No. 201.—Marked thus: B + M. On top of northeast corner of culvert 1 500 feet west of Pleasant Hill Station. Elevation, 441·08 feet.

B. M. No. 206.—Marked thus: B + M. On top of bridge seat at southeast corner of bridge No. 63, 2 feet therefrom and one-half mile west of Greenwood Station. Elevation, 505·41 feet.

R. R. S. 1.—Ground in center of track in front of railroad station at Jefferson City, Mo.

X Road 2.—Ground in center of track at county road crossing at Cole Station, Mo.

R. R. S. 3.—Ground in center of track in front of railroad station at Scott, Mo.

X Road 4.—Ground in center of track at county road crossing three-fourths of a mile west of Elston, Mo.

R. R. S. 5.—Ground in center of track in front of railroad station at Elston, Mo.

X Road 6.—Ground in center of track at county road crossing 1 mile east of Center Town, Mo.

R. R. S. 7.—Ground in center of track in front of railroad station at Center Town, Mo.

* Letter of James W. Way, chief engineer Missouri Pacific Railroad, etc., dated St. Louis, Mo., May 5, 1891.

X Road 8.—Ground in center of track at county road crossing one-half mile east of McGirk Station, Mo.

X Road 9.—Ground in center of track at county road crossing at McGirk Station, Mo.

X Road 10.—Ground in center of track at county road crossing 2 miles west of McGirk Station, Mo.

X Road 11.—Ground in center of track at county road crossing 2 miles east of California, Mo.

X Road 12.—Ground in center of track at county road crossing 1 mile east of California, Mo.

R. R. S 13.—Ground in center of track in front of railroad station at California, Mo.

X Road 14.—Ground in center of track at county road crossing 3 miles west of California, Mo.

X Road 15.—Ground in center of track at county road crossing 2½ miles west of Moniteau, Mo.

R. R. S. 16.—Ground in center of track in front of railroad station at Tipton, Mo.

X Road 17.—Ground in center of track at railroad crossing at Tipton, Mo.

X Road 18.—Ground in center of track at county road crossing 2 miles west of Tipton, Mo.

R. R. S. 19.—Ground in center of track in front of railroad station at Syracuse, Mo.

X Road 20.—Ground in center of track at county road crossing at milepost 170.

R. R. S. 21.—Ground in center of track in front of railroad station at Otterville, Mo.

X Road 22.—Ground in center of track at county road crossing near milepost 177.

X Road 23.—Ground in center of track at county road crossing 1 mile east of Smithton, Mo.

R. R. S. 24.—Ground in center of track in front of railroad station at Smithton, Mo.

X Road 25.—Ground in center of track at county road crossing one-fourth mile east of milepost 183.

X Road 26.—Ground in center of track at county road crossing 2½ miles east of Sedalia, Mo.

R. R. S. 27.—Ground in center of track in front of union railroad station at Sedalia, Mo.

X Road 28.—Ground in center of track at county (telegraph) road crossing one-fourth mile east of milepost 192.

R. R. S. 29.—Ground in center of track in front of railroad station at Dresden, Mo.

X Road 30.—Ground in center of track at county road crossing one-fourth mile east of milepost 197.

X Road 31.—Ground in center of track at county road crossing 2 miles west of Lamonte, Mo.

X Road 32.—Ground in center of track at county road crossing 2 miles east of Knobnoster, Mo.

R. R. S. 33.—Ground in center of track in front of railroad station at Knobnoster, Mo.

X Road 34.—Ground in center of track at county road crossing one-half mile west of Clear Fork Creek.

R. R. S. 35.—Ground in center of track in front of railroad station at Montserratt, Mo.

X Road 36.—Ground in center of track at county road crossing 1½ miles west of Montserratt, Mo.

X Road 37.—Ground in center of track at county road crossing 1½ miles east of Warrensburg, Mo.

R. R. S. 38.—Ground in center of track in front of railroad station at Warrensburg, Mo.

X Road 39.—Ground in center of track at county road crossing 1½ miles west of Warrensburg, Mo.

X Road 40.—Ground in center of track at county road crossing 1½ miles east of Center View, Mo.

R. R. S. 41.—Ground in center of track in front of railroad station at Center View, Mo.

X Road 42.—Ground in center of track at county road crossing 1½ miles west of Center View, Mo.

X Road 43.—Ground in center of track at county road crossing 3 miles east of Holden, Mo.

R. R. S. 44.—Ground in center of track in front of railroad station at Holden, Mo.

R. R. S. 45.—Ground in center of track in front of railroad station at Kingsville, Mo.

X Road 46.—Ground in center of track at county road crossing 4½ miles west of Kingsville, Mo.

R. R. S. 47.—Ground in center of track in front of railroad station at Strasburg, Mo.

X Road 48.—Ground in center of track at county road crossing 3 miles east of Pleasant Hill, Mo.

R. R. S. 49.—Ground in center of track in front of railroad station at Pleasant Hill, Mo.

R. R. S. 50.—Ground in center of track in front of railroad station at Lees Summit, Mo.

X Road 51.—ground in center of track at county road crossing 2 miles west of Lees Summit, Mo.

R. R. S. 52.—Ground in center of track in front of railroad station at Little Blue, Mo.

X Road 53.—Ground in center of track at county road crossing 4½ miles east of Independence, Mo.

X Road 54.—Ground in center of track at county road crossing one-fourth mile east of Elm Park, Mo.

R. R. S. 55.—Ground in center of track in front of railroad station at Independence, Mo.

X Road 56.—Ground in center of track at county road crossing at Mount Washington, Mo.

X Road 57.—Top of rail at crossing of Missouri Pacific Railway and Belt Line Railroad east of Kansas City, Mo., north rail, north track Missouri Pacific Railway, and east rail, east track Belt Line.

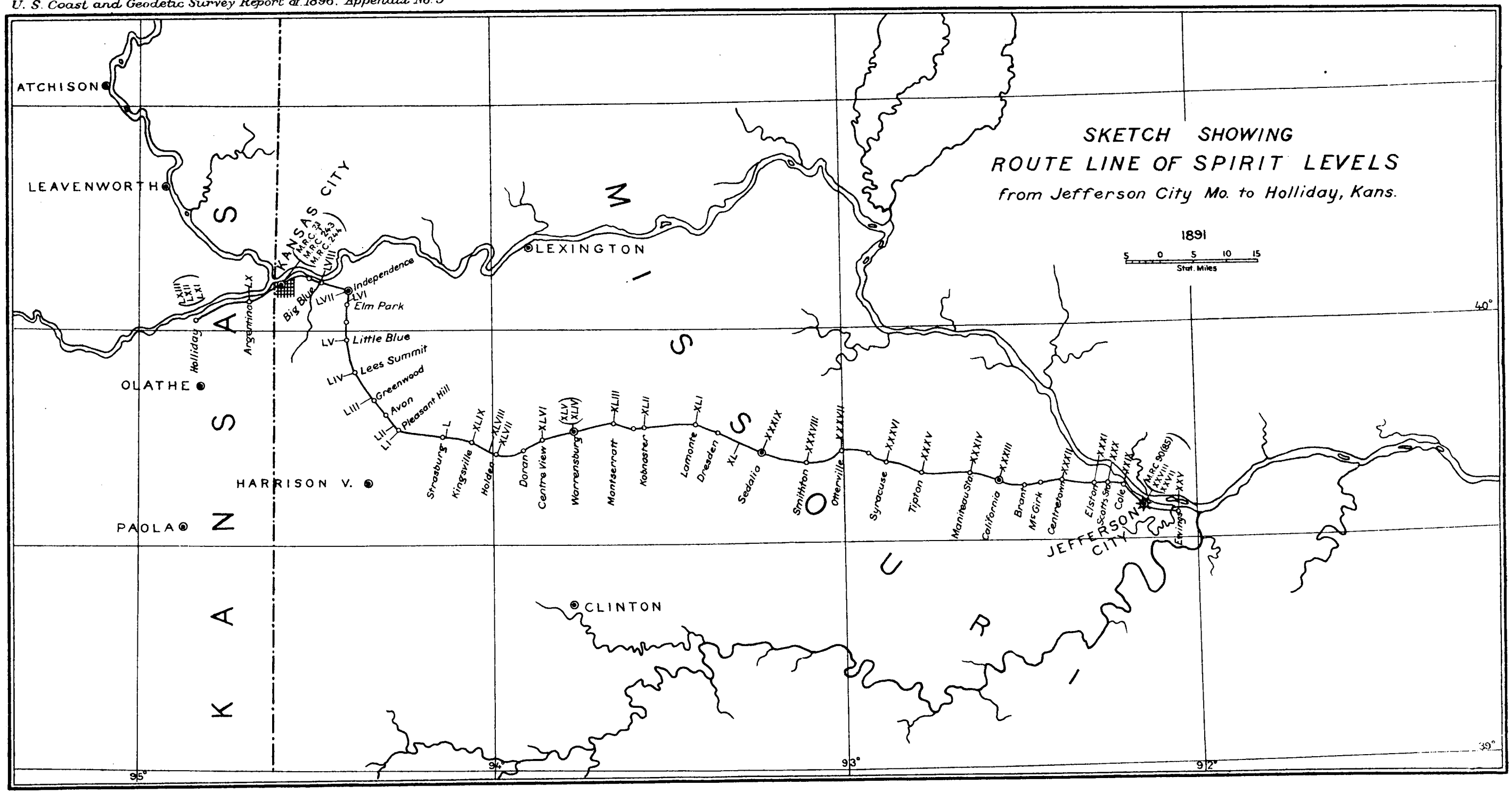
R. R. S. 58.—Top of rail (Atchison, Topeka and Santa Fe track) in front of Union Station, Kansas City, Mo.

R. R. S. 59.—Ground in center of south track in front of railroad station at Argentine, Kans.

R. R. S. 60.—Ground in center of north track in front of railroad station at Turner, Kans.

R. R. S. 61.—Ground in center of north track in front of railroad station at Morris, Kans.

R. R. S. 62.—Ground in center of north track in front of railroad station at Holliday, Kans.


SKETCH SHOWING
ROUTE LINE OF SPIRIT LEVELS
from Jefferson City Mo. to Holliday, Kans.
1891
5 0 5 10 15
Stat. Miles
ATCHISON
LEAVENWORTH
KANSAS CITY
M.R.C. 23
M.R.C. 243
M.R.C. 244
LVIII
LEXINGTON
Independence
LVII
LVI
Elm Park
Big Blue
LX
Argentina
LXIII
LXII
LXI
Holliday
OLATHE
LV
Little Blue
LIV
Lees Summit
LIII
Greenwood
LII
Avon
LI
Pleasant Hill
L
Strasburg
XLIX
Kingsville
XLVIII
XLVII
Holden
XLVI
Doran
Centre View
XLV
XLIV
Warrensburg
XLIII
Montserrat
XLII
Kobnaster
XLI
Lamonte
Dresden
XL
Sedalia
XXXIX
Smithton
XXXVIII
Otterville
XXXVII
Syracuse
XXXVI
Tipton
XXXV
Moniteau Sta.
XXXIV
California
XXXIII
Brant
McGirk
Centretown
XXXII
Elston
XXXI
Scotts Sta.
XXX
Cole
XXIX
M.R.C. 90(85)
XXVIII
XXVII
XXV
Ewings
JEFFERSON CITY
HARRISON V.
PAOLA
CLINTON
KANSAS
MISSOURI
40°
39°
95°
94°
93°
92°

APPENDIX No. 6.—1896.

ESTABLISHMENT OF THE UNITED STATES NAVAL OBSERVATORY CIRCLE, AND THE DETERMINATION OF THE GEOGRAPHICAL POSITION OF THE CENTER OF THE CLOCK ROOM.

By E. D. PRESTON, Assistant.

On the 1st day of August, 1894, a joint resolution of Congress was approved, which provided for the establishment of a circle around the United States Naval Observatory. The said act was embodied in public resolution No. 36, and was entitled:

Joint resolution to establish an observatory circle as a provision for guarding the delicate astronomical instruments at the United States Naval Observatory against smoke or currents of heated air in their neighborhood, and undue vibrations from traffic upon the extension of public thoroughfares in the vicinity, and for other purposes.

Section 10, of the act just cited, reads as follows:

That the said appraisers are hereby authorized to call upon the Superintendent of the Coast and Geodetic Survey to make such surveys as may be necessary to carry into effect the provisions of this act, and the said Superintendent is authorized and required to make such surveys under the direction of the said Commissioners.

The appraisers named by the honorable Secretary of the Navy, and under whom the survey was undertaken and carried out, were Hon. John W. Ross, chairman of the Commissioners of the District of Columbia; Mr. T. E. Waggaman, and Capt. F. V. McNair, U. S. N., Superintendent of the Naval Observatory. I was most effieiently aided in the field and office work by Messrs. J. B. Boutelle and C. C.Yates, of the Coast and Geodetic Survey.

The provisions of the joint resolution, briefly stated, were as follows:

A circle with the centre coinciding with the centre of the clock room and with a radius of 1 000 feet was to be established and described on the ground. All that portion of the original Naval Observatory property lying outside the said circle was to be sold, and all that land lying within the said circle and not then belonging to the United States was to be acquired by purchase. The methods by which these transfers were to be made, as well as the steps to be taken in case of non-agreement as to price between purchasers and sellers, and other possible contingencies, are well defined in the act of Congress. They form, however, no part of the work undertaken by the Coast and Geodetic Survey, and are entirely without the province of this service. The present paper, therefore, has for its object a brief account of the method employed in laying out the circle, a statement of the accuracy attained in the final results, and, as incident thereto, a new determination of the position of the centre of the clock room, which is the initial point of longitudes for the United States.

Several methods were suggested for the establishment of the circle. The first one was simply to select that radius of the proposed circle which lay over the most level part of the grounds, determine one point of the circumference by direct measurement, and run in the entire circle by the ordinary method of tangents, as employed by railroad engineers. This did not appear feasible, or at least did not seem capable of giving a high degree of accuracy in the results, without extraordinary care, on account of the extremely abrupt nature of the topography of some parts of the circle. Moreover, this method had already been employed by some surveyors a few years ago, and

the closing error was given as 1 foot. It was desirable to mark the boundaries more closely than this. Besides, a different method of getting at the same results would check the previous determination and give increased confidence in the work.

The second method proposed was that of using a tapeline of 100 feet length as a telemeter and determining its distance by measuring the angle subtended at the centre of the circle. Four such distances were to be fixed, and the intervening quadrants were to be established by the ordinary way, already mentioned. This plan, although elegant in conception, when examined closely did not turn out to be practicable. In the first place, because it would have involved cutting a number of lines through the beautiful groves of the Observatory, and secondly, because it required a very high degree of accuracy for the measure of the angles at the centre.

A simple geometrical construction shows that the uncertainty in the length of one of the radii is about twenty times that of the angular measures at the centre: or, using the formula for finite differences,

$$\triangle b = \frac{-a \sin \triangle C}{\sin (C + \triangle C)}$$

it appears that an error of 1 second in the angle (C) at the centre would imply an error of about one-tenth of a foot in the distance (b) from the centre; a is taken as 1 000 feet, the radius of the circle; the value of C for this particular case is 2° 51′ 57″·5, this being half the angle subtended by a chord of 100 feet on a circle of the dimensions given. Besides, since 1 second on the circumference of a circle of this radius is in the neighborhood of one-sixteenth of an inch, the pointings with the telescope must define the limiting lines of the telemeter to this degree of accuracy, which would require an instrument capable of supporting a power greater than was then available. Moreover, it would have been a difficult matter to keep the tapeline at a known length within one-sixteenth of an inch. Although quite easy under favorable conditions, in the present case the precautions necessary as regards temperature, tension, inclination, etc., would have made the operation a troublesome and unsatisfactory one. It was therefore evident that by this method the uncertainty of the length of the radii of the circle would be about a quarter of a foot.

The third method (see Pl. I), which was adopted, consisted in inscribing a decagon within the proposed circle, making the apices of the angles at the centre coincident with the centre of the clock room, and the exterior sides as near to the circumference as the configuration of the ground would admit. It was desirable to have all the corners of the decagon near and within the circle; in two cases, however, in order to get intervisibility, it was necessary to place the stations a short distance outside the circle, and in others, to avoid building exceptionally high signals, the points were located considerably inside the circumference. But these distances were not so great that their measurement involved errors greater than would necessarily ensue from the instruments and methods employed in the triangulation. One of the exterior sides of the decagon was measured as a base line. Three angles were measured in each triangle, and the triangulation was carried around to close on the original line. Owing to the fact that two of the exterior points (H and I) were not intervisible, the point I was determined in two ways, which supplied a check equal in point of accuracy to that accorded any of the other stations. The station at the centre was on a scaffold 20 feet high, built over the clock room, and having the point of occupation vertically over the centre of the room. By this procedure the greatest uncertainty in the lengths of the radii did not exceed three-hundredths of a foot.

The following were the angles at the centre adjusted for station error:

	°	′	″
AOB	25	54	36·7
BOC	39	17	27·0
COD	35	27	10·0
DOE	35	40	35·4
EOF	29	04	58·5
FOG	27	15	31·5
GOH	41	09	36·0
HOI	36	58	54·0
IOK	70	18	49·3
KOA	18	52	21·6

Additional angles for the determination of the position of the centre of clock room by the three-point problem were measured as follows:

	°	′	″
Capitol to Monument	17	14	07·3
Monument to Fairfax Theological Seminary	48	43	34·5

BASE LINE.

The base line was measured with a steel tape 100 feet in length, supported at eight points under a tension of 5 kilogrammes. After correcting for inclination, temperature, and tension, the following results were obtained:

Length of base.

	Ft.
1st measure	444·798
2d "	·809
3d "	·802
4th "	·803
5th "	·803
Mean	444·803 ± 0·001

The following corrections were applied:

For inclination $\frac{(\text{Difference in height})^2}{\text{Twice the distance.}}$

For temperature 0·000011 per degree Centigrade.

For tension 0·013 feet per tape length.

The above table shows that any one of the five measures is sufficiently accurate for the triangulation which it was intended to construct upon the base line. It is, however, but a reassertion of a fact many times established that it is much easier to attain high accuracy in linear measurement than it is to preserve it in the angular measurement of geodetic work.

The following were the resulting lines in the different triangles:

Radial sides.		Exterior sides.		
O to *A*	993·87	*A* to *B*		444·80
B	990·21	*B*	*C*	662·52
C	980·22	*C*	*D*	570·84
D	849·62	*D*	*E*	585·05
E	1 001·22	*E*	*F*	500·07
F	990·03	*F*	*G*	454·89
G	916·43	*G*	*H*	637·48
H	896·31	*H*	*K*	1 538·59
I	903·50	*I*	*K*	1 106·62
K	1 012·20	*I*	*A*	1 333·62
		K	*A*	329·42

The average correction to an angle at the center to close the horizon was 0″·16, while the average correction to an angle to close the triangles was 2″·1. It should be stated here that different instruments were employed in the two cases. The angles at the center were measured with theodolite No. 140 (8″ diam.), reading to 2 seconds. The exterior points were occupied with theodolite No. 156 (6″ diam.), reading to 5 seconds; moreover, the measures were not made by the same observer. Since one of the sides is about 330 feet in length, an error of 2″ in an adjacent angle would imply an inaccuracy of centering and pointing not greater than one-twenty-fifth of an inch. There are few signal poles used in triangulation that will give the same centre to this degree of precision when observed from different sides, so that an error of a few seconds was quite within unavoidable discrepancies.

The average length of a radial line is 953 feet; the average exterior side is 742 feet long. The side of a triangle is then, say, approximately 850 feet. Two seconds being about 1-100 000 part of the radius, we might expect in each new base an error of less than one one-hundredth of a foot from angular errors in its own triangle; but there would be some compensation of errors in the continuous development of the scheme of figures.

As a matter of fact, we may readily calculate the error to be expected in the last or closing side from the known probable errors of the base and measured angles. Applying the usual formula

$$r_a^2 = \left(\frac{a r_1}{b}\right)^2 + a^2 r^2_2 \sin^2 1'' \Sigma (\cot^2 B + \cot^2 A)$$

where a and b are the lengths of the last side and base, and where A indicates angles opposite the required sides and B those opposite the given sides, and where r_1 and r_2 stand for the probable error of the base and of an angle, respectively, we find a resulting probable error of 0·02 feet from both base line and angle measures. That of the base line is, however, without significance when compared with the uncertainties in the angle measures.

The actual discrepancy found agrees sufficiently well with this, and we may therefore conclude that an accuracy has been attained in the final result commensurate with the precision of the instruments employed and in reasonable accord with the method of observing.

If we start from the measured base $A\ B$ with length of 444·80 feet, and carry the computation around the decagon to close again in the same line, we derive a value for $A\ B$ of 444·79 feet. This circuit is by the most direct way, and ignores for our present purpose the point I, as well as the figures $K\ O\ I$ and $A\ O\ I$. If, however, we carry the computation by the same route around to the line $K\ O$ and then set out from the base again and proceed in the opposite direction, meeting the previous computation on the line $K\ O$, we get a discrepancy of 0·03 feet. This might have been expected, since the probable error of the last side, as we see from the formula, is a function of its length.

If we calculate the error to be expected in this line from the known probable errors of the base line and the angular measures, we get 0·04 feet, which is also practically the discrepancy found. As the computation was carried to the third decimal place only, a difference in results of one unit in the second place may occur through loss by decimals. We may therefore give 0·03 feet as the greatest uncertainty of any of the radii of the circle.

With the establishment of the Observatory Circle arose the necessity for an accurate survey of the original property. This was done in October, 1894, all the original points being recovered, and the astronomical azimuth of the sides being determined by connection with the side $O\ C$ of the triangulation.

The bearings of the lines, together with the distances, are given in Pl. I.

The following table of areas shows the superficial contents in the various divisions adopted:

Contents in acres to be bought (additive) or sold (subtractive).

		+	−
Plat I (north and east of Mass. Ave.)			14·449
Massachusetts avenue (triangle 2)	0·184		
" " " 1	0·162		
" " Curve	3·355		
" " Southeast	3·164		
	6·865		6·865
Plat II (south and west of Mass. Ave.)			1·218
Normanstone		1·732	
Plat III (south of circle)			1·706
Weaver North of avenue	0·034		
South of avenue	8·398		
Avenue	0·213		
	8·645	8·645	
Barnes		0·389	
Young		0·714	
Avenue South of Barbour	0·066		
Barbour	0·359		
	0·425	0·425	
Industrial Home		6·764	
Dumbarton		7·895	
		26·564	24·238
		24·238	
Amount to be added		2·326	
Area of original tract		69·795	
Area of circle		72·121	

At the request of the Navy Department, Plot I, lying north and east of Massachusetts avenue, was subdivided into 31 lots, as shown in Pl. I. The approximate dimensions were furnished by Capt. F. V. McNair, and the boundaries were traced on the ground and permanently marked by heavy stakes. This plot was subsequently rearranged by the Department into three subdivisions. The bearings and distances of the two arrangements are on file in the archives of the Survey.

As a matter of curiosity it may be stated that in disposing of this land the Department was forced to name the price of one of the subdivisions to eight decimal places.

The two conditions imposed were that Subdivision B, together with Lots XI to XVIII, i. e., 4·25 acres, should be sold for 30 cents per foot, and to satisfy certain other conditions the total area of 14·45 acres should be sold for $141 454·27. These conditions being rigid, the remaining 10·20 acres had to be disposed of at $0·19336765 per square foot.

THE DETERMINATION OF THE POSITION OF THE NAVAL OBSERVATORY.

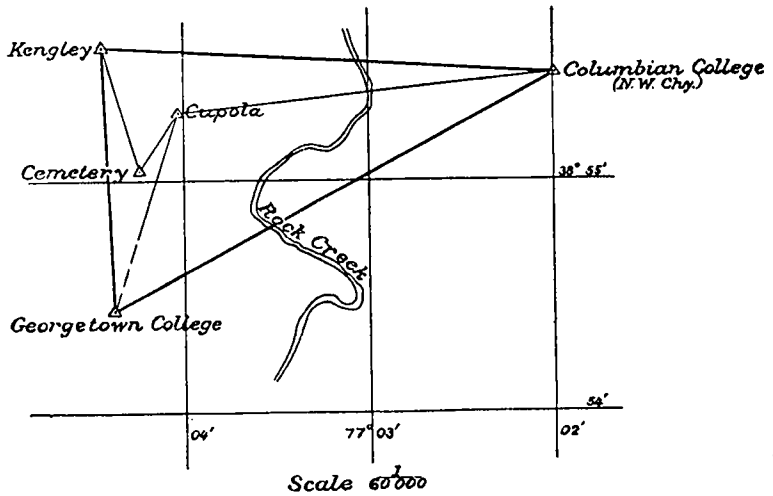
The occupation of the center of the clock room made it possible to make an independent determination of the initial point for longitudes in the United States. Three prominent triangulation points of the Coast and Geodetic Survey were visible from this station, which enabled us to fix the position by the three-point problem with a very short series of observations.

Each pointing at the center was made in three positions of the circle 120° apart with two series in each position; one series consists of a pointing with telescope direct, and one with telescope reversed, so that each angle was given twelve independent measures. The facility with which this last determination was made, as well as the accuracy of the results, seems to warrant a statement here of the different determinations.

I.

In July, 1881, Mr. F. C. Donn, under the direction of Mr. Charles Junken, of the United States Coast and Geodetic Survey, made a triangulation to determine the proposed site of the new Naval Observatory. It was based on the known points, Kengley, Columbian College, and Georgetown College, as shown by the following sketch:

No. 1



The adjustment of this work gave two angle equations and one side equation, from which the position of the cupola on the old house standing at the time near the present Observatory was

	°	′	″
φ =	38	55	17·46
λ =	77	4	1·80

By subsequent linear measurements, Prof. William Harkness connected the position of this cupola with the center of the clock room. These give as the result of Junken's triangulation:

	°	′	″
φ	38	55	17·01
λ	77	04	2·22

II.

In 1893 Prof. William Harkness determined the position of the new Naval Observatory, by means of a small 4-inch theodolite, reading to 20 seconds of arc. The following stations were occupied:

New Naval Observatory, center of small dome.

Old Naval Observatory, center of small dome.

Soldiers' Home, center of southwest turret of tower.

The following sketch (No. 2) shows the relative poitions:

Professor Harkness kindly furnished a copy of his observations to the Superintendent of the Coast and Geodetic Survey, and from them Mr. Schott has deduced the position of the new Naval Observatory, employing in the adjustment one angle equation and four side equations.

The position from these observations is

	°	′	″
φ	38	55	17·03
λ	77	04	2·25

III.

In 1894 the occupation of the clock room in the prosecution of the work connected with the Observatory circle furnished an occasion for a new determination of the geographical position of the new Observatory, and three known points of the triangulation of the Coast and Geodetic Survey were incidentally included in the regular series of angle measurements.

The following sketch (No. 3) shows the relative positions of the points used and of the point of occupation:

These data were also submitted to Mr. Schott, who deduces the following result from the position sought:

	°	′	″
φ	38	55	17·05
λ	77	04	2·25

We then have for the geodetic position of the new Naval Observatory the following results:

Derived from—	Observer.	ϕ	λ	Date.	Remarks.
		″	″		
5 trig. pts.	Junken.	17·01	2·22	1881	6-inch theod. reading to 10″. Triang. 2 angle and 1 side equations.
7 trig. pts.	Harkness.	·03	2·25	1893	4-inch theod. reading to 20″. Triang. 1 angle and 4 side equations.
3 trig. pts.	Preston.	·05	2·25	1894	8-inch theod. reading to 2″. Three-point problem.

The position of the new Naval Observatory (center of clock room) has been determined astronomically by Professor Eastman, and the results are given in Astronomy and Astro-Physics (vol. 12, p. 699). Giving the work a differential character and basing his results on previous determinations of the old Naval Observatory, Professor Eastman arrives at the following results:

$$\varphi = 38^\circ\ 55'\ 14''{\cdot}68$$
$$\lambda = 5^h\ 8^m\ 15{\cdot}71^s = 77^\circ\ 3'\ 55''{\cdot}65$$

Comparing these with the mean of the geodetic determinations already given, and assuming that the deviations of the vertical are the same in amount and direction at the two stations, we have a deflection of the zenith at the new Naval Observatory of 2″·35 toward the south, and one of 6″·59 toward the east.

We may safely assume that the deflections of the vertical are fairly compensated in the combination of observations from 12 points, and therefore, giving equal weights to the three determinations, that the geodetic position of the center of the clock room at the new Naval Observatory is

	°	′	″
Latitude	38	55	17·03
Longitude	77	04	2·24 = 5^h 08^m $16·15^s$

The probable error for either coordinate is less than 1 foot, corresponding in accuracy with the position of the geodetic points upon which the work is based.

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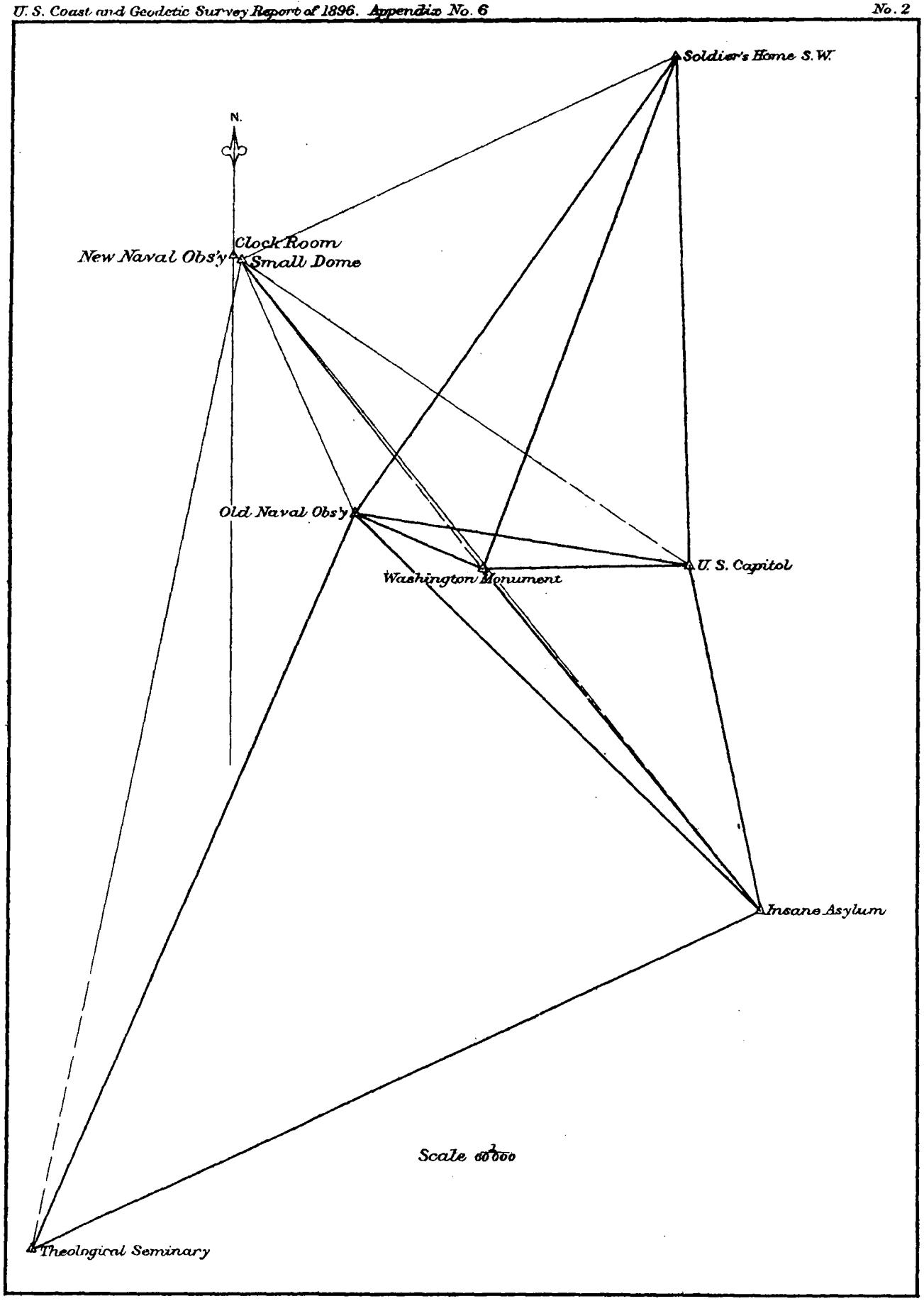
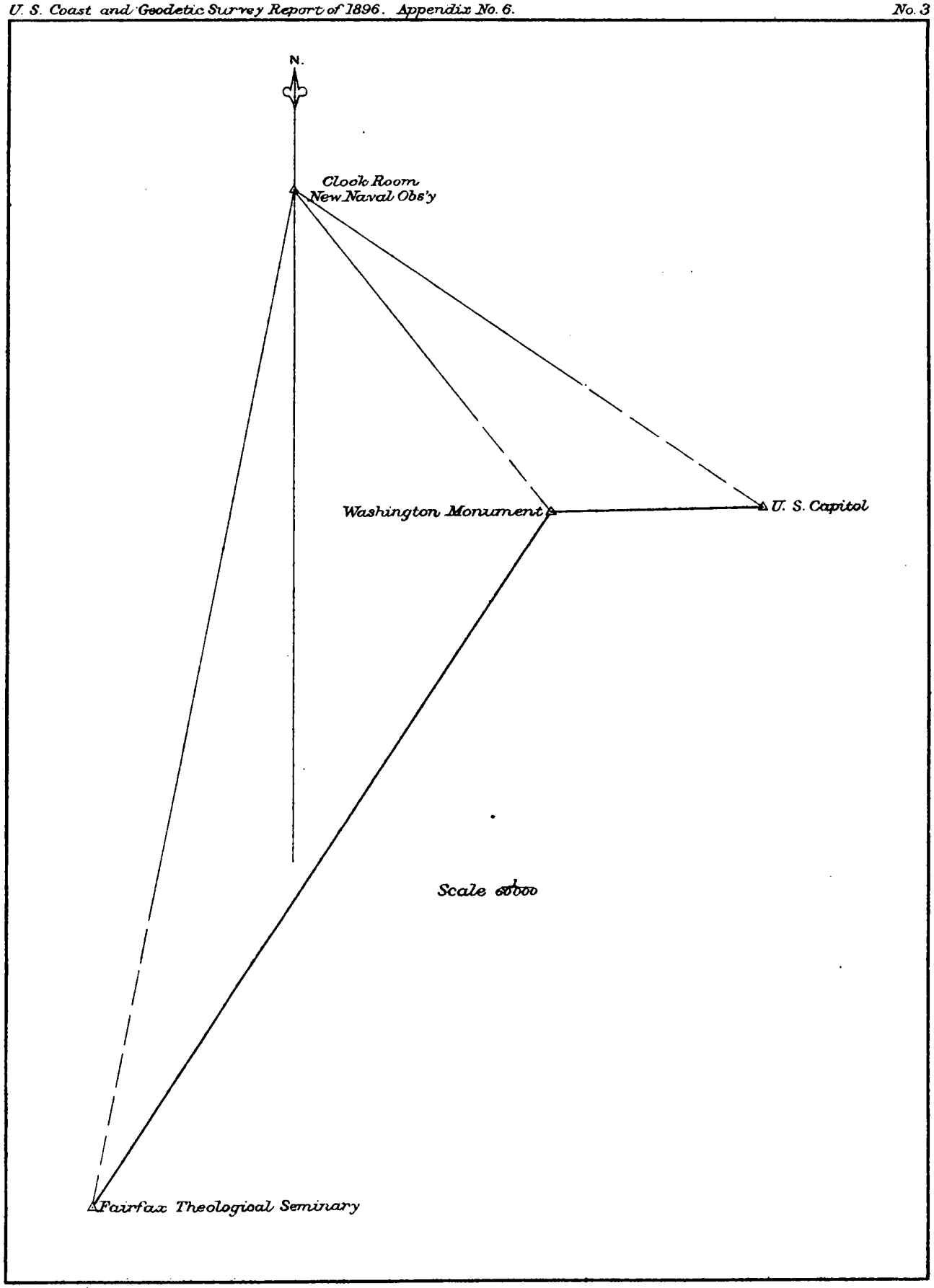
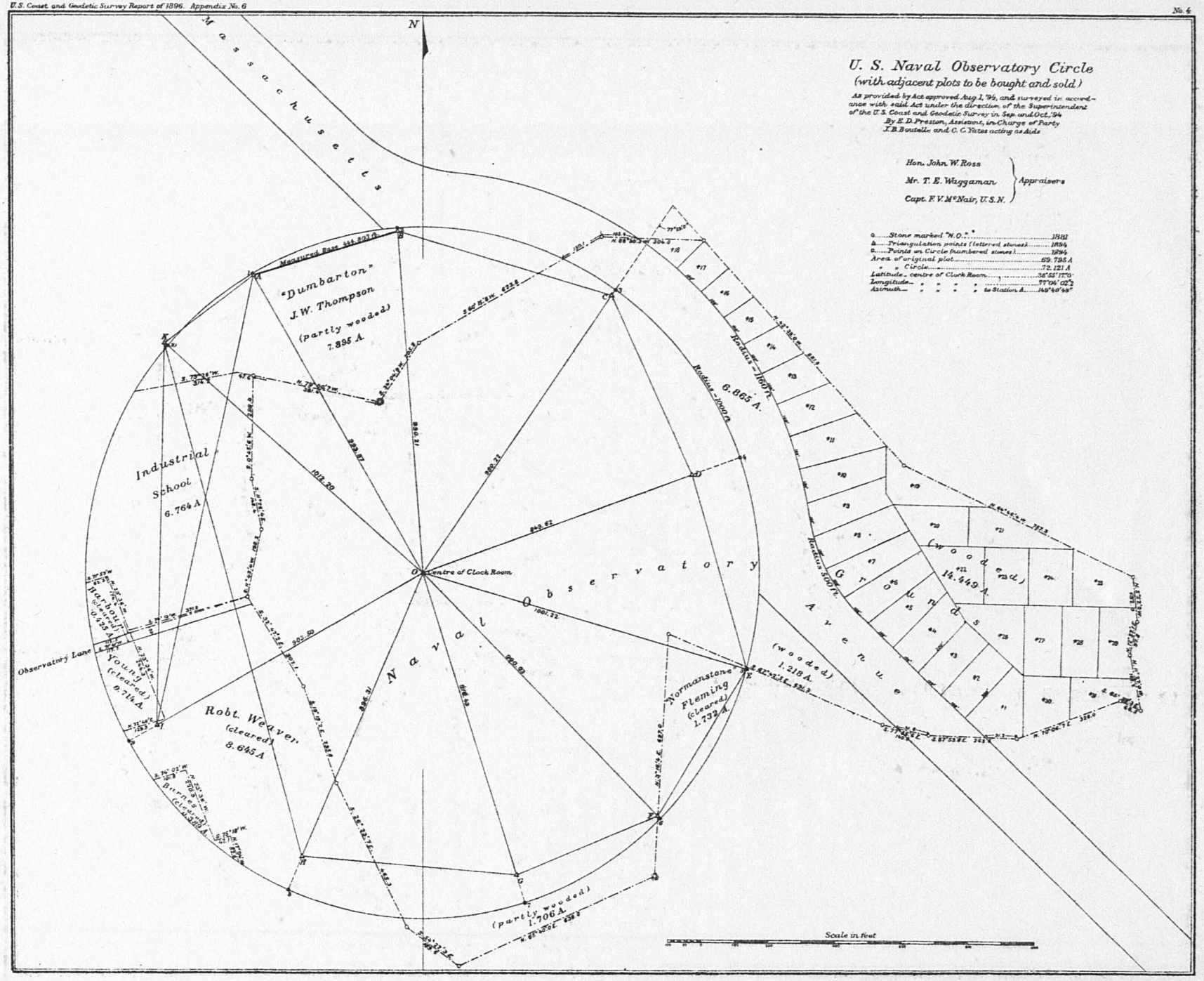

Soldier's Home S.W.
N.
Clock Room
New Naval Obs'y
Small Dome
Old Naval Obs'y
U. S. Capitol
Washington Monument
Insane Asylum
Scale 1/60000
Theological Seminary


N.
Clock Room
New Naval Obs'y
Washington Monument
U. S. Capitol
Scale 60000
Fairfax Theological Seminary



U. S. Naval Observatory Circle

(with adjacent plots to be bought and sold)

As provided by Act approved Aug 2, '94, and surveyed in accordance with said Act under the direction of the Superintendent of the U.S. Coast and Geodetic Survey in Sep. and Oct. '94
By E. D. Preston, Assistant, in Charge of Party
J. B. Boutelle and C. C. Yates acting as Aids

Hon. John W. Ross
Mr. T. E. Waggaman } Appraisers
Capt. F. V. McNair, U.S.N.

a ..... Stone marked "N.O."	1881
b ..... Triangulation points (lettered stones)	1894
c ..... Points on Circle (numbered stones)	1894
Area of original plot	59.795 A
" " Circle	72.121 A
Latitude " centre of Clock Room	38°55'17"9
Longitude " " " "	77°04'02"5
Azimuth " " " " to Station b	148°46'49"

APPENDIX No. 7—1896.

A NEW SOLUTION OF A PRINCIPAL GEODETIC PROBLEM.

By CHAS. H. KUMMELL, Computer.

In my article in No. 2671 Astr. Nachr. "On the determination of the shortest distance between two points on a spheroid," I stated on page 105 that the inverse problem could not advantageously be solved by the forms given. A closer study, however, has gradually developed new forms well adapted to its most comprehensive solution.

This geodetic problem can properly only occur between intervisible points, since one of its data is the astronomical azimuth a_1 from the first to the second point. This must, however, first be reduced to the azimuth of the geodetic line or brachisthode α_1 by a formula first developed by Bessel and given by Helmert in the form:

$$\alpha_1 = a_1 - \frac{1}{12}\rho'' e^2 \frac{\Delta s^2}{a^2}\left(\cos^2\varphi_1 \sin 2a_1 + \frac{\Delta s}{a}\sin 2\varphi_1 \sin a_1\right) + \underline{|e^2.\, s^4|} \qquad (1)$$

Where $\rho'' = \frac{1}{\text{arc } 1''}$, e=eccentricity of meridian, a=equatorial radius, Δs=geodetic distance between the points, φ_1=astronomical latitude of first point. The symbol $\underline{|e^2.\, s^4|}$ indicates that the remainder of the series is of the second order with respect to e and of the fourth order with respect to $\frac{\Delta s}{a}$, which is generally a much smaller quantity than e and is about equal to it if $\Delta s = 500\ 000^m$. For the geodetic problem involving the encircling of the globe there can be no astronomical azimuth given.

Let φ_1=astronomical latitude of first point,
Δs=shortest distance,
a_1=azimuth of brachisthode at first point,
be the data of the problem, and let it be required to find
$\varphi_2 = \varphi_1 + \Delta\varphi$=astronomical latitude of second point,
$\Delta\lambda$=difference of longitudes,
$a_2 = 180^\circ + a_1 + \Delta\alpha$=back azimuth.
Also let ψ_1=reduced latitude of first point,
$\psi_2 = \psi_1 + \Delta\psi$=reduced latitude of second point,
ψ_0=highest (or lowest) reduced latitude of brachisthode at a point where it is perpendicular to the meridian.
Then the equation of the brachisthode is:

$$\cos\psi_0 = \sin\alpha\cos\psi = \sin a_1 \cos\psi_1 = -\sin\alpha_2\cos\psi_2, \qquad (2)$$

and the well-known relations between the astronomical and reduced latitudes are:

$$\tan\psi = \sqrt{1-e^2}\tan\varphi = \frac{b}{a}\tan\varphi \qquad (3)$$

$$\sin\psi = \frac{b\sin\varphi}{a\cos(e,\varphi)}\left(\text{viz., if } \sin(e,\varphi) = e\sin\varphi \quad \therefore \cos(e,\varphi) = \sqrt{1-e^2\sin^2\varphi}\right) \qquad (4)$$

$$\cos\psi = \frac{\cos\varphi}{\cos(e,\varphi)} \qquad (5)$$

Let ds=differential of the arc of the brachisthode,

dm=differential of the arc of the meridian ellipse.

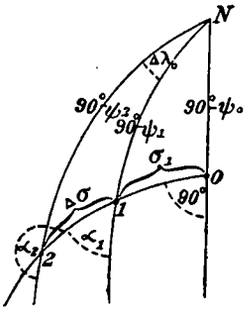
$$\text{then } ds=\frac{dm}{\cos\alpha}=-a\frac{d\psi}{\cos\alpha}\sqrt{1-e^2\cos^2\psi}=-ad\psi\cos\psi\sqrt{\frac{1-e^2\cos^2\psi}{\cos^2\psi-\cos^2\psi_0}} \tag{6}$$

Also let $d\lambda$=differential of longitude

$$=\frac{\sin\alpha}{a\cos\psi}ds=-\frac{\tan\alpha}{\cos\psi}d\psi\sqrt{1-e^2\cos^2\psi}=-\frac{\cos\psi_0}{\cos\psi}d\psi\sqrt{\frac{1-e^2\cos^2\psi}{\cos^2\psi-\cos^2\psi_0}} \tag{7}$$

$$\text{We have then } \Delta s=-a\int_{\psi_1}^{\psi_1+\Delta\psi}\frac{d\psi\cos\psi}{\sqrt{\cos^2\psi-\cos^2\psi_0}}\sqrt{1-e^2\cos^2\psi} \tag{8}$$

$$\Delta\lambda=-\int_{\psi_1}^{\psi_1+\Delta\psi}\frac{\cos\psi_0}{\cos\psi}d\psi\sqrt{\frac{1-e^2\cos^2\psi}{\cos^2\psi-\cos^2\psi_0}} \tag{9}$$



Assume spherical right triangles N01 and N02 in which $N0=90°-\psi_0$, $N1=90°-\psi_1$, $N2=90°-\psi_2$, so that the spherical arc 0.1.2 has at 0 the azimuth 90°, at 1 the azimuth α_1 and at 2 the forward azimuth $\alpha_2-180°$, or back azimuth α_2; then

$$\cos\psi_0=\sin\alpha_1\cos\psi_1=-\sin\alpha_2\cos\psi_2,$$

the equation of the brachisthode. Denote $0.1=\sigma_1$; $0.2=\sigma_2=\sigma_1+\Delta\sigma$. Then we have along this arc

$$\sin\psi=\sin\psi_0\cos\sigma \tag{10}$$

$$\therefore\cos\psi\,d\psi=-\sin\psi_0\sin\sigma\,d\sigma. \tag{11}$$

Transforming the integrals (8), (9) to the new variable σ and integrating between the limits σ_1 and $\sigma_2=\sigma_1+\Delta\sigma$, we have:

$$\Delta s=a\int_{\sigma_1}^{\sigma_1+\Delta\sigma}d\sigma\sqrt{1-e^2\cos^2\psi_0-e^2\sin^2\psi_0\sin^2\sigma} \tag{8'}$$

$$\Delta\lambda=\int_{\sigma_1}^{\sigma_1+\Delta\sigma}\frac{\cos\psi_0}{1-\sin^2\psi_0\cos^2\sigma}d\sigma\sqrt{1-e^2\cos^2\psi_0-e^2\sin^2\psi_0\sin^2\sigma} \tag{9'}$$

These are elliptic integrals to the modulus $\nu=\dfrac{e\sin\psi_0}{\sqrt{1-e^2\cos^2\psi_0}}$ (12)

and putting $e\cos\psi_0=\sin\eta$ $\quad\therefore\ \gamma=\dfrac{\sqrt{e^2-\sin^2\eta}}{\cos\eta}$ (13)

$$\gamma\sin\sigma=\sin(\gamma,\sigma)\qquad\therefore\ \sqrt{1-\gamma^2\sin^2\sigma}=\cos(\gamma,\sigma) \tag{14}$$

These integrals take the forms:

$$\Delta s = a\cos\eta\int_{\sigma_1}^{\sigma_1+\Delta\sigma} d\sigma\cos(\gamma,\sigma) \tag{8^{II}}$$

$$\Delta\lambda = e\sin\eta\cos\eta\int_{\sigma_1}^{\sigma_1+\Delta\sigma} d\sigma\frac{\cos(\gamma,\sigma)}{1-\cos^2\eta\cos^2(\gamma,\sigma)} \tag{9^{II}}$$

In the geodetic problem φ_1, Δs, and α_1 are known; and ψ_1, ψ_0, η, γ, and σ_1 can be readily computed. We have then to determine from (8^{II}) the range of integration $\Delta\sigma$ and use this in (9^{II}) to determine $\Delta\lambda$.

Placing in (9^{I}) $e=0$ and denoting the integral by $\Delta\lambda_0$= the spherical difference of longitude, we have

$$\Delta\lambda_0 = \int_{\sigma_1}^{\sigma_1+\Delta\sigma}\frac{\cos\psi_0\, d\sigma}{1-\sin^2\psi_0\cos^2\sigma} = \left[\arctan\frac{\tan\sigma}{\cos\psi_0}\right]_{\sigma_1}^{\sigma_1+\Delta\sigma}$$
$$= \left[\arctan\lambda\right]_{\lambda_1}^{\lambda_1+\Delta\lambda_0} \tag{15}$$

so that we have all along the brachisthode

$$\tan\lambda = \frac{\tan\sigma}{\cos\psi_0} \tag{16}$$

and we have also

$$\Delta\lambda_0 = \int_{\sigma_1}^{\sigma_1+\Delta\sigma}\frac{e\sin\eta\, d\sigma}{1-\cos^2\eta\cos^2(\gamma,\sigma)} \tag{15^{1}}$$

Deducting this from (9^{II}), we have

$$\Delta\lambda = \Delta\lambda_0 - e\sin\eta\int_{\sigma_1}^{\sigma_1+\Delta\sigma}\frac{d\sigma}{1+\cos\eta\cos(\gamma,\sigma)} \tag{17}$$

which simpler form may replace (9^{II}).

By Taylor's series we have:

$$\Delta\lambda = \Delta\lambda_0 - e\sin\eta\left\{\Delta\sigma\cdot\frac{1}{1+\cos\eta\cos(\gamma,\sigma_1)} + \frac{\Delta\sigma^2}{2}\cdot\frac{d}{d\sigma}\cdot\frac{1}{1+\cos\eta\cos(\gamma,\sigma_1)}\right\} + \boxed{e^4\cdot s^3} \tag{18}$$

$$= \Delta\lambda_0 - \frac{e\sin\eta\,\Delta\sigma}{1+\cos\eta\cos(\gamma,\sigma_1)} - \frac{\Delta\sigma^2}{2}\cdot\frac{\gamma^2\, e\sin\eta\cos\eta\sin\sigma_1\cos\sigma_1}{\cos(\gamma,\sigma_1)\,[1+\cos\eta\cos(\gamma,\sigma_1)]} + \boxed{e^4\cdot s^3} \tag{19}$$

For this we can write with the same order of precision:

$$\Delta\lambda = \Delta\lambda_0 - \frac{e\sin\eta\,\Delta\sigma}{1+\cos\eta\cos(\gamma,\sigma_1)} - \frac{\Delta\sigma^2}{4}\gamma^2\, e\tan\tfrac{1}{2}\eta\cos\eta\sin 2\sigma_1 + \boxed{e^4\cdot s^3}$$

$$= \Delta\lambda_0 - \frac{e\sin\eta\,\Delta\sigma}{1+\cos\eta\cos(\gamma,\sigma_1)} - \frac{e^3}{2}\cdot\frac{\tan\frac{1}{2}\eta}{\cos\eta}\sin 2\psi_1\cos\alpha_1\,\Delta\sigma^2 + \boxed{e^4\cdot s^3} \tag{20}$$

which is sufficient for any distance on the globe. The simpler form

$$\Delta\lambda = \Delta\lambda_0 - e\tan\tfrac{1}{2}\eta\,\Delta\sigma + \boxed{e^4\cdot s^2} \tag{21}$$

can be safely used for distances considerably greater than between intervisible points. If, however, $\Delta\alpha$ and $\Delta\varphi$ are known, we may use with advantage Dalby's theorem:

$$\tan\tfrac{1}{2}\Delta\lambda = -\frac{\cos\frac{1}{2}\Delta\varphi}{\sin\frac{1}{2}(\varphi_1+\varphi_2)}\tan\tfrac{1}{2}\Delta\alpha = -\frac{\cos\frac{1}{2}\Delta\varphi}{\sin\varphi_{1.5}}\tan\tfrac{1}{2}\Delta\alpha \tag{22}$$

which formula is of the order of precision $\boxed{e^4\cdot s^4}$ (see Helmert, page 151).

If we integrate (8^{II}) in the same manner we have:

$$\Delta s = a\cos\eta\left\{\Delta\sigma\cos(\gamma,\sigma_1)+\frac{\Delta\sigma^2}{2}\cdot\frac{d}{d\sigma}\cos(\gamma,\sigma_1)+\frac{\Delta\sigma^3}{6}\frac{d^2}{d\sigma^2}\cos(\gamma,\sigma_1)+\ \ldots\ \right\} \tag{23}$$

Now

$$\frac{d}{d\sigma}\cos(\gamma,\sigma_1)=-\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos(\gamma,\sigma_1)}$$

$$\frac{d^2}{d\sigma^2}\cos(\gamma,\sigma_1)=-\frac{\gamma^2(1-2\sin^2\sigma_1)\cos^2(\gamma,\sigma_1)+\gamma^4\sin^2\sigma_1\cos^2\sigma_1}{\cos^3(\gamma,\sigma_1)}$$

$$=-\frac{\cos^4(\gamma,\sigma_1)-\beta^2}{\cos^3(\gamma,\sigma_1)}\qquad\text{where }\beta^2=1-\gamma^2$$

$$\frac{d^3}{d\sigma^3}\cos(\gamma,\sigma_1)=\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos^5(\gamma,\sigma_1)}\left[\cos^4(\gamma,\sigma_1)+3\beta^2\right]$$

. . . . . .

$$\text{hence }\Delta s=a\cos\eta\left\{\Delta\sigma\cos(\gamma,\sigma_1)-\frac{\Delta\sigma^2}{2}\cdot\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos(\gamma,\sigma_1)}-\frac{\Delta\sigma^3}{6}\cdot\frac{\cos^4(\gamma,\sigma_1)-\beta^2}{\cos^3(\gamma,\sigma_1)}\right.$$

$$\left.+\frac{\Delta\sigma^4}{24}\cdot\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos^5(\gamma,\sigma_1)}\left[\cos^4(\gamma,\sigma_1)+3\beta^2\right]+\boxed{e^2\cdot s^5}\right. \tag{24}$$

This series being from its second term of the second order in eccentricity depends more on $\Delta\sigma$ to be a small quantity for its convergence and must not be used for very great distances. To obtain a series convergent for great distances, we may either develop cos (γ, σ) by the binomial theorem according to powers of $\gamma^2 < e^2$ and integrate, or better transform (8^{II}) to a modulus $\gamma'=\frac{1-\beta}{1+\beta}<\gamma$ and new amplitudes σ_1', $\sigma_1'+\Delta\sigma'$, which leads to a more convergent series. Such a series is given by Helmert, Vol. I, page 221, etc. Or we may descend still further in the modular scale until the modulus vanishes, as I have done in my article mentioned above. The best device for practical purposes, however, would be a table for $\int_0^\sigma d\sigma\cos(\gamma,\sigma)=E(\gamma,\sigma)$, which ought to extend from $\gamma=0$ to $\gamma=e$ and from $\sigma=0$ to $\sigma=90°$.

The table which Legendre has published in his Traité de Fonctions Elliptiques, Table IX, page 291, is such a table with intervals of 1° for $\gamma=\sin\theta$ and σ, too large, though, for convenient interpolation. However, we can use this table to find $E(\gamma,\sigma_1)$ from γ and σ_1 and then we have to the same modulus

$$E(\gamma,\sigma_1+\Delta\sigma)=\frac{\Delta s}{\cos\eta}+E(\gamma,\sigma_1) \tag{25}$$

which gives by inverse interpolation $\sigma_1+\Delta\sigma$. We are then in possession of the important quantity $\Delta\sigma$, so that in the spherical triangle 1. *N.* 2 three parts $90-\psi_1$, $180-\alpha_1$, $\Delta\sigma$ are given; and to determine the parts $\psi_1+\Delta\psi$, $\Delta\lambda_0$, $\alpha_1+\Delta\alpha$ is a problem of spherical trigonometry. However, the following system, using also the right triangle 0. *N.* 2, is very convenient:

$$\sin\psi_2=\sin\psi_0\cos\sigma_2 \tag{26}$$

$$\sin\alpha_2=-\frac{\cos\psi_1}{\cos\psi_2}\sin\alpha_1 \tag{27}$$

$$\sin\Delta\lambda_0=-\frac{\sin\alpha_2}{\cos\psi_1}\sin\Delta\sigma=\frac{\sin\alpha_1}{\cos\psi_2}\sin\Delta\sigma \tag{28}$$

Finally we pass from ψ_2 to φ_2 by (4) or tables for this purpose (for instance, Albrecht's Formelsammlung, page 197) and from $\Delta\lambda_0$ to $\Delta\lambda$ by (20) or (21).

I consider now the case when $\frac{\Delta s}{a}$ or $\Delta\sigma$ are nearly of the same order as e. If Δs had to be

determined from $\Delta\sigma$ then (24) would have the right kind of convergence for this case. Since Δs is given we have to express $\Delta\sigma$ in a series of $\frac{\Delta s}{a}$, which is obtained by the following process:

$$\text{If } \frac{\Delta s}{a\cos\eta} = \int_{\sigma_1}^{\sigma_1+\Delta\sigma} d\sigma \cos(\gamma,\sigma)$$

$$\text{then } \Delta\sigma = \frac{\Delta s}{a\cos\eta}\cdot\frac{1}{\cos(\gamma,\sigma_1)} + \frac{\Delta s^2}{2a^2\cos^2\eta}\cdot\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\right] + \frac{\Delta s^3}{6a^3\cos^3\eta}\cdot\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\right]\right] + \ldots \quad (29)$$

$$\text{We have } \frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\right] = \frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos^4(\gamma,\sigma_1)}$$

$$\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\right]\right] = \frac{\gamma^2(1-2\sin^2\sigma_1)\cos^2(\gamma,\sigma_1) + 4\gamma^2\sin^2\sigma_1\cos^2\sigma_1}{\cos^7(\gamma,\sigma_1)}$$

$$= \frac{-4\beta^2 + 3(1+\beta^2)\cos^2(\gamma,\sigma_1) - 2\cos^4(\gamma,\sigma_1)}{\cos^7(\gamma,\sigma_1)}$$

$$\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\frac{d}{d\sigma}\left[\frac{1}{\cos(\gamma,\sigma_1)}\right]\right]\right] = -\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos^{10}(\gamma,\sigma_1)}\left\{28\beta^2 - 15(1+\beta^2)\cos^2(\gamma,\sigma_1) + 6\cos^4(\gamma,\sigma_1)\right\}$$

. . . . . .

$$\text{Hence } \Delta\sigma = \frac{\Delta s}{a\cos\eta}\cdot\frac{1}{\cos(\gamma,\sigma_1)} + \frac{\Delta s^2}{2a^2\cos^2\eta}\cdot\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos^4(\gamma,\sigma_1)} - \frac{\Delta s^3}{6a^3\cos^3\eta}\cdot\frac{4\beta^2 - 3(1+\beta^2)\cos^2(\gamma,\sigma_1) + 2\cos^4(\gamma,\sigma_1)}{\cos^7(\gamma,\sigma_1)}$$

$$- \frac{\Delta s^4}{24a^4\cos^4\eta}\cdot\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos^{10}(\gamma,\sigma_1)}\left\{28\beta^2 - 15(1+\beta^2)\cos^2(\gamma,\sigma_1) + 6\cos^4(\gamma,\sigma_1)\right\} + \boxed{e^2\,.\,s^5} \quad (30)$$

Four terms are developed in series (24) and (30), although three generally exceed the required precision. This pair of series are then to three terms, omitting in the third the parts exceeding the order $\boxed{e^2\,.\,s^3}$:

$$\Delta s = a\cos\eta\left\{\Delta\sigma\cos(\gamma,\sigma_1) - \frac{\Delta\sigma^2}{2}\cdot\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos(\gamma,\sigma_1)} - \frac{\Delta\sigma^3}{6}\cdot\frac{\gamma^2\cos 2\sigma_1}{\cos(\gamma,\sigma_1)}\right\} + \boxed{e^2\,.\,s^4} \quad (24^{\text{I}})$$

$$\Delta\sigma = \frac{\Delta s}{a\cos\eta}\cdot\frac{1}{\cos(\gamma,\sigma_1)} + \frac{\Delta s^2}{2a^2\cos^2\eta}\cdot\frac{\gamma^2\sin\sigma_1\cos\sigma_1}{\cos^4(\gamma,\sigma_1)} + \frac{\Delta s^3}{6a^3\cos^3\eta}\cdot\frac{\gamma^2\cos 2\sigma_1}{\cos^5(\gamma,\sigma_1)} + \boxed{e^2\,.\,s^4} \quad (30^{\text{I}})$$

These series are expressed in terms of reduced latitudes by means of the relations:

$$\gamma^2 = \frac{e^2\sin^2\psi_0}{\cos^2\eta} \quad (31)$$

$$\gamma^2\sin\sigma_1\cos\sigma_1 = \frac{e^2\sin\psi_1\cos\psi_1}{\cos^2\eta}\cos\alpha_1 \quad (32)$$

$$\cos\eta\cos(\gamma,\sigma_1) = \sqrt{1-e^2\cos^2\psi_1} \quad (33)$$

$$\Delta s = a\Delta\sigma(1-e^2\cos^2\psi_1)^{\frac{1}{2}} - a\frac{\Delta\sigma^2}{2}\cdot\frac{e^2\sin\psi_1\cos\psi_1}{(1-e^2\cos^2\psi_1)^{\frac{1}{2}}}\cos\alpha_1 - a\frac{\Delta\sigma^3}{6}\cdot\frac{e^2(\sin^2\psi_1 - \cos^2\psi_1\cos^2\alpha_1)}{(1-e^2\cos^2\psi_1)^{\frac{1}{2}}} + \boxed{e^2\,.\,s^4} \quad (24^{\text{II}})$$

$$\Delta\sigma = \frac{\Delta s}{a(1-e^2\cos^2\psi_1)^{\frac{1}{2}}} + \frac{\Delta s^2 e^2\sin\psi_1\cos\psi_1\cos\alpha_1}{2a^2(1-e^2\cos^2\psi_1)^2} + \frac{\Delta s^3 e^2(\sin^2\psi_1 - \cos^2\psi_1\cos^2\alpha_1)}{6a^3(1-e^2\cos^2\psi_1)^{\frac{5}{2}}} + \boxed{e^2\,.\,s^4} \quad (30^{\text{II}})$$

Also in terms of astronomical latitudes they are:

$$\Delta s = \frac{b\Delta\sigma}{\cos(e,\varphi_1)} - \frac{a\Delta\sigma^2}{2\cos(e,\varphi_1)} e^2 \sin\varphi_1 \cos\varphi_1 \cos\alpha_1 - \frac{b\Delta\sigma^3}{6\cos(e,\varphi_1)} e^2\left(\sin^2\varphi_1 - \frac{a^2}{b^2}\cos^2\varphi_1\cos^2\alpha_1\right) + \overline{e^2 \cdot s^4} \qquad (24^{III})$$

$$\Delta\sigma = \frac{\Delta s}{b}\cos(e,\varphi_1) + \frac{a\Delta s^2}{2b^3}\cos^2(e,\varphi_1)\, e^2 \sin\varphi_1\cos\varphi_1\cos\alpha_1 + \frac{\Delta s^3}{6b^3}\cos^3(e,\varphi_1)\, e^2\left(\sin^2\varphi_1 - \frac{a^2}{b^2}\cos^2\varphi_1\cos^2\alpha_1\right) + \overline{e^2 \cdot s^4} \qquad (30^{III})$$

The following forms are, however, better adapted to computation:

$$\Delta s = (\Delta s)\left\{1 - B\Delta\sigma\cos\alpha_1\left(1 + \frac{2}{3}\Delta\sigma\cot 2\sigma_1\right)\right\} + \overline{e^2 \cdot s^4} \qquad (24^{IV})$$

$$\Delta\sigma = (\Delta\sigma)\left\{1 + B(\Delta\sigma)\cos\alpha_1\left(1 + \frac{2}{3}(\Delta\sigma)\cot 2\sigma_1\right)\right\} + \overline{e^2 \cdot s^4} \qquad (30^{IV})$$

where

$$(\Delta s) = \frac{b\Delta\sigma}{\cos(e,\varphi_1)} \qquad (34)$$

$$(\Delta\sigma) = \frac{\Delta s}{b}\cos(e,\varphi_1) \qquad (35)$$

$$B = \frac{e^2}{4}\cdot\frac{a}{b}\sin 2\varphi_1 \qquad (36)$$

This factor B could be tabulated for the latitude as argument. For intervisible points, however, the third term is generally insensible, and we have then

$$\Delta s = (\Delta s)\,(1 - B_1\,\Delta\sigma\cos\alpha_1) + \overline{e^2 \cdot s^3} \qquad (24^{V})$$

$$\Delta\sigma = (\Delta\sigma)\,(1 + B_1\,(\Delta\sigma)\cos\alpha_1) + \overline{e^2 \cdot s^3} \qquad (30^{V})$$

and even (34) and (35) will be sufficient.

The formulas (26), (27), (28) could now be used, but there is the difficulty that by using seven-place logarithmic tables ψ_2 hence φ_2 and α_2 hence a_2 could not be obtained more precise than $0''{\cdot}01$, and the use of ten-place tables is too laborious. But there is now a circumstance peculiar to the geodetic problem between intervisible points, that the quantities $\Delta\alpha$ and $\Delta\varphi$ are of the order $\overline{s}$ and can be computed with great precision from their sine or tangent. I shall now sketch out a convenient scheme for the computation.

1. Reduction of astronomical azimuth to geodetic azimuth by (1) or with sufficient precision

$$a_1 - \alpha_1 = A_1\,\Delta s^2 \sin a_1 + \overline{e^2 \cdot s^3} \qquad (37)$$

where the logarithm of $A_1 = \frac{1}{12}\rho''\frac{e^2}{a^2}\cos^2\varphi_1$ is tabulated for latitude. (38)

2. Computation of σ_1 by the formula

$$\tan\sigma_1 = \frac{a}{b}\cot\varphi_1\cos\alpha_1 \qquad (39)$$

3. Computation of $\Delta\sigma$. Compute

$$\log(\Delta\sigma) = \log\frac{\Delta s}{b}\cos(e,\varphi_1) \qquad (35^{I})$$

where log cos (e, φ_1) is either taken from a table, such as Helmert has given in Hoehere Geodæsie Volume I, page 625, for Bessel's elements, or else is computed by the formula:

$$\log\log\left[-\cos(e,\varphi_1)\right]=\log\left(\frac{e^2}{2}M\sin^2\varphi_1\right)+\frac{e^2}{2}M\sin^2\varphi_1 \tag{40}$$

then compute $\log \mathrm{I}=\log[(\Delta\sigma)B_1\cos\alpha_1]$ and, ($\log B$ being tabulated) (41)

also, if necessary, $\log \mathrm{II}=\log[\mathrm{I}\times\frac{2}{3}(\Delta\sigma)\cot 2\sigma_1]$ (42)

then compute $\log(\Delta\sigma'')=\log(\rho''(\Delta\sigma))$
and we have finally $\log\Delta\sigma''=\log(\Delta\sigma'')+M\,\mathrm{I}+M\,\mathrm{II}$ (43)

4. Computation of $\Delta\alpha$. We have

$$\sin\sigma_1=\cot\psi_0\cot\alpha_1$$

$$\sin(\sigma_1+\Delta\sigma)=\cot\psi_0\cot(\alpha_1+\Delta\alpha)$$

$$\therefore\frac{\sin(\sigma_1+\Delta\sigma)+\sin\sigma_1}{\sin(\sigma_1+\Delta\sigma)-\sin\sigma_1}=\frac{\cot(\alpha_1+\Delta\alpha)+\cot\alpha_1}{\cot(\alpha_1+\Delta\alpha)-\cot\alpha_1}$$

$$\text{or}\quad\frac{\tan\sigma_{1.5}}{\tan\frac{1}{2}\Delta\sigma}=-\frac{\sin(2\alpha_1+\Delta\alpha)}{\sin\Delta\alpha}=-\sin 2\alpha_1\cot\Delta\alpha-\cos 2\alpha_1$$

hence

$$\tan\Delta\alpha=-\frac{\sin 2\alpha_1\cot\sigma_{1.5}\tan\frac{1}{2}\Delta\sigma}{1+\cos 2\alpha_1\cot\sigma_{1.5}\tan\frac{1}{2}\Delta\sigma}$$

$$=\frac{\tan(\Delta\alpha)}{1-\Sigma} \tag{44}$$

where

$$\tan(\Delta\alpha)=-\sin 2\alpha_1\cot\sigma_{1.5}\tan\tfrac{1}{2}\Delta\sigma \tag{45}$$

and

$$\Sigma=\cot 2\alpha_1\tan(\Delta\alpha) \tag{46}$$

$(\Delta\alpha)$ is generally an approximate value for $\Delta\alpha$, except when α_1 is near 90°, for then $(\Delta\alpha)=2\Delta\alpha$. Formula (44), however, is rigorous in all cases.

5. Computation of $\Delta\varphi$. We have

$$\tan\tfrac{1}{2}\Delta\psi=-\frac{\cos\alpha_{1.5}}{\cos\frac{1}{2}\Delta\alpha}\tan\tfrac{1}{2}\Delta\sigma \tag{47}$$

We have now $\tan\Delta\psi=\dfrac{2\tan\frac{1}{2}\Delta\psi}{1-\tan^2\frac{1}{2}\Delta\psi}$

and also

$$\tan\Delta\psi=\frac{\tan(\psi_1+\Delta\psi)-\tan\psi_1}{1+\tan(\psi_1+\Delta\psi)\tan\psi_1}$$

$$=\frac{b/a\,[\tan(\varphi_1+\Delta\varphi)-\tan\varphi_1]}{1+(1-e^2)\tan(\varphi_1+\Delta\varphi)\tan\varphi_1}$$

$$=\frac{b/a\tan\Delta\varphi}{1-e^2\dfrac{\sin(\varphi_1+\Delta\varphi)\sin\varphi_1}{\cos\Delta\varphi}}$$

$$=\frac{b/a\tan\Delta\varphi}{\cos^2(e,\varphi_1)-e^2\sin\varphi_1\cos\varphi_1\tan\Delta\varphi}$$

Solving for $\tan\Delta\varphi$ we have:

$$\tan\Delta\varphi=\frac{a/b\cos^2(e,\varphi_1)\tan\Delta\psi}{1+\dfrac{a}{b}e^2\sin\varphi_1\cos\varphi_1\tan\Delta\psi} \tag{48}$$

or placing

$$\tan(\Delta\varphi)=\frac{a}{b}\cos^2(e,\varphi_1)\tan\Delta\psi \tag{49}$$

and

$$\mathrm{C}_1=\frac{e^2}{2}\cdot\frac{\sin 2\varphi_1}{\cos^2(e,\varphi_1)} \tag{50}$$

we have $$\tan \Delta\varphi = \frac{\tan (\Delta\varphi)}{1+C_1 \tan (\Delta\varphi)} \qquad (51)$$

The computation of $\Delta\varphi$ may then be done as follows:

First compute $\log \tan \frac{1}{2}\Delta\psi = \log \left(-\frac{\cos \alpha_{1\cdot 5}}{\cos \frac{1}{2}\Delta\alpha} \tan \frac{1}{2}\Delta\sigma \right)$

then $$\log \tan \Delta\psi = \log (2 \tan \tfrac{1}{2}\Delta\psi) + M \tan^2 \tfrac{1}{2}\Delta\psi \,(1+\tfrac{1}{2}\tan^2 \tfrac{1}{2}\Delta\psi)$$

or if $\tan \frac{1}{2}\Delta\psi$ is small enough

$$\log \tan \Delta\psi = \log (2 \tan \tfrac{1}{2}\Delta\psi) + M \tan^2 \tfrac{1}{2}\Delta\psi$$

or even $$= \log (2 \tan \tfrac{1}{2}\Delta\psi)$$

Then compute $\log \tan (\Delta\varphi) = \log \left(\frac{a}{b} \cos^2 (e, \varphi_1) \tan \Delta\psi \right)$

and we have finally $\log \tan \Delta\varphi = \log \tan (\Delta\varphi) + MC_1^* \tan (\Delta\varphi)\,(1+\frac{1}{2} C_1 \tan (\Delta\varphi))$

or $= \log \tan (\Delta\varphi) + MC_1 \tan (\Delta\varphi)$

or $= \log \tan (\Delta\varphi)$

6. Computation of $\Delta\lambda$. This might be computed rigorously by (28) and (21), but since Dalby's theorem holds good far beyond the greatest intervisible distances it is more convenient to use it. We have then

$$\tan \tfrac{1}{2}\Delta\lambda = -\frac{\cos \frac{1}{2}\Delta\varphi}{\sin \varphi_{1\cdot 5}} \tan \tfrac{1}{2}\Delta\alpha \qquad (52)$$

*Log MC should be tabulated for latitude.

I shall now compute the position of Königsberg from Berlin with Bessel's elements. (See Helmert's Höhere Geodaesie, Band I, Seite 244.)

$\log \Delta s^2 = 11{\cdot}4485$ $\log \sin 2a_1 = 9{\cdot}9414$ $\log A_1 = 8{\cdot}0192$ $\log (a_1 - \alpha_1) = 9{\cdot}4091$	Berlin ⟶ Königsberg.		$a_1 = 239^\circ\ 33'\ 00''{\cdot}946$ $\alpha_1 - a_1 = \quad\quad -0\ \ 257$ $\alpha_1 = 239\ \ 33\ \ 00\ \ {\cdot}689$ $\Delta\alpha = +5\ \ 43\ \ 08\ \ {\cdot}674$
$\log \Delta s^2 = 11{\cdot}4485$ $\log \sin 2\alpha_2 = 9{\cdot}8808$ $\log A_2 = 7{\cdot}9737$ $\log (a_2 - \alpha_2) = 9{\cdot}3030$	Königsberg ⟶ Berlin.		$\alpha_2 = 65\ \ 16\ \ 09\ \ {\cdot}363$ $a_2 - \alpha_2 = \quad\quad +0\ \ {\cdot}201$ $a_2 = 65\ \ 16\ \ 09\ \ {\cdot}564$
$\varphi_1 = 52^\circ\ 30'\ 16''{\cdot}700$ $\Delta\varphi = +2\ \ 12\ \ 33\ \ {\cdot}900$	Berlin. $\Delta s = 529979^m{\cdot}58$		$\lambda_1 = 0\ \ 00\ \ 00\ \ {\cdot}000$ $\Delta\lambda = -7\ \ 06\ \ 00\ \ {\cdot}000$
$\varphi_2 = 54\ \ 42\ \ 50\ \ {\cdot}600$	Königsberg.		$\lambda_2 = 7\ \ 06\ \ 00\ \ {\cdot}000$ E.
$\log \frac{a}{b} = 0{\cdot}0014541\ 8$ $\log \cot \varphi_1 = 9{\cdot}8849076\ 6$ $\log \cos \alpha_1 = 9{\cdot}7048223\ 6$ $\log \tan \sigma_1 = 9{\cdot}5911842\ 0$	$\sigma_1 = -21^\circ\ 18'\ 40''{\cdot}052$	$\log \tan \frac{1}{2}\Delta\sigma = 8{\cdot}6193484\ 4$ $\log \cot \sigma_{1\cdot5} = 0{\cdot}4648138\ 6$ $\log \sin 2\alpha_1 = 9{\cdot}9413966\ 2$ $\log \tan (\Delta\alpha) = 9{\cdot}0255589\ 2$	$\frac{1}{2}\Delta\sigma = 2^\circ\ 23'\ 00''{\cdot}704$ $\sigma_{1\cdot5} = -18\ \ 55\ \ 39\ \ {\cdot}348$ $2\alpha_1 = 119\ \ 06\ \ 01\ \ {\cdot}378$
$\log \Delta s = 5{\cdot}7242591\ 4$ $-\log b = 3{\cdot}1968107\ 2$ $\log \cos (e, \varphi_1) = 9{\cdot}9990857\ 5$ $\log (\Delta\sigma) = 8{\cdot}9201556\ 1$		$\log \cot 2\alpha_1 = 9{\cdot}7455444$ $\log \Sigma = 8{\cdot}7711033$ $\log (1 - \Sigma) = 0{\cdot}0249099\ 6$ $\log \tan \Delta\alpha = 9{\cdot}0006489\ 6$	$\Sigma = -0{\cdot}0590341\ 5$ $1 - \Sigma = \quad 1{\cdot}0590341\ 5$ $\Delta\alpha = +5^\circ\ 43'\ 08''{\cdot}674$
$\log B_1 = 7{\cdot}2087$ $\log \cos \alpha_1 = 9{\cdot}7048$ $\log I = 5{\cdot}8337$	$\log M = 6{\cdot}6378$	$\log \cos \alpha_{1\cdot5} = 9{\cdot}6657174\ 7$ $\log \sec \frac{1}{2}\Delta\alpha = \quad 5410\ 6$ $\log \tan \frac{1}{2}\Delta\sigma = 8{\cdot}6193484\ 4$	$\alpha_{1\cdot5} = 242\ \ 24\ \ 35\ \ {\cdot}026$ $\frac{1}{2}\Delta\alpha = +2\ \ 51\ \ 34\ \ {\cdot}337$
$\log \frac{2}{3} = 9.824$ $\log \cot 2\sigma_1 = 0{\cdot}036$ $\log II = 4{\cdot}614$	$\log M = 6{\cdot}638$	$\log \tan \frac{1}{2}\Delta\psi = 8{\cdot}2856069\ 9$ $\log 2 = 0{\cdot}3010300\ 0$ $+\ 1618\ 4$	$\log M = 6{\cdot}63778$ $\log \tan^2 \frac{1}{2}\Delta\psi = 6{\cdot}57121$ $3{\cdot}20899$ (+8)
$\log \rho'' = 5{\cdot}3144251\ 3$ $\log (\Delta\sigma'') = 4{\cdot}2345807\ 4$ $MI = \quad -296\ 1$ $MII = \quad\ 17\ 9$ $\log \Delta\sigma'' = 4{\cdot}2345529\ 2$	$\log MI = 2{\cdot}4715$ $\log MII = 1{\cdot}252$ $\Delta\sigma = 4^\circ\ 46'\ 01''{\cdot}408$	$\log \tan \psi = 8{\cdot}5867988\ 3$ $\log \frac{a}{b} = 0{\cdot}0014541\ 8$ $\log \cos^2 (e, \varphi_1) = 9{\cdot}9981715\ 0$ $\log \tan (\Delta\varphi) = 8{\cdot}5864245\ 1$ $-\ 542\ 4$ $\log \tan \Delta\varphi = 8{\cdot}5863702\ 7$	$\log MC_1 = 4{\cdot}1479$ $\log \tan (\Delta\varphi) = 8{\cdot}5864$ $2{\cdot}7343$ $\Delta\varphi = +2^\circ\ 12'\ 33''{\cdot}900$
		$\log \cos \frac{1}{2}\Delta\varphi = 9{\cdot}9999192\ 6$ $\log \operatorname{cosec} \varphi_{1\cdot5} = 0{\cdot}0942092\ 0$ $\log \tan \frac{1}{2}\Delta\alpha = 8{\cdot}6985333\ 4$ $\log \tan \frac{1}{2}\Delta\lambda = 8{\cdot}7926618\ 0$	$\frac{1}{2}\Delta\varphi = +1\ \ 06\ \ 16\ \ {\cdot}950$ $\frac{1}{2}\Delta\lambda = -3\ \ 33\ \ 00\ \ {\cdot}000$ $\Delta\lambda = -7\ \ 06\ \ 00\ \ {\cdot}000$

The agreement of these results with Helmert's, which were computed by ten-place logarithms, is very satisfactory. He found $\Delta\sigma\ (\Delta\varphi)=4^\circ\ 46'\ 01''\cdot41025$ and $\alpha_2=65^\circ\ 16'\ 09''\cdot36534$, the other quantities being identical.

The following example, in which the points are intervisible, is taken from the latest edition of the Coast Survey Tables, which are based on Clarke's spheroidal elements.

$\log \Delta s^2 = 10\cdot089$	Mt. Blue ⟶ Ragged.	$a_1 = 300^\circ\ 44'\ 02''\cdot91$
$\log \sin 2a_1 = \bar{9}\cdot944$		$\alpha_1 - a_1 = +0\cdot016$
$\log A_1 = 8\cdot159$		$\alpha_1 = 300\ 44\ 02\ \cdot926$
$\log (a_1 - \alpha_1) = \bar{8}\cdot192$		$\Delta\alpha = +50\ 03\ \cdot883$
$\log \Delta s^2 = 10\cdot089$		$\alpha_2 = 121\ 34\ 06\ \cdot809$
$\log \sin 2\alpha_1 = \bar{9}\cdot950$		$a_2 - \alpha_2 = -0\ \cdot016$
$\log A_2 = 8\cdot167$	Ragged ⟶ Mt. Blue.	$a_2 = 121\ 34\ 06\ \cdot793$
$\log (a_2 - \alpha_2) = \bar{8}\cdot206$		
$\varphi_1 = 44^\circ\ 43'\ 41''\cdot437$	Mt. Blue.	$\lambda_1 = 70\ 20\ 33\ \cdot157$
$\Delta\varphi = -\ 30\ 56\cdot052$	$\Delta s = 110743^m\cdot7$	$\Delta\lambda = -1\ 11\ 27\ \cdot828$
$\varphi_2 = 44\ 12\ 45\cdot385$	Ragged.	$\lambda_2 = 69\ 09\ 05\ \cdot329$
$\log \frac{a}{b} = 0\cdot0014747\ 9$	$\log \tan \frac{1}{2}\Delta\sigma = 7\cdot9393537\ 2$	$\frac{1}{2}\Delta\sigma = 0\ 29\ 53\ \cdot775$
$\log \cot \varphi_1 = 0\cdot0041208\ 0$	$\log \cot \sigma_{1\cdot5} = 0\cdot2767416\ 8$	$\sigma_{1\cdot5} = +27\ 52\ 05\ \cdot093$
$\log \cos \alpha_1 = 9\cdot7084678\ 8$	$\log \sin 2\alpha_1 = \bar{9}\cdot9437679\ 5$	$2\alpha_1 = 241\ 28\ 05\ \cdot852$
$\log \tan \sigma_1 = 9\cdot7140634\ 7$	$\log \tan (\Delta\alpha) = \bar{8}\cdot1598633\ 5$	
$\sigma_1 = +27^\circ\ 22'\ 11''\cdot318$	$\log \cot 2\alpha_1 = 9\cdot73534$	
$\log \Delta s = 5\cdot0443191$	$\log \Sigma = 7\cdot89520$	$\Sigma = 0\cdot0078560$
$-\log b = 3\cdot1967762\ 2$		
$\log \cos (e, \varphi_1) = 9\cdot9992708\ 5$	$\log (1-\Sigma) = 9\cdot9965747\ 2$	$1-\Sigma = 0\cdot9921440$
$\log (\Delta\sigma) = 8\cdot2403661\ 7$	$\log \tan \Delta\alpha = \bar{8}\cdot1632886\ 3$	$\Delta\alpha = +0^\circ\ 50'\ 03''\cdot883$
$\log B_1 = 7\cdot2298$	$\log \cos \alpha_{1\cdot5} = 9\cdot7137429\ 4$	$\alpha_{1\cdot5} = 301\ 09\ 04\ \cdot867$
$\log \cos \alpha_1 = 9\cdot7085$	$\log \sec \frac{1}{2}\Delta\alpha = 115\ 0$	$\frac{1}{2}\Delta\alpha = +0\ 25\ 01\ \cdot942$
$\log I = 5\cdot1787$	$\log \tan \frac{1}{2}\Delta\sigma = 7\cdot9393537\ 2$	
$\log \rho'' = 5\cdot3144251\ 3$	$\log \tan \frac{1}{2}\Delta\psi = \bar{7}\cdot6531081\ 6$	$\log M = 6\cdot6378$
$\log (\Delta\sigma'') = 3\cdot5547913\ 0$	$\log 2 = 0\cdot3010300\ 0$	$\log \tan^2 \frac{1}{2}\Delta\psi = \bar{5}\cdot3062$
$MI = +65\ 5$	$+87\ 9$	$\bar{1}\cdot9440$
$\log \Delta\sigma'' = 3\cdot5547978\ 5$	$\log \tan \Delta\psi = \bar{7}\cdot9541469\ 5$	
$\log M = 6\cdot6378$	$\log \frac{a}{b} = 0\cdot0014747\ 9$	
$\log MI = 1\cdot8165$	$\log \cos^2 (e, \varphi_1) = 9\cdot9985417\ 0$	$\log MC_1 = 4\cdot1687$
$\Delta\sigma = 0^\circ\ 59'\ 47''\cdot549$	$\log \tan (\Delta\varphi) = \bar{7}\cdot9541634\ 4$	$\log \tan (\Delta\varphi) = \bar{7}\cdot9542$
	$+132$	$\bar{2}\cdot1229$
	$\log \tan \Delta\varphi = \bar{7}\cdot9541767\ 1$	$\Delta\varphi = -0^\circ\ 30'\ 56''\cdot052$
	$\log \cos \frac{1}{2}\Delta\varphi = 9\cdot9999956\ 0$	$\frac{1}{2}\Delta\varphi = -0\ 15\ 28\ \cdot026$
	$\log \operatorname{cosec} \varphi_{1\cdot5} = 0\cdot1545667\ 1$	$\varphi_{1\cdot5} = 44\ 28\ 13\ \cdot411$
	$\log \tan \frac{1}{2}\Delta\alpha = 7\cdot8622355\ 9$	
	$\log \tan \frac{1}{2}\Delta\lambda = \bar{8}\cdot0167979\ 0$	$\frac{1}{2}\Delta\lambda = -0\ 35\ 43\ \cdot914$

The agreement with the results by the Coast Survey formulæ is also satisfactory, only the longitude λ_2 is greater by 0″·002.

I come now to the consideration of the third class of geodetic problems, when the distance is so small that the convergence of the series depends almost entirely on the small quantity $\frac{\Delta s}{a}$. The effect on my solution would consist in the omission of the reduction of astronomical to geodetic azimuth, the computation of $\Delta\sigma$ in one term, and in passing directly from $\tan\frac{1}{2}\Delta\psi$ to $\tan\frac{1}{2}\Delta\varphi$ by the approximate relation:

$$\tan\tfrac{1}{2}\Delta\varphi=\frac{b}{a}\cos^2(e,\varphi_1)\tan\tfrac{1}{2}\Delta\psi \qquad (53)$$

With all these simplifications, however, it is easily seen that the unnecessary rigor of my forms does not very well suit this class. It is much more convenient to compute $\Delta\varphi$, $\Delta\lambda$, and $\Delta\alpha$ from a few terms of the series given by Helmert, page 268. We find this plan followed in the convenient tables published by Prof. R. S. Woodward, pages 70–77 of Smithsonian Geographical Tables. He uses for each of the required quantities two terms and checks by Dalby's Theorem. Thus he has in our notation:*

$$\Delta\varphi=-\frac{\rho''}{R_1}\Delta s\cos\alpha_1-\frac{\rho''\tan\varphi_1}{2R_1N_1}\Delta s^2\sin^2\alpha_1+\boxed{s^3}$$

$$\Delta\lambda=\frac{\rho''}{N_1}\Delta s\sin\alpha_1-\frac{\rho''}{N_1^2}\sin\varphi_1\Delta s^2\sin\alpha_1\cos\alpha_1+\boxed{s^3}$$

$$\Delta\alpha=-\frac{\rho''}{N_1}\tan\varphi_1\Delta s\sin\alpha_1+\frac{\rho''}{2}\cdot\frac{1+2\tan^2\varphi_1}{N_1^2}\Delta s^2\sin\alpha_1\cos\alpha_1+\boxed{s^3}$$

and tabulates the factors depending only on the latitude. The limiting distance for the use of these tables is given by the author 12 000^m for 0″·01 to be reliable.

The Coast Survey Tables go an order higher in the computation of $\Delta\varphi$, using the equivalent of the following four terms from Helmert's more complete series, page 298, which, written in our notation and employing the principal radii of curvature $R=\frac{b^2}{a\cos^3(e,\varphi)}$, $N=\frac{a}{\cos(e,\varphi)}$ are as follows:

$$\Delta\varphi=-\frac{\rho''}{R_1}\Delta s\cos\alpha_1-\frac{\rho''}{2}\cdot\frac{\tan\varphi_1}{R_1N_1}\Delta s^2\sin^2\alpha_1-\frac{3}{4}e^2\frac{\sin 2\varphi_1}{\rho''\cos^2(e,\varphi_1)}[\Delta\varphi]^2+\frac{1+3\tan^2\varphi_1}{6N_1^2}(\Delta\varphi)\Delta s^2\sin^2\alpha_1$$
$$+\boxed{e^2\cdot s^4}$$

where

$$(\Delta\varphi)=\frac{\rho''}{R_1}\Delta s\cos\alpha_1 \qquad \text{and} \qquad [\Delta\varphi]=(\Delta\varphi)+\frac{\rho''}{2}\cdot\frac{\tan\varphi_1}{R_1N_1}\Delta s^2\sin^2\alpha_1$$

and the logarithms of the factors

$$B=\frac{\rho''}{R};\qquad C=\frac{\rho''}{2}\cdot\frac{\tan\varphi}{RN};\qquad D=\frac{3}{4}e^2\frac{\sin 2\varphi_1}{\rho''\cos^2(e_1\varphi_1)};\qquad E=\frac{1+3\tan^2\varphi_1}{6N^2}$$

are tabulated.

The longitude is then computed by the approximate formula:

$$\sin\Delta\lambda=\frac{\sin\alpha_1}{\cos\varphi_2}\sin\left(\frac{\Delta s}{N_2}\right)$$

and the azimuth by Dalby's theorem. If results are required correct to 0″·001, then these tables should not be used for distances >75 000^m. In their proper limits they are very convenient. An attempt to extend their sphere by adding terms would not be advisable, because we should have to add to the series for $\Delta\varphi$ three troublesome terms; also the approximate formula for $\Delta\lambda$ had to be replaced by a series of seven terms.† Only the azimuth could be still computed by Dalby's theorem.

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*Smithsonian Geographical tables p. lx.

†Vide Helmert's Geodæsie Vol. I, page 298.

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APPENDIX No. 8—1896.

TABLES OF CROSS SECTIONS ON THE NORTH SHORES OF NANTUCKET AND MARTHAS VINEYARD, MASSACHUSETTS.

By H. L. MARINDIN, Assistant.

OFFICE OF THE COAST AND GEODETIC SURVEY,
Washington, D. C., February 29, 1896.

SIR: I have the honor to submit tabulated cross sections of the shores of the islands of Nantucket and Marthas Vineyard, off the coast of Massachusetts, being the results from the reduction of the field notes of a party in my charge during the summer of 1894.

The comparison of the position of the shore line (high-water line) in 1887 and 1894 indicates a retreat of the shore of 0·18 m. per year for that part of the north shore of Nantucket lying between the harbor of Nantucket and the western end of the island. This large erosion was not anticipated, judging by the comparatively sheltered position of the northern shore, but it might have been inferred from the well-defined retreat of both the eastern and southern shores, that for the former having been found to have been 0·19 m. per year and for the latter 1·42 m. per year between 1846 and 1891.

The reduction of the cross sections measured on the north shore of Marthas Vineyard between the harbor of Edgartown and the bluffs south of Cottage City indicates an advance of this sandy shore at the rate of 0·2 m. per year between 1888 and 1894. This is so far the only instance where an accretion to the shore is noted on either of the islands under examination.

The observations made in 1891–92 on the south shore show a rapid wasting away of the coast line. The yearly loss has not been ascertained, as no comparison has as yet been made with earlier surveys; but we know that the waste on the south shore is not compensated by any known accretion to the northern shore.

Before closing I would respectfully recommend the reduction of the field notes of cross sections measured between Long Point and the entrance into the inner harbor of Nantucket—this would complete the contour of the island—and also that a comparison be made between the results of the reduction of the observations made on the south shore of the "Vineyard" in 1891–92 with earlier surveys.

In asking that the accompanying tables be published in the Annual Report, it may be said that two objects will be attained—one, the multiplication of copies of information, the value of which increases as time passes; and another, by offering the possibility of reproducing with accuracy the position of the shore line at the date of the surveys compared, or, in other words, reproducing the topographical delineation of the shore line without recourse to the aid of the topographical sheet.

Very respectfully,

HENRY L. MARINDIN,
Assistant.

Gen. W. W. DUFFIELD,
Superintendent United States Coast and Geodetic Survey.

CROSS-SECTION No. 2.

[Origin: Latitude, 41° 17′ 29″·52; longitude, 70° 6′ 21″·48; azimuth, 179° 5′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	7·8	
20	4·8	
40	4·3	
60	4·2	
80	4·5	
100	4·9	
120	5·1	
140	4·2	
160	4·3	
180	2·8	
200	3·6	
220	3·2	
240	5·7	
260	7·5	
280	6·6	
300	7·4	
320	4·8	
340	4·9	
360	5·2	
380	5·7	
400	5·2	
412	4·6	Beach stake.
420	3·3	
440	0·4	
460	— 2·0	Water.
480	— 3·0	
500	— 5·0	
550	— 4·5	
600	— 6·5	
650	— 7·0	
700	— 6·5	
750	— 7·5	
800	— 5·0	
850	— 5·0	
900	— 6·5	
950	— 6·5	
1 000	— 7·5	
1 050	— 8·0	
1 100	— 8·5	
1 150	— 7·5	
1 200	— 8·0	
1 250	— 8·5	
1 300	— 9·0	
1 350	— 8·5	
1 400	— 6·0	
1 450	— 7·0	
1 500	— 8·0	
1 550	— 7·5	
1 600	— 8·0	
1 650	— 8·0	
1 700	— 9·0	
1 750	— 6·5	
1 800	—10·0	
1 850	— 8·0	
1 900	—13·0	
1 950	—16·0	
2 000	—16·0	
2 050	—17·5	
2 100	—19·5	
2 150	—20·5	
2 200	—21·5	

CROSS-SECTION No. 4.

[Origin: Latitude, 41° 17′ 30″·57; longitude, 70° 6′ 26″·85; azimuth, 179° 4′.]

0	42·5	
20	42·8	

CROSS-SECTION No. 4—Continued.

[Origin: Latitude, 41° 17′ 30″·57; longitude, 70° 6′ 26″·85; azimuth, 179° 4′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
40	34·6	
60	20·4	
80	14·5	
100	10·6	
120	5·2	
140	4·9	
160	4·5	
180	3·9	
200	3·2	
220	4·8	
240	8·1	
260	10·7	
280	12·2	
290	12·0	Bluff stake.
300	11·7	
320	11·7	
350	5·2	Shore line in 1887.
360	5·2	
380	4·6	Shore line in 1894.
396	— 1·5	Low-water line in 1894.
400	— 2·0	
450	— 5·5	
500	— 3·0	
550	— 6·5	
600	— 7·0	
650	— 7·5	
700	— 7·0	
750	— 6·0	
800	— 6·5	
850	— 6·5	
900	— 8·5	
950	— 8·0	
1 000	— 7·5	
1 050	— 8·5	
1 100	— 9·0	
1 150	— 9·5	
1 200	— 8·5	
1 250	— 8·0	
1 300	— 8·5	
1 350	— 5·5	
1 400	— 7·5	
1 450	— 7·5	
1 500	— 8·0	
1 550	— 7·5	
1 600	— 7·5	
1 650	— 8·0	
1 700	— 7·5	
1 750	— 9·5	
1 800	— 8·5	
1 850	—13·5	
1 900	—15·0	
1 950	—15·5	
2 000	—16·5	
2 050	—19·5	
2 100	—20·5	
2 150	—21·5	

CROSS-SECTION No. 6.

[Origin: Latitude, 41° 17′ 33″·94; longitude, 70° 6′ 32″·31; azimuth, 179° 42′.]

0	39·6	
20	39·3	
40	39·4	
60	38·7	
80	38·1	
100	38·8	

CROSS-SECTION No. 6—Continued.

[Origin: Latitude, 41° 17′ 33″·94; longitude, 70° 6′ 32″·31; azimuth, 179° 42′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
120	34·3	
140	35·6	
160	36·8	
180	35·9	
198	34·9	Edge of bluff.
200	32·0	
220	12·2	
223	9·7	Begins rapid rise.
240	5·8	
247	.....	Shore line in 1887.
250	4·9	Foot of bluff.
267	.....	Shore line in 1894.
288	— 1·5	Low-water line in 1894.
300	— 5·0	
350	— 5·5	
400	— 5·5	
450	— 6·0	
500	— 7·5	
550	— 8·5	
600	— 8·0	
650	— 7·0	
700	— 8·5	
750	— 9·0	
800	— 9·0	
850	— 6·5	
900	— 9·5	
950	— 9·0	
1 000	— 8·0	
1 050	— 8·0	
1 100	— 9·0	
1 150	— 7·5	
1 200	— 8·0	
1 250	— 7·0	
1 300	— 7·5	
1 350	— 8·0	
1 400	— 8·0	
1 450	— 9·0	
1 500	— 8·0	
1 550	— 8·5	
1 600	— 9·0	
1 650	— 9·0	
1 700	—10·0	
1 750	—12·5	
1 800	—16·0	
1 850	—17·5	
1 900	—18·0	
1 950	—19·0	

CROSS-SECTION No. 8.

[Origin: Latitude, 41° 17′ 33″·38; longitude, 70° 6′ 33″·22; azimuth, 179° 14′.]

0	42·0	
20	42·3	
40	44·8	
60	45·2	
80	45·9	
100	46·8	
120	48·3	
140	49·8	
160	49·1	
180	46·2	
200	46·0	
214	40·3	Bluff stake.
220	33·8	

CROSS-SECTION No. 8—Continued.

[Origin: Latitude, 41° 17′ 33″·38″; longitude, 70° 6′ 33″·22; azimuth, 179° 14′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
240	16·0	
256	5·8	Foot of bluff.
263	4·2	Shore line in 1878.
270	.....	Shore line in 1894.
290	— 1·5	Low-water line in 1894.
300	— 3·0	
350	— 6·0	
400	— 4·5	
450	— 7·0	
500	— 9·0	
550	—10·0	
600	—10·0	
650	— 9·5	
700	— 9·5	
750	— 9·5	
800	—10·0	
850	— 9·5	
900	— 9·0	
950	— 8·5	
1 000	— 9·0	
1 050	— 7·5	
1 100	— 6·7	
1 150	— 9·0	
1 200	— 8·5	
1 250	— 8·0	
1 300	— 7·5	
1 350	— 7·5	
1 400	— 8·5	
1 450	— 8·5	
1 500	— 8·5	
1 550	— 8·5	
1 600	— 9·0	
1 650	— 9·5	
1 700	—10·5	
1 750	—13·5	
1 800	—14·5	
1 850	—17·5	
1 900	—19·0	

CROSS-SECTION No. 10.

[Origin: Latitude, 41° 17′ 32″·80; longitude, 70° 6′ 42″·89; azimuth, 179° 49′.]

0	47·0	
20	42·3	
40	42·9	
60	51·7	
80	52·0	
100	48·6	
120	48·9	
140	53·2	
160	61·2	
180	67·0	
200	61·8	
214	56·4	Bluff stake.
216	55·9	Edge of bluff.
220	48·4	
240	23·4	
255	7·0	Foot of bluff.
260	4·3	
270	.....	Shore line in 1894.
274	.....	Shore line in 1887.
282	— 1·5	Low-water line in 1894.
300	— 4·0	
350	— 4·5	

CROSS-SECTION NO. 10—Continued.

[Origin: Latitude, 41° 17′ 32″·80; longitude, 70° 6′ 42″·89; azimuth, 179° 49′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
400	— 6·0	
450	— 8·5	
500	—10·0	
550	—10·5	
600	—10·5	
650	—10·0	
700	— 9·5	
750	— 9·0	
800	—10·0	
850	—10·0	
900	—10·0	
950	— 9·5	
1 000	— 9·5	
1 050	— 8·5	
1 100	— 9·0	
1 150	— 9·0	
1 200	— 8·0	
1 250	— 7·0	
1 300	— 9·0	
1 350	— 8·7	
1 400	— 8·2	
1 450	— 8·2	
1 500	— 9·0	
1 550	— 8·7	
1 600	— 9·2	
1 650	— 9·2	
1 700	—10·2	
1 750	—12·5	
1 800	—16·2	
1 850	—17·2	
1 900	—20·0	
1 950	—21·2	
2 000	—21·7	

CROSS-SECTION NO. 12.

[Origin: Latitude, 41° 17′ 32″·02; longitude, 70° 6′ 47″·14; azimuth, 178° 53′.]

0	35·9	
20	30·7	
40	29·4	
60	33·0	
80	35·1	
100	37·7	
120	38·5	
140	39·9	
160	44·4	
180	50·8	
200	59·4	
214	55·9	Bluff stake.
220	46·4	
240	22·2	
257	4·0	Foot of bluff.
268	2·8	Shore line in 1894.
285	.....	Low-water line in 1894.
286	— 1·5	Shore line in 1878.
300	— 4·0	
350	— 5·5	
400	— 5·7	
450	— 7·5	
500	— 9·7	
550	— 9·0	
600	— 8·7	
650	— 8·7	
700	— 8·2	

CROSS-SECTION NO. 12—Continued.

[Origin: Latitude, 41° 17′ 32″·02; longitude, 70° 6′ 47″·14; azimuth, 170° 53′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
750	— 7·2	
800	— 9·7	
850	— 8·7	
900	— 9·2	
950	— 9·2	
1 000	— 9·2	
1 050	— 9·2	
1 100	— 9·7	
1 150	— 9·2	
1 200	— 9·0	
1 250	— 9·0	
1 300	— 8·5	
1 350	— 8·0	
1 400	— 8·5	
1 450	— 8·5	
1 500	— 9·0	
1 550	— 9·0	
1 600	— 9·5	
1 650	—10·0	
1 700	—10·5	
1 750	—12·5	
1 800	—17·0	
1 850	—18·5	
1 900	—19·5	
1 950	—21·0	
2 000	—21·5	

CROSS-SECTION NO. 14.

[Origin: Latitude, 41° 17′ 33″·71; longitude, 70° 6′ 53″·15; azimuth, 179° 30′.]

0	37·3	
20	45·3	
40	51·2	
60	54·3	
80	54·4	
100	49·0	
120	45·0	
140	53·2	
160	51·4	
168	51·8	Bluff stake.
169	51·9	Edge of bluff.
180	30·0	
192	8·0	Foot of bluff.
200	3·6	
203	.....	Shore line in 1894.
221	.....	Shore line in 1887.
221	.....	Low-water line in 1894.
223	— 1·5	Low-water line in 1887.
250	— 4·5	
300	— 7·0	
350	— 5·2	
400	— 7·0	
450	— 9·0	
500	— 9·0	
550	— 9·0	
600	— 9·0	
650	— 9·2	
700	— 9·2	
750	— 6·7	
800	— 7·7	
850	— 9·5	
900	— 8·5	
950	—10·0	
1 000	— 9·0	

CROSS-SECTION No. 14—Continued.

[Origin: Latitude, 41° 17′ 33″·71; longitude, 70° 6′ 53″·15; azimuth, 179° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 050	— 9·5	
1 100	— 9·5	
1 150	— 8·5	
1 200	— 9·0	
1 250	— 9·5	
1 300	— 8·5	
1 350	— 8·5	
1 400	— 8·5	
1 450	— 9·0	
1 500	— 9·5	
1 550	—10·0	
1 600	—11·0	
1 650	—10·5	
1 700	—14·5	
1 750	—17·5	
1 800	—19·5	
1 850	—20·5	
1 900	—21·5	

CROSS-SECTION No. 16.

[Origin: Latitude, 41° 17′ 32″·09; longitude, 70° 6′ 58″·52; azimuth, 179° 32′.]

0	30·6	
20	37·2	
40	42·2	
60	42·0	
80	41·0	
100	40·8	
120	34·7	
140	35·6	
160	39·6	
180	47·6	
200	53·1	
214	51·1	Edge of bluff.
220	37·0	
236	7·3	Foot of bluff.
240	5·3	
250	.....	Shore line in 1894.
260	— 0·2	
262	.....	Shore line in 1887.
264	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 6·5	
400	— 6·0	
450	— 6·5	
500	— 8·5	
550	— 9·5	
600	— 9·7	
650	— 8·7	
700	— 8·5	
750	— 9·0	
800	— 9·5	
850	— 9·0	
900	— 9·0	
950	— 7·0	
1 000	— 9·5	
1 050	— 9·5	
1 100	— 9·5	
1 150	— 9·0	
1 200	— 8·5	
1 250	— 8·5	
1 300	— 8·0	
1 350	— 8·0	
1 400	— 8·5	

CROSS-SECTION No. 16—Continued.

[Origin: Latitude, 41° 17′ 32″·09; longitude, 70° 6′ 58″·52; azimuth, 179° 32′.]

Distance from origin.	Height above or below mean sea level	Remarks.
Metres.	*Feet.*	
1 450	— 9·0	
1 500	— 8·5	
1 550	—10·0	
1 600	—10·5	
1 650	— 7·5	
1 700	—11·0	
1 750	—15·5	
1 800	—18·5	

CROSS-SECTION No. 18.

[Origin: Latitude, 41° 17′ 32″·09; longitude, 70° 7′ 3″·70; azimuth, 179° 22′.]

0	39·2	
20	43·4	
40	48·0	
60	51·2	Near porch of Sanitarium.
80	47·3	
100	46·0	
120	47·1	
140	45·2	
160	45·5	
180	44·1	
200	50·9	
214	42·2	Bluff stake.
220	28·2	
235	4·6	Foot of bluff.
240	2·8	
251	.....	Shore line in 1894.
260	.....	Shore line in 1887.
266	— 1·5	Low-water line in 1894.
300	— 5·5	
350	— 6·5	
400	— 3·5	
450	— 7·0	
500	— 8·5	
550	— 9·0	
600	— 8·0	
650	— 7·5	
700	— 8·5	
750	— 9·0	
800	— 9·0	
850	— 8·5	
900	— 8·5	
950	— 8·0	
1 000	— 8·2	
1 050	— 9·5	
1 100	— 9·0	
1 150	— 9·0	
1 200	— 9·0	
1 250	— 8·5	
1 300	— 8·5	
1 350	— 8·0	
1 400	— 8·0	
1 450	— 8·5	
1 500	— 9·0	
1 550	—11·0	
1 600	— 6·5	
1 650	—10·5	
1 700	—13·0	
1 750	—16·0	
1 800	—18·0	
1 850	—20·5	
1 900	—21·5	

CROSS-SECTION NO. 20.

[Origin: Latitude, 41° 17′ 29″·23; longitude, 70° 7′ 9″·00; azimuth, 179° 21′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	39·4	
20	34·4	
40	39·8	
60	37·5	
80	33·3	
100	33·7	
120	34·2	
140	35·4	
160	34·9	
180	29·8	
200	34·8	
220	39·1	
240	40·0	
260	42·4	
280	42·0	
300	42·3	
305	42·2	Bluff stake.
306	42·2	Edge of bluff.
320	14·2	
328	5·0	Foot of bluff.
338	.....	Shore line in 1894.
340	1·4	
352	.....	Shore line in 1887.
355	— 1·5	Low-water line 1894.
400	— 5·5	
450	— 6·0	
500	— 6.5	
550	— 6·0	
600	— 8·5	
650	— 8·5	
700	— 9·5	
750	— 9·0	
800	— 9·5	
850	— 9·5	
900	—10·0	
950	— 9·5	
1 000	— 9·0	
1 050	— 9·0	
1 100	— 9·5	
1 150	—10·0	
1 200	— 9·5	
1 250	— 9·0	
1 300	— 9·0	
1 350	— 8·5	
1 400	— 8·0	
1 450	— 7·5	
1 500	— 8·0	
1 550	— 8·7	
1 600	—10·7	
1 650	— 8·0	
1 700	— 6·7	
1 750	—11.5	
1 800	—14.5	
1 850	—17·5	
1 900	—18·0	
1 950	—21·0	
2 000	—21·5	

CROSS-SECTION NO. 22.

[Origin: Latitude, 41° 17′ 31″·54; longitude, 70° 7′ 14″·13; azimuth, 179° 13′.]

0	13·3	
20	14·6	
40	16·5	

CROSS-SECTION NO. 22—Continued.

[Origin: Latitude, 41° 17′ 31″·54; longitude, 70° 7′ 14″·13; azimuth, 179° 13′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
60	17·3	
80	19·3	
100	20·0	
120	21·7	
140	21·3	
160	21·4	
180	20·5	
200	17·3	
220	17·9	
240	21·3	
244	22·2	Bluff stake.
246	21·0	Edge of bluff.
250	4·7	Foot of bluff.
266	.....	Shore line in 1894.
276	.....	Shore line in 1887.
282	— 1·5	Low-water line 1894.
300	— 4·5	
350	— 5·5	
400	— 6·7	
450	— 5·5	
500	— 6·5	
550	— 7·5	
600	— 8·0	
650	— 9·5	
700	— 9·5	
750	— 9·7	
800	— 8·7	
850	— 9·7	
900	— 8·7	
950	— 7·7	
1 000	— 9·5	
1 050	— 8·7	
1 100	— 8·7	
1 150	— 8·7	
1 200	— 8·7	
1 250	— 8·7	
1 300	— 8·5	
1 350	— 8·0	
1 400	— 7·7	
1 450	— 8·5	
1 500	— 9·7	
1 550	—10·7	
1 600	— 6·7	
1 650	— 7·7	
1 700	—11·7	
1 750	—14·5	
1 800	—16·7	
1 850	—19·5	

CROSS-SECTION NO. 24.

[Origin: Latitude, 41° 17′ 32″·38; longitude, 70° 7′ 19″·64; azimuth, 179° 14′.]

0	20·4	
20	20·7	
40	15·2	
60	11·7	
80	11·3	
100	9·7	
120	9·3	
140	9·0	
160	11·7	
180	13·9	
200	14·0	
220	16·8	

CROSS-SECTION No. 24—Continued.

[Origin: Latitude, 41° 17′ 32″·38; longitude, 70° 7′ 19″·64; azimuth, 179° 14′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
229	19·5	Bluff stake.
230	19·9	Edge of bluff.
233	5·1	Foot of bluff.
240	2·8	
244	.....	Shore line in 1894.
250	.....	Shore line in 1887.
260	— 1·5	Low-water line in 1894.
300	— 4·0	
350	— 6·5	
400	— 8·0	
450	— 5·7	
500	— 7·5	
550	— 5·7	
600	— 9·2	
650	— 6·7	
700	— 9·5	
750	— 8·7	
800	— 9·7	
850	— 9·2	
900	— 8·7	
950	— 8·7	
1 000	— 7·7	
1 050	— 8·5	
1 100	— 9·2	
1 150	— 9·2	
1 200	— 9·2	
1 250	— 9·2	
1 300	— 9·2	
1 350	— 8·2	
1 400	— 8·2	
1 450	— 9·7	
1 500	— 8·7	
1 550	— 6·2	
1 600	— 9·2	
1 650	—13·5	
1 700	—17·5	
1 750	—19·5	
1 800	—19·7	
1 850	—20·2	

CROSS-SECTION No. 26.

[Origin: Latitude, 41° 17′ 32″·57; longitude, 70° 7′ 24″·92; azimuth, 179° 30′.]

0	8·7	
20	10·2	
40	8·6	
60	6·8	
80	6·6	
100	6·3	
120	8·0	
140	11·2	
160	14·4	
180	14·7	
200	17·2	
214	21·5	Bluff stake and edge.
218	6·2	Foot of bluff.
229	.....	Shore line in 1894.
243	.....	Shore line in 1887.
250	— 1·5	Low-water line in 1894.
300	— 4·7	
350	— 6·7	
400	— 5·7	
450	— 4·7	
500	— 7·7	

CROSS-SECTION No. 26—Continued.

[Origin: Latitude 41° 17′ 32″·57; longitude, 70° 7′ 24″·92; azimuth 179° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
550	— 6·7	
600	— 8·5	
650	— 9·5	
700	— 9·2	
750	—10·2	
800	—10·7	
850	—10·2	
900	—10·2	
950	—10·2	
1 000	— 9·5	
1 050	— 9·2	
1 100	— 8·2	
1 150	— 8·2	
1 200	— 8·7	
1 250	— 9·2	
1 300	—10·2	
1 350	— 8·7	
1 400	— 9·2	
1 450	—10·2	
1 500	—10·0	
1 550	— 6·7	
1 600	—10·5	
1 650	—14·7	
1 700	—17·7	
1 750	—19·2	
1 800	—20·2	
1 850	—20·7	
1 900	—20·7	

CROSS-SECTION No. 28.

[Origin: Latitude, 41° 17′ 28″·68; longitude, 70° 7′ 29″·74; azimuth, 178° 57′.]

0	39·6	
20	35·2	
40	32·4	
60	29·6	
80	19·6	
100	8·5	
120	4·8	
139	4·5	Edge of pond.
160	.....	Pond.
180	.....	"
200	.....	"
220	.....	"
240	3·8	Edge of pond.
260	5·4	
280	5·4	
300	8·0	
320	11·8	
336	14·5	Bluff stake.
340	14·8	Edge of bluff.
353	.....	Shore line in 1894.
358	.....	Shore line in 1887.
369	— 1·5	Low-water line in 1894.
400	— 3·7	
450	— 6·7	
500	— 7·2	
550	— 6·2	
600	— 7·7	
650	— 5·7	
700	— 9·7	
750	— 8·2	
800	— 9·7	
850	— 9·0	

CROSS-SECTION No. 28—Continued.

[Origin: Latitude, 41° 17′ 28″·68; longitude, 70° 7′ 29″·74; azimuth, 178° 57′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
900	—10·0	
950	— 9·5	
1 000	— 9·0	
1 050	— 9·5	
1 100	— 9·5	
1 150	— 9·5	
1 200	— 9·0	
1 250	— 8·5	
1 300	— 8·0	
1 350	— 8·0	
1 400	— 8·5	
1 450	— 9·0	
1 500	—10·0	
1 550	—10·5	
1 600	—10·5	
1 650	— 8·0	
1 700	—11·0	
1 750	—16·5	
1 800	—18·0	
1 850	—19·0	
1 900	—19·5	
1 950	—20·0	
2 000	—20·0	

CROSS-SECTION No. 29.

[Origin: Latitude, 41° 17′ 32″·41; longitude, 70° 7′ 35″·24; azimuth, 179° 37′.]

0	39·6	
20	26·4	
40	27·8	
60	31·7	
80	34·8	
100	26·6	
120	23·4	
140	20·4	
160	22·3	
180	22·0	
200	24·0	
216	20·8	Bluff stake.
217	20·2	Edge of bluff.
220	5·6	Foot of bluff.
230	.....	Shore line in 1878, 1894.
240	— 1·5	Low-water line in 1894.
250	— 2·0	
300	— 4·5	
350	— 6·5	
400	— 7·5	
450	— 8·5	
500	— 8·5	
550	— 8·0	
600	— 8·5	
650	— 8·5	
700	—10·0	
750	— 9·0	
800	— 9·5	
850	— 9·5	
900	— 9·0	
950	— 8·5	
1 000	— 7·5	
1 050	— 7·5	
1 100	— 9·0	
1 150	— 9·0	
1 200	— 9·0	

CROSS-SECTION No. 29—Continued.

[Origin: Latitude, 41° 17′ 32″·41; longitude, 70° 7′ 35″·24; azimuth, 179° 37′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 250	— 8·5	
1 300	— 8·5	
1 350	— 9·5	
1 400	—10·0	
1 450	—10·5	
1 500	—10·0	
1 550	— 7·0	
1 600	—13·5	
1 650	—17·0	
1 700	—17·5	
1 750	—19·0	
1 800	—20·0	
1 850	—20·5	
1 900	—20·5	
1 950	—21·5	

CROSS-SECTION No. 31.

[Origin: Latitude, 41° 17′ 34″·39; longitude, 70° 7′ 40″·65; azimuth, 179° 37′.]

0	31·8	
20	24·8	
40	24·9	
60	27·9	
80	28·5	
100	28·0	
120	28·0	
140	25·3	
153	24·1	Bluff stake.
154	23·9	Edge of bluff.
161	6·2	Foot of bluff.
173	.....	Shore line in 1887.
179	.....	Shore line in 1894.
187	— 1·5	Low-water line in 1894.
200	— 5·5	
250	— 4·7	
300	— 6·5	
350	— 5·0	
400	— 7·5	
450	— 9·5	
500	— 9·5	
550	— 8·7	
600	— 6·0	
650	— 6·0	
700	— 8·5	
750	— 9·5	
800	— 8·5	
850	— 8·5	
900	— 9·5	
950	— 9·5	
1 000	— 9·0	
1 050	— 9·0	
1 100	— 8·5	
1 150	— 7·5	
1 200	— 8.5	
1 250	— 8·5	
1 300	— 8·7	
1 350	— 9·5	
1 400	—10·5	
1 450	— 7·7	
1 500	— 9·0	
1 550	—14·7	
1 600	—17·2	
1 650	—18·7	

CROSS-SECTION NO. 31—Continued.

[Origin: Latitude, 41° 17′ 34″·39; longitude, 70° 7′ 40″·65; azimuth, 179° 37′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 700	—19·2	
1 750	—19·7	
1 800	—20·7	
1 850	—21·2	
1 900	—21·7	

CROSS-SECTION NO. 33.

[Origin: Latitude, 41° 17′ 29″·56; longitude, 70° 7′ 45″·69; azimuth, 179° 37′.]

0	31·5	
20	36·3	
40	37·5	
60	36·9	
80	31·0	
100	30·5	
120	34·2	
140	32·4	
160	32·7	
180	33·9	
200	34·9	
220	32·1	
240	28·6	
260	20·5	
280	17·2	
300	18·7	
305	19·6	Bluff stake.
309	12·3	Foot of steep slope.
320	7·3	
327	5·2	Shore line in 1887.
340	.....	Shore line in 1894.
351	— 1·5	Low-water line in 1894.
400	— 4·0	
450	— 4·5	
500	— 6·5	
550	— 4·5	
600	— 6·5	
650	— 7·5	
700	— 8·7	
750	— 9·5	
800	— 8·0	
850	— 8·0	
900	— 8·5	
950	—10·0	
1 000	—10·0	
1 050	— 9·0	
1 100	— 8·5	
1 150	— 8·0	
1 200	— 8·5	
1 250	— 8·0	
1 300	— 8·0	
1 350	— 8·0	
1 400	— 8·5	
1 450	— 9·0	
1 500	—10·0	
1 550	—11·5	
1 600	— 7·0	
1 650	—12·5	
1 700	—16·0	
1 750	—17·5	
1 800	—18·5	
1 850	—19·7	
1 900	—20·0	
1 950	—20·5	
2 000	—20·5	

CROSS-SECTION NO. 35.

[Origin: Latitude, 41° 17′ 32″·93; longitude, 70° 7′ 50″·92; azimuth, 179° 37′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	46·1	
20	42·3	
40	45·4	
60	40·9	
80	36·8	
100	32·9	
120	37·2	
140	41·2	
160	35·0	
180	24·0	
214	21·7	Bluff stake.
220	15·1	
225	13·0	Edge of bluff.
229	5·6	Foot of bluff.
247	.....	Shore line in 1887, 1894.
260	— 1·5	Low-water line in 1894.
300	— 2·0	
350	— 4·5	
400	— 6·5	
450	— 4·5	
500	— 8·0	
550	— 8·5	
600	— 8·0	
650	—10·0	
700	— 9·0	
750	—10·0	
800	— 9·5	
850	— 9·0	
900	— 8·0	
950	— 8·5	
1 000	— 8·0	
1 050	— 8·0	
1 100	— 8·2	
1 150	— 8·2	
1 200	— 8·0	
1 250	— 8·5	
1 300	— 8·5	
1 350	— 7·2	
1 400	—10·2	
1 450	— 8·2	
1 500	— 7·5	
1 550	—14·2	
1 600	—16·5	
1 650	—17·5	
1 700	—18·7	
1 750	—19·7	
1 800	—20·7	
1 850	—21·0	
1 900	—21·2	

CROSS-SECTION NO. 37.

[Origin: Latitude, 41° 17′ 33″·35; longitude, 70° 7′ 56″·03; azimuth, 180° 00′.]

0	49·7	
20	51·1	
40	50·2	
60	47·4	
80	42·1	
100	34·3	
120	25·6	
140	22·5	
160	29·3	
180	23·8	

CROSS-SECTION NO. 37—Continued.

[Origin: Latitude, 41° 17′ 33″·35; longitude, 70° 7′ 56″·03; azimuth, 180° 00′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
200	29·2	
214	18·1	Bluff stake.
216	17·7	Edge of bluff.
220	5·2	Foot of bluff.
233	.....	Shore line in 1887, 1894.
245	— 1·5	Low-water line in 1894.
300	— 5·2	
350	— 5·5	
400	— 5·5	
450	— 4·5	
500	— 5·0	
550	— 7·0	
600	— 8·2	
650	— 9·0	
700	— 8·5	
750	— 8·5	
800	— 9·0	
850	— 9·0	
900	— 9·0	
950	— 9·0	
1 000	— 8·5	
1 050	— 8·5	
1 100	— 9·0	
1 150	— 8·5	
1 200	— 8·0	
1 250	— 8·0	
1 300	— 8·5	
1 350	— 8·5	
1 400	—10·5	
1 450	— 7·5	
1 500	—11·7	
1 550	—15·5	
1 600	—17·5	
1 650	—19·0	
1 700	—19·5	
1 750	—20·5	
1 800	—21·0	
1 850	—22·0	

CROSS-SECTION NO. 39.

[Origin: Latitude, 41° 17′ 33″·67; longitude, 70° 8′ 01″·42; azimuth, 179° 16′.]

0	30·5	
20	25·0	
40	18·0	
60	15·3	
80	12·6	
100	8·0	
120	6·2	
140	6·6	
160	9·9	
180	18·1	
198	14·2	Bluff stake.
200	14·2	Edge of bluff.
203	5·5	Foot of bluff.
215	.....	Shore line in 1894.
219	.....	Shore line in 1887.
230	— 1·5	Low-water line in 1894.
250	— 2·5	
300	— 5·5	
350	— 5·5	
400	— 4·5	
450	— 5·0	

CROSS-SECTION NO. 39—Continued.

[Origin: Latitude, 41° 17′ 33″·67; longitude, 70° 8′ 01″·42; azimuth, 179° 16′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
500	— 6·5	
550	— 7·0	
600	— 9·0	
650	— 9·0	
700	— 8·5	
750	— 9·5	
800	—10·0	
850	— 9·5	
900	— 9·0	
950	— 8·5	
1 000	— 8·0	
1 050	— 8·5	
1 100	— 7·5	
1 150	— 8·0	
1 200	— 8·2	
1 250	— 7·5	
1 300	— 8·2	
1 350	— 8·7	
1 400	— 7·7	
1 450	—12·7	
1 500	—16·7	
1 550	—17·5	
1 600	—18·7	
1 650	—19·5	
1 700	—20·2	
1 750	.....	
1 800	.....	
1 850	.....	

CROSS-SECTION NO. 41.

[Origin: Latitude, 41° 17′ 32″·86; longitude, 70° 8′ 6″·45; azimuth, 179° 30′.]

0	18·9	
20	18·1	
40	15·6	
60	12·4	
80	5·0	
100	4·1	
120	4·4	
140	7·5	
160	6·0	
180	9·0	
183	9·7	Cut in bluff.
200	9·2	
214	10·7	Bluff stake.
216	10·5	Edge of bluff.
217	6·1	Foot of bluff.
230	....	Shore line in 1894.
237	.....	Shore line in 1887.
240	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 7·5	
400	— 4·5	
450	— 7·0	
500	— 6·5	
550	— 7·7	
600	— 7·2	
650	— 9·2	
700	— 9·2	
750	— 9·7	
800	— 9·2	
850	— 9·7	
900	— 9·2	

CROSS-SECTION No. 41—Continued.

[Origin: Latitude, 41° 17′ 32″·86; longitude, 70° 8′ 6″·45; azimuth, 179° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
950	— 8·2	
1 000	— 8·5	
1 050	— 8·2	
1 100	— 7·7	
1 150	— 8·2	
1 200	— 8·2	
1 250	— 7·2	
1 300	— 8·5	
1 350	— 9·2	
1 400	—10·2	
1 450	— 7·5	
1 500	—15·7	
1 550	—17·5	
1 600	—18·7	
1 650	—19·7	
1 700	—20·2	

CROSS-SECTION No. 43.

[Origin: Latitude, 41° 17′ 33″·00; longitude, 70° 8′ 11″·70; azimuth, 179° 16′.]

0	27·8	
20	22·2	
40	20·6	
60	20·3	
80	20·2	
100	20·3	
120	21·5	
140	19·1	
160	8·7	
180	10·4	
198	16·8	Bluff stake.
200	15·2	
201	14·4	Edge of bluff.
203	4·5	Foot of bluff.
218	.....	Shore line in 1894.
230	.....	Shore line in 1887.
230	— 1·5	Low-water line in 1894.
250	— 2·5	
300	— 4·0	
350	— 6·7	
400	— 4·7	
450	— 7·0	
500	— 7·5	
550	— 8·2	
600	— 8·2	
650	— 8·2	
700	— 8·2	
750	— 8·2	
800	— 8·5	
850	— 8·5	
900	— 9·5	
950	— 8·5	
1 000	— 8·5	
1 050	— 7·5	
1 100	— 8·5	
1 150	— 8·5	
1 200	— 9·0	
1 250	— 7·0	
1 300	— 9·5	
1 350	— 7·2	
1 400	— 9·5	
1 450	—15·0	
1 500	—16·5	

CROSS-SECTION No. 43—Continued.

[Origin: Latitude, 41° 17′ 33″·00; longitude, 70° 8′ 11″·70; azimuth, 179° 16′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 550	—18·5	
1 600	—19·0	
1 650	—19·5	
1 700	—20·0	
1 750	—20·5	
1 800	—21·0	
1 850	—21·7	

CROSS-SECTION No. 45.

[Origin: Latitude, 41° 17′ 30″·17; longitude, 70° 8′ 16″·89; azimuth, 179° 45′.]

0	4·9	
20	8·9	
40	9·5	
60	10·2	
80	13·4	
100	15·1	
120	11·8	
140	11·0	
160	8·1	
180	5·6	
200	5·2	
220	5·2	
240	6·0	
260	7·6	
275	11·6	Bluff stake.
277	10·7	Edge of bluff.
278	7·1	Foot of bluff.
294	.....	Shore line in 1894.
305	.....	Shore line in 1887.
310	— 1·5	Low-water line in 1894.
350	— 4·5	
400	— 5·0	
450	— 7·5	
500	— 7·2	
550	— 8·0	
600	— 8·5	
650	— 8·2	
700	— 7·5	
750	— 7·7	
800	— 8·7	
850	— 8·2	
900	— 8·7	
950	— 7·7	
1 000	— 7·7	
1 050	— 8·7	
1 100	— 7·7	
1 150	— 8·2	
1 200	— 7·2	
1 250	— 7·7	
1 300	— 7·5	
1 350	— 8·7	
1 400	— 6·7	
1 450	— 8·5	
1 500	—12·5	
1 550	—15·5	
1 600	—17·5	
1 650	—18·5	
1 700	—19·5	
1 750	—20·5	
1 800	—20·7	
1 850	—20·7	
1 900	—21·5	

CROSS-SECTION No. 47.

[Origin: Latitude, 41° 17′ 35″·43; longitude, 70° 8′ 22″·35; azimuth, 179° 26′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	2·3	
20	4·2	
40	5·8	
48	7·3	Bluff stake.
60	5·3	
80	5·0	
93	3·7	Beach stake.
127	.....	Shore line in 1894.
140	.....	Shore line in 1887.
148	— 1·5	Low-water line in 1894.
200	— 3·5	
250	— 5·5	
300	— 6·7	
350	— 8·5	
400	— 8·7	
450	— 8·7	
500	— 7·7	
550	— 9·2	
600	— 9·2	
650	— 8·2	
700	— 7·7	
750	— 8·7	
800	— 8·7	
850	— 8·5	
900	— 8·2	
950	— 8·5	
1 000	— 8·5	
1 050	— 7·7	
1 100	— 8·5	
1 150	— 6·7	
1 200	— 9·5	
1 250	— 6·5	
1 300	— 9·7	
1 350	—13·0	
1 400	—15·5	
1 450	—16·7	
1 500	—18·5	
1 550	—19·5	
1 600	—20·0	
1 650	—21·5	
1 700	—22·0	

CROSS-SECTION No. 49.

[Origin: Latitude, 41° 17′ 38″·25; longitude, 70° 8′ 27″·37; azimuth, 179° 40′.]

0	2·1	
9	2·8	Stake on small rise.
20	3·2	
30	.....	Shore line in 1887, 1894.
48	— 1·5	Low-water line in 1894.
100	— 3·7	
150	— 7·2	
200	— 8·2	
250	— 7·2	
300	— 8·5	
350	— 8·7	
400	— 8·7	
450	— 8·7	
500	— 7·5	
550	— 8·7	
600	— 8·7	
650	— 9·2	
700	— 8·7	

CROSS-SECTION No. 49—Continued.

[Origin: Latitude, 41° 17′ 38″·25; longitude, 70° 8′ 27″·37; azimuth, 179° 40′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
750	— 8·2	
800	— 7·7	
850	— 8·5	
900	— 9·0	
950	— 7·7	
1 000	— 7·0	
1 050	— 9·0	
1 100	— 7·5	
1 150	— 8·5	
1 200	—11·0	
1 250	—13·5	
1 300	—16·5	
1 350	—17·5	
1 400	—18·5	
1 450	—19·0	
1 500	—19·0	
1 550	—21·0	
1 600	—21·2	
1 650	—22·0	

CROSS-SECTION No. 51.

[Origin: Latitude, 41° 17′ 31″·57; longitude, 70° 8′ 32″·79; azimuth, 179° 30′.]

0	29·2	
20	25·7	
40	21·3	
60	19·8	
80	20·7	
100	19·8	
120	19·2	
140	20·4	
160	21·4	
180	22·9	
200	22·0	
220	25·1	
229	26·1	Bluff stake.
231	26·2	Edge of bluff.
237	5·9	Foot of bluff.
243	.....	Shore line in 1887.
248	.....	Shore line in 1894.
263	— 1·5	Low-water line in 1894.
300	— 3·5	
350	— 5·5	
400	— 6·5	
450	— 7·5	
500	— 8·5	
550	— 7·5	
600	— 9·0	
650	— 9·5	
700	— 9·7	
750	— 9·5	
800	— 8·5	
850	— 8·2	
900	— 9·2	
950	— 9·0	
1 000	— 8·2	
1 050	— 8·7	
1 100	— 8·7	
1 150	— 8·7	
1 200	— 8·7	
1 250	— 9·5	
1 300	— 5·5	
1 350	— 8·7	

CROSS-SECTION NO. 51—Continued.

[Origin: Latitude, 41° 17′ 31″·57; longitude, 70° 8′ 32″·79; azimuth, 179° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 400	—10·5	
1 450	—12·5	
1 500	—16·0	
1 550	—17·5	
1 600	—18·5	

CROSS-SECTION NO. 53.

[Origin: Latitude, 41° 17′ 32″·15; longitude, 70° 8′ 37″·65; azimuth, 179° 26′.]

0	31·9	
20	30·6	
40	29·0	
60	28·9	
80	30·8	
100	31·7	
120	29·2	
140	28·8	
160	30·3	
180	32·2	
200	40·2	
214	31·4	Bluff stake.
216	30·2	Top of bluff.
220	16·2	
224	4·9	Foot of bluff.
230	.....	Shore line in 1894.
232	.....	Shore line in 1887.
247	— 1·5	Low-water line in 1894.
300	— 6·2	
350	— 5·7	
400	— 7·5	
450	— 8·2	
500	— 9·2	
550	— 9·7	
600	— 8·7	
650	— 7·5	
700	— 9·2	
750	— 9·2	
800	— 9·5	
850	— 9·2	
900	— 8·7	
950	— 8·5	
1 000	— 8·7	
1 050	— 8·7	
1 100	— 8·2	
1 150	— 8·7	
1 200	— 8·7	
1 250	— 9·5	
1 300	— 5·5	
1 350	— 7·5	
1 400	—11·5	
1 450	—14·5	
1 500	—15·5	
1 550	—17·5	
1 600	—18·2	
1 650	—19·5	
1 700	—20·2	

CROSS-SECTION NO. 55.

[Origin: Latitude, 41° 17′ 31″·70; longitude, 70° 8′ 43″·36; azimuth, 179° 38′.]

0	21·0	
20	23·8	

CROSS-SECTION NO. 55—Continued.

[Origin: Latitude, 41° 17′ 31″·70; longitude, 70° 8′ 43″·36; azimuth, 179° 38′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
40	21·1	
60	22·7	
80	25·5	
100	24·3	
120	22·0	
140	20·5	
160	19·7	
180	19·8	
200	25·1	
214	30·7	Bluff stake.
215	30·8	Edge of bluff.
220	13·6	
222	6·5	Foot of bluff.
232	.....	Shore line in 1887, 1894.
251	— 1·5	Low-water line in 1894.
300	— 5·7	
350	— 5·7	
400	— 6·7	
450	— 6·5	
500	— 7·5	
550	— 8·7	
600	— 9·5	
650	— 8·5	
700	— 9·5	
750	— 9·0	
800	— 8·5	
850	— 8·0	
900	— 8·5	
950	— 9·5	
1 000	— 9·5	
1 050	— 9·0	
1 100	— 9·0	
1 150	— 8·5	
1 200	— 9·0	
1 250	— 9·5	
1 300	— 5·5	
1 350	— 7·0	
1 400	—11·5	
1 450	—12·5	
1 500	—15·5	
1 550	—16·0	
1 600	—18·5	
1 650	—19·5	
1 700	—20·0	
1 750	—20·5	
1 800	—20·7	

CROSS-SECTION NO. 57.

[Origin: Latitude, 41° 17′ 32″·57; longitude, 70° 8′ 48″·47; azimuth, 179° 20′.]

0	19·7	
20	23·8	
40	25·0	
60	27·9	
80	28·5	
100	29·4	
120	29·3	
140	27·2	
160	25·0	
180	25·7	
183	26·1	Bluff stake.
190	6·1	Foot of bluff.
203	.....	Shore line in 1887, 1894.

CROSS-SECTION No. 57—Continued.

[Origin: Latitude, 41° 17′ 32″·57; longitude, 70° 8′ 48″·47; azimuth, 179° 20′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
215	— 1·5	Low-water line in 1894.
250	— 4·7	
300	— 6·5	
350	— 7·5	
400	— 7·0	
450	— 8·5	
500	— 8·0	
550	— 8·5	
600	— 8·0	
650	— 8·5	
700	— 8·5	
750	— 9·5	
800	— 9·5	
850	— 9·5	
900	— 9·5	
950	— 8·5	
1 000	— 8·5	
1 050	— 7·5	
1 100	— 8·0	
1 150	— 8·0	
1 200	— 8·5	
1 250	— 9·0	
1 300	— 6·5	
1 350	— 7·5	
1 400	—12·0	
1 450	—13·5	
1 500	—16·0	
1 550	—17·5	
1 600	—19·0	
1 650	—19·5	
1 700	—20·2	
1 750	—21·5	

CROSS-SECTION No. 59.

[Origin: Latitude, 41° 17′ 31″·50; longitude, 70° 8′ 53″·54; azimuth, 179° 12′.]

0	17·1	
20	16·8	
40	19·0	
60	20·8	
80	18·6	
100	18·6	
120	18·4	
140	20·2	
160	20·1	
180	17·6	
200	20·5	
214	20·4	Bluff stake.
219	7·1	Foot of bluff.
219	.....	Shore line in 1887.
221	.....	Shore line in 1894.
250	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 8·0	
400	— 7·0	
450	— 6·5	
500	— 8·0	
550	— 8·5	
600	— 8·5	
650	— 9·5	
700	— 9·5	
750	— 9·0	
800	— 8·5	

CROSS-SECTION No. 59—Continued.

[Origin: Latitude, 41° 17′ 31″·50; longitude, 70° 8′ 53″·54; azimuth, 179° 12′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
850	— 7·5	
900	— 8·0	
950	— 9·0	
1 000	— 9·0	
1 050	— 9·0	
1 100	— 7·5	
1 150	— 7·7	
1 200	— 9·0	
1 250	— 9·5	
1 300	—10·0	
1 350	— 7·5	
1 400	—10·0	
1 450	—13·0	
1 500	—14·5	
1 550	—15·2	
1 600	—18·0	
1 650	—19.2	
1 700	—19·7	
1 750	—20·5	
1 800	—20·7	
1 850	—21·7	

CROSS-SECTION No. 61.

[Origin: Latitude, 41° 17′ 30″·79; longitude, 70° 8′ 58″·87; azimuth, 180° 00′.]

0	19·5	
20	17·0	
40	15·2	
60	10·4	
80	10·7	
100	11·5	
122	7·9	Edge of pond.
137	7·6	" " "
140	9·0	
160	10·6	
180	9·8	
200	17·0	
206	20·6	Bluff stake.
207	20·6	Edge of bluff.
214	9.1	Foot of bluff.
253	.....	Shore line in 1887, 1894.
270	— 1·5	Low-water line in 1894.
300	— 2·5	
350	— 6·5	
400	— 8·0	
450	— 7·5	
500	— 6·5	
550	— 7·5	
600	— 9·0	
650	— 8·5	
700	— 9·0	
750	— 9·0	
800	— 9·0	
850	— 9·0	
900	— 9·5	
950	— 9·2	
1 000	— 9·2	
1 050	— 8·2	
1 100	— 7·2	
1 150	— 8·2	
1 200	— 8·2	
1 250	— 8·7	
1 300	— 8·7	

CROSS-SECTION No. 61—Continued.

[Origin: Latitude, 41° 17′ 30″·79; longitude, 70° 8′ 58″·87; azimuth, 180° 00′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 350	— 8·2	
1 400	— 8·5	
1 450	—10·5	
1 500	—12·5	
1 550	—14·0	
1 600	—16·0	
1 650	—17·7	
1 700	—18·2	
1 750	—19·2	
1 800	—19·7	
1 850	—20·2	
1 900	—20·5	
1 950	—20·7	

CROSS-SECTION No. 63.

[Origin: Latitude, 41° 17′ 32″·80; longitude, 70° 9′ 4″·30; azimuth, 179° 13′.]

0	11·1	
20	10·9	
40	12·3	
60	16·5	
80	19·6	
100	21·5	
120	21·5	
140	20·6	
160	25·8	
168	28·7	Bluff stake.
169	29·8	Edge of bluff.
177	10·2	Foot of bluff.
192	.....	Shore line in 1894.
195	.....	Shore line in 1887.
250	— 2·0	
300	— 6·0	
350	— 7·2	
400	— 7·5	
450	— 8·5	
500	— 8·5	
550	— 6·5	
600	— 9·5	
650	— 9·5	
700	— 9·5	
750	—10·0	
800	—10·5	
850	—10·0	
900	— 9·5	
950	— 9·0	
1 000	— 8·5	
1 050	— 9·0	
1 100	— 7·5	
1 150	— 8·5	
1 200	— 9·5	
1 250	— 8·5	
1 300	— 9·5	
1 350	—10·0	
1 400	—10·5	
1 450	—13·5	
1 500	—15·5	
1 550	—16·5	
1 600	—18·0	
1 650	—19·5	
1 700	—20·0	
1 750	—21·5	

CROSS-SECTION No. 65.

[Origin: Latitude, 41° 17′ 31″·60; longitude, 70° 9′ 9″·50; azimuth, 179° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	17·3	
20	19·0	
40	18·9	
60	14·9	
80	15·1	
100	15·5	
120	16·4	
140	17·2	
160	17·0	
180	17·2	
200	21·8	
214	26·3	Bluff stake.
215	28·1	Edge of bluff.
220	20·3	
228	7·4	Foot of bluff.
238	.....	Shore line in 1887, 1894.
248	— 1·5	Low-water line in 1894.
300	— 4·0	
350	— 4·5	
400	— 7·5	
450	— 7·5	
500	— 7·5	
550	— 8·5	
600	— 9·5	
650	— 9·0	
700	— 9·5	
750	— 8·5	
800	— 9·0	
850	— 9·5	
900	— 9·5	
950	— 9·5	
1 000	— 9·0	
1 050	— 9·5	
1 100	— 8·0	
1 150	— 8·5	
1 200	— 8·0	
1 250	— 8·5	
1 300	— 8·5	
1 350	— 9·5	
1 400	— 7·5	
1 450	—11·5	
1 500	—14·0	
1 550	—16·5	
1 600	—18·5	
1 650	—18·5	
1 700	—20·0	
1 750	—20·5	

CROSS-SECTION No. 67.

[Origin: Latitude, 41° 17′ 35″·10; longitude, 70° 9′ 14″·82; azimuth, 180° 10′.]

0	1·7	Marshy ground.
20	4·2	
40	16·0	
60	22·0	
80	24·8	
100	30·2	
113	33·9	Bluff stake.
120	20·4	
125	6·9	Edge of bluff.
132	.....	Shore line in 1887.
135	.....	Shore line in 1894.

CROSS-SECTION NO. 67—Continued.

[Origin: Latitude, 41° 17′ 35″·10; longitude, 70° 9′ 14″·82; azimuth, 180° 10′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
145	— 1·5	Low-water line in 1894.
200	— 1·5	
250	— 5·2	
300	— 7·2	
350	— 7·5	
400	— 7·7	
450	— 8·7	
500	— 8·7	
550	— 8·7	
600	— 8·7	
650	— 9·2	
700	— 9·7	
750	—10·2	
800	—10·2	
850	— 9·5	
900	— 9·2	
950	— 9·0	
1 000	— 8·0	
1 050	— 7·2	
1 100	— 7·0	
1 150	— 7·7	
1 200	— 7·7	
1 250	— 6·7	
1 300	— 9·2	
1 350	—12·0	
1 400	—15·0	
1 450	—17·0	
1 500	—18·0	
1 550	—18·5	
1 600	—19·5	
1 650	—20·5	
1 700	—20·5	
1 750	—21·5	

CROSS-SECTION NO. 69.

[Origin: Latitude, 41° 17′ 33″·32; longitude, 70° 9′ 20″·03; azimuth, 179° 30′.]

0	3·5	Edge of marsh.
20	3·4	
40	3·4	
43	3·4	Edge of marsh.
60	4·9	
80	7·8	
100	13·0	
120	22·8	
140	33·0	
160	28·4	
168	30·5	Bluff stake.
169	31·0	Edge of bluff.
182	6·6	Foot of bluff.
192	.....	Shore line in 1894.
194	.....	Shore line in 1887.
202	— 1·5	Low-water line in 1894.
250	— 5·0	
300	— 4·5	
350	— 8·0	
400	— 8·5	
450	— 7·0	
500	— 5·5	
550	— 7·7	
600	—10·0	
650	—10·0	
700	— 9·5	

CROSS-SECTION NO. 69—Continued.

[Origin: Latitude, 41° 17′ 33″·32; longitude, 70° 9′ 20″·03; azimuth, 179° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
750	—10·5	
800	—10·5	
850	— 8·5	
900	— 9·0	
950	— 8·5	
1 000	— 8·5	
1 050	— 8·0	
1 100	— 7·7	
1 150	— 7·2	
1 200	— 8·2	
1 250	— 8·7	
1 300	— 6·2	
1 350	— 9·7	
1 400	—11·7	
1 450	—13·5	
1 500	—15·7	
1 550	—16·5	
1 600	—17·7	
1 650	—18·5	
1 700	—19·5	
1 750	—20·5	
1 800	—20·7	

CROSS-SECTION NO. 71.

[Origin: Latitude, 41° 17′ 33″·35; longitude, 70° 9′ 25″·44; azimuth, 179° 54′.]

0	9·2	Thick underbrush and marshy ground.
20	15·4	
40	20·7	
60	22·7	
80	23·2	
100	20·8	
120	23·0	
140	32·0	
160	39·6	
171	40·4	Bluff stake.
180	24·5	
197	.....	Shore line in 1887–94.
211	— 1·5	Low-water line in 1894.
250	— 4·2	
300	— 6·0	
350	— 4·0	
400	— 7·7	
450	— 7·7	
500	— 8·2	
550	— 8·2	
600	— 9·7	
650	—10·7	
700	— 9·7	
750	— 8·2	
800	— 8·7	
850	— 9·0	
900	— 9·2	
950	— 9·2	
1 000	— 9·2	
1 050	— 8·2	
1 100	— 8·7	
1 150	— 8·0	
1 200	— 7·5	
1 250	— 8·5	
1 300	— 8·0	
1 350	— 7·0	

CROSS-SECTION No. 71—Continued.

[Origin: Latitude, 41° 17′ 33″·35; longitude, 70° 9′ 25″·44; azimuth, 179° 54′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 400	—10·5	
1 450	—13·0	
1 500	—14·5	
1 550	—16·0	
1 600	—17·0	
1 650	—18·0	
1 700	—19·5	
1 750	—20·5	
1 800	—21·0	

CROSS-SECTION No. 73.

[Origin: Latitude, 41° 17′ 32″·57; longitude, 70° 9′ 30″·56; azimuth, 179° 45′.]

0	20·0	
20	22·6	
40	25·0	
60	27·4	
80	29·0	
100	30·4	
120	31·0	
140	30·5	
160	29·7	
180	32·5	
200	39·7	
214	39·8	Bluff stake.
215	39·4	Edge of bluff.
220	22·6	
226	8·0	Foot of bluff.
239	.....	Shore line in 1887, 1894.
300	— 4·5	
350	— 1·5	
400	— 5·5	
450	— 7·0	
500	— 7·5	
550	— 7·5	
600	— 8·5	
650	— 6·0	
700	— 9·5	
750	—10·0	
800	— 9·5	
850	— 9·5	
900	— 9·0	
950	— 9·5	
1 000	— 9·0	
1 050	— 9·0	
1 100	— 7·5	
1 150	— 8·0	
1 200	— 7·5	
1 250	— 7·5	
1 300	— 8·0	
1 350	— 5·0	
1 400	— 7·5	
1 450	—10·0	
1 500	—12·0	
1 550	—13·5	
1 600	—15·5	
1 650	—16·5	
1 700	—17·5	
1 750	—18·5	
1 800	—19·5	
1 850	—20·5	
1 900	—21·0	
1 950	—21·5	

CROSS-SECTION No. 75.

[Origin: Latitude, 41° 17′ 33″·48; longitude, 70° 9′ 35″·50; azimuth, 179° 52′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	23·9	
20	27·4	
40	30·3	
60	33·1	
80	34·8	
100	34·8	
120	33·5	
140	34·3	
160	33·3	
180	30·6	
183	31·6	Bluff stake.
185	30·5	Edge of bluff.
194	6·8	Foot of bluff.
214	.....	Shore line in 1887.
222	.....	Shore line in 1894.
234	— 1·5	Low-water line in 1894.
250	— 3·5	
300	— 6·0	
350	— 3·0	
400	— 7·0	
450	— 7·5	
500	— 8·5	
550	— 7·5	
600	— 9·0	
650	— 9·5	
700	— 8·5	
750	— 9·0	
800	—10·0	
850	—11·0	
900	— 9·5	
950	— 9·0	
1 000	— 9·0	
1 050	— 7·5	
1 100	— 8·0	
1 150	— 8·0	
1 200	— 7·0	
1 250	— 8·7	
1 300	— 9·0	
1 350	— 9·0	
1 400	—10·5	
1 450	—12·0	
1 500	—14·5	
1 550	—16·0	
1 600	—16·5	
1 650	—17·5	
1 700	—18·5	
1 750	—19·0	
1 800	—20·5	
1 850	—21·0	
1 900	—21·5	
1 950	—22·0	

CROSS-SECTION No. 77.

[Origin: Latitude, 41° 17′ 33″·29; longitude, 70° 9′ 41″·00; azimuth, 180° 11′.]

0	25·1	
20	28·5	
40	30·0	
60	32·5	
80	32·2	
100	29·6	
120	24·6	
140	19·6	

CROSS-SECTION No. 77—Continued.

[Origin: Latitude, 41° 17′ 33″·29; longitude, 70° 9′ 41″·00; azimuth, 180° 11′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
160	17·7	
180	22·6	
200	27·2	
214	24·2	Bluff stake.
216	23·6	Edge of bluff.
220	10·4	
222	5·5	Foot of bluff.
231	.....	Shore line in 1887, 1894.
247	— 1·5	Low-water line in 1894.
250	— 2·0	
300	— 5·0	
350	— 5·5	
400	— 3·5	
450	— 7·5	
500	— 8·5	
550	— 8·5	
600	— 9·0	
650	— 9·5	
700	— 8·5	
750	— 9·5	
800	— 9·5	
850	— 8·5	
900	— 7·5	
950	— 8·5	
1 000	— 8·0	
1 050	— 7·0	
1 100	— 8·5	
1 150	— 8·5	
1 200	— 8·5	
1 250	— 8·0	
1 300	— 8·5	
1 350	— 6·0	
1 400	— 9·5	
1 450	—12·5	
1 500	—13·7	
1 550	—15·5	
1 600	—16·5	
1 650	—17·5	
1 700	—18·0	
1 750	—19·0	
1 800	—19·5	
1 850	—20·0	
1 900	—20·5	
1 950	—21·0	
2 000	—22·5	

CROSS-SECTION No. 79.

[Origin: Latitude, 41° 17′ 32″·90; longitude, 70° 9′ 46″·07; azimuth, 179° 41′.]

0	14·7	
20	16·0	
40	19·4	
60	23·1	
80	24·8	
100	26·7	
120	25·8	
140	25·0	
160	25·0	
180	25·9	
198	27·7	Edge of bluff.
200	20·8	
204	14·2	Foot of bluff.
220	8·6	

CROSS-SECTION No. 79—Continued.

[Origin: Latitude, 41° 17′ 32″·90; longitude, 70° 9′ 46″·07; azimuth, 179° 41′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
240	.....	Shore line in 1887, 1894.
256	— 1·5	Low-water line in 1894.
300	— 5·0	
350	— 4·0	
400	— 3·5	
450	— 7·0	
500	— 7·5	
550	— 8·0	
600	— 7·0	
650	— 9·5	
700	—10·0	
750	— 9·5	
800	—10·0	
850	— 8·5	
900	— 8·5	
950	— 7·0	
1 000	— 8·0	
1 050	— 6·5	
1 100	— 8·0	
1 150	— 8·2	
1 200	— 8·2	
1 250	— 8·2	
1 300	— 8·2	
1 350	— 9·2	
1 400	— 5·7	
1 450	—10·7	
1 500	— 8·2	
1 550	—14·0	
1 600	—15·2	
1 650	—16·2	
1 700	—16·7	
1 750	—17·7	
1 800	—18·2	
1 850	—18·2	
1 900	—20·0	
1 950	—19·7	
2 000	—20·7	

CROSS-SECTION No. 81.

[Origin: Latitude, 41° 17′ 33″·25; longitude, 70° 9′ 51″·35; azimuth, 179° 40′.]

0	17·4	
20	17·6	
40	16·8	
60	15·0	
80	14·4	
100	12·3	
120	14·1	
140	14·4	
160	14·0	
180	18·5	
200	18·6	
214	18·1	
215	19·0	
221	7·1	
232	.....	Shore line in 1878, 1894.
245	— 1·5	Low-water line in 1894.
300	— 5·5	
350	— 3·0	
400	— 6·0	
450	— 6·0	
500	— 8·5	

CROSS-SECTION NO. 81—Continued.

[Origin: Latitude, 41° 17′ 33‴·25; longitude, 70° 9′ 51‴·35; azimuth, 179° 40′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
550	— 7·5	
600	— 8·5	
650	— 7·5	
700	— 7·5	
750	— 9·0	
800	— 8·0	
850	— 9·0	
900	— 7·5	
950	— 8·0	
1 000	— 8·5	
1 050	— 7·5	
1 100	— 7·5	
1 150	— 8·0	
1 200	— 8·0	
1 250	— 8·0	
1 300	— 8·5	
1 350	—10·5	
1 400	— 7·5	
1 450	—11·0	
1 500	—13·0	
1 550	—14·5	
1 600	—15·5	
1 650	—16·0	
1 700	—17·5	
1 750	—17·5	
1 800	—19·0	
1 850	—20·0	
1 900	—20·0	
1 950	—20·5	

CROSS-SECTION NO. 83.

[Origin: Latitude, 41° 17′ 33‴·51; longitude, 70° 9′ 56‴·81; azimuth, 179° 52′.]

0	12·4	
20	15·8	
40	17·0	
60	17·1	
80	14·3	
100	12·5	
120	13·4	
140	14·2	
160	15·4	
180	17·6	
200	20·6	
214	19·7	Bluff stake.
216	18·3	Edge of bluff.
219	6·3	Foot of bluff.
231	.....	Shore line in 1887, 1894.
242	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 3·5	
400	— 7·5	
450	— 4·5	
500	— 7·0	
550	— 7·0	
600	— 6·0	
650	— 7·5	
700	— 7·5	
750	— 8·5	
800	— 8·0	
850	— 8·5	
900	— 8·5	
950	— 7·5	

CROSS-SECTION NO. 83—Continued.

[Origin: Latitude, 41° 17′ 33‴·51; longitude, 70° 9′ 56‴·81; azimuth, 179° 52′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 000	— 8·5	
1 050	— 8·0	
1 100	— 8·0	
1 150	— 7·5	
1 200	— 8·0	
1 250	— 8·0	
1 300	— 9·0	
1 350	— 9·5	
1 400	— 6·0	
1 450	—10·0	
1 500	—12·0	
1 550	—14·5	
1 600	—15·0	
1 650	—16·0	
1 700	—16·5	
1 750	—17·0	
1 800	—18·0	
1 850	—20·0	
1 900	—20·0	
1 950	—20·5	

CROSS-SECTION NO. 85.

[Origin: Latitude, 41° 17′ 35‴·00; longitude, 70° 10′ 2‴·15; azimuth, 179° 45′.]

0	2·9	Dried pond.
20	7·8	
40	13·4	
60	18·8	
80	17·7	
100	17·2	
120	21·3	
140	22·0	
160	22·3	
172	22·4	Bluff stake.
176	20·7	Edge of bluff.
199	.....	Shore line in 1887, 1894.
210	— 1·5	Low-water line in 1894.
250	— 2·5	
300	— 4·5	
350	— 6·0	
400	— 7·0	
450	— 3·5	
500	— 6·0	
550	— 7·0	
600	— 7·5	
650	— 7·5	
700	— 7·5	
750	— 7·0	
800	— 8·0	
850	— 7·5	
900	— 7·5	
950	— 7·0	
1 000	— 7·0	
1 050	— 7·5	
1 100	— 7·5	
1 150	— 8·0	
1 200	— 8·0	
1 250	— 8·0	
1 300	— 8·5	
1 350	— 6·5	
1 400	— 9·5	
1 450	—12·5	
1 500	—14·0	

CROSS-SECTION No. 85—Continued.

[Origin: Latitude, 41° 17′ 35″·00; longitude, 70° 10′ 2″·15; azimuth, 179° 45′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 550	—14·5	
1 600	—15·5	
1 650	—16·5	
1 700	—17·5	
1 750	—18·0	
1 800	—20·0	
1 850	—20·5	

CROSS-SECTION No. 87.

[Origin: Latitude, 41° 17′ 35″·75; longitude, 70° 10′ 7″·13; azimuth, 179° 53′.]

0	3·5	Edge of level ground.
20	7·1	
40	12·2	
60	14·1	
80	17·3	
100	23·8	
120	17·7	
140	16·8	
160	16·1	Bluff stake.
161	16·0	Edge of bluff.
190	.....	Shore line in 1887, 1894.
195	— 1·5	Low-water line in 1894.
200	— 1·7	
250	— 1·7	
300	— 4·5	
350	— 4·7	
400	— 4·7	
450	— 3·7	
500	— 6·7	
550	— 6·0	
600	— 6·2	
650	— 9·0	
700	— 8·0	
750	— 6·7	
800	— 7·2	
850	— 6·7	
900	— 6·7	
950	— 7·2	
1 000	— 6·7	
1 050	— 6·2	
1 100	— 7·7	
1 150	— 7·7	
1 200	— 7·7	
1 250	— 7·2	
1 300	— 9·2	
1 350	— 5·7	
1 400	— 8·7	
1 450	—13·5	
1 500	—14·5	
1 550	—15·2	
1 600	—15·7	
1 650	—17·2	
1 700	—18·7	
1 750	—19·2	
1 800	—19·2	

CROSS-SECTION No. 89.

[Origin: Latitude, 41° 17′ 34″·58; longitude, 70° 10′ 12″·21; azimuth, 179° 35′.]

0	16·1	
20	15·8	

CROSS-SECTION No. 89—Continued.

[Origin: Latitude, 41° 17′ 34″·58; longitude, 70° 10′ 12″·21; azimuth, 179° 35′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
40	14·1	
60	13·4	
80	15·0	
100	13·5	
120	11·5	
140	18·6	
160	28·3	
180	28·6	
200	19·0	
214	17·9	Bluff stake.
219	11·7	Edge of bluff.
221	7·3	Foot of bluff.
234	.....	Shore line in 1887, 1894.
242	— 1·5	Low-water line in 1894.
263	— 1·5	Shoal.
287	— 1·5	Shoal.
300	— 2·5	
350	— 6·0	
400	— 6·5	
450	— 2·7	
500	— 6·5	
550	— 6·0	
600	— 6·5	
650	— 9·0	
700	— 8·0	
750	— 8·5	
800	— 6·5	
850	— 6·5	
900	— 7·0	
950	— 5·7	
1 000	— 6·5	
1 050	— 6·7	
1 100	— 7·0	
1 150	— 7·7	
1 200	— 7·0	
1 250	— 7·7	
1 300	— 7·2	
1 350	— 8·7	
1 400	— 6·5	
1 450	— 9·2	
1 500	—13·5	
1 550	—15·2	
1 600	—16·2	
1 650	—16·5	
1 700	—17·0	
1 750	—17·7	
1 800	—17·7	
1 850	—18·2	
1 900	—18·2	
1 950	—18·7	
2 000	—19·5	
2 050	—20·2	
2 100	—21·7	

CROSS-SECTION No. 91.

[Origin: Latitude, 41° 17′ 33″·41; longitude, 70° 10′ 17″·50; azimuth, 179° 53′.]

0	25·6	
20	23·2	
40	23·0	
60	23·2	
80	25·4	
100	26·6	
120	25·4	

CROSS-SECTION No. 91—Continued.

[Origin: Latitude, 41° 17′ 33″·41; longitude, 70° 10′ 17″·50; azimuth, 179° 53′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
140	26·4	
160	31·0	
180	33·3	
200	27·5	
214	29·4	Bluff stake.
220	23·2	
240	12·8	
242	6·0	Foot of bluff.
262	.....	Shore line 1887, 1894.
270	— 1·5	Low-water line in 1894.
300	— 3·0	
350	— 5·0	
400	— 5·5	
450	— 4·5	
500	— 3·0	
550	— 8·0	
600	— 7·0	
650	— 7·5	
700	— 8·0	
750	— 7·5	
800	— 8·0	
850	— 8·5	
900	— 5·5	
950	— 6·5	
1 000	— 6·5	
1 050	— 7·5	
1 100	— 7·0	
1 150	— 7·0	
1 200	— 7·5	
1 250	— 7·0	
1 300	— 8·0	
1 350	— 7·5	
1 400	— 8·5	
1 450	— 9·0	
1 500	— 8·0	
1 550	— 8·5	
1 600	—13·5	
1 650	—15·5	
1 700	—16·5	
1 750	—16·5	
1 800	—16·7	
1 850	—16·7	
1 900	—17·5	
1 950	—18·5	
2 000	—19·0	
2 050	—19·5	
2 100	—20·0	
2 150	—20·5	

CROSS-SECTION No. 93.

[Origin: Latitude, 41° 17′ 34″·29; longitude, 70° 10′ 22″·73; azimuth, 179° 57′.]

0	10·1	
20	10·8	
40	13·5	
60	16·6	
80	17·1	
100	14·4	
120	11·7	
140	13·5	
160	21·9	
180	23·4	
200	14·7	

CROSS-SECTION No. 93—Continued.

[Origin: Latitude, 41° 17′ 34″·29; longitude, 70° 10′ 22″·73; azimuth, 170° 57′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
214	14·9	Bluff stake.
216	15·1	
222	5·4	Foot of bluff.
230	.....	Shore line in 1894.
240	.....	Shore line in 1887.
260	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 6·2	
400	— 7·5	
450	— 4·0	
500	— 5·0	
550	— 7·0	
600	— 7·2	
650	— 9·7	
700	—10·2	
750	— 8·7	
800	— 8·2	
850	— 7·7	
900	— 6·7	
950	— 6·2	
1 000	— 7·2	
1 050	— 8·2	
1 100	— 7·7	
1 150	— 7·2	
1 200	— 8·2	
1 250	— 9·2	
1 300	— 8·7	
1 350	— 9·2	
1 400	— 8·7	
1 450	—10·2	
1 500	— 9·2	
1 550	—11·7	
1 600	—14·2	
1 650	—15·7	
1 700	—16·2	
1 750	—17·2	
1 800	—17·7	
1 850	—17·7	
1 900	—18·7	
1 950	—19·2	
2 000	—20·2	

CROSS-SECTION No. 95.

[Origin: Latitude, 41° 17′ 33″·58; longitude, 70° 10′ 28″·02; azimuth, 179° 41′.]

0	27·9	
20	29·0	
40	28·2	
60	28·3	
80	29·4	
100	33·9	
120	34·9	
140	38·2	
160	33·6	
180	26·1	
200	16·5	
214	19·7	
215	20·3	Top of bluff.
218	6·3	Foot of bluff.
229	.....	Shore line in 1894.
238	.....	Shore line in 1887.
247	— 1·5	Low-water line in 1894.
270	— 1·5	Shoal.

CROSS-SECTION No. 95—Continued.

[Origin: Latitude, 41° 17′ 33″·58; longitude, 70° 10′ 28″·02; azimuth, 179° 41′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
285	— 1·5	Shoal.
300	— 2·2	
350	— 5·2	
400	— 4·7	
450	— 3·2	
500	— 8·2	
550	— 9·7	
600	— 9·7	
650	—10·7	
700	—10·2	
750	— 8·7	
800	— 8·2	
850	— 7·5	
900	— 6·5	
950	— 6·7	
1 000	— 8·5	
1 050	— 7·0	
1 100	— 8·2	
1 150	— 7·7	
1 200	— 8·2	
1 250	— 9·2	
1 300	— 9·2	
1 350	— 9·0	
1 400	— 9·5	
1 450	— 8·5	
1 500	—10·5	
1 550	— 9·5	
1 600	— 9·0	
1 650	—14·0	
1 700	—16·5	
1 750	—17·0	
1 800	—17·5	
1 850	—18·5	
1 900	—19.0	
1 950	—19·5	
2 000	—20·0	

CROSS-SECTION No. 97.

[Origin: Latitude, 41° 17′ 32″·83; longitude, 70° 10′ 33″·05; azimuth, 179° 40′.]

0	23·7	
20	23·7	
40	21·0	
60	20·2	
80	21·7	
100	20·8	
120	19.2	
140	21·0	
160	28·0	
180	30·4	
200	23·2	
214	24·3	Bluff stake.
220	10·6	
221	8·2	Foot of bluff.
234	.....	Shore line in 1894.
244	.....	Shore line in 1887.
252	— 1·5	Low-water line in 1894.
274	— 1·5	Shoal.
304	— 1·5	Shoal.
350	— 6·2	
400	— 4·0	
450	— 7·5	
500	— 9·5	

CROSS-SECTION No. 97—Continued.

[Origin: Latitude, 41° 17′ 32″·83; longitude, 70° 10′ 33″·05; azimuth, 179° 40′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
550	—10·0	
600	—11·0	
650	— 9·5	
700	— 9·0	
750	— 9·5	
800	—10·0	
850	—10·0	
900	— 7·5	
950	— 8·5	
1 000	— 9·0	
1 050	— 9·0	
1 100	— 7·7	
1 150	— 7·7	
1 200	— 9·7	
1 250	— 9·7	
1 300	—10·2	
1 350	— 9·7	
1 400	—10·7	
1 450	—10·2	
1 500	— 9·7	
1 550	—10·2	
1 600	—10·2	
1 650	— 9·7	
1 700	—13·5	
1 750	—17·7	
1 800	—19·2	
1 850	—19·7	
1 900	—19·7	
1 950	—20·2	
2 000	—20·0	
2 050	—19·5	
2 100	—20·2	
2 150	—21·0	

CROSS-SECTION No. 99.

[Origin: Latitude, 41° 17′ 32″·35; longitude, 70° 10′ 38″·38; azimuth, 179° 44′.]

0	25·5	
20	27·3	
40	28·4	
60	26·7	
80	29·3	
100	34·0	
120	31·7	
140	20·7	
160	16·6	
180	20·2	
200	19·1	
214	18·5	Bluff stake.
220	6·3	Foot of bluff.
233	.....	Shore line in 1887, 1894.
250	— 1·5	Low-water line in 1894.
300	— 3·7	
350	— 6·7	
400	— 5·5	
450	— 7·0	
500	— 8·2	
550	— 8·7	
600	— 9·2	
650	— 9·2	
700	— 8·2	
750	— 7·7	
800	— 7·7	

CROSS-SECTION NO. 99—Continued.

[Origin: Latitude, 41° 17′ 32″·35; longitude, 70° 10′ 38″·38; azimuth, 179° 44′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
850	— 8·2	
900	— 6·2	
950	— 6·2	
1 000	— 9·2	
1 050	— 8·7	
1 100	— 8·2	
1 150	— 8·2	
1 200	— 8.7	
1 250	— 9·2	
1 300	— 9·2	
1 350	— 9·2	
1 400	— 9·2	
1 450	— 9·2	
1 500	— 8·7	
1 550	— 9·2	
1 600	—10·2	
1 650	— 9·2	
1 700	—11·7	
1 750	—16·2	
1 800	—17·7	
1 850	—17·2	
1 900	—17·7	
1 950	—18·5	
2 000	—19·0	
2 050	—19·5	
2 100	—20·0	

CROSS-SECTION NO. 101.

[Origin: Latitude, 41° 17′ 31″·70; longitude, 70° 10′ 43″·79; azimuth, 179° 52′.]

0	16·9	
20	17·9	
40	16·3	
60	13·3	
80	15·8	
100	25·2	
120	22·5	
122	28·7	
150	13·1	
160	10·6	
180	16·7	
200	10·6	
214	20·2	
220	7·8	Foot of bluff.
235	.....	Shore line in 1894.
241	.....	Shore line in 1887.
252	— 1·5	
300	— 4·5	
350	— 4·5	
400	— 3·0	
450	— 8·5	
500	—10·0	
550	— 9·5	
600	— 9·0	
650	— 8·0	
700	— 6·5	
750	— 8·5	
800	— 9·5	
850	— 9·0	
900	— 8·5	
950	— 4·0	
1 000	— 6·5	
1 050	— 8·5	

CROSS SECTION NO. 101—Continued.

[Origin: Latitude, 41° 17′ 31″·70; longitude, 70° 10′ 43″·79; azimuth, 179° 52′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 100	— 8·5	
1 150	— 9·0	
1 200	— 9·5	
1 250	— 9·5	
1 300	— 8.5	
1 350	— 9·0	
1 400	— 9·5	
1 450	— 9·0	
1 500	— 9·0	
1 550	— 9·5	
1 600	— 9·5	
1 650	—10·0	
1 700	— 9·5	
1 750	—10·5	
1 800	—19·5	
1 850	—15·5	
1 900	—17·5	
1 950	—18·0	
2 000	—19·0	

CROSS-SECTION NO. 103.

[Origin: Latitude, 41° 17′ 31″·44; longitude, 70° 10′ 48″·90; azimuth, 179° 30′.]

0	4·2	
20	3·6	
40	5·1	
60	5·7	
80	6·8	
100	9·2	
120	5·2	
140	3·6	
160	3·6	
180	6·4	
200	4·2	
214	12·6	
215	13·6	
218	6·4	Foot of bluff.
231	.....	Shore line in 1894.
240	.....	Shore line in 1887.
250	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 5·5	
400	— 6·0	
450	—10·0	
500	— 9·5	
550	— 9·5	
600	—10·5	
650	—10·0	
700	—10·0	
750	— 8·0	
800	— 7·5	
850	— 8·0	
900	— 9·0	
950	— 8·2	
1 000	— 8·2	
1 050	— 9·0	
1 100	— 9·0	
1 150	— 7·5	
1 200	— 8·5	
1 250	— 8·5	
1 300	— 9·0	
1 350	— 8·5	
1 400	— 9·5	

CROSS-SECTION No. 103—Continued.

[Origin: Latitude, 41° 17′ 31″·44; longitude, 70° 10′ 48″·90; azimuth, 179° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 450	— 9·5	
1 500	— 9·5	
1 550	—10·0	
1 600	— 9·5	
1 650	— 9·5	
1 700	—10·0	
1 750	—10·0	
1 800	— 8·5	
1 850	—12·0	
1 900	—15·5	
1 950	—18·0	
2 000	—19·0	
2 050	—19·5	
2 100	—20·0	

CROSS-SECTION No. 105.

[Origin: Latitude, 41° 17′ 31″·50; longitude, 70° 10′ 54″·15; azimuth, 180° 00′.]

0	11·8	
20	7·5	
40	4·9	
60	5·2	
80	2·5	
92	2·5	Dry pond.
107	2·5	Dry pond.
120	7·4	
140	8·2	
160	12·1	
180	18·6	
200	10·4	
214	11·9	
216	11·9	
218	5·1	Foot of bluff.
230	.....	Shore line in 1894.
238	.....	Shore line in 1887.
250	— 1·5	Low-water line in 1894.
300	— 3·5	
350	— 2·0	
400	— 8·0	
450	— 8·5	
500	— 9·0	
550	— 9·0	
600	— 8·0	
650	— 9·0	
700	— 9·5	
750	— 8·0	
800	— 6·5	
850	— 7·0	
900	— 8·0	
950	— 8·0	
1 000	— 8·0	
1 050	— 8·5	
1 100	— 8·0	
1 150	— 8·0	
1 200	— 8·5	
1 250	— 9·0	
1 300	— 8·5	
1 350	— 9·0	
1 400	— 9·5	
1 450	— 9·5	
1 500	— 9·5	
1 550	— 9·0	
1 600	— 9·0	

CROSS-SECTION No. 105—Continued.

[Origin: Latitude, 41° 17′ 31″·50; longitude, 70° 10′ 54″·15; azimuth, 180° 00′.]

Distance from origin.	Height above or below mean sea level.	Remarks
Metres.	*Feet.*	
1 650	— 8·5	
1 700	— 9·5	
1 750	— 8·2	
1 800	—10·5	
1 850	—13·2	
1 900	—15·5	
1 950	—18·0	
2 000	—18·7	
2 050	—20·0	
2 100	—20·2	

CROSS-SECTION No. 107.

[Origin: Latitude, 41° 17′ 30″·40; longitude, 70° 10′ 59″·30; azimuth, 179° 53′.]

0	8·6	
20	6·0	
40	5·7	
60	6·1	
80	6·3	
100	5·2	
120	4·6	
140	2·1	
160	2·8	
180	4·0	
200	7·0	
214	13·9	Bluff stake.
215	14·3	Top of bluff.
218	7·8	Foot of bluff.
240	3·3	
257	.....	Shore line in 1894.
273	.....	Shore line in 1887.
275	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 5·5	
400	— 5·2	
450	— 7·0	
500	— 7·0	
550	— 7·0	
600	—10·5	
650	— 9·5	
700	— 9·5	
750	— 9·0	
800	— 9·5	
850	— 8·5	
900	— 7·5	
950	— 6·5	
1 000	— 7·5	
1 050	— 9·5	
1 100	— 8·5	
1 150	— 8·0	
1 200	— 9·0	
1 250	— 9·7	
1 300	—10·0	
1 350	— 9·7	
1 400	—10·2	
1 450	— 9·7	
1 500	— 9·2	
1 550	— 9·5	
1 600	— 9·7	
1 650	— 9·7	
1 700	— 8·2	
1 750	— 9·2	
1 800	— 9·2	

CROSS-SECTION NO. 107—Continued.

[Origin: Latitude, 41° 17′ 30″·40; longitude, 70° 10′ 59″·30; azimuth, 179° 53′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 850	— 9·7	
1 900	—11·5	
1 950	—16·5	
2 000	—17·7	
2 050	—18·7	
2 100	—19·2	
2 150	—19·7	
2 200	—20·0	
2 250	—20·5	
2 300	—20·7	

CROSS-SECTION NO. 109.

[Origin: Latitude, 41° 17′ 31″·70; longitude, 70° 11′ 4″·81; azimuth, 180° 8′.]

0	11·4	
20	7·8	
40	5·4	
60	5·1	
80	3·2	
100	2·2	
120	2·1	
140	3·0	
160	5·8	
180	9·2	
200	8·0	
214	12·2	Bluff stake.
218	5·4	Foot of bluff.
235	.....	Shore line in 1894.
247	.....	Shore line in 1887.
250	— 1·5	Low-water line in 1894.
300	— 1·7	
350	— 4·0	
400	— 5·2	
450	— 6·7	
500	— 8·7	
550	—10·2	
600	— 9·2	
650	— 9·2	
700	— 6·2	
750	— 5·2	
800	— 7·5	
850	— 6·7	
900	— 6·7	
950	— 8·2	
1 000	— 9·7	
1 050	— 9·2	
1 100	— 9·2	
1 150	— 9·0	
1 200	— 9·5	
1 250	— 9·5	
1 300	— 9·5	
1 350	—10·0	
1 400	— 9·5	
1 450	— 9·0	
1 500	— 8·5	
1 550	— 8·7	
1 600	— 9·0	
1 650	— 9·0	
1 700	— 8·5	
1 750	— 9·5	
1 800	— 9·5	
1 850	—10·0	
1 900	—13·5	

CROSS-SECTION NO. 109—Continued.

[Origin: Latitude, 41° 17′ 31″·70; longitude, 70° 11′ 4″·81; azimuth, 180° 8′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 950	—16·0	
2 000	—16·5	
2 050	—18·0	
2 100	—18·5	
2 150	—19·0	
2 200	—19·5	
2 250	—19·5	
2 300	—20·0	
2 350	—20·5	
2 400	—21·5	

CROSS-SECTION NO. 111.

[Origin: Latitude, 41° 17′ 32″·09; longitude, 70° 11′ 9″·76; azimuth, 180° 10′.]

0	5·9	
20	4·0	
31	3·3	Dried up pond.
40	2·1	" "
60	1·6	" "
80	1·8	" "
100	1·6	" "
120	1·9	" "
122	1·9	" "
140	3·0	
160	9·6	
180	12·6	
200	15·2	
214	15·6	Bluff stake.
220	9·8	
225	4·4	Foot of bluff.
229	.....	Shore line in 1894.
247	.....	Shore line in 1878.
258	— 1·5	Low-water line in 1894.
300	— 2·7	
350	— 3·5	
400	— 5·7	
450	— 7·0	
500	— 8·5	
550	— 7·7	
600	— 7·2	
650	— 9·7	
700	— 6·2	
750	— 5·5	
800	— 5·2	
850	— 7·2	
900	—11·7	
950	—11·2	
1 000	—10·7	
1 050	—10·2	
1 100	— 8·7	
1 150	— 7·5	
1 200	— 9·7	
1 250	— 9·5	
1 300	— 9·2	
1 350	— 5·2	
1 400	— 8·7	
1 450	— 8·7	
1 500	— 9·7	
1 550	— 9·2	
1 600	— 9·5	
1 650	— 9·7	
1 700	— 9·7	
1 750	—10·2	

CROSS-SECTION No. 111—Continued.

[Origin: Latitude, 41° 17′ 32″·09; longitude, 70° 11′ 9″·76; azimuth, 180° 10′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 800	— 9·7	
1 850	—10·7	
1 900	—13·5	
1 950	—15·2	
2 000	—16·5	
2 050	—17·7	
2 100	—17·7	
2 150	—18·5	
2 200	—19·2	
2 250	—20·2	
2 300	—20·7	

CROSS-SECTION No. 113.

[Origin: Latitude, 41° 17′ 36″·33; longitude, 70° 11′ 14″·79; azimuth, 179° 28′.]

0	1·4	Marshy ground.
20	2·6	
40	4·4	
60	10·8	
76	14·4	Top of bluff.
80	12·0	
100	7·8	
107	5·0	Foot of bluff.
110	.....	Shore line in 1894.
116	.....	Shore line in 1887.
134	— 1·5	Low-water line in 1894.
176	— 1·7	
226	— 4·0	
276	— 5·7	
326	— 8·7	
376	— 7·7	
426	— 5·2	
476	— 6·2	
526	— 3·5	
576	— 6·7	
626	— 8·5	
676	— 9·5	
726	— 9·0	
776	— 9·5	
826	— 9·0	
876	— 9·0	
926	— 8·5	
976	— 8·0	
1 026	— 7·5	
1 076	— 6·0	
1 126	— 7·0	
1 176	— 9·0	
1 226	— 9·0	
1 276	— 9·5	
1 326	— 9·5	
1 376	— 9·5	
1 426	— 9·5	
1 476	— 9·5	
1 526	— 9·5	
1 576	— 9·0	
1 626	— 9·5	
1 676	— 9·5	
1 726	—10·5	
1 776	— 9·5	
1 826	—11·0	
1 876	—13·5	
1 926	—15·5	

CROSS-SECTION No. 113—Continued.

[Origin: Latitude, 41° 17′ 36″·33; longitude, 70° 11′ 14″·79; azimuth, 179° 28′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 976	—17·5	
2 026	—18·0	
2 076	—19·5	
2 126	—20·5	

CROSS-SECTION No. 115.

[Origin: Latitude, 41° 17′ 32″·64; longitude, 70° 11′ 20″·20; azimuth, 180° 8′.]

0	13·6	
20	6·6	
40	7·7	
60	11·5	
80	11·0	
100	8·6	
120	4·0	
140	2·6	
160	5·4	
180	6·6	
198	13·6	Top of bluff.
220	6·6	
228	5·6	Foot of sloping ground.
230	.....	Shore line in 1887.
252	.....	Shore line in 1894.
268	— 1.5	Low-water line in 1894.
300	— 3·7	
350	— 4·7	
400	— 5·7	
450	— 5·2	
500	— 5·7	
550	— 6·2	
600	— 8·2	
650	— 8·7	
700	— 8·7	
750	— 9·2	
800	— 7·0	
850	— 7·2	
900	— 8·2	
950	— 7·5	
1 000	— 6·2	
1 050	— 5·5	
1 100	— 6·5	
1 150	— 7·5	
1 200	— 8·2	
1 250	— 8·2	
1 300	— 8·2	
1 350	— 7·5	
1 400	— 9·0	
1 450	— 9·5	
1 500	— 9.5	
1 550	— 9·5	
1 600	— 9·0	
1 650	— 9·0	
1 700	— 9·5	
1 750	—10·0	
1 800	— 9·5	
1 850	— 9·5	
1 900	—10.0	
1 950	— 9·5	
2 000	—13·5	
2 050	—18·0	
2 100	—19·0	
2 150	—19·5	

CROSS-SECTION NO. 117.

[Origin: Latitude, 41° 17′ 32″·25; longitude, 70° 11′ 25″·01; azimuth, 179° 40′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	20·2	
20	25·2	
40	24·4	
60	24·6	
80	24·1	
100	25·0	
120	23·0	
140	6·3	
160	4·8	
180	2·4	
200	14·0	
214	4·5	
235	.....	Shore line in 1887, 1894.
257	— 1·5	Low-water line in 1894.
300	— 1·0	
350	— 5·5	
400	— 4·2	
450	— 6·5	
500	— 6·5	
550	— 7·0	
600	— 8·0	
650	— 6·5	
700	— 8·5	
750	— 6·0	
800	— 6·0	
850	— 8·0	
900	— 7·0	
950	— 5·5	
1 000	— 6·5	
1 050	— 7·0	
1 100	— 6·5	
1 150	— 7·5	
1 200	— 8·0	
1 250	— 7·5	
1 300	— 8·0	
1 350	— 8·5	
1 400	— 8·5	
1 450	— 9·0	
1 500	— 9·0	
1 550	— 9·5	
1 600	— 8·0	
1 650	— 9·5	
1 700	— 9·0	
1 750	— 9·0	
1 800	— 9·0	
1 850	— 9·0	
1 900	—10·0	
1 950	— 9·5	
2 000	—10·0	
2 050	—16·5	
2 100	—18·5	
2 150	—19·0	
2 200	—19·5	
2 250	—20·5	
2 300	—21·0	

CROSS-SECTION NO. 119.

[Origin: Latitude, 41° 17′ 30″·79; longitude, 70° 11′ 30″·25; azimuth, 179° 40′.]

0	21·2	
20	23·9	
40	25·9	
60	21·0	

CROSS-SECTION NO. 119—Continued.

[Origin: Latitude, 41° 17′ 30″·79; longitude, 70° 11′ 30″·25; azimuth, 179° 40′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
80	17·8	
100	11·0	
120	4·5	
140	2·7	
160	2·8	
180	4·2	
200	3·5	
214	9·3	Top of bluff.
216	6·4	Foot of bluff.
235	.....	Shore line in 1887, 1894.
266	— 1·5	Low-water line in 1894.
300	— 2·0	
350	— 3·0	
400	— 5·7	
450	— 6·5	
500	— 5·5	
550	— 6·5	
600	— 6·5	
650	— 5·5	
700	— 5·0	
750	— 7·5	
800	— 8·5	
850	— 5·5	
900	— 6·5	
950	— 5·5	
1 000	— 6·0	
1 050	— 7·0	
1 100	— 7·0	
1 150	— 6·5	
1 200	— 7·0	
1 250	— 6.5	
1 300	— 7·0	
1 350	— 7·5	
1 400	— 7·5	
1 450	— 7·2	
1 500	— 8·2	
1 550	— 7·5	
1 600	— 8·2	
1 650	— 7·2	
1 700	— 8·2	
1 750	— 8·2	
1 800	— 8·2	
1 850	— 8·5	
1 900	— 9·2	
1 950	— 9·2	
2 000	— 9·2	
2 050	—11·2	
2 100	—14·7	
2 150	—17·5	
2 200	—18·7	
2 250	—19·5	
2 300	—20·2	

CROSS-SECTION NO. 121.

[Origin: Latitude, 41° 17′ 30″·08; longitude, 70° 11′ 35″·36; azimuth, 179° 58′.]

0	3·3	
20	2·3	
40	2·4	
60	2·1	
76	2·2	Marshy ground.
80	2·0	" "
100	1·3	" "

CROSS-SECTION No. 121—Continued.

[Origin: Latitude, 41° 17′ 30″·08; longitude, 70° 11′ 35″·36; azimuth, 179° 58′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
120	1·2	Marshy ground.
122	1·2	" "
140	1·7	
160	4·4	
180	3·6	
200	4·5	
214	7·2	Bluff stake.
218	6·6	Foot of bluff.
237	.....	Shore line in 1887, 1894.
250	— 1·5	Low-water line in 1894.
259	.....	Shoal, inner end.
280	.....	Shoal, outer end.
300	— 1·7	
350	— 3·0	
400	— 4·7	
450	— 2·7	
500	— 5·7	
550	— 7·2	
600	— 3·7	
650	— 6·2	
700	— 6·7	
750	— 7·7	
800	— 5·7	
850	— 4·5	
900	— 3·2	
950	— 5·7	
1 000	— 5·7	
1 050	— 6·7	
1 100	— 6·7	
1 150	— 8·7	
1 200	— 6·2	
1 250	— 5·7	
1 300	— 5·7	
1 350	— 5·7	
1 400	— 5·5	
1 450	— 5·5	
1 500	— 5·5	
1 550	— 5·5	
1 600	— 7·0	
1 650	— 7·5	
1 700	— 8·5	
1 750	— 7·5	
1 800	— 8·5	
1 850	— 8·5	
1 900	— 9·2	
1 950	— 8·5	
2 000	— 9·5	
2 050	— 9·0	
2 100	—13·5	
2 150	—17·5	
2 200	—18·0	
2 250	—18·5	
2 300	—19·0	
2 350	—19·2	
2 400	—19·5	

CROSS-SECTION No. 123.

[Origin: Latitude, 41° 17′ 24″·31; longitude, 70° 11′ 40″·23; azimuth, 179° 0′.]

0	0·4	Madeket Harbor.
20	2·3	
40	4·0	
60	5·4	

CROSS-SECTION No. 123—Continued.

[Origin: Latitude, 41° 17′ 24″·31; longitude, 70° 11′ 40″·23; azimuth, 179° 0′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
80	6·3	
100	5·2	
120	3·6	
140	5·4	
160	4·7	
180	3·6	
200	3·0	
220	5·6	
240	1·8	
251	1·3	Marshy.
260	1·2	"
280	1·3	"
282	1.1	Marshy.
300	3·1	
320	3·6	
340	2·7	
360	5·2	
369	7·1	Bluff.
380	5·8	
387	3·0	Beach.
400	.....	Shore line in 1894.
406	.....	Shore line in 1887.
410	— 1·5	Low-water line in 1894.
423	.....	Shoal, inner edge.
480	.....	Shoal, outer edge.
500	— 4·0	
550	— 5·0	
600	— 7·0	
650	— 7·0	
700	— 5·5	
750	— 4·5	
800	— 5·0	
850	— 6·5	
900	— 5·5	
950	— 5·0	
1 000	— 4·5	
1 050	— 3·5	
1 100	— 4·5	
1 150	— 6·5	
1 200	— 6·5	
1 250	— 9·5	
1 300	— 7·5	
1 350	— 6·0	
1 400	— 5·5	
1 450	— 6·0	
1 500	— 5·5	
1 550	— 5·5	
1 600	— 5·5	
1 650	— 6·0	
1 700	— 6·0	
1 750	— 5·5	
1 800	— 6·0	
1 850	— 5·5	
1 900	— 7·5	
1 950	— 9·5	
2 000	— 8·5	
2 050	— 9·0	
2 100	— 9·5	
2 150	—10·0	
2 200	— 7·0	
2 250	— 9·5	
2 300	—14·0	
2 350	—15·0	
2 400	—17·5	
2 450	—18·0	
2 500	—19·5	

CROSS-SECTION No. 123—Continued.

[Origin: Latitude, 41° 17′ 24″·31; longitude, 70° 11′ 40″·23; azimuth, 179° 0′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
2 550	—19·5	
2 600	—20·0	
2 650	—20·5	
2 700	—20·5	

CROSS-SECTION No. 125.

[Origin: Latitude, 41° 17′ 27″·09; longitude, 70° 11′ 46″·24; azimuth, 180° 0′.]

0	1·3	Madeket Harbor.
20	1·9	
24	1·9	Marshy.
40	1·0	"
60	1·2	"
80	1·2	"
100	1·0	"
120	0·9	"
140	1·1	"
160	1·1	"
176	1·3	Marshy.
180	2·0	
200	6·6	
220	10·3	
240	9·3	
260	9·6	
268	9·9	Top of bluff.
273	4·9	Foot of bluff.
292	.....	Shore line in 1887, 1894.
324	— 1·5	Low-water line in 1894.
350	— 2·0	
400	— 4·5	
450	— 5·5	
500	— 7·5	
550	— 5·0	
600	— 4·7	
650	— 5·0	
700	— 4·0	
750	— 3·0	
800	— 3·0	
850	— 3·0	
900	— 3·0	
950	— 3·0	
1 000	— 3·5	
1 050	— 4·0	
1 100	— 4·5	
1 150	— 9·0	
1 200	— 8·5	
1 250	— 7·0	
1 300	— 4·5	
1 350	— 3·5	
1 400	— 5·0	
1 450	— 4·5	
1 500	— 5·5	
1 550	— 6·0	
1 600	— 6·5	
1 650	— 5·0	
1 700	— 4·5	
1 750	— 5·5	
1 800	— 8·0	
1 850	— 9·0	
1 900	— 8·5	
1 950	— 8·5	
2 000	— 9·0	
2 050	— 9·0	

CROSS-SECTION No. 125—Continued.

[Origin: Latitude, 41° 17′ 27″·09; longitude, 70° 11′ 46″·24; azimuth, 180° 0′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
2 100	— 7·5	
2 150	— 8·0	
2 200	—11·0	
2 250	—19·5	
2 300	—16·0	
2 350	—17·5	
2 400	—18·0	
2 450	—19·5	
2 500	—20·0	
2 550	—20·0	
2 600	—20·5	
2 650	—20·5	

CROSS-SECTION No. 127.

[Origin: Latitude, 41° 17′ 28″·00; longitude, 70° 11′ 51″·5; azimuth, 180° 0′.]

0	1·0	Madeket Harbor.
20	1·3	
40	1·5	
60	5·2	
80	1·8	
100	1·8	
107	1·4	Marsh.
120	2·8	
140	2·5	
160	6·0	
180	3·8	
200	8·4	
220	8·2	
240	11·4	
244	12·3	Top of bluff.
248	5·0	Foot of bluff.
263	.....	Shore line in 1894.
268	.....	Shore line in 1887.
284	— 1·5	Low-water line in 1894.
350	— 4·2	
400	— 4·2	
450	— 4·5	
500	— 5·2	
550	— 6·0	
600	— 4·2	
650	— 3·7	
700	— 3·7	
750	— 3·7	
800	— 3·7	
850	— 3·7	
900	— 3·7	
950	— 3·7	
1 000	— 3·7	
1 050	— 3·7	
1 100	— 4·2	
1 150	— 3·7	
1 200	— 3·5	
1 250	— 3·2	
1 300	— 3·7	
1 350	— 3·7	
1 400	— 4·5	
1 450	— 5·2	
1 500	— 8·2	
1 550	— 6·7	
1 600	— 7·5	
1 650	— 5·5	
1 700	— 5·2	

CROSS-SECTION No. 127—Continued.

[Origin: Latitude, 41° 17′ 28″·00; longitude, 70° 11′ 51″·5; azimuth, 180° 0′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 750	— 4·7	
1 800	— 9·0	
1 850	— 9·5	
1 900	— 9·0	
1 950	— 8·5	
2 000	— 9·0	
2 050	— 9·0	
2 100	— 9·0	
2 150	— 7·5	
2 200	—10·0	
2 250	—13·2	
2 300	—15·5	
2 350	—17·5	
2 400	—18·5	
2 450	—19·5	
2 500	—20·0	
2 550	—21·0	

CROSS-SECTION No. 129.

[Origin: Latitude, 41° 17′ 27″·81; longitude, 70° 11′ 56″·67; azimuth, 179° 53′.]

0	0·1	Madeket Harbor.
20	1·6	
40	1·1	
54	1·3	Marsh.
60	1·0	
80	1·0	
100	1·0	
120	2·4	
140	5·9	
160	11·2	
179	13·6	Top of small bluff.
181	9·0	Sudden bluff.
200	1·4	
220	1·4	
240	3·0	
257	12·0	Top of bluff.
261	4·8	Foot of bluff.
264	.....	Shore line in 1894.
269	.....	Shore line in 1887.
282	— 1·5	Low-water line in 1894.
300	— 2·7	
350	— 4·2	
400	— 5·5	
450	— 5·5	
500	— 5·2	
550	— 3·7	
600	— 4·2	
650	— 3·7	
700	— 4·2	
750	— 4·7	
800	— 5·2	
850	— 7·2	
900	— 8·2	
950	— 8·7	
1 000	— 9·2	
1 050	— 8·7	
1 100	—10·5	
1 150	—10·7	
1 200	—11·7	
1 250	—10·2	
1 300	— 9·2	
1 350	— 9·2	

CROSS-SECTION No. 129—Continued.

[Origin: Latitude, 41° 17′ 27″·81; longitude, 70° 11′ 56″·67; azimuth, 179° 53′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 400	— 9·7	
1 450	—10·5	
1 500	— 6·7	
1 550	— 7·7	
1 600	— 6·5	
1 650	— 6·2	
1 700	— 6·0	
1 750	— 5·2	
1 800	— 7·0	
1 850	— 8·0	
1 900	— 8·5	
1 950	— 9·0	
2 000	— 8·5	
2 050	— 8·5	
2 100	— 8·0	
2 150	— 9·5	
2 200	— 7·7	
2 250	— 9·5	
2 300	—13·5	
2 350	—15·5	
2 400	—17·5	
2 450	—18·7	
2 500	—20·5	
2 550	—20·5	
2 600	—20·5	
2 650	—20·5	
2 700	—20·5	
2 750	—21·0	
2 800	—21·0	
2 850	—21·0	
2 900	—21·5	

CROSS-SECTION No. 131.

[Origin: Latitude, 41° 17′ 27″·80; longitude, 70° 12′ 1″·76; azimuth, 179° 48′.]

0	0·6	
8	1·7	Marshy.
20	2·3	"
40	1·1	"
60	2·3	"
80	1·2	"
100	0·9	"
103	1·0	Marshy.
120	3·0	
134	10·6	Edge of bluff.
140	12·3	
160	7·0	
180	1·1	
200	1·8	
220	6·4	
240	9·4	
257	.....	Shore line in 1894.
260	.....	Shore line in 1887.
270	— 1·5	Low-water line in 1894.
300	— 4·5	
350	— 6·0	
400	— 6·1	
450	— 4·0	
500	— 3·7	
550	— 4·7	
600	— 6·5	
650	— 9·5	
700	—11·5	

CROSS-SECTION No. 131—Continued.

[Origin: Latitude, 41° 17′ 27″·80; longitude, 70° 12′ 1″·76; azimuth, 179° 48′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
750	—12·0	
800	—12·0	
850	—10·5	
900	— 9·5	
950	— 8·5	
1 000	— 8·5	
1 050	— 8·5	
1 100	— 8·5	
1 150	—10·5	
1 200	—10·0	
1 250	— 9·0	
1 300	— 8·0	
1 350	— 8·0	
1 400	— 7·5	
1 450	— 7·0	
1 500	— 7·0	
1 550	— 7·5	
1 600	— 8·0	
1 650	— 7·2	
1 700	— 8·0	
1 750	— 6·0	
1 800	— 8·0	
1 850	— 9·0	
1 900	— 8·5	
1 950	— 9·0	
2 000	— 8·5	
2 050	— 8·5	
2 100	— 8·5	
2 150	—11·0	
2 200	— 8·5	
2 250	—10·5	
2 300	—13·7	
2 350	—17·2	
2 400	—18·7	
2 450	—18·7	
2 500	—19·2	
2 550	—19·7	
2 600	—20·2	
2 650	—20·2	
2 700	—20·2	
2 750	—20·2	
2 800	—20·2	
2 850	—20·7	

CROSS-SECTION No. 133.

[Origin: Latitude, 41° 17′ 24″·76; longitude, 70° 12′ 7″·17; azimuth, 179° 56′.]

0	1·3	Madeket Harbor.
20	1·2	
40	1·0	
60	1·2	
80	1·4	
100	0·5	
120	0·9	
140	0·9	
160	1·3	
180	0·6	
200	1·6	Marshy.
220	11·6	
240	2·8	
260	5·7	
280	4·4	
300	5·9	

CROSS-SECTION No. 133—Continued.

[Origin: Latitude, 41° 17′ 24″·76; longitude, 70° 12′ 7″·17; azimuth, 179° 56′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
320	9·2	
346	.....	Shore line in 1887, 1894.
356	— 1·5	Low-water line in 1894.
406	— 5·2	
456	— 5·2	
512	— 4·7	
556	— 4·2	
612	— 5·7	
656	— 9·2	
712	—11·7	
756	—11·7	
813	—12·2	
856	—11·7	
912	—10·7	
956	— 7·5	
1 012	— 4·2	
1 056	— 5·5	
1 112	— 7·7	
1 156	— 8·2	
1 212	— 8·2	
1 256	— 7·2	
1 312	— 6·7	
1 356	— 6·2	
1 412	— 6·2	
1 456	— 6·2	
1 512	— 6·7	
1 556	— 6·2	
1 612	— 6·2	
1 656	— 7·2	
1 712	— 5·7	
1 756	— 7·7	
1 812	— 7·2	
1 856	— 7·7	
1 912	— 8·5	
1 956	— 9·7	
2 012	— 9·7	
2 056	— 7·7	
2 112	— 8·2	
2 156	— 8·2	
2 212	— 7·7	
2 256	— 8·2	
2 312	—10·2	
2 356	— 8·2	
2 412	—12·0	
2 456	—17·0	
2 512	—18·0	
2 556	—18·5	
2 612	—19·5	
2 656	—20·0	
2 712	—19·5	
2 756	—18.7	
2 812	—20·0	

CROSS-SECTION No. 135.

[Origin: Latitude, 41° 17′ 21″·39; longitude, 70° 12′ 12″·60; azimuth, 179° 55′.]

0	1·3	Madeket Harbor.
6	1·7	Marsh.
20	1·0	"
40	0·6	"
60	0·6	"
80	0·7	"
100	1·0	"

CROSS-SECTION No. 135—Continued.

[Origin: Latitude, 41° 17′ 21″·39; longitude, 70° 12′ 12″·60; azimuth, 179° 55′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
120	1·3	Marsh.
140	1·7	"
160	1·1	"
180	1·1	"
200	1·0	"
220	0·8	"
240	0·9	"
260	2·5	"
279	0·9	Marsh.
300	9·1	
320	6·4	
340	1·7	
360	3·6	
380	2·9	
400	7·6	
417	14·7	Top of bluff.
432	4·8	Foot of bluff.
440	.....	Shore line in 1887, 1894.
450	— 1·5	Low-water line in 1894.
500	— 5·5	
550	— 6·5	
600	— 4·5	
650	— 4·5	
700	— 7·5	
750	—12·5	
800	—13·0	
850	—13·5	
900	—13·0	
950	—11·0	
1 000	— 5·7	
1 050	— 4·0	
1 100	— 3·5	
1 150	— 6·5	
1 200	— 6·5	
1 250	— 6·5	
1 300	— 6·0	
1 350	— 5·5	
1 400	— 6·0	
1 450	— 6·0	
1 500	— 5·5	
1 550	— 4·5	
1 600	— 5·5	
1 650	— 5·5	
1 700	— 6·5	
1 750	— 7·0	
1 800	— 7·5	
1 850	— 7·0	
1 900	— 9·7	
1 950	— 8·2	
2 000	— 8·2	
2 050	— 9·2	
2 100	— 8·7	
2 150	— 7·5	
2 200	— 7·7	
2 250	— 7·7	
2 300	— 8·2	
2 350	— 8·7	
2 400	— 9·7	
2 450	— 7·2	
2 500	—11·2	
2 550	—14·0	
2 600	—15·5	
2 650	—16·2	
2 700	—18·2	
2 750	—19·2	

CROSS-SECTION No. 135—Continued.

[Origin: Latitude, 41° 17′ 21″·39; longitude, 70° 12′ 12″·60; azimuth, 179° 55′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
2 800	—18·5	
2 850	—20·2	
2 900	—21·2	

CROSS-SECTION No. 137.

[Origin: Latitude, 41° 17′ 20″·09; longitude, 70° 12′ 17″·79; azimuth, 179° 48′.]

0	1·3	Madeket Harbor.
8	1·6	Marsh.
20	1·1	"
40	0·9	"
60	1·3	"
80	1·4	"
100	1·4	"
120	1·3	"
140	1·2	"
160	1·3	"
180	1·2	"
200	1·1	"
220	1·3	"
240	1·4	"
260	1·4	"
280	1·1	"
297	1·8	Edge of marsh.
320	5·6	
340	4·0	
360	4·8	
380	4·6	
400	9·5	
419	15·0	Top of bluff.
446	4·4	Foot of bluff.
460	.....	Shore line in 1894.
462	.....	Shore line in 1887.
480	— 1·5	Low-water line in 1894.
500	— 2·7	
550	— 6·0	
600	— 5·2	
650	— 2·7	
700	— 5·7	
750	— 9·7	
800	—13·7	
850	—14·2	
900	—11·7	
950	— 8·7	
1 000	— 7·5	
1 050	— 3·5	
1 100	— 3·0	
1 150	— 3·0	
1 200	— 2·5	
1 250	— 5·0	
1 300	— 4·0	
1 350	— 4·5	
1 400	— 3·5	
1 450	— 4·0	
1 500	— 3·5	
1 550	— 3·5	
1 600	— 4·5	
1 650	— 4·5	
1 700	— 6·5	
1 750	— 8·0	
1 800	— 9·5	
1 850	— 8·5	

CROSS-SECTION NO. 137—Continued.

[Origin: Latitude, 41° 17′ 20″·09; longitude, 70° 12′ 17″·79; azimuth, 179° 48′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 900	— 8·0	
1 950	— 9·5	
2 000	— 8·5	
2 050	— 8·5	
2 100	— 6·5	
2 150	— 8·5	
2 200	— 7·0	
2 250	— 7·5	
2 300	— 8·5	
2 350	— 8·0	
2 400	— 9·0	
2 450	— 9·5	
2 500	— 8·0	
2 550	— 9·0	
2 600	—11·5	
2 650	—14·5	
2 700	—16·0	
2 750	—16·5	
2 800	—18·0	
2 850	—19·5	
2 900	—20·0	

CROSS-SECTION NO. 139.

[Origin: Lagitude, 41° 17′ 19″·44; longitude, 70° 12′ 22″·76; azimuth, 180° 28′.]

0	1·4	
24	0·9	Edge of marsh.
46	1·2	Marsh.
60	2·8	"
80	1·1	"
100	0·9	"
120	1·1	"
140	1·1	"
160	1·2	"
180	0·7	"
200	1.0	"
222	2·2	"
240	5·4	
260	7·0	
280	4·7	
300	4·8	
320	4·0	
340	2·4	
360	2·7	
380	4·6	
400	5·2	
420	11·1	
435	11·3	Bluff stake.
439	7·0	Foot of bluff.
449	.....	Shore line in 1887.
465	.....	Shore line in 1894.
500	— 1·5	Low-water line in 1894.
550	— 2·0	
600	— 4·0	
650	— 3·0	
700	—13·5	
750	—14·5	
800	—14·5	
850	—13·0	
900	—11·5	
950	— 8·5	
1 000	— 4·0	

CROSS-SECTION NO. 139—Continued.

[Origin: Latitude, 41° 17′ 19″·44; longitude, 70° 12′ 22″·76; azimuth, 180° 28′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 050	— 2·0	
1 100	— 2·0	
1 150	— 2·0	
1 200	— 3·5	
1 250	— 4·0	
1 300	— 4·0	
1 350	— 3·5	
1 400	— 2·7	
1 450	— 2·0	
1 500	— 2·5	
1 550	— 4·2	
1 600	— 4·5	
1 650	— 6·0	
1 700	— 7·0	
1 750	— 8·5	
1 800	— 7·5	
1 850	— 8·0	
1 900	— 7·0	
1 950	— 9·0	
2 000	— 8·0	
2 050	— 6·0	
2 100	— 6·5	
2 150	— 7·0	
2 200	— 7·0	
2 250	— 8·0	
2 300	— 7·0	
2 350	— 7·5	
2 400	— 8·0	
2 450	— 7·5	
2 500	— 6·2	
2 550	— 8·2	
2 600	—12·5	
2 650	—13·7	
2 700	—15·7	
2 750	—17·2	
2 800	—18·2	
2 850	—19·5	
2 900	—19·2	
2 950	—20·2	
3 000	—20·2	

CROSS-SECTION NO. 141.

[Origin: Latitude, 41° 17′ 23″·24; longitude, 70° 12′ 27″·76; azimuth, 180° 56′.]

0	0·7	Madeket Harbor.
20	2·6	
40	3·9	
60	5·0	
80	4·0	
100	3·0	
120	4·0	
140	2·8	
160	2·5	
180	4·2	
200	3·8	
220	3·9	
240	3·9	
260	2·5	
281	7·9	Bluff stake.
284	4·1	Foot of bluff.
294	.....	Shore line in 1887.
312	.....	Shore line in 1894.

CROSS-SECTION NO. 141—Continued.

[Origin: Latitude, 41° 17′ 23″·24; longitude, 70° 12′ 27″·76; azimuth, 180° 56′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
330	— 1·5	Low-water line in 1894.
400	— 1·5	
450	— 1·5	
500	—12·0	
550	—17·5	
600	—16·0	
650	—14·5	
700	—13·5	
750	— 9·0	
800	— 5·0	
850	— 2·0	
900	— 1·5	
950	— 3·0	
1 000	— 4·0	
1 050	— 3·2	
1 100	— 3·0	
1 150	— 3·0	
1 200	— 3·0	
1 250	— 3·0	
1 300	— 4·5	
1 350	— 5·0	
1 400	— 7·0	
1 450	— 6·5	
1 500	— 5·0	
1 550	— 5·5	
1 600	— 7·0	

CROSS-SECTION NO. 141—Continued.

[Origin: Latitude, 41° 17′ 23″·24; longitude, 70° 12′ 27″·76; azimuth, 180° 56′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 650	— 7·5	
1 700	— 6·0	
1 750	— 6·5	
1 800	— 6·0	
1 850	— 6·0	
1 900	— 6·0	
1 950	— 6·0	
2 000	— 6·5	
2 050	— 7·0	
2 100	— 6·5	
2 150	— 6·5	
2 200	— 7·0	
2 250	— 8·0	
2 300	— 6·5	
2 350	— 7·5	
2 400	— 9·0	
2 450	— 5·5	
2 500	—10·0	
2 550	—13·0	
2 600	—16·0	
2 650	—17·5	
2 700	—18·0	
2 750	—20·0	
2 800	—21·0	
2 850	—20·5	
2 900	—21·0	

TABLE NO. 1.—*Changes in shore line of northern shore of Nantucket Island from 1887 to 1894.*

Cross-section.	Position of origin.			Distance from origin to high-water line in—		Yearly change since 1887.		Remarks.
	Latitude.	Longitude.	Azimuth.	1887.	1894.	Advance.	Retreat.	
	° ′ ″	° ′ ″	° ′	*Metres.*	*Metres.*	*Metres.*	*Metres.*	
No. 2	41 17 29·52	70 06 21·48	179 05	384	426	+6·00	.....	At south end of west jetty.
4	" " 30·57	" " 26·85	179 04	350	380	+4·28	.....	
6	" " 33·94	" " 32·31	179 42	247	267	+2·85	.....	
8	" " 33·38	" " 33·22	179 14	263	270	+1·00	.....	
10	" " 32·80	" " 42·89	179 49	274	270	.....	—0·57	
12	" " 32·02	" " 47·14	178 53	286	268	.....	—2·57	
14	" " 33·71	" " 53·15	179 30	221	203	.....	—2·57	
16	" " 32·09	" " 58·52	179 32	262	250	.....	—1·71	
18	" " 32·09	70 07 03·70	179 22	260	251	.....	—1·28	
20	" " 29·23	" " 09·00	179 21	352	338	.....	—2·00	
22	" " 31·54	" " 14·13	179 13	276	266	.....	—1·42	
24	" " 32·28	" " 19·64	179 14	250	244	.....	—0·85	
26	" " 32·57	" " 24·92	179 30	243	229	.....	—2·00	
28	" " 28·68	" " 29·74	178 57	358	353	.....	—0·71	
29	" " 32·41	" " 35·24	179 37	230	230	+0·00	—0·00	
31	" " 34·39	" " 40·65	179 37	173	179	+0·86	.....	
33	" " 29·56	" " 45·69	179 37	327	340	+1·85	.....	
35	" " 32·93	" " 50·92	179 37	247	247	+0·00	—0·00	
37	" " 33·35	" " 56·03	180 00	233	233	+0·00	—0·00	
39	" " 33·67	70 08 01·42	179 16	219	215	.....	—0·57	
41	" " 32·86	" " 06·45	179 30	237	230	.....	—1·00	
43	" " 33·00	" " 11·70	179 16	230	218	.....	—1·71	
45	" " 30·17	" " 16·89	179 45	305	294	.....	—1·57	
47	" " 35·43	" " 22·35	179 26	140	127	.....	—1·85	
49	" " 38·25	" " 27·37	179 40	30	30	+0·00	—0·00	

TABLE No. 1.—*Changes in shore line of northern shore of Nantucket Island from 1887 to 1894*—Continued.

Cross-section.	Position of origin.			Distance from origin to high-water line in—		Yearly change since 1887.		Remarks.
	Latitude.	Longitude.	Azimuth.	1887.	1894.	Advance.	Retreat.	
	° ′ ″	° ′ ″	° ′	*Metres.*	*Metres.*	*Metres.*	*Metres.*	
51	41 17 31·57	70 08 32·79	179 30	243	248	+0·71	.....	
53	" " 32·15	" " 37·65	179 26	232	230	.....	—0·28	
55	" " 31·70	" " 43·36	179 38	232	232	+0·00	—0·00	
57	" " 32·57	" " 48·47	179 20	203	203	+0·00	—0·00	
59	" " 31·50	" " 53·54	179 12	219	221	+0·28	.....	
61	" " 30·79	" " 58·87	180 00	253	253	+0·00	—0·00	
63	" " 32 80	70 09 04·30	179 13	195	192	.....	—0·43	
65	" " 31·60	" " 09·50	179 30	238	238	+0·00	—0·00	
67	" " 35·10	" " 14·82	180 10	132	135	+0·43	.....	
69	" " 33·32	" " 20·03	179 30	194	192	.....	—0·28	
71	" " 33·35	" " 25·44	179 54	197	197	+0·00	—0·00	
73	" " 32·57	" " 30·56	179 45	239	239	+0·00	—0·00	
75	" " 33·48	" " 35·50	179 52	214	222	+1·14	.....	
77	" " 33·29	" " 41·00	180 11	231	231	+0·00	—0·00	
79	" " 32·90	" " 46·07	179 41	240	240	+0·00	—0·00	
81	" " 33·25	" " 51·35	179 40	232	232	+0·00	—0·00	
83	" " 33·51	" " 56·81	179 52	231	231	+0·00	—0·00	
85	" " 35·00	70 10 02·15	179 45	199	199	+0·00	—0·00	
87	" " 35·75	" " 07·13	179 53	190	190	+0·00	—0·00	
89	" " 34·58	" " 12·21	179 35	234	234	+0·00	—0·00	
91	" " 33·41	" " 17·50	179 53	262	262	+0·00	—0·00	
93	" " 34·29	" " 22·73	179 57	240	230	.....	—1·43	
95	" " 33·58	" " 28·02	179 41	238	229	.....	—1·28	
97	" " 32·83	" " 33·05	179 40	244	234	.....	—1·42	
99	" " 32·35	" " 38·38	179 44	233	233	+0·00	—0·00	
101	" " 31·70	" " 43·79	179 52	241	235	.....	—0·85	
103	" " 31·44	" " 48·90	179 30	240	231	.....	—1·28	
105	" " 31·50	" " 54·15	180 00	238	230	.....	—1·14	
107	" " 30·40	" " 59·30	179 53	273	257	.....	—2·28	
109	" " 31·70	70 11 04·81	180 08	247	235	.....	—1·71	
111	" " 32·09	" " 09·76	180 10	247	229	.....	—2·57	
113	" " 36·33	" " 14·79	179 28	116	110	.....	—0·85	
115	" " 32·64	" " 20·20	180 08	230	252	+3·14	.....	
117	" " 32·25	" " 25·01	179 40	235	235	+0·00	—0·00	
119	" " 30·79	" " 30·25	179 40	235	235	+0·00	—0·00	
121	" " 30·08	" " 35·36	179 58	237	237	+0·00	—0·00	
123	" " 24·31	" " 40·23	179 00	406	400	.....	—0·85	
125	" " 27·09	" " 46·24	180 00	292	292	+0·00	—0·00	
127	" " 28·00	" " 51·50	180 00	268	263	.....	—0·71	
129	" " 27·81	" " 56·67	179 53	269	264	.....	—0·71	
131	" " 27·80	70 12 01·76	179 48	260	257	.....	—0·43	
133	" " 26·51	" " 07·17	179 56	346	346	+0·00	—0·00	
135	" " 21·39	" " 12·60	179 55	440	440	+0·00	—0·00	
137	" " 20·09	" " 17·79	179 48	462	460	.....	—0·28	
139	" " 19·44	" " 22·76	180 28	449	465	+2·28	.....	
141	" " 23·24	" " 27·76	180 56	294	312	+2·57	.....	At Eel Point.
			Sums....	17 987	17 897	+28·39	—41·16	
			Means...	253·3	252·0	.....	— 0·18	

MARTHAS VINEYARD, MASSACHUSETTS.

Cross-Section No. 1.

[Origin: Latitude, 41° 23′ 32″.73; longitude, 70° 30′ 25″.04; azimuth, 270° 5′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	16·7	
20	6·3	
30	2·4	
40	2·7	
60	2·6	
80	2·9	
100	3·4	
120	4·0	
128	.....	Shore line in 1888.
134	.....	Shore line in 1894.
150	— 1·3	
200	— 1·8	
250	— 1·8	
300	— 1·8	
350	— 2·3	
400	— 2·3	
450	— 2·8	
500	— 9·3	
550	—17·6	
600	—20·1	
650	—22·3	
700	—23·3	
750	—23·3	
800	—23·3	
850	—24·1	
900	—25·8	
950	—25·8	
1 000	—26·6	
1 050	—27·8	
1 100	—28·1	
1 150	—29·3	
1 200	—31·1	

Cross-Section No. 3.

[Origin: Latitude, 41° 23′ 41″.00; longitude, 70° 30′ 25″.47; azimuth, 269° 30′.]

0	17·7	
20	16·1	
40	15·2	
60	13·3	
80	13·1	
100	15·7	
107	17·1	
110	8·0	
120	.....	Shore line in 1894.
123	.....	Shore line in 1888.
150	— 1·6	
200	— 2·6	
250	— 3·1	
300	— 3·1	
350	— 3·1	
400	— 3·6	
450	— 3·6	
500	— 3·1	
550	— 2·6	
600	— 4·6	
650	— 7·1	
700	—11·1	
750	—18·6	
800	—20·1	
850	—20·1	
900	—20·6	

Cross-Section No. 3—Continued.

[Origin: Latitude, 41° 23′ 41″.00; longitude, 70° 30′ 25″.47; azimuth, 269° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
950	—22·1	
1 000	—22·6	
1 050	—23·6	
1 100	—24·6	
1 150	—25·6	

Cross-Section No. 5.

[Origin: Latitude, 41° 23′ 47″.80; longitude, 70° 30′ 24″.10; azimuth, 270° 10′.]

0	0·5	Pond shore.
20	0·9	
40	1·1	
60	1·4	
80	5·4	
98	.....	Shore line in 1894.
116	.....	Shore line in 1888.
150	— 1·6	
200	— 2·6	
250	— 2·1	
300	— 3·1	
350	— 3·6	
400	— 3·1	
450	— 3·6	
500	— 3·6	
550	— 4·1	
600	— 4·1	
650	— 4·6	
700	— 7·1	
750	—10·1	
800	—15·6	
850	—19·1	
900	—20·6	
950	—21·1	
1 000	—21·6	
1 050	—23·1	
1 100	—24·1	
1 150	—25·1	
1 200	—27·3	

Cross-Section No. 9.

[Origin: Latitude, 41° 24′ 02″.56; longitude, 70° 30′ 25″.52; azimuth, 268° 7′.]

0	1·4	
20	4·1	
40	5·2	
60	5·9	
70	.....	Shore line in 1894.
81	.....	Shore line in 1888.
100	— 1·1	Low-water line in 1894.
150	— 2·3	
200	— 2·1	
250	— 2·6	
300	— 3·1	
350	— 3·3	
400	— 3·6	
450	— 4·6	
500	— 6·1	
550	— 5·1	
600	— 4·6	

MARTHAS VINEYARD, MASSACHUSETTS—Continued.

CROSS-SECTION No. 9—Continued.

[Origin: Latitude, 41° 24′ 02″·56; longitude, 70° 30′ 25″·52; azimuth, 268° 7′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
650	— 5·6	
700	— 7·1	
750	— 6·1	
800	— 6·6	
850	— 8·6	
900	—11·1	
950	—12·1	
1 000	—11·6	
1 050	—18·1	
1 100	—23·1	
1 150	—24·1	
1 200	—26·1	

CROSS-SECTION No. 11.

[Origin: Latitude, 41° 24′ 6″·15; longitude, 70° 30′ 33″·49; azimuth, 226° 56′.]

0	1·7	
20	2·6	
40	5·2	
60	5·1	
80	4·6	
100	6·4	
106	.....	Shore line in 1888.
108	.....	Shore line in 1894.
112	— 1·1	
150	— 2·1	
200	— 5·1	
250	— 7·1	
300	— 7·6	
350	— 8·1	
400	— 9·1	
450	— 9·1	
500	— 7·6	
550	— 3·1	
600	— 3·1	
650	— 4·1	
700	— 4·1	
750	— 5·1	
800	— 5·1	
850	— 5·6	
900	— 6·1	
950	— 6·1	
1 000	— 7·1	
1 050	— 8·1	
1 100	— 8·6	
1 150	— 9·1	
1 200	—10·1	
1 250	—10·1	

CROSS-SECTION No. 13.

[Origin: Latitude, 41° 24′ 10″·05; longitude, 70° 30′ 39″·00; azimuth, 185° 35′.]

0	1·9	
8	5·3	
20	5·0	
40	4·5	
60	5·9	
80	5·5	
100	5·6	

CROSS-SECTION No. 13—Continued.

[Origin: Latitude, 41° 24′ 10″·05; longitude, 70° 30′ 39″·00; azimuth, 185° 35′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
115	8·0	
120	3·9	
128	.....	Shore line in 1888, 1894.
135	— 1·1	
150	— 1.8	
200	— 1·8	
250	— 2·3	
300	— 2·3	
350	— 1·8	
400	— 3·3	
450	— 4·8	
500	— 4·8	
550	— 4·8	
600	— 3·8	
650	— 5·1	
700	— 5·8	
750	— 6·8	
800	— 5·8	
850	— 7·3	
900	—10·3	
950	—11·8	
1 000	—11·8	
1 050	—12·3	
1 100	—12·8	
1 150	—12·3	
1 200	—12·8	
1 250	—13·8	
1 300	—14·8	
1 350	—15·3	
1 400	—15·8	
1 450	—15·8	
1 500	—16·3	
1 550	—16·3	
1 600	—17·8	

CROSS-SECTION No. 15.

[Origin: Latitude, 41° 24′ 12″·00; longitude, 70° 30′ 49″·47; azimuth, 187° 28′.]

0	1·6	
20	4·2	
40	8·3	
60	7·6	
80	2·8	
85	.....	Shore line in 1888, 1894.
110	— 1·1	
150	— 2·1	
200	— 3·6	
250	— 3·6	
300	— 2·1	
350	— 4·6	
400	— 5·1	
450	— 6·1	
500	— 5·6	
550	— 5·6	
600	— 8·1	
650	—10·1	
700	—11·1	
750	—11·6	
800	—13·1	
850	—14·6	
900	—16·1	
950	—16·6	

MARTHAS VINEYARD, MASSACHUSETTS—Continued.

CROSS-SECTION NO. 15—Continued.

[Origin: Latitude, 41° 24′ 12″·00; longitude, 70° 30′ 49″·47; azimuth, 187° 28′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
1 000	—16·6	
1 050	—16·6	
1 100	—17·1	
1 150	—17·6	
1 200	—17·6	
1 250	—17·6	
1 300	—18·1	
1 350	—19·3	
1 400	—20·6	
1 450	—21·1	
1 500	—21·6	
1 550	—22·1	
1 600	—22·3	

CROSS-SECTION NO. 17.

[Origin: Latitude, 41° 24′ 11″·83; longitude, 70° 31′ 3″·00; azimuth, 188° 41′.]

0	1·4	
20	5·2	
40	8·8	
60	7·2	
80	2·8	
83	.....	Shore line in 1894.
96	.....	Shore line in 1888.
124	— 1·1	
150	— 1·8	
200	— 3·1	
250	— 2·8	
300	— 4·8	
350	— 4·1	
400	— 6·8	
450	— 6·3	
500	— 8·8	
550	— 9·8	
600	—12·3	
650	—14·8	
700	—15·3	
750	—16·3	
800	—16·3	
850	—16·8	
900	—18·8	
950	—19·3	
1 000	—19·3	
1 050	—19·3	
1 100	—19·8	
1 150	—20·3	
1 200	—20·3	
1 250	—20·8	
1 300	—21·3	
1 350	—21·8	
1 400	—22·3	
1 450	—23·6	
1 500	—23·3	
1 550	—23·3	

CROSS-SECTION NO. 19.

[Origin: Latitude, 41° 24′ 10″·70; longitude, 70° 31′ 11″·71; azimuth, 191° 10′.]

0	19·2	
20	19·0	

CROSS-SECTION NO. 19—Continued.

[Origin: Latitude, 41° 24′ 10″·70; longitude, 70° 31′ 11″·71; azimuth, 191° 10′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
40	17·4	
60	16·4	
80	18·1	
100	13·8	
120	7·2	
127	.....	Shore line in 1888.
132	.....	Shore line in 1894.
140	— 1·1	
150	— 1·6	
200	— 1·6	
250	— 3·1	
300	— 5·1	
350	— 4·1	
400	— 6·1	
450	— 7·1	
500	—10·1	
550	—12·1	
600	—14·1	
650	—15·6	
700	—18·1	
750	—21·1	
800	—23·1	
850	—23·6	
900	—24·1	
950	—24·1	
1 000	—23·6	
1 050	—23·6	
1 100	—24·1	
1 150	—24·1	
1 200	—24·6	
1 250	—24·6	
1 300	—24·6	
1 350	—24·6	
1 400	—24·6	
1 450	—25·1	
1 500	—25·6	

CROSS-SECTION NO. 21.

[Origin: Latitude, 41° 24′ 10″·70; longitude, 70° 31′ 23″·24; azimuth, 194° 17′.]

0	19·6	
20	20·5	
40	20·7	
60	20·1	
80	18·5	
100	17·6	
120	15·5	
140	15·4	
148	.....	Shore line in 1888.
160	2·1	
164	.....	Shore line in 1894.
173	— 1·1	
200	— 2·3	
250	— 3·3	
300	— 5·3	
350	— 4·1	
400	— 7·8	
450	— 8·8	
500	—10·8	
550	—13·3	
600	—16·1	
650	—19·1	

MARTHAS VINEYARD, MASSACHUSETTS—Continued.

CROSS-SECTION No. 21—Continued.

[Origin: Latitude, 41°.24′ 10″.70; longitude, 70° 31′ 23″.24; azimuth, 194° 17.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
700	—23·8	
750	—24·8	
800	—24·8	
850	—24·8	
900	—24·8	
950	—25·3	
1 000	—25·3	
1 050	—25·3	
1 100	—25·8	
1 150	—25·8	
1 200	—25·8	
1 250	—25·8	
1 300	—25·8	
1 350	—25·8	
1 400	—26·1	
1 450	—26·8	

CROSS-SECTION No. 23.

[Origin: Latitude, 41° 24′ 14″.61; longitude, 70° 31′ 33″.14; azimuth, 198° 00′.]

0	1·5	
20	4·3	
40	3·5	
57	5·3	Bluff stake.
60	4·2	
70	.....	Shore line in 1894.
82	.....	Shore line in 1888.
104	— 1·1	
150	— 5·3	
200	— 5·1	
250	— 5·6	
300	— 8·1	
350	— 9·6	
400	—11·1	
450	—13·1	
500	—18·1	
550	—23·1	
600	—24·1	
650	—25·6	
700	—25·6	
750	—25·6	
800	—26·1	
850	—26·5	
900	—26·5	
950	—26·5	
1 000	—26·5	
1 050	—26·5	
1 100	—26·1	
1 150	—26·1	
1 200	—26·1	
1 250	—26·1	
1 300	—26·1	
1 350	—27·1	
1 400	—27·1	
1 450	—27·3	
1 500	—28·1	
1 550	—28·1	

CROSS-SECTION No. 25.

[Origin: Latitude, 41° 24′ 16″.60; longitude, 70° 31′ 44″.00; azimuth, 202° 30′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
0	0·8	Water in marsh.
20	1·1	
31	1·7	Edge of marsh.
40	4·4	
60	4·8	
62	5·2	R. road track.
78	7·9	Top of bluff.
81	4·1	Foot of bluff.
87	.....	Shore line in 1894.
96	.....	Shore line in 1888.
150	— 3·6	
200	— 6·3	
250	— 6·3	
300	— 7·1	
350	— 7·6	
400	—10·6	
450	—17·6	
500	—21·6	
550	—24·1	
600	—26·1	
650	—26·1	
700	—26·6	
750	—26·6	
800	—26·6	
850	—26·6	
900	—26·6	
950	—26·6	
1 000	—26·6	
1 050	—26·6	
1 100	—26·6	
1 150	—26·6	
1 200	—26·6	
1 250	—26·1	
1 300	—26·6	
1 350	—26·6	
1 400	—27·3	

CROSS-SECTION No. 27.

[Origin: Latitude, 41° 24′ 20″.48; longitude, 70° 31′ 53″.81; azimuth, 206° 54′.]

0	0·7	Edge of pond.
20	5·1	
41	8·3	Top of bluff.
47	3·8	
58	.....	Shore line in 1894.
60	.....	Shore line in 1888.
100	— 5·6	
150	— 3·6	
200	— 5·6	
250	— 6·1	
300	— 7·1	
350	—13·1	
400	—20·1	
450	—22·6	
500	—22·6	
550	—25·1	
600	—26·6	

MARTHAS VINEYARD, MASSACHUSETTS—Continued.

Cross-Section No. 27—Continued.

[Origin: Latitude, 41° 24′ 20″.48; longitude, 70° 31′ 53″.81; azimuth, 206° 54′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
650	—27.6	
700	—27.6	
750	—27.6	
800	—27.6	
850	—26.6	
900	—26.6	
950	—27.1	
1 000	—27.6	
1 050	—27.6	
1 100	—27.1	
1 150	—26.6	
1 200	—27.1	
1 250	—26.6	
1 300	—26.6	
1 350	—26.6	

Cross-Section No. 29.

[Origin: Latitude, 41° 24′ 23″.66; longitude, 70° 32′ 4″.26; azimuth, 210° 5′.]

0	0.9	Edge of pond.
20	4.0	
40	6.2	
53	8.3	Bluff stake.
60	3.8	
62	3.1	Foot of bluff.
67	.....	Shore line in 1888.
73	1.1	Shore line in 1894.
100	— 4.1	
150	— 4.6	
200	— 5.1	
250	— 5.6	
300	— 6.3	
350	— 9.3	
400	—16.8	
450	—22.3	
500	—24.3	
550	—26.3	
600	—26.3	
650	—27.6	
700	—27.3	
750	—27.3	
800	—27.3	
850	—27.3	
900	—27.3	
950	—27.3	
1 000	—27.8	
1 050	—27.8	
1 100	—27.3	
1 150	—27.3	
1 200	—26.3	
1 250	—26.3	
1 300	—26.3	

Cross-Section No. 31.

[Origin: Latitude, 41° 24′ 24″.47; longitude, 70° 32′ 16″.27; azimuth, 212° 3′.]

0	— 0.3	Water in pond.
20	2.6	
40	2.3	
60	3.5	

Cross-Section No. 31—Continued.

[Origin: Latitude, 41° 24′ 24″.47; longitude, 70° 32′ 16″.27; azimuth, 212° 3′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
80	2.8	
100	1.8	
120	4.4	
140	5.8	
148	8.4	
160	7.0	
165	6.4	Bluff stake.
178	1.1	Shore line in 1894.
179	.....	Shore line in 1888.
186	— 1.1	
200	— 4.1	
250	— 5.1	
300	— 5.6	
350	— 3.6	
400	— 7.1	
450	—12.1	
500	—15.6	
550	—23.3	
600	—24.1	
650	—25.3	
700	—26.6	
750	—27.1	
800	—27.1	
850	—27.6	
900	—27.6	
950	—27.6	
1 000	—27.6	
1 050	—27.6	
1 100	—28.1	
1 150	—28.1	
1 200	—28.1	
1 250	—28.6	
1 300	—27.6	

Cross-Section No. 33.

[Origin: Latitude, 41° 24′ 25″.73; longitude, 70° 32′ 28″.63; azimuth, 213° 34′.]

0	— 1.1	Water in pond.
20	7.0	
40	8.2	
60	8.8	
80	5.6	
100	3.4	
120	4.2	
140	6.6	
153	7.7	
160	7.1	
180	1.7	
198	1.3	Marsh.
222	1.2	
240	2.2	
260	6.0	
280	7.2	
283	7.0	Bluff stake.
287	3.1	Foot of bluff.
295	.....	Shore line in 1888.
298	1.1	Shore line in 1894.
304	— 1.1	
350	— 4.8	
400	— 6.3	
450	— 7.8	
500	— 4.8	
550	—10.3	

MARTHAS VINEYARD, MASSACHUSETTS—Continued.

CROSS-SECTION NO. 33—Continued.

[Origin: Latitude, 41° 24′ 25″·73; longitude, 70° 32′ 28″·63; azimuth, 213° 34′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
600	—17·8	
650	—21·6	
700	—23·3	
750	—23·8	
800	—24·8	
850	—24·8	
900	—24·8	
950	—25·8	
1 000	—26·3	
1 050	—26.3	
1 100	—26·8	
1 150	—27·3	
1 200	—27·8	
1 250	—27·8	
1 300	—27·8	
1 350	—28·3	

CROSS-SECTION NO. 35.

[Origin: Latitude, 41° 24′ 35″·17; longitude, 70° 32′ 33″·79; azimuth, 220° 00′.]

0	0·1	Edge of water in pond.
20	1·5	
40	1·3	
60	2·0	
80	3·3	
100	8·5	Top of bluff.
121	.....	Shore line in 1888.
123	.....	Shore line in 1894.
132	— 1·1	
150	— 4·1	
200	— 6·6	
250	— 6·6	
300	— 5·6	
350	— 6·1	
400	— 9·6	
450	—17·1	
500	—21·1	
550	—23·1	
600	—24·1	
650	—24·6	
700	—25·8	
750	—26·1	
800	—26·3	
850	—26·3	
900	—26·6	
950	—26·6	
1 000	—26·6	
1 050	—26·6	
1 100	—26·6	
1 150	—27·1	
1 200	—27·6	

CROSS-SECTION NO. 37.

[Origin: Latitude, 41° 24′ 40″·29; longitude, 70° 32′ 42″·96; azimuth, 226° 42′.]

0	0·4	Edge of water in pond.
20	1·7	
40	1·1	
60	1·1	
64	1·1	Marsh.
80	3·5	

CROSS-SECTION NO. 37—Continued.

[Origin: Latitude, 41° 24′ 40″·29; longitude, 70° 32′ 42″·96; azimuth, 226° 42′.]

Distance from origin.	Height above or below mean sea level.	Remarks.
Metres.	*Feet.*	
95	7·4	
100	7·0	
120	6·5	
140	.....	Shore line in 1888.
143	1·1	Shore line in 1894.
153	— 1·1	
200	— 4·6	
250	— 5·6	
300	— 6·3	
350	— 7·1	
400	— 9·6	
450	—13·3	
500	—19·8	
550	—22·6	
600	—24·1	
650	—24·6	
700	—25·1	
750	—25·1	
800	—25·6	
850	—26·1	
900	—26·6	
950	—27·1	
1 000	—27·6	
1 050	—27·8	
1 100	—28·1	
1 150	—28·1	
1 200	—28·1	

CROSS-SECTION NO. 39.

[Origin: Latitude, 41° 24′ 48″·03; longitude, 70° 32′ 48″·77; azimuth, 232° 30′.]

0	0·2	
17	7·5	
20	7·3	
40	6·9	
60	6·7	
76	.....	Shore line in 1888.
78	1·1	Shore line in 1894.
88	— 1·1	
100	— 3.1	
150	— 6·1	
200	— 6·1	
250	— 8·1	
300	— 5·8	
350	—11·1	
400	—16·1	
450	—22·1	
500	—24·1	
550	—24·3	
600	—25·3	
650	—26·3	
700	—26·8	
750	—26·8	
800	—26·8	
850	—27·3	
900	—27·3	
950	—26·8	
1 000	—26·8	
1 050	—27·3	
1 100	—28·1	
1 150	—28·3	
1 200	—27·3	
1 250	—27·3	
1 300	—27·3	

TABLE NO. 2.—*Changes in the shore line of northern shore of Marthas Vineyard, Massachusetts, from 1888 to 1894.*

Cross section.	Position of origin.			Distance to high water line in—		Yearly change since 1888.		Remarks.
	Latitude.	Longitude.	Azimuth.	1888.	1894.	Advance.	Retreat.	
	° ′ ″	° ′ ″	° ′	*Metres.*	*Metres.*	*Metres.*	*Metres.*	
No. 1	41 23 32·73	70 30 25·04	270 05	128	134	1·00	.....	At mouth of Edgartown Harbor.
3	" " 41·00	" " 25·47	269 30	123	120	.....	0·50	
5	" " 47·80	" " 24·10	270 10	116	98	.....	3·00	
7	" " 54·23	" " 33·40	270 00	.....	.....	.....	.....	
9	41 24 02·56	" " 25·52	268 07	81	70	.....	1·83	
11	" " 06·15	" " 33·49	226 56	106	108	0·33	.....	
13	" " 10·05	" " 39·00	185 35	128	128	0·0	0·0	
15	" " 12·00	" " 49·47	187 28	85	85	0·0	0·0	
17	" " 11·83	70 31 03·00	188 41	96	83	.....	2·16	
19	" " 10·70	" " 11·71	191 10	127	132	0·83	.....	
21	" " 10·70	" " 23·24	194 17	148	164	2·66	.....	
23	" " 14·61	" " 33·14	198 00	82	70	.....	2·00	
25	" " 16·60	" " 44·00	202 30	96	87	.....	1·50	
27	" " 20·48	" " 53·81	206 54	60	58	.....	0·33	
29	" " 23·66	70 32 04·26	210 05	67	73	1·00	.....	
31	" " 24·47	" " 16·27	212 03	179	178	.....	0·16	
33	" " 25·73	" " 28·63	213 34	295	298	0·50	.....	
35	" " 35·17	" " 33·79	220 00	121	123	0·33	.....	
37	" " 40·29	" " 42·96	226 42	140	143	0·50	.....	
39	" " 48·03	" " 48·77	232 30	76	78	0·33	.....	
41	" " 54·78	" " 55·60	238 15	.....	.....	.....	.....	At south end of R. R. bridge.
			Sums....	2 254	2 230	7·48	11.48	
			Means ..	112·7	111·5	0·20	.....	

APPENDIX No. 9—1896.

FIELD METHOD OF REDUCING PORTABLE TRANSIT TIME OBSERVATIONS.

By G. R. PUTNAM, Assistant.

These notes are intended to give an example and brief explanation of the method of time reduction as now generally used in field computations on the Coast and Geodetic Survey. In the office computations and more rigid work the method of least square reduction is adhered to, as explained by Assistant Schott in Appendix No. 14, Report Coast and Geodetic Survey for 1880 ("Determination of time by means of the transit instrument"), and as generally given in works on practical astronomy. This field method makes use of successive approximations to determine the collimation (c) and azimuth (a) errors, and takes no account of weights. The method here described differs from approximate methods sometimes employed, in that all the observations are combined in deriving c and a. As by its use some saving of labor may be effected and results may be obtained not differing materially for some purposes from those derived with the more rigid reductions, it will be found of value for field work.

In the following memoranda the nomenclature and formulas used by Assistant Schott in the above-mentioned appendix are adhered to, and reference may be made to that paper for general instructions in regard to time determinations, adjustment of instruments, and full explanation of the various corrections.

In Form 1* are given the observations of a set of ten stars as read from a chronograph sheet, with level readings and reduction as far as the derivation of $\alpha - t_1$; the t_1 here indicating the observed time of transit corrected for rate, diurnal aberration, and inclination, but not corrected for collimation or azimuth errors. The corrections for rate and diurnal aberration and the pivot inequality may often be neglected in field reductions, but are shown here for the sake of completeness. In this example the level readings with telescope pointing north and south are combined separately, and the mean then taken to derive the level error of the instrument for each group of stars. This is done to avoid the unequal effect of any lack of symmetry in the pivots; and to give equal weights to the separate readings it would be desirable that the north and south

* The constants of the instrument used in this example are as follows:
1 division of striding level = 1″·674 (= 0·0279s. × 4).
Pivot inequality = — 0·010s. Band West.
Equatorial intervals of lines, Band West,

	s.		s.
Line 1	+ 15·20	Line 7	— 2·52
2	+ 12·69	8	— 5·11
3	+ 10·15	9	— 10·09
4	+ 5·06	10	— 12·65
5	+ 2·52	11	— 15·15
6	— 0·09		

readings should be equal in number, as for instance two north and two south (in this example they are unequal). There is also shown a convenient method for obtaining the average time of transit from the eleven lines. In the column to the right of the observed times the time for the middle line is written, and below it the sums respectively for each two lines at nearly equal intervals from the middle. These sums should of course be approximately equal and double the middle time, thus affording a ready check on any discordant observation or erroneous chronograph reading. At the foot of the column the sum of the whole is written, and this divided by eleven of course gives the average time for the eleven lines, which is then written beneath the observed times. In general, this average can be arrived at by adding only the decimal part of the second column and such part of the integral numbers as exceed double the middle time, as will be understood by examining the example. In the case of two stars in this set, the observations were not complete, and the reduction is made by the equatorial intervals. Where only a few lines are missed and the lines are uniformly spaced, a fair approximation can be obtained by taking the mean of remaining lines equidistant from the middle. An approximate reduction can also be obtained by comparing the observed lines with observations of the same star on another evening. The balance of the computation on this form follows customary methods, and is explained by the marginal data. The $\alpha - t_1$ at the foot of the columns represents the chronometer correction from each star, uncorrected for the collimation and azimuth errors of the instrument.

In Form 2 is shown the derivation of the collimation (c) and azimuth (a) errors of the instrument, and the final chronometer correction ($\triangle$T) from each star. The $\alpha - t_1$ derived in Form 1 are written together in a column, grouped for the two positions of the instrument, followed by columns containing the collimation (C) and azimuth (A) factors of the stars. The observing list is so selected that each group of stars observed in one position of the instrument shall contain a low north or azimuth star and several stars near the zenith or time stars. The latter are preferably some north and some south of the zenith, so that their mean azimuth factor shall be nearly zero. If this is impracticable it is desirable for convenience in computation that the mean azimuth factors for the two groups shall be nearly equal. Such a selection of time stars as will, as far as possible, eliminate instrumental errors is important, though it is not always practicable, as for instance in high latitudes, where stars north of the zenith are too slow to make good time stars.

In this computation to derive c and a, the time stars in each position of the instrument are combined and treated as one star, by taking the means of their $\alpha - t_1$, and of their star factors C and A, respectively, these means being written below the separate stars in this form, together with the azimuth stars. On the assumption that the means of the time stars in the two positions of the instrument are equally affected by the azimuth correction, the first approximation to c is found by dividing the difference between the mean $\alpha - t_1$, by the difference between the C. In the example, c (first approximation) $= \frac{(\alpha - t_1)_w - (\alpha - t_1)_e}{C_w - C_e} = \frac{-3{\cdot}94 - (-4{\cdot}07)}{+1{\cdot}25 - (-1{\cdot}32)} = \frac{+0{\cdot}13}{+2{\cdot}57} = +{\cdot}051$. The sign of C is arbitrarily taken as plus for band west and minus for band east, and the resulting sign of c may be derived by inspection, or by the rule of subtracting the east values from the west, both $\alpha - t_1$ and C. Using this approximation to c, the correction Cc is then subtracted from the $\alpha - t_1$ of the means of the time stars and of the azimuth stars, and the values in column $\alpha - t_1 - Cc$ obtained. Separate values for the azimuth error of the instrument are then derived for each position of the instrument by dividing the difference between the $\alpha - t_1 - Cc$ for the mean of the time stars and the azimuth star by the difference between their A. In the example,

$$a_w = \frac{(\alpha - t_1 - Cc)_{\text{time stars}} - (\alpha - t_1 - Cc)_{\text{az. star}}}{A_{\text{time stars}} - A_{\text{az. star}}} = \frac{-4{\cdot}00 - (-4{\cdot}64)}{+\ {\cdot}08 - (-1{\cdot}03)} = \frac{+\ {\cdot}64}{+1{\cdot}11} = +0^s{\cdot}577 \text{ and } a_e = \frac{-4{\cdot}00 - (-5{\cdot}23)}{{\cdot}00 - (-2{\cdot}53)} = \frac{+1{\cdot}23}{+2{\cdot}53} = +0^s{\cdot}486.$$

The sign of a may be obtained by inspection or by following rule to subtract values for azimuth star from values for mean of time stars, both $\alpha - t_1 - Cc$ and A. With these values of a_w and a_e the corrections Aa are applied, giving the values $\alpha - t_1 - Cc - Aa$ in the last column. If these do not agree for the stars east and west it indicates that the mean values $\alpha - t_1$ used in deriving c were not equally affected by the azimuth error, so that their difference was not entirely due to c, as was assumed. An improved value of c may now be obtained by treating

the difference in the last column as still an error of collimation, and thus obtaining a correction to the first approximate value of c. Thus, in the example, $\frac{-4{\cdot}05-(-4{\cdot}00)}{+1{\cdot}25-(-1{\cdot}32)}=\frac{-\ {\cdot}05}{+2{\cdot}57}=-0^{s}{\cdot}019$. Applying this correction to the first approximate value of $c=+{\cdot}051$, we have for a second approximation, $c=+{\cdot}032$. Proceeding as before, improved values for a_w and a_e are found. If the star sets are well chosen and the instrumental errors small the first approximation will generally suffice. If the values of $\alpha-t_1-Cc-Aa$ differ by but a few hundredths, east and west, there is little gained by making a closer adjustment; the time will probably not be changed at all, but the instrumental errors and star residuals will be slightly altered, as is apparent from the example, where the closer adjustment is made for the purpose of illustrating the method.

In the first approximation the value of c may at once be derived more closely when there is much difference between the mean A for the time stars, by estimating the effect of this difference in A on the $\triangle$T, and allowing for this effect when deriving c in the first place. The formula for c then becomes $c=\frac{(\alpha-t)_w-(\alpha-t)_e-(A_w-A_e)\times a}{C_w-C_e}$. It is here necessary to estimate the azimuth of the instrument a roughly in advance, and this may be done by inspection. Thus, in the example, assuming $a=+0^{s}{\cdot}5$, we have $c=\frac{-3{\cdot}94+4{\cdot}07-(+{\cdot}08)\times(+0{\cdot}5)}{+1{\cdot}25+1{\cdot}32}=\frac{+{\cdot}09}{+2{\cdot}57}=+0^{s}{\cdot}035$, agreeing closely with the value given by the second approximation.

When satisfactory values of c, a_w, and a_e have been obtained, the corrections Cc and Aa are applied separately to each star, as shown in the upper part of Form 2, and the values of the chronometer correction ($\triangle$T) derived separately. The residuals are taken for each group from the mean of that group, and thus furnish a convenient check on the computation, as their sums for each group should approximate zero. Unusual residuals also point to possible errors in the $\alpha-t_1$. The mean of the $\triangle$T from the separate stars gives the final chronometer correction at the epoch of the mean right ascension of the stars observed.

The above example is a time set observed in telegraphic longitude work, and is more elaborate both as to number of observations and computation than would be required for many purposes where an approximate method of time reduction would be employed. The method, even in so complete a form as here given, may be applied with rapidity, however, where systematic forms are used, and with the aid of Crelle's multiplication tables. Special attention should be paid throughout to signs. The formula for the chronometer correction (omitting diurnal aberration and rate corrections) is $\triangle T=\alpha-(t+Aa+Bb+Cc)$. (Report 1880, Appendix 14, page 14.) Let $t_1=t+Bb$, then $\triangle T=(\alpha-t_1)-Aa-Cc$, so that it will be seen that the corrections Aa and Cc are to be subtracted algebraically throughout from $\alpha-t_1$.

FORM 1.

[Station, Washington, D. C. Date, May 17, 1896. Observer, G. R. Putnam.

Star.	17 H. Can. Ven.		η Urs. Maj.		η Bootis.		11 Bootis.		α Draco.	
Position of band.	West.		West.		West.		West.		West.	
Direction of objective for level reading.	S. W. end.	E. end.			S. W. end.	E. end.			N. W. end.	E. end.
Level readings.	22·7 div.	24·1 div.			27·8	20·0			28·0	19·9
	27·1	19·9			22·9	24·8			22·9	24·9
ΣW. and ΣE.	49·8	44·0			50·7	44·8			50·9	44·8
ΣW. − ΣE.	+5·8				+5·9				+6·1	
Remarks and computation of *b*.			Means of levels. N. +6·10 S. +5·85 +5·98 × ^{s}·0279 =		^{s}+·167 −·010 pivot inequality. +·157 b_w					
Observed transit.	*h. m. s.*		*h. m. s.*		*h. m. s.*		*h. m. s.*		*h. m. s.*	
Line 1	13 29 56·90	Mean. ^{s}14·20	13 43 10·60		13 49 34·45		13 56 17·20		14 01 07·55	
2	13 30 00·10		14·35		37·05		20·00		13·30	
3	03·30		18·30		39·70		22·80		19·35	
4	09·70	Correction.	26·15		45·00		28·40		31·25	
5	12·90		30·15		47·75		31·50		37·30	
6	16·00		33·80	33·80	50·25	50·25	34·30	34·30	43·00	43·00
7	19·30	$=\frac{15·15}{10}$	37·95	68·10	52·95	100·70	36·90	68·40	49·00	86·30
8	22·60	× 1·26	41·70	7·85	55·70	0·70	40·05	8·45	55·20	6·45
9	29·00	= + 1·92	49·70	8·00	13 50 00·90	0·60	45·65	8·45	14 02 06·90	6·25
10	32·20		53·60	7·95	03·75	0·80	48·60	8·60	12·90	6·20
11	—		57·55	8·15	06·50	0·95	51·50	8·70	18·85	6·40
Mean.	16·12		33·99	10·85	50·36	4·00	34·26	2·90	43·15	1·60
Cor. for rate.	+ ·03		+ ·02		+ ·01		+ ·01		·00	
" " diur. aberration.	− ·02		− ·02		− ·02		− ·02		− ·04	
Cor. for inclination.	(B=1·26)+ ·20		(B=1·53)+ ·24		(B=1·00)+ ·16		(B=1·11)+ ·17		(B=2·12)+ ·33	
t_1	13 30 16·33		13 43 34·23		13 49 50·51		13 56 34·42		14 01 43·44	
a	13 30 12·26		13 43 30·14		13 49 46·82		13 56 30·53		14 01 38·92	
$a-t_1$	−4·07		−4·09		−3·69		−3·89		−4·52	

FORM 1.

Instrument, transit No. 18. Chronometer, Negus, 1836 (daily rate $1^{s}\cdot51$ gaining).]

d Bootis.		α Bootis.		λ Bootis.		θ Bootis.		5 Urs. Min.	
East.		East.		East.		East.		East.	
S. W. end. E. end. 27·1 20·9 22·7 25·2 49·8 46·1 +3·7				N. W. end. E. end. 27·2 20·9 22·9 25·3 50·1 46·2 +3·9				N. W. end. E. end. 22·2 26·0 27·2 21·0 49·4 47·0 +2·4	
		Means of levels. N.+3·15 S.+3·70 +3·42×·0279=		$+^{s}\cdot095$ +·010 pivot inequality. $+\cdot105b_e$				Thin clouds and hazy. Temperature 76° F.	
h. *m.* *s.*		*h.* *m.* *s.*		*h.* *m.* *s.*		*h.* *m.* *s.*		*h.* *m.* *s.*	
14 05 29·40	Mean.	14 10 45·50		14 12 11·15		14 21 22·30		14 26 53·15	
32·20	44·76	48·20		14·80		26·40		27 03·15	
34·85		50·90		18·60		30·60		14·25	
40·60	Correc-	56·20		25·95		38·90		35·30	
43·35	tion.	58·90		29·50		42·90		45·85	
46·20	12·69	14 11 01·65	01·65	33·45	33·45	47·35	47·35	57·15	57·15
48·90	$=\frac{}{10}$	04·30	03·20	37·00	66·50	51·35	94·25	14 28 07·00	112·85
51·90	×1·11	07·10	3·30	40·70	6·65	55·40	4·30	18·00	3·30
57·30		12·30	3·20	48·00	6·60	14 22 03·60	4·20	38·70	2·95
—	=1·41	15·20	3·40	51·80	6·60	07·80	4·20	49·50	2·65
14 06 02·90		17·70	3·20	55·25	6·40	11·95	4·25	14 29 00·05	3·20
46·17		01·63	6·95	33·29	3·20	47·14	1·55	56·55	72·10
·00		− ·01		− ·01		− ·02		− ·03	
− ·02		− ·02		− ·02		− ·03		− ·06	
(B=1·08) + ·11		(B=1·01) + ·11		(B=1·44) + ·15		(B=1·59) + ·17		(B=3·33) + ·35	
14 05 46·26		14 11 01·71		14 12 33·41		14 21 47·26		14 27 56·81	
14 05 42·32		14 10 57·90		14 12 29·18		14 21 42·97		14 27 51·37	
−3·94		−3·81		−4·23		−4·29		−5·44	

FORM 2.

[Station, Washington, D. C. Date, May 17, 1896.]

	Star.	Position.	$a-l_1$	C	A	Cc	Aa	ΔT $a-l_1-Cc-Aa$	v	
			s.			s.	s.	s.	s.	
	17 H. Can. Ven	W	−4·07	+1·26	+ ·02	+ ·04	+ ·01	−4·12	+ ·10	
	η Urs. Maj.	W	−4·09	+1·56	− ·30	+ ·05	− ·17	−3·97	− ·04	
	η Bootis	W	−3·69	+1·06	+ ·36	+ ·03	+ ·20	−3·92	− ·10	
	11 Bootis	W	−3·89	+1·13	+ ·22	+ ·04	+ ·12	−4·05	+ ·03	at $14^h\,02^m\cdot0$
	α Draconis	W	−4·52	+2·36	−1·03	+ ·08	− ·58	−4·02	·00	$\Delta T = -04^s\cdot024$
	d Bootis	E	−3·94	−1·11	+ ·25	− ·04	+ ·13	−4·04	+ ·01	
	α Bootis	E	−3·81	−1·06	+ ·35	− ·03	+ ·18	−3·96	− ·07	
	λ Bootis	E	−4·23	−1·46	− ·20	− ·05	− ·10	−4·08	+ ·05	
	θ Bootis	E	−4·29	−1·64	− ·38	− ·05	− ·19	−4·05	+ ·02	
	5 Urs. Min.	E	−5·44	−4·18	−2·53	− ·13	−1·28	−4·03	·00	
1st approx.			$a-l_1$	C	A	Cc	$a-l_1-Cc$	Aa	$a-l_1-Cc-Aa$	s
	Mean of time stars.	W	−3·94	+1·25	+ ·08	+ ·06	−4·00	+ ·05	−4·05	$c=+·051$
	Azimuth star	W	−4·52	+2·36	−1·03	+ ·12	−4·64	− ·59	−4·05	$a_w=+·577$
	Mean of time stars.	E	−4·07	−1·32	·00	− ·07	−4·00	·00	−4·00	$a_e=+·486$
	Azimuth star	E	−5·44	−4·18	−2·53	− ·21	−5·23	−1·23	−4·00	
2d approx	Mean of time stars.	W				+ ·04	−3·98	+ ·04	−4·02	$c=+·032$
	Azimuth star	W				+ ·08	−4·60	− ·58	−4·02	$a_w=+·559$
	Mean of time stars.	E				− ·04	−4·03	·00	−4·03	$a_e=+·506$
	Azimuth star	E				− ·13	−5·31	−1·28	−4·03	

APPENDIX No. 10—1896.

DETERMINATION OF THE CONSTANT OF ABERRATION FROM LATITUDE OBSERVATIONS WITH THE ZENITH TELESCOPE AT HONOLULU, H. I., AND SAN FRANCISCO, CAL.

Report by E. D. PRESTON, Assistant.

THE CONSTANT OF ABERRATION.

The results of the work on the constant of aberration have been made public in Bulletins Nos. 28 and 32. Since their appearance considerable work has been done in this direction and the observations by the methods explained in the aforesaid bulletins lead to values agreeing very closely with the generally accepted constant. The mean of the results from the series at Honolulu and San Francisco gives the value 20″·458, which differs only 0″·005 from the mean of 24 results given by Professor Newcomb* and only 0″·003 from the adjusted value by Professor Harkness,† and moreover lies between them.

The contribution of the United States Coast and Geodetic Survey to this important problem has never yet appeared in the Annual Report, and it is therefore inserted in the present volume with some minor changes and additions to the original matter as it appeared in the bulletins.

The amount of data utilized in the present case is considerable. The actual observations at Honolulu extended over a period of about thirteen months, and those at San Francisco about fifteen months, and the total number of conditional equations employed was 9 138, of which about one-fourth contained four and the remainder two unknown quantities.

The insertion in the Annual Report of these two papers combined into one appendix and somewhat amplified makes the Report complete in its information as to the work of the office and gives the determination of the constant of aberration by the Coast and Geodetic Survey a permanent form.

DETERMINATION OF THE CONSTANT OF ABERRATION.

HONOLULU OBSERVATIONS.

The astronomical observations made by the author at Waikiki near Honolulu in 1891 and 1892 showed conclusively that the latitude of this place had a periodic variation. Its value on July 0, 1891, was 21° 16′ 24″·41 and for any subsequent time during the period of observation it may be found by substitution in the formula:

$$\begin{aligned}\text{Latitude} = 21^\circ\,16'\,24''\cdot386 &+0\cdot028\cos\theta - 0\cdot297\sin\theta \\ &-0\cdot039\cos 2\theta - 0\cdot006\sin 2\theta \\ &+0\cdot040\cos 3\theta + 0\cdot001\sin 3\theta\end{aligned}$$

where θ is the angular distance of the pole from its assumed place on July 0, on the supposition that its daily motion is 0°·925.

* The Elements of the Four Inner Planets and the Fundamental Constants of Astronomy. Washington, Government Printing Office, 1895.

† The Solar Parallax and its Related Constants. Washington, 1891.

The work having come under Professor Newcomb's observation, he made the suggestion that the individual results as already prepared for publication should be discussed with a view of bringing out a correction to the constant of aberration.

The method proposed contemplated a simultaneous determination of the constant of aberration and the changes of latitude, and the solution was all the more desirable because recent work indicates that the usually accepted value for this constant (20″·445) is susceptible of improvement and also that by a combined determination we should have an independent check on the law of latitude change deduced from these same observations.

The plan to be followed in the solution was outlined by Professor Newcomb and transmitted to the Superintendent of the Coast and Geodetic Survey in letter of January 14, 1893. On account of other duties the work could not be taken up immediately, but during the latter part of May, while on leave of absence at Spruce Grove, Pa., I formed more than 2 000 of the conditional equations. The remaining ones were computed after my return and the subnormals were derived by Mr. Moss during the month of June. After several interruptions the subject was again taken up and prepared for publication.

The following extract is from Professor Newcomb's letter above referred to:

Memorandum for determining simultaneously the variations of latitude and the constant of aberration from a homogeneous series of observations of pairs of stars with the zenith telescope, the latitude from each individual pair, using assumed declinations, having first been completely determined.

Let us put

R = that part of the reduction to apparent place which depends on the aberration

$$= Co' + Dd' = h \cos (H + \alpha) \sin \delta + i \cos \delta$$

$A = \frac{R + R'}{2 \times 20{\cdot}45}$ R and R' being the reduction for the North and South stars of a pair respectively.

N = an angle increasing uniformly with the time, so as to make a revolution in 386 days.

φ_1 = the latitude derived from a single observation of a single pair of stars.

φ_0 = an approximate arbitrarily assumed value of the latitude to be used unchanged throughout.

$$\Delta\varphi = \varphi_1 - \varphi_0$$

Then each individual latitude from a pair of stars will give rise to an equation of condition of the form

$$z + x \cos N + y \sin N - A\rho = \Delta\varphi$$

where the significance of the four unknown quantities z, x, y, and ρ are z correction to latitude minus correction of half sum of declinations of pairs of stars, quantities which need not and can not be determined separately.

x and y = coefficients of periodic variation of latitude

ρ = correction to constant aberration.

The unknown quantity z will have the same value for the same pair of stars all the way through, but not for any two pairs.

The shortest and most rigorous methods of solving the equations of condition will then be this. Divide the equations into as many groups as there are pairs of stars, all the equations from each pair forming a group. Form each group from the normal equation for four unknown quantities in the usual way. Supposing all the equations to be of equal weight, the normal in z will be merely the sum of the groups. From the normal in z thus found determine z as a function of the other three unknowns and of the sum of the values $\Delta\varphi$, which will be done by merely dividing the sum by the number of equations. Substitute this value of z in the other three normals derived from the group, thus getting three equations, which we may call "subnormals," involving only x, y, and ρ. Having done this with all the groups, the sum of all the subnormals in x will be the final normal equation for determining x, and so on with the other unknown quantities.

The principle of this method differs from that of the method adopted by the Germans in two points. It assumes that during the time of any series of observations which are combined to attain a single set of results the changes in the latitude can be represented by a single periodic term of known period. It does not assume that this law is valid outside the particular series under discussion.

On the other hand, the German method makes no hypothesis respecting a law of variation of the latitude except that the latitude remains constant during certain short intervals of time.

But the present method involves a more rigorous adjustment of the declinations of the stars, since practically each star is considered independently as a group by itself. In other words, the value of z for each star being applied to its assumed declination, all the declinations will be reduced to a uniform, comparable system.

It so happens that the period during which observations were made corresponds almost precisely to time of revolution of the principal axis of inertia of the earth about the axis of rotation.

From the day on which the first observations were made to that on which the last were made—that is, from June 6, 1891, to June 25, 1892, both inclusive—makes an interval of 386 days. This differs so little from that adopted in the discussion of the variations of latitude that, for the sake of convenience in dealing with the circular functions, it was assumed as the period, and the initial value was placed at June 6. The difference of apparent and adopted period, from Chandler's mean period of about 428 days, would arise from the addition of his annual term.

The entire series gives rise to 2 370 conditional equations distributed by pairs and groups as follows:

GROUP.

Pair.	I	II	III	IV	V	VI	VII	VIII
1	43	45	31	33	31	38	39	42
2	54	45	37	33	37	38	44	39
3	55	36	37	32	34	39	42	39
4	55	42	35	31	29	38	40	43
5	56	36	33	29	33	38	40	37
6	50	33	33	32	32	35	39	34
7	51	37	32	32	31	36	34	37
8	.....	33	36	30	30	33	33	39
Sums	364	307	274	252	257	295	311	310

The different groups will be designated by Roman numerals and the individual pairs by Arabic subscripts, e. g., the fifth pair of the third group is III_5.

The observation of I_1 on June 7, 1891, gave for φ_1 the value of 24″·67; φ_0 is taken as 24″·00, and we therefore have $\Delta\varphi = \varphi_1 - \varphi_0 = +0''{\cdot}67$. The angular distance traveled by the pole since June 6 is 0°·933, and hence $\cos N = +1{\cdot}00$ and $\sin N = +0{\cdot}02$.

The positions of the two stars forming this pair were:

	Right ascension.			Declination.	
	h.	*m.*	*s.*	°	′
I_{1a}.....	13	27	46	− 7	4
I_{1b}.....	13	30	5	+49	34

and the values of $h \cos(H+\alpha) \sin\delta + i \cos\delta = R$ for the first and second stars respectively are:

$$-3''{\cdot}87 \text{ and } +11''{\cdot}63$$

from which $A = +0{\cdot}19$.

The conditional equation for June 7 and for the observation on I_1 is therefore

$$z + 1{\cdot}00\,x + 0{\cdot}02\,y + 0{\cdot}19\,\rho = +0''{\cdot}67.$$

For facility of computation, instead of using the equation in the form given by Professor Newcomb on page 3, $+A$ was used instead of $-A$. This amounts to changing ρ into $-\rho$; that is, taking ρ as the negative of the correction to the constant of aberration. In this way an equation of condition was formed for each one of the individual results for the latitude, making, as tabulated above, an aggregate of 2 370 equations, containing four unknown quantities and known terms.

The method of dividing these equations into blocks for short intervals is shown by the following table, where all the observations on the first pair of Group I are used and the partial sum is derived from the first block preparatory to forming the subnormal equations. This division into blocks was made to save the labor of forming the products of the coefficients for each separate equation. A final result is obtained which is, with only insignificant errors, the same as if each equation had been multiplied separately.

I_1—1891.

										"
June	7	z	+ 1·00	x	+ 0·02	y	+ 0·19	ρ	=	+ 0·67
	8	z	+ 1·00		+ ·03		+ ·20		=	− 0·16
	9	z	+ 1·00		+ ·05		+ ·21		=	+ 0·84
	11	z	+ 1·00		+ ·08		+ ·22		=	+ 0·14
		$4z$	+ 4·00	x	+ 0·18	y	+ 0·82		=	+ 1·49
	13	z	+ 0·99	x	+ 0·11	y	+ 0·24	ρ	=	+ 0·82
	15	z	+ ·99		+ ·15		+ ·25		=	+ 0·50
	16	z	+ ·99		+ ·16		+ ·26		=	+ 0·58
	17	z	+ ·98		+ ·18		+ ·27		=	+ 0·75
	18	z	+ ·98		+ ·19		+ ·28		=	+ 0·12
	22	z	+ 0·97	x	+ 0·26	y	+ 0·30	ρ	=	+ 0·81
	26	z	+ ·95		·32		+ ·33		=	+ 0·26

I_1—1892.

April	9	z	+ 0·30	x	− 0·95	y	− 0·30	ρ	=	+ 1·32
	19	z	+ ·45		− ·89		− ·23		=	+ 0·88
	24	z	+ ·52		− ·85		− ·18		=	+ 1·12
	25	z	+ ·53		− ·85		− ·18		=	+ 1·34
May	1	z	+ 0·61	x	− 0·79	y	− 0·13	ρ	=	+ 1·08
	4	z	+ ·65		− ·76		− ·10		=	+ 0·22
	5	z	+ ·66		− ·75		− ·09		=	+ 1·07
	9	z	+ ·71		− ·70		− ·06		=	+ 0·56
	10	z	+ ·72		− ·69		− ·05		=	+ 0·84
	13	z	+ ·76		− ·65		− ·02		=	+ 0·64
	14	z	+ 0·77	x	− 0·64	y	− 0·01	ρ	=	+ 0·52
	15	z	+ ·78		− ·63		·00		=	+ 0·87
	18	z	+ ·81		− ·59	+	·02		=	+ 1·30
	21	z	+ ·83		− ·55	+	·05		=	+ 0·86
	22	z	+ ·84		− ·54	+	·06		=	+ 1·03
	24	z	+ 0·86	x	− 0·51	y	+ 0·08	ρ	=	+ 0·78
	25	z	+ ·87		− ·50	+	·09		=	+ 0·70
	26	z	+ ·87		− ·48	+	·09		=	+ 0·34
	28	z	+ ·89		− ·45	+	·11		=	+ 0·64
	29	z	+ ·90		− ·44	+	·12		=	+ 1·10
June	3	z	+ 0·93	x	− 0·36	y	+ 0·16	ρ	=	+ 0·52
	4	z	+ ·94		− ·35	+	·17		=	+ ·90
	5	z	+ ·94		− ·33	+	·18		=	+ ·82
	7	z	+ ·95		− ·30	+	·20		=	+ ·42
	11	z	+ 0·97	x	− 0·24	y	+ 0·23	ρ	=	+ 0·90
	13	z	+ ·98		− ·21	+	·24		+	·07
	17	z	+ ·99		− ·14	+	·27		+	·62
	18	z	+ 0·99	x	− 0·13	y	+ 0·28	ρ	=	+ 1·18
	19	z	+ ·99		− ·11	+	·29		=	+ 1·14
	22	z	+ 1·00		− ·06	+	·31		=	+ 0·65
	24	z	+ 1·00		− ·03	+	·32		=	+ 0·52
	25	z	+ 1·00		− ·01	+	·33		=	+ 0·74

A similar summary was made for each pair, the blocks being chosen to conveniently fit the dates of observation. The block interval rarely exceeded ten days. The total number of these block equations is 534.

From these tables the subnormals were formed according to the following scheme:

Compartment A contains the "block equations," the first of which has been previously given. In B are found the mean equations, corresponding line for line with A, from which they were derived.

Compartment C is deduced by multiplying the coefficient of x in B by the corresponding equations in A.

In D we have the equations resulting from multiplying the coefficients of y in B by the corresponding equation in A, and E comes from a similar use of the coefficient of ρ in B.

It is evident that by multiplying the coefficients of x in B by the coefficients of z in A we get the coefficients of x in A, so that the first column of C is the same as the second column of A, and it is therefore not written in Compartment C.

Likewise by multiplying the coefficients of y in B by the coefficients of z in A we get the coefficients of y in A, i. e., the third column in A, so that the first column in D is the same as the third column of A; also the coefficients of y in B by those of x in A give the coefficients of y in C, i. e., the third column of C (first column of C is unwritten), so that the second column of D is the same as the third column of C, and is not put down.

The products of the coefficients of y in B by those of y in A give the third column in D (first written one), and the coefficients of ρ in B by those of ρ in A give the fourth column in D.

E is formed in the same way, by multiplying the coefficients of ρ in B by the corresponding equations in A, it only being necessary to begin writing down the products derived from the coefficients of ρ in B by those of ρ in A.

In regard to the right-hand members of the equations in the several compartments, they are derived from the right-hand members of A by the same process; that is to say, the multiplication of the several coefficients of B is extended to the known members of A to get the corresponding members of C, D, and E.

I.—FORMATION OF SUBNORMALS FOR PAIR 1.

A.

$4z$	+	4·00x	+	0·18y + 0·82ρ	= +	1·49
5	+	4·93	+	0·79 + 1·30	= +	2·77
2	+	1·92	+	0·58 + 0·63	= +	1·07
4	+	1·80	−	3·54 − 0·89	= +	4·66
6	+	4·11	−	4·34 − 0·45	= +	4·41
5	+	4·03	−	2·95 + 0·12	= +	4·58
5	+	4·39	−	2·38 + 0·49	= +	3·56
4	+	3·76	−	1·34 + 0·71	= +	2·66
3	+	2·94	−	0·59 + 0·74	= +	1·59
5	+	4·98	−	0·34 + 1·53	= +	4·23

B.

z + 1·000	x	+ 0·045y	+	0·205ρ	= +	0·372
+ 0·986		+ ·158	+	·260	= +	0·554
+ 0·960		+ ·290	+	·315	= +	0·535
+ 0·450		− ·885	−	·222	= +	1·165
+ 0·685		− ·723	−	·075	= +	0·735
+ 0·806		− ·590	+	·024	= +	0·916
+ 0·878		− ·476	+	·098	= +	0·712
+ 0·940		− ·335	+	·178	= +	0·665
+ 0·930		− ·197	+	·247	= +	0·530
+ 0·996		− ·068	+	·306	= +	0·846

(*a*) 43	+	36·86	−	13·93 + 5·00	= +	31·02
1	+	0·857	−	0·324 + 0·116	= +	0·721

C.

	+	4·00	+	0·18 + 0·82	= +	1·49
	+	4·86	+	0·78 + 1·28	= +	2·73
	+	1·84	+	0·56 + 0·60	= +	1·03
	+	0·81	−	1·59 − 0·40	= +	2·10
	+	2·82	−	2·97 − 0·31	= +	3·02
	+	3·25	−	2·38 + 0·10	= +	3·69
	+	3·85	−	2·09 + 0·43	= +	3·13
	+	3·53	−	1·26 + 0·67	= +	2·50
	+	2·88	−	0·58 + 0·73	= +	1·56
	+	4·96	−	0·34 + 1·52	= +	4·21

D.

	+	0·01	+	0·04	= +	0·07
	+	0·12	+	·21	= +	0·44
	+	0·17	+	·18	= +	0·31
	+	3·13	+	·79	= −	4·12
	+	3·14	+	·33	= −	3·19
	+	1·74	−	·07	= −	2·70
	+	1·13	−	·23	= −	1·69
	+	0·45	−	·24	= −	0·89
	+	0·12	−	·15	= −	0·31
	+	0·02	−	·10	= −	0·29

(*c*)	+ (36·86)	+	32·80 −	9·69 + 5·44	= +	25·46
	+ (36·86)	+	31·59 −	11·94 + 4·28	= +	26·58
		+	1·21 +	2·25 + 1·16	= −	1·12

(*d*)	(−13·93)	−	(9·69)	+ 10·83 + 0·76	= −	12·37
	(−13·93)	−	(11·94)	+ 4·51 − 1·62	= −	10·04
				+ 2·25 + 5·52 + 2·38	= −	2·33

E.

				+ 0·17	= +	0·31
				+ ·34	= +	0·72
				+ ·20	= +	0·34
				+ ·20	= −	1·03
				+ ·03	= +	0·33
				+ ·00	= +	0·11
				+ ·05	= +	0·35
				+ ·13	= +	0·47

				+ ·18	= +	0·39
				+ ·47	= +	1·29
(*e*)	+ (5·00)	+	(5·44)	+ (0·76) + 1·77	= +	2·62
	+ (5·00)	+	(4·29)	− (1·62) + 0·58	= +	3·61
				+ (1·15) + (2·38) + 1·19	= −	0·99

The subnormals from the first pair of Group I are therefore—

$$\begin{array}{rrrr} +1'21\,x & +2'25\,y & +1'16\,\rho & =-1'12 \\ +2'25 & +5'52 & +2'38 & =-2'33 \\ +1'16 & +2'38 & +1'19 & =-0'99 \end{array}$$

The total number of subnormal equations is 186.

The quantities inclosed in parentheses are, for the upper line, the sums of the blank columns which in a full scheme would be written above them, and for the lower line the coefficients arising from the elimination of z by means of equation (a); for example, the lower line of (c) is obtained by multiplying the lower line of (a) by 36·86; the lower line of (d) by multiplying the lower line of (a) by (— 13·93), etc. These parentheses quantities are not necessary for the computation, but serve as a partial check on the side coefficients of the resulting subnormals.

The following are the mean subnormals for the respective groups:

MEAN SUBNORMALS IN x.

Group.						
						″
I	+1·47	x	+2·83	y +1·64	ρ	=—0·54
II	+1·51		—2·64	—1·72		=+1·21
III	+3·82		—1·37	—1·96		=+0·49
IV	+4·96		+1·96	—1·18		=+0·45
V	+1·07		+1·89	—0·01		=—0·35
VI	+1·05		—2·01	—0·21		=+0·33
VII	+4·00		—2·48	+0·50		=+2·33
VIII	+7·83		+1·12	+3·16		=+0·65

MEAN SUBNORMALS IN y.

Group.						
						″
I	+2·83	x	+7·76	y +3·71	ρ	=—1·38
II	—2·64		+7·40	+4·25		=—2·54
III	—1·37		+0·68	+0·84		=—0·31
IV	+1·96		+0·99	—0·36		=+0·12
V	+1·89		+4·55	+0·26		=—0·82
VI	—2·01		+5·21	+0·48		=—0·96
VII	—2·48		+1·87	—0·28		=—1·65
VIII	+1·12		+0·61	+0·58		=—0·14

MEAN SUBNORMALS IN ρ.

Group.						
						″
I	+1·64	x	+3·71	y +2·06	ρ	=—0·64
II	—1·72		+4·25	+2·59		=—1·59
III	—1·96		+0·84	+1·09		=—0·33
IV	—1·18		—0·36	+0·33		=—0·14
V	—0·01		+0·26	+0·06		=—0·03
VI	—0·21		+0·48	+0·05		=—0·10
VII	+0·50		—0·28	+0·08		=+0 29
VIII	+3·16		+0·58	+1·32		=+0·18

From the 63 groups of subnormals we deduce the following normal equations in x, y, and ρ:

$$\begin{array}{rrrr} 204\cdot2\,x- & 8\cdot44\,y+ & 0\cdot11\,\rho & =+37\cdot12 \\ 8\cdot44\,x+ & 224\cdot8\,y+ & 71\cdot94\,\rho & =-60\cdot07 \\ 0\cdot11\,x+ & 71\cdot94\,y+ & 58\cdot50\,\rho & =-18\cdot29 \end{array}$$

from which $x = +0\cdot171$

$y = -0\cdot264$

$\rho = +0\cdot012$

The coefficient A having been used with a reversed sign throughout, the value of ρ to be applied to the constant of aberration is $-0\cdot012$, and the result is

$$\text{Constant of aberration} = 20''\cdot445 - 0''\cdot012 = 20''\cdot433.$$

The above method of forming the normal and subnormal equations has greatly abridged the work. That this treatment is entirely adequate and legitimate may be seen from the following general statement:

Our conditional equations being of the form

$$\begin{array}{rrrrr} a_1\,z+ & b_1\,x+ & c_1\,y+ & d_1\,\rho & =n_1 \\ a_2\,z+ & b_2\,x+ & c_2\,y+ & d_2\,\rho & =n_2 \\ a_3\,z+ & b_3\,x+ & c_3\,y+ & d^3\,\rho & =n_3 \\ \text{etc.} & & & \text{etc.} & \end{array}$$

the corresponding normal ones are

$$\begin{aligned}
[a\,a]\,z + [a\,b]\,x + [a\,c]\,y + [a\,d]\,\rho &= [a\,n]\\
[b\,a]\,z + [b\,b]\,x + [b\,c]\,y + [b\,d]\,\rho &= [b\,n]\\
[c\,a]\,z + [c\,b]\,x + [c\,c]\,y + [c\,d]\,\rho &= [c\,n]\\
\text{etc.} \qquad\qquad & \text{etc.}
\end{aligned}$$

Since the coefficients of z in the conditional equation are all unity, the normal equation in z is found theoretically correct by simply summing the equations, and no contraction of the work is necessary or possible in this case.

To obtain the normal equation in x, mean coefficients for short periods are used. If we represent the difference between the actual coefficients a, b, c, etc., and the mean values by α, β, γ, etc., where we may put

$$\frac{a_1+a_2+a_3+\text{etc.}}{m} = A = a_1+\alpha_1 = a_2+\alpha_2 = \text{etc.}$$

$$\frac{b_1+b_2+b_3+\text{etc.}}{n} = B = b_1+\beta_1 = b_2+\beta_2 = \text{etc.}$$

Our approximate normal equation in x would be

$$\begin{aligned}
&(a_1\,b_1 + a_1\,\beta_1)\,z + (b_1\,b_1 + b_1\,\beta_1)\,x + (c_1\,b_1 + c_1\,\beta_1)\,y + \text{etc.}\\
&+ (a_2\,b_2 + a_2\,\beta_2)\,z + (b_2\,b_2 + b_2\,\beta_2)\,x + (c_2\,b_2 + c_2\,\beta_2)\,y + \text{etc.}\\
&+ (a_3\,b_3 + a_3\,\beta_3)\,z + (b_3\,b_3 + b_3\,\beta_3)\,x + (c_3\,b_3 + c_3\,\beta_3)\,y + \text{etc.}\\
&\text{etc.} \qquad\qquad \text{etc.} \qquad\qquad \text{etc.}
\end{aligned}$$

This differs from one formed rigorously for this particular group of n members by the quantity

$$(a_1\,\beta_1 + a_2\,\beta_2 + a_3\,\beta_3 + \text{etc.})\,z + (b_1\,\beta_1 + b_2\,\beta_2 + b_3\,\beta_3 + \text{etc.})\,x + (a_1\,\beta_1 + c_2\,\beta_2 + c_3\,\beta_3 + \text{etc.})\,y + \text{etc.}$$

Since the coefficients of z in the conditional equation are all unity, and therefore equal, it is evident that the quantity

$$(a_1\,\beta_1 + a_2\,\beta_2 + a_3\,\beta_3 + \text{etc.})$$

reduces to zero.

The term

$$(b_1\,\beta_1 + b_2\,\beta_2 + b_3\,\beta_3 + \text{etc.})$$

also reduces to zero in the first subgroup of I (from June 7 to June 11) because all the coefficients of x in this particular case happen to be equal.

The term

$$(c_1\,\beta_1 + c_2\,\beta_2 + c_3\,\beta_3 + \text{etc.})$$

is not inappreciable, and its magnitude depends, of course, on the range of the values $c_1\,c_2\,c_3$, etc., and on their irregularity. Since the sum of

$$\beta_1 + \beta_2 + \beta_3 + \text{etc.}$$

is zero, the aforesaid term will always be small and will only be in error compared with the coefficient that would have resulted from a use of the actual values of $b_1\,b_2\,b_3$, etc., by the difference of the positive and negative results in the final sum.

Recalling now the general form of the conditional equation

$$z + x\cos N + y\sin N - A\rho = \Delta\varphi$$

we see that the coefficients of x and y are continuous functions, varying with the date, so that any irregularity of the coefficients in any particular subgroup would come from an unequal distribution of the observations over that particular period. When the observations are uniformly distributed there would be a fair compensation between the excess and defect of the results from using a mean multiplier instead of the actual coefficients.

The coefficient of ρ varies with the date as well as with the star's position, but since it is comparatively small and changes slowly the effect of using a mean coefficient in this case does not materially alter the result.

As a practical test of the validity of the foregoing assertions we may compare the normal equation in x for Group I, pair 1, derived in regular way, with that used in the abridged method of calculation.

Instead of the equation previously given

$$36{\cdot}86\,z + 32{\cdot}80\,x - 9{\cdot}69\,y + 5{\cdot}44\,\rho = +25{\cdot}4\,;$$

we get $38{\cdot}86\,z + 32{\cdot}86\,x - 9{\cdot}57\,y + 5{\cdot}47\,\rho = +25{\cdot}45$

so that the subnormal would be

$$1{\cdot}27\,x + 2{\cdot}37\,y + 1{\cdot}19\,\rho = -1{\cdot}13$$

As only one or, at most, two significant figures are required in the deduced value of ρ, the final normal equations formed by the abridged method would appear to give the necessary accuracy.

The equation between mean and apparent declination of a star, employing the notation given in the American ephemeris is:

$$\delta - \delta_0 = \tau\mu' + Aa' + Bb' + Cc' + Dd'$$
$$= \tau\mu' + g\cos(G + \alpha_0) + h\cos(H + \alpha_0)\sin\delta_0 + i\cos\delta_0$$

The constant of aberration enters only the last two terms of these, and the periodic effect of them on the star's place and on the deduced latitude are shown graphically in Plate 2.

The quantities C and D are simply periodic functions, the first depending on the cosine and the second on the sine of the sun's longitude. They therefore pass through their period during the year and have their maximum values at 18·76 and 20·45, respectively.

c' and d' being independent of the time and depending solely on the star's place would have the effect of changing the curves for C and D by a certain fixed ratio which would generally be less than unity. In the illustration we have the value of $Cc' + Dd'$ for each of the stars a and b of pair 1 in Group I, shown graphically throughout the year by a light dotted line. The sum of these two effects appears as a heavy dotted line and the resulting effect on the latitude of the place of observation is indicated by a full heavy line. C and D are each represented by a light full line.

The positions of the stars as previously given are:

	Right ascension. h.	m.	s.	Declination. °	′
I_a	13	27	46	− 7	4
I_b	13	30	5	+ 49	34

and we have

For I_{1a} $c' = \tan\omega\cos\delta - \sin\alpha\sin\delta = +0{\cdot}385$

$d' = \cos\alpha\sin\delta = +0{\cdot}114$

For I_{1b} $c' = +0{\cdot}573$

$d' = -0{\cdot}703$

From these constants and the varying day numbers

$$C = -20''{\cdot}4451\cos\omega\cos\odot$$
$$D = -20\ {\cdot}4451\sin\odot$$

the following tables were calculated for every 20 days throughout the year, and it is this table that is plotted in illustration No. 2.

STAR I_{1a}.

1891.		C	D	Cc'	Dd'	Sum.
June	0	− 6·3	−19·3	−2·4	−2·2	−4·6
	20	− 0·2	−20·4	−0·1	−2·3	−2·4
July	10	+ 6·0	−19·4	+2·3	−2·2	+0·1
	30	+11·5	−16·2	+4·4	−1·8	+2·6
Aug.	19	+15·7	−11·2	+6·0	−1·3	+4·7
Sept.	8	+18·2	− 4·9	+7·0	−0·6	+6·4
	28	+18·7	+ 2·1	+7·2	+0·2	+7·4
Oct.	18	+16·9	+ 8·8	+6·5	+1·0	+7·5
Nov.	7	+13·1	+14·6	+5·0	+1·7	+6·7
	27	+ 7·7	+18·6	+3·0	+2·1	+5·1
Dec.	17	+ 1·3	+20·4	+0·5	+2·3	+2·8
1892.						
Jan.	6	− 5·3	+19·6	−2·0	+2·2	+0·2
	26	−11·2	+16·4	−4·3	+1·9	−2·4
Feb.	15	−15·7	+11·1	−6·0	+1·3	−4·7
Mar.	6	−18·3	+ 4·6	−7·0	+0·5	−6·5
	26	−18·6	− 2·5	−7·2	−0·3	−7·5
Apr.	15	−16·8	− 9·2	−6·5	−1·0	−7·5
May	5	−13·0	−14·7	−5·0	−1·7	−6·7
	25	− 7·8	−18·6	−3·0	−2·0	−5·1
June	14	− 1·8	−20·4	−0·7	−2·3	−3·0
July	4	+ 4·4	−19·9	+1·7	−2·3	−0·6

STAR I_{1b}.

1891.	Cc'	Dd'	Sum.	Total effect.	
				Ia+Ib	$\frac{Ia+Ib}{2}$
June 0	− 3·6	+13·6	+10·0	+ 5·4	+ 2·7
20	− 0·1	+14·3	+14·2	+11·8	+ 5·9
July 10	+ 3·4	+13·6	+17·0	+17·1	+ 8·6
30	+ 6·6	+11·4	+18·0	+20·6	+10·3
Aug. 19	+ 9·0	+ 7·9	+16·9	+21·6	+10·8
Sept. 8	+10·4	+ 3·4	+13·8	+20·2	+10·1
28	+10·7	− 1·5	+ 9·2	+16·6	+ 8·3
Oct. 18	+ 9·7	− 6·2	+ 3·5	+11·0	+ 5·5
Nov. 7	+ 7·5	−10·3	− 2·8	+ 3·9	+ 2·0
27	+ 4·4	−13·1	− 8·7	− 3·6	− 1·8
Dec. 17	+ 0·7	−14·3	−13·6	−10·8	− 5·4
1892.					
Jan. 6	− 3·0	−13·8	−16·8	−16·6	− 8·3
26	− 6·4	−11·5	−17·9	−20·3	−10·2
Feb. 15	− 9·0	− 7·8	−16·8	−21·5	−10·8
Mar. 6	−10·5	− 3·2	−13·7	−20·2	−10·1
26	−10·7	+ 1·8	− 8·9	−16·4	− 8·2
Apr. 15	− 9·6	+ 6·5	− 3·1	−10·6	− 5·3
May 5	− 7·4	+10·3	+ 2·9	− 3·8	− 1·9
25	− 4·5	+13·1	+ 8·6	+ 3·5	+ 1·8
June 14	− 1·0	+14·3	+13·3	+10·3	+ 5·2
July 4	+ 2·5	+14·0	+16·5	+15·9	+ 8·0

We have here, then, a representation of the variation of the total effect on the latitude of those terms depending on the aberration for this particular pair.

The range and maximum values of C and D are seen in the second and third columns of Table I. The subsequent ones show how these are modified by the star numbers, and the effect of declination is apparent by comparing the corresponding values of $Cc'+Dd'$ for the two stars. In fact, an inspection of the formulæ shows how the effect on the latitude is influenced by the star's position.

For stars near the equator, and especially so when these stars are far from the equinoxial points, the curve for Dd' becomes more nearly a straight line. The second term of c' would also be small under this supposition, and for those cases where the star is north of the equator and the right ascension is near 6^h the sign of the second term will be the same as that of the first, and their difference being taken the curve for this term will also be much reduced in amplitude. We may also more easily appreciate the effect of a change in the aberration constant on the variation of latitude by comparing Plates 1 and 2.

The following table gives the values of the terms cos α sin δ for every hour of right ascension and every 10 degrees of declination. It also shows the values of the second term of c', that is, the sine of the right ascension multiplied by the sine of the declination.

Values of cos α sin δ.

Declination.	Right ascension.							
δ	0	1	2	3	4	5	6	Hours.
	0	15	30	45	60	75	90	Degrees.
90	1·000	0·966	0·866	0·707	0·500	0·259	0·000	
80	985	951	853	696	492	255	000	
70	940	908	814	664	470	243	000	
60	866	837	750	612	433	224	000	
50	766	740	663	542	383	198	000	
40	643	621	557	455	321	166	000	
30	500	483	433	354	250	129	000	
20	342	330	296	242	171	089	000	
10	174	168	150	123	087	045	000	
00	000	000	000	000	000	000	000	

A glance at this table will show how the star's position affects the terms of the reduction from mean to apparent place in which the aberration factor enters.

AGREEMENT OF CURVE WITH OBSERVATION.

By substitution in the normal equations for z we get the values of this quantity corresponding to the 63 different pairs of stars.

The following are the mean values of z for each group:

	″
I	+ 0·35
II	+ ·26
III	+ ·31
IV	+ ·15
V	+ ·31
VI	+ ·20
VII	+ ·40
VIII	+ ·44
Mean	+ 0·30

In order to compare the results of the present investigation with those derived by treating the observations according to Albrecht's methods (U. S. C. and G. Survey Bulletin No. 27) it must be borne in mind that the values given on page 16 of the bulletin have not only been reduced to a mean-declination system for each particular group, but all the groups have moreover been compared with the first one taken as a standard, and corrected accordingly.

These corrections deduced from the least square adjustment were as follows:

	″
Group I	0·00
II	+ ·07
III	+ ·03
IV	+ ·28
V	+ ·12
VI	+ ·18
VII	+ ·02
VIII	— ·04

It is therefore necessary, in applying our present curve to the diagram on page 17 of Bulletin No. 27, to increase the mean value of z by the mean of the quantities just given and we have as a result

$$z = + 0{\cdot}38$$

so that the equation

$$z + x \cos N + y \sin N + A\rho = \Delta\varphi = \varphi_1 - \varphi_0$$

for June 20, 1891, would be

$$+ 0{\cdot}38 + 0{\cdot}17 \cos 13^\circ - 0{\cdot}26 \sin 13^\circ + 0{\cdot}11\, x\, (+ {\cdot}01) = \varphi_1 - 24''{\cdot}00$$

or

$$24''{\cdot}48 = \varphi_1$$

The values of succeeding dates will be modified by the periodic terms of the variation of the latitude and by the different values for A. The following are the mean values of A for the respective groups:

	″
I	+ 0·09
II	+ ·23
III	+ ·44
IV	+ ·48
V	+ ·35
VI	+ ·06
VII	— ·14
VIII	— ·17
Mean	+ 0·17

By using a mean value for A the platted curve will never be in error more than 0·01, which may be overlooked in the comparison of theory and observation.

As the object of this paper is primarily to bring out the constant of aberration and the variations of latitude simultaneously, it is not thought worth while to replat the original observations for comparison with our newly determined curve. The curve is simply displaced by a constant quantity which adapts it to the adjusted values in Bulletin No. 27.

The agreement is shown equally well whether we apply the curve to the original observations or whether the corrected curve is applied to the adjusted observations. The values of the latitude therefore on a scale comparable with those of page 16 of Bulletin No. 27 are as follows:

Date.	Latitude.	Date.	Latitude.
1891.	″	1892.	″
June 20	24.48	Jan. 6	24·31
July 10	·39	Jan. 26	·42
July 30	·29	Feb. 15	·50
Aug. 19	·20	Mar. 6	·57
Sept. 8	·13	Mar. 26	·65
Sept. 28	·08	Apr. 15	·68
Oct. 18	·07	May 5	·68
Nov. 7	·09	May 25	·66
Nov. 27	·14	June 14	·60
Dec. 17	·21		

These values correspond to the dotted curve in fig. 1. The small circles are the results from observations on the same scale, and the lower curve is the one derived in Bulletin No. 27 displaced vertically. It appears that Newcomb's method, in addition to a determination of the aberration constant, brings out simultaneously the periodic variations of the latitude, agreeing practically with the results from Albrecht's method. The period is slightly different in the two treatments.

PROBABLE ERROR OF OBSERVATION.

Without attempting to calculate the residuals from the 2 370 conditional equations, we can arrive at a very close approximation to the probable error of observation by selecting a few representative groups. The time from the beginning of July, 1891, to the beginning of June, 1892, is almost completely covered by the work in Groups III, V, and VIII, so that the probable error from these groups may fairly be taken as involving those conditions, such as temperature, humidity, etc., which influence errors of observation.

By substituting in all the conditional equations for III, V, and VIII, we may therefore get the probable errors of observation sufficiently accurate for our purpose.

We have—

Group.	No. of conditional equations.	Mean errors of observation.
		″
III	274	0·312
V	257	0·283
VIII	310	0·295
		$\Sigma = 0·297$

Taking an average value, we assume the mean error of observation to be

$0''·297$.

This includes the probable error of declination which has an average value for the 63 pairs of $0''·257$. (See Appendix No. 2, Report of 1892, page 158.)

The weights of the quantities x, y, and ρ are found by writing -1 for the absolute term of the normal equation in x and zero for the absolute term in the remaining two, and solving and continuing this process for each unknown quantity.

The result is

$$\begin{aligned}\text{Weights of } x &= 204\\ y &= 137\\ \rho &= 35\end{aligned}$$

and the mean errors are, for x, y, and ρ, respectively,

$$\varepsilon_x = \frac{\varepsilon}{\sqrt{p_x}} = \frac{\cdot 297}{14\cdot 3} = 0\cdot 021$$

$$\varepsilon_y = \frac{\varepsilon}{\sqrt{p_y}} = \frac{\cdot 297}{11\cdot 7} = 0\cdot 025$$

$$\varepsilon_\rho = \frac{\varepsilon}{\sqrt{p_\rho}} = \frac{\cdot 297}{5\cdot 9} = 0\cdot 050$$

and the corresponding probable errors are

$$\begin{aligned}r_x &= \pm 0\cdot 014\\ r_y &= \cdot 017\\ r_\rho &= \cdot 034\end{aligned}$$

The definitive result of the constant of aberration from the latitude observations of 1891–92, made at Waikiki, Hawaiian Islands, on the part of the United States Coast and Geodetic Survey, is therefore

$$\text{Constant of aberration} = 20''\cdot 433 \pm 0\cdot 034.$$

This value of the aberration constant, combined with the latest determinations of the velocity of light (V=186,330 miles) and Clarke's value for the earth's equatorial radius (R=3,963·30 miles), gives for the sun's distance and horizontal parallax the following results:

Distance=92,709,000 miles.
Parallax=8″·82.

SAN FRANCISCO OBSERVATIONS.

The refined methods employed during the last few years in studying the changes of latitude have incidentally thrown light on one of the fundamental constants of astronomy. Continuous measures of small differences of zenith distances, carried on with a view of detecting a suspected motion of the pole, furnish material for the determination of the effect of aberration. The long series of observations made at Waikiki, Hawaiian Islands, in 1891 and 1892, were discussed for this purpose, and now the still longer series made by Professor Davidson, at San Francisco, have just been subjected to the same treatment. The methods, however, were essentially different. Both are due to Professor Newcomb, and the work of computation has been done in the Coast and Geodetic Survey Office, partly by myself and partly by Mr. C. C. Yates, under my supervision.

In the Waikiki observations an attempt was made to determine simultaneously the variations of latitude and a correction to the constant of aberration. This involved the formation and solution of 2 370 conditional equations of the form

$$z + x \cos N + Y \sin N + A\rho = \triangle\varphi$$

The result fully justified the method. The latitude curve agreed almost precisely with that found by an independent treatment according to the German method, and a very fair value was deducted for the correction ρ.

The details of this work are given in the former part of this paper and in Bulletin No. 28, United States Coast and Geodetic Survey.

In the San Francisco observations it was desirable to shorten the labor because here we have nearly 7 000 conditional equations. To apply the method of least squares for the purpose of determining four unknown quantities, to such a mass of data, would require great labor. The periodic variations of latitude were therefore accepted as already deduced by Mr. C. A. Schott, and the conditional equations were formed containing only two unknown quantities, one of which was the correction to the aberration constant.

The following groups of stars were observed:

Group.	Right ascension.				Period of observation.	Mean date.
	h.	*m.*	*h.*	*m.*		
I	14	1	to 17	4	May 27, '91, to July 1, '91	June 13
					Mar. 6, '92, " June 5, '92	Apr. 21
II	17	10	" 20	3	May 27, '91, " Aug. 13, '91	July 5
					May 10, '92, " Aug. 19, '92	June 30
III	20	10	" 23	2	July 4, '91, " Sep. 22, '91	Aug. 13
					July 30, '92, " Aug. 19, '92	Aug. 10
IV	23	10	" 2	3	Aug. 15, '91, " Oct. 30, '91	Sep. 22
V	2	6	" 5	1	Sep. 23, '91, " Dec. 2, '91	Oct. 8
VI	5	6	" 8	8	Nov. 5, '91, " Jan. 23, '92	Dec. 14
VII	8	12	" 11	3	Dec. 17, '91, " Mar. 8, '92	Jan. 27
VIII	11	20	" 13	58	Jan. 27, '92, " May 7, '92	Mar. 18

The equation furnished by Mr. Schott was as follows:

$$\text{Latitude} = \varphi = 37^\circ\ 47'\ 28''{\cdot}334 + 0''{\cdot}172 \sin\left\{\frac{360^\circ}{431}\,t + 3^\circ{\cdot}7\right\}$$
$$+ 0''{\cdot}074 \sin\left\{\frac{360^\circ}{365\frac{1}{4}}\,t + 20^\circ{\cdot}5\right\}$$

When t is the number of days from January 0, 1891.

The foregoing equation gives the following values for the latitude from May 29, 1891, to August 31, 1892. The tabular values are to be added to 37° 47′ 20″ to get the actual values:

Date.	Latitude.	Date.	Latitude.	Date.	Latitude.
1891.	″	1891.	″	1892.	″
May 29	8·48	Oct. 31	8·12	Mar. 29	8·47
June 3	·47	Nov. 5	·12	Apr. 3	·48
8	·46	10	·13	8	·49
15	·44	15	·13	13	·50
18	·42	20	·14	18	·50
23	·41	25	·14	23	·51
28	·39	30	·15	28	·51
July 3	·37	Dec. 5	·16	May 3	·52
8	·35	10	·17	8	·52
13	·34	15	·18	13	·52
18	·32	20	·20	18	·52
23	·30	25	·21	23	·52
28	·28	30	·22	28	·51
Aug. 2	·27	1892.		June 2	·51
7	·25	Jan. 4	·24	7	·51
12	·24	9	·25	12	·50
17	·22	14	·27	17	·50
22	·21	19	·28	22	·49
27	·19	24	·30	27	·48
Sept. 1	·18	29	·31	July 2	·48
6	·17	Feb. 3	·33	7	·47
11	·16	8	·34	12	·46
16	·15	13	·36	17	·45
21	·14	18	·37	22	·44
26	·13	23	·39	27	·42
Oct. 1	·13	28	·40	Aug. 1	·41
6	·12	Mar. 4	·41	6	·40
11	·12	9	·43	11	·39
16	·12	14	·44	16	·38
21	·12	19	·45	21	·36
26	·12	24	·46		

When the preceding values are compared with those resulting from observation the outstanding differences represent the combined effect of two independent quantities. One is the correction to reduce the mean declination of each pair of stars to the mean of all the pairs, and the other a certain function of the quantity 20″·4451, which is the aberration constant and which appears as

a factor in two terms of the reduction from the mean to the apparent place of the stars. The tabular values are considered applicable for two days on each side of the date given.

Each directly observed latitude will therefore furnish an equation of the form

$$C+Kx=\Delta\varphi$$

where C is the correction to the mean declination of the pair,
K is the sum of $h \cos (H+\alpha) \sin \delta$ for both stars,
x is minus one-half the factor by which the aberration constant used in the reductions must be multiplied in order to get the correction to this constant, and
$\Delta\varphi$ is the difference between the observed value of the latitude and the mean latitude plus its periodic variation.

Each pair will then give conditional equations of the form

$$\begin{aligned} C+Kx&=\Delta_1\varphi \\ C+Kx&=\Delta_2\varphi \\ C+Kx&=\Delta_3\varphi \\ &\text{etc., etc.,} \end{aligned} \qquad (1)$$

where each equation corresponds to a separate observation.

If there are n observations the normal equations for this pair will be

$$\begin{aligned} n\,C+[K]x&=[\Delta\varphi] \\ [K]\,C+[KK]x&=[K\Delta\varphi] \end{aligned}$$

from which by eliminating C

$$x=\frac{[K\Delta\varphi]-\frac{[K][\Delta\varphi]}{n}}{[KK]-\frac{[K]^2}{n}}$$

This is the direct method. In practice, however, as Professor Newcomb suggested, each K was multiplied by .04, so as to make the general mean somewhat less than unity, which procedure gave a value of x 25 times greater than its true value. The value found from the normal equation is therefore to be divided by 25.

In the solution by the above scheme the declination correction disappears, and we have finally 6 768 equations containing only x and known terms. A mean equation gives the value sought.

The interpretation of the result is easily made by considering the form of the conditional equations and the relation between the coefficient of x and the aberration constant.

The quantity 20″.4451 enters as a factor into the expression $h \cos (H+\alpha) \sin \delta + i \cos \delta$, or in Bessel's notation into $Cc'+Dd'$. This expression is added to the declination of each star in finding its apparent place, and the latitude comes from summing the declinations and dividing by two. Hence any change in the above factor affects the deduced latitude by only half as much, and since $\Delta\varphi$ is equal to $\varphi-\varphi_0$, or to the observed latitude minus the mean latitude corrected for periodic variation, the effect on $\Delta\varphi$ is equal to its effect on φ and is of the same sign. Moreover, the sign of x must be opposite to the sign of the correction to 20″.4451, since the term $+Kx$ represents the excess of the $\Delta\varphi$ deduced with this value over that which would come from using the new value.

In general if the value of x as used in the equations comes out $+a$, the correction to be applied to the constant of aberration is $-1{\cdot}64a$, or the value of the aberration constant given by the observations is

$$20''{\cdot}4451 - 20''{\cdot}4451 \left(\frac{2\,a}{(25)}\right)$$

In forming the coefficients for determining x each group was taken up separately and the quantities were tabulated according to the following scheme where all numbers are given for the first pair of Group I:

1891.	$\Delta\phi$	K	K^2	$K\Delta\phi$
May 28	+0·62	+ 0·4	+ 0·16	+0·25
29	−0·12	+ 0·4	+ 0·16	−0·05
June 1	+0·11	+ 0·4	+ 0·16	+0·04
3	+0·85	+ 0·5	+ 0·25	+0·42
5	−0·01	+ 0·5	+ 0·25	0·00
6	−0·32	+ 0·5	+ 0·25	−0·16
7	+0·18	+ 0·6	+ 0·36	+0·11
8	+0·12	+ 0·6	+ 0·36	+0·07
12	+0·27	+ 0·6	+ 0·36	+0·16
13	−0·01	+ 0·6	+ 0·36	−0·01
14	−0·09	+ 0·7	+ 0·49	−0·06
17	−0·56	+ 0·7	+ 0·49	−0·39
18	+0·54	+ 0·7	+ 0·49	+0·38
19	0·00	+ 0·8	+ 0·64	0·00
20	−0·53	+ 0·8	+ 0·64	−0·42
21	−0·14	+ 0·8	+ 0·64	−0·11
22	+0·01	+ 0·8	+ 0·64	+0·01
25	+0·54	+ 0·8	+ 0·64	+0·43
26	+0·29	+ 0·8	+ 0·64	+0·23
27	+0·57	+ 0·9	+ 0·81	+0·51
28	+0·02	+ 0·9	+ 0·81	+0·02
29	+0·45	+ 0·9	+ 0·81	+0·40
(22 obs.)	+2·79	+14·7	+10·41	+1·83

1892.	$\Delta\phi$	K	KK	$K\Delta\phi$
Mar. 6	+0·58	− 1·0	+ 1·00	−0·58
12	−0·10	− 1·0	+ 1·00	+0·10
20	−0·50	− 0·9	+ 0·81	+0·45
21	+0·10	− 0·8	+ 0·64	−0·08
22	−0·13	− 0·8	+ 0·64	+0·10
23	−0·05	− 0·8	+ 0·64	+0·04
24	−0·79	− 0·8	+ 0·64	+0·63
25	−0·24	− 0·8	+ 0·64	+0·19
27	−0·23	− 0·8	+ 0·64	+0·18
29	+0·15	− 0·7	+ 0·49	−0·10
30	−0·51	− 0·7	+ 0·49	+0·36
Apr. 3	−0·24	− 0·6	+ 0·36	+0·14
4	+0·07	− 0·6	+ 0·36	−0·04
5	+0·38	− 0·6	+ 0·36	−0·23
9	−0·03	− 0·5	+ 0·25	+0·02
11	+0·35	− 0·5	+ 0·25	−0·17
15	+0·01	− 0·4	+ 0·16	0·00
16	−0·28	− 0·4	+ 0·16	+0·11
17	−0·24	− 0·4	+ 0·16	+0·10
18	−0·16	− 0·4	+ 0·16	+0·06
19	+0·24	− 0·4	+ 0·16	−0·10
21	−0·35	− 0·3	+ 0·09	+0·10
22	−0·35	− 0·3	+ 0·09	+0·10
24	+0·15	− 0·3	+ 0·09	−0·04
25	−0·19	− 0·2	+ 04	+0·04
26	−0·17	− 0·2	+ 04	+ 08
May 8	−0·41	0·0	+ 00	00
Sums	−2·94	−15·2	+10·36	+1·41
May 10	−0·23	0·0	0·00	0·00
11	−0·03	+ 0·1	+ 0·01	0·00
12	−0·89	+ 0·1	+ 0·01	−0·09
13	−0·30	+ 0·1	+ 0·01	−0·03
16	−0·05	+ 0·2	+ 0·04	−0·01
18	+0·02	+ 0·2	+ 0·04	0·00
20	+0·18	+ 0·2	+ 0·04	+0·04
21	+0·43	+ 0·3	+ 0·09	+0·13
29	−0·03	+ 0·4	+ 0·16	−0·01
30	+0·10	+ 0·4	+ 0·16	+0·04
31	+0·18	+ 0·4	+ 0·16	+0·07
June 1	−0·02	+ 0·5	+ 0·25	−0·01
2	−0·60	+ 0·5	+ 0·25	−0·03
	−1·24	+ 3·4	+ 1·22	+0·10
Total sum	−1·39	+ 2·9	+21·99	+3·35

$$n = 62$$
$$[K]^2 = 8.51$$
$$[K]\,[\Delta\varphi] = -4.03$$

From the foregoing values the equation in x corresponding to (2) is

$$-21.85\,x = +3''.41$$

Found in the same manner are the following equations, which are deduced from all the observations.

EQUATIONS IN x.

Pair.	Group I.	Pair.	Group II.	Pair.	Group III.
1	$+21.85x = +3.41$:	1	$+14.84x = -0.19$:	1	$+9.03x = +2.58$
2	30.39 −4.46	1₂	21.32 −2.72	2	9.65 −2.46
3	27.07 −0.27	2	30.27 −0.45	3	0.05 −0.08
4	12.82 −0.13	3	30.94 −3.16	3₂	8.40 +1.08
5	29.03 −7.36	3₂	33.94 −3.68	4	8.44 −2.53
6	12.80 +5.22	4	36.33 +0.21	5	9.83 −0.84
7	21.90 −0.99	4₂	2.18 −0.59	5₂	9.42 −0.95
6₂	3.87 −0.18	5	37.09 +2.37	6	10.11 −0.06
7₁	3.09 −0.42	6	38.86 −0.05	7	7.95 −1.95
7₂	3.09 −0.65	7	36.87 +1.45	8	4.07 +0.05
7₄	8.72 +0.46	8	34.09 +1.58	8₂	4.12 −1.77
7₅	8.68 −1.11	8₂	33.47 +0.87	9	8.01 −2.41
8	17.56 +3.84	9	30.26 +4.03	10	4.27 −3.26
9	14.08 +3.04	9₂	32.14 +1.34	11	6.09 −2.31
10	22.26 −4.17	10	25.81 +0.73	12	8.66 +1.53
11	15.92 −2.65	11	31.08 +1.76	13	7.15 +0.16
11₂	6.21 −0.29	11₂	19.49 +2.26	14	5.46 −0.21
11₃	5.67 +0.48	11₃	0.15 −0.27	14₂	0.01 −0.05
11₄	5.97 +0.38	11₄	0.10 +0.04		
12	18.52 +1.33	12	11.81 −0.52		
12₂	4.98 −0.54	12₂	29.39 +2.98		
13	18.58 −2.05	13	29.00 +0.47		
13₂	4.77 −0.06	14	11.34 −0.78		
14	21.70 +0.88	14₂	25.50 +1.67		
	$+339.5x = -6.29$		$+596.3x = +9.35$		$+120.7x = -13.48$

Pair.	Group IV.	Pair.	Group V.	Pair.	Group VI.
1	$+3.49x = +2.35$	1	$+1.73x = -0.50$	1	$+1.25x = -0.61$
2	3.77 −0.84	2	2.13 +0.97	1₂	0.00 0.00
3	3.22 −1.20	3	2.37 +0.65	2	0.33 +0.24
3₂	5.90 −0.64	4	2.48 +0.23	2₂	1.29 +0.60
4	2.60 +0.90	5	2.60 −1.63	3	1.28 +1.07
4₂	2.70 +0.33	6	1.30 −1.29	4	1.14 −0.51
5	3.46 −0.65	6₂	0.43 −1.03	5	0.24 −0.05
6	2.16 +1.43	7	2.28 +0.86	5₂	1.20 +0.86
7	3.11 −0.32	8	1.67 −0.26	6	1.09 −1.49
8	2.43 +1.36	9	2.13 −0.45	7	1.21 −0.22
9	2.51 −2.34	9₂	1.54 −0.36	7₂	0.17 +0.24
9₂	2.46 −1.98	10	1.76 +0.65	8ₐ	0.00 +0.01
10	2.62 −0.83	11	2.02 −0.72	8ᵦ	0.93 +0.96
11	1.77 +0.76	12	1.40 +0.28	9	0.86 −0.49
12	1.60 −0.08	13	1.52 −0.88	10	0.94 −0.22
13	0.95 −0.30	14	1.28 −0.35	11	2.40 −0.65
14	1.35 +0.04	15	1.41 −0.98	12	0.65 −0.22
		16	1.28 −0.98	12₂	0.67 +0.85
		17	0.29 +0.09	13	0.19 −0.17
		17₂	0.75 −0.21	13₂	0.23 −0.07
		18	0.92 +0.08	14	0.14 −0.16
				15	0.84 −0.15
				15₂	0.99 +0.41
				16	0.63 −1.38
				17	0.31 −0.24
				18	0.36 +0.35
				18₂	0.01 +0.03
	$+46.10x = -2.01$		$33.29x = -5.83$		$19.35x = -1.01$

Pair.	Group VII.		Pair.	Group VIII.	
1	$+1\cdot19x=$	$-0\cdot71$	1	$+8\cdot38x=$	$-0\cdot23$
1_2	$1\cdot06$	$-0\cdot39$	2	$9\cdot64$	$+3\cdot17$
2	$1\cdot30$	$-0\cdot58$	3	$3\cdot64$	$-0\cdot37$
2_2	$1\cdot17$	$-1\cdot13$	4	$4\cdot80$	$-0\cdot22$
2_3	$0\cdot46$	$+0\cdot19$	5	$4\cdot14$	$+0\cdot59$
2_4	$0\cdot36$	$+0\cdot04$	6	$4\cdot59$	$-0\cdot45$
3	$1\cdot51$	$-0\cdot72$	7	$4\cdot89$	$+0\cdot39$
4	$1\cdot97$	$-0\cdot67$	8	$3\cdot84$	$-0\cdot31$
5	$1\cdot41$	$+0\cdot15$	9	$5\cdot92$	$-1\cdot60$
5_2	$1\cdot50$	$-0\cdot52$	10	$2\cdot36$	$-1\cdot29$
6	$1\cdot21$	$-0\cdot32$	10_2	$2\cdot76$	$-1\cdot32$
7	$1\cdot42$	$-0\cdot05$	11	$6\cdot35$	$+0\cdot22$
8	$1\cdot48$	$-0\cdot04$	11_2	$6\cdot14$	$-0\cdot39$
8_2	$1\cdot35$	$-0\cdot41$	12	$4\cdot00$	$-0\cdot23$
9	$1\cdot19$	$-0\cdot12$	13	$5\cdot43$	$+1\cdot05$
10	$1\cdot40$	$+0\cdot05$	14	$2\cdot02$	$-0\cdot66$
10_2	$1\cdot33$	$-0\cdot22$	14_2	$4\cdot79$	$-0\cdot10$
10_3	$0\cdot43$	$-0\cdot27$	15	$5\cdot39$	$-0\cdot66$
11	$1\cdot35$	$+0\cdot19$			
11_2	$1\cdot37$	$-0\cdot22$			
11_3	$0\cdot43$	$-0\cdot24$			
12	$1\cdot06$	$-0\cdot19$			
12_2	$3\cdot00$	$-0\cdot57$			
13	$1\cdot15$	$-0\cdot35$			
14	$0\cdot19$	$-0\cdot46$			
15	$1\cdot06$	$-0\cdot23$			
16	$0\cdot54$	$-0\cdot08$			
	$31\cdot89x=$	$-7\cdot87$		$89\cdot08x=$	$-1\cdot81$

The value of x from Group I would therefore be—

$$x=\frac{-6\cdot29}{339\cdot5}=-0\cdot0185$$

and the correction to the constant of aberration from this group is $+1\cdot64\times0\cdot0185=+0\cdot030$, from which the value sought is $20''\cdot445+0''\cdot030=20''\cdot475$.

The following summary gives the equations in x for each group, the resulting values of x, the number of observations, and the final corrections:

SUMMARY OF EQUATIONS IN x.

Group.	Equations in x		x	n	$1\cdot64x$
I	$339\cdot5$	$x=-6\cdot29$	$-0\cdot0185$	1 202	$-0\cdot030$
II	$596\cdot3$	$x=+9\cdot35$	$+0\cdot0157$	1 399	$+0\cdot026$
III	$120\cdot7$	$x=-13\cdot48$	$-0\cdot1117$	720	$-0\cdot183$
IV	$46\cdot1$	$x=-2\cdot01$	$-0\cdot0436$	497	$-0\cdot072$
V	$33\cdot3$	$x=-5\cdot83$	$-0\cdot1751$	682	$-0\cdot286$
VI	$19\cdot04$	$x=-1\cdot01$	$-0\cdot0517$	811	$-0\cdot085$
VII	$31\cdot9$	$x=-7\cdot87$	$-0\cdot2468$	788	$-0\cdot404$
VIII	$89\cdot1$	$x=-1\cdot81$	$-0\cdot0203$	669	$-0\cdot033$
	1 276·3	$x=-28\cdot95$	$-0\cdot0227$	6 768	$-0\cdot037$

Constant of aberration $=20''\cdot445+0''\cdot037=20''\cdot482$.

Values of aberration constant from groups.

	″
I	20·475
II	·419
III	·628
IV	·517
V	·731
VI	·530
VII	·849
VIII	·478

These values weighted with the coefficients of x above give the same value, viz:

Constant of aberration $= 20''{\cdot}482$.

PROBABLE ERROR.

The probable error of this result is estimated in the following way: The values of C, the corrections to the assumed declinations, were calculated for each pair through two representative groups. These values and the values of x substituted in all the conditional equations of the groups chosen gave residuals from which the mean error of observation was calculated. The number of equations being represented by m and the number of unknown quantities determined being equal to μ, the mean error of observation is

$$e=\sqrt{\frac{[v\,v]}{m-\mu}}$$

In the present case the average value of e from the two groups involving 51 pairs and 2 013 observations was $\pm$ 0·389.

The normal equations were then solved for each pair in order to get the weight of the unknown quantity x. These normal equations were

$$\begin{aligned} n\,C\ +\ [K]\,x&=0\\ [K]\,C+[K\,K]\,x&=1 \end{aligned}$$

from which x is equal to the reciprocal of the quantity

$$[K^2]-\frac{[K]^2}{n}$$

This last written value is therefore the weight of x or $\sqrt{p_x}$, and the mean error of x from each pair would be found by dividing the mean error of observation by $\sqrt{p_x}$. An average value for the 51 pairs of the mean error of x from 1 pair gave (0·395). The probable error is therefore $0{\cdot}6745\times(0{\cdot}395)=0{\cdot}266$. The value of x as derived from the conditional equation must be multiplied by 1·64 in order to get the correction to the aberration constant. Hence the probable error of this correction from one pair of stars may be taken as (·436) and the probable error of the result depending on 176 pairs would be

$$\frac{0{\cdot}436}{\sqrt{176}}=\frac{0{\cdot}436}{13{\cdot}3}=0{\cdot}033$$

This is on the assumption that the average mean error for 51 pairs is the same as the average for 176 pairs, a supposition which seems to be justified, within reasonable limits, by the range of the values calculated.

The constant of aberration from the San Francisco observations may then be given as

$$20''{\cdot}482 \pm 0''{\cdot}033$$

This value used in connection with the velocity of light and the earth's radius given in the first part of the paper reduces the solar parallax to 8″·797 and increases the sun's distance to 92 931 000 miles; so that we would have, giving equal weights to the Honolulu and San Francisco observations, the following values from all the observations of the Coast and Geodetic Survey:

Constant of aberration	20″·458
Solar parallax	8″·808
Sun's distance	92 820 000

Comparing these with the results given in the two volumes mentioned in the preface, we have

	Constant of aberration.	Solar parallax.	Sun's distance.
	//	//	
Newcomb.	20·463	8·790	92 845 000
C. & G. Survey.	20·458	8·808	92 820 000
Harkness.	20·455	8·809	92 797 000

Newcomb's value, 20″·463, is the mean of 24 miscellaneous results from different observatories. The sun's distance is derived from this and from the velocity of light, 299 860 km., and the earth's radius, 6 378·2 km., given on page 147.

The difference between the extreme values for the sun's distance is much less than the probable error ascribed by Professor Harkness to his result (p. 140), and the Coast and Geodetic Survey value differs from the mean of all three by about 1 per cent of this probable error.

We may repeat, in conclusion, that the observations which furnish the data discussed in the preceding pages were made with an entirely different object in view. The deduction of the constant of aberration was an afterthought, and was not undertaken until the observations had fully subserved the purpose for which they were originally and specifically made. That they should furnish such plausible values is a matter of satisfaction without, however, attributing undue importance to the close accord with standard work in this direction.

Nevertheless, a new and independent determination of this quantity can not fail to be of value when we remember that one of the most accurate means of finding the sun's distance is by use of the aberration constant, which has been the subject of this paper.

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CURVES OF PERIODIC VARIATION OF LATITUDE

BY

NEWCOMB'S AND ALBRECHT'S METHOD

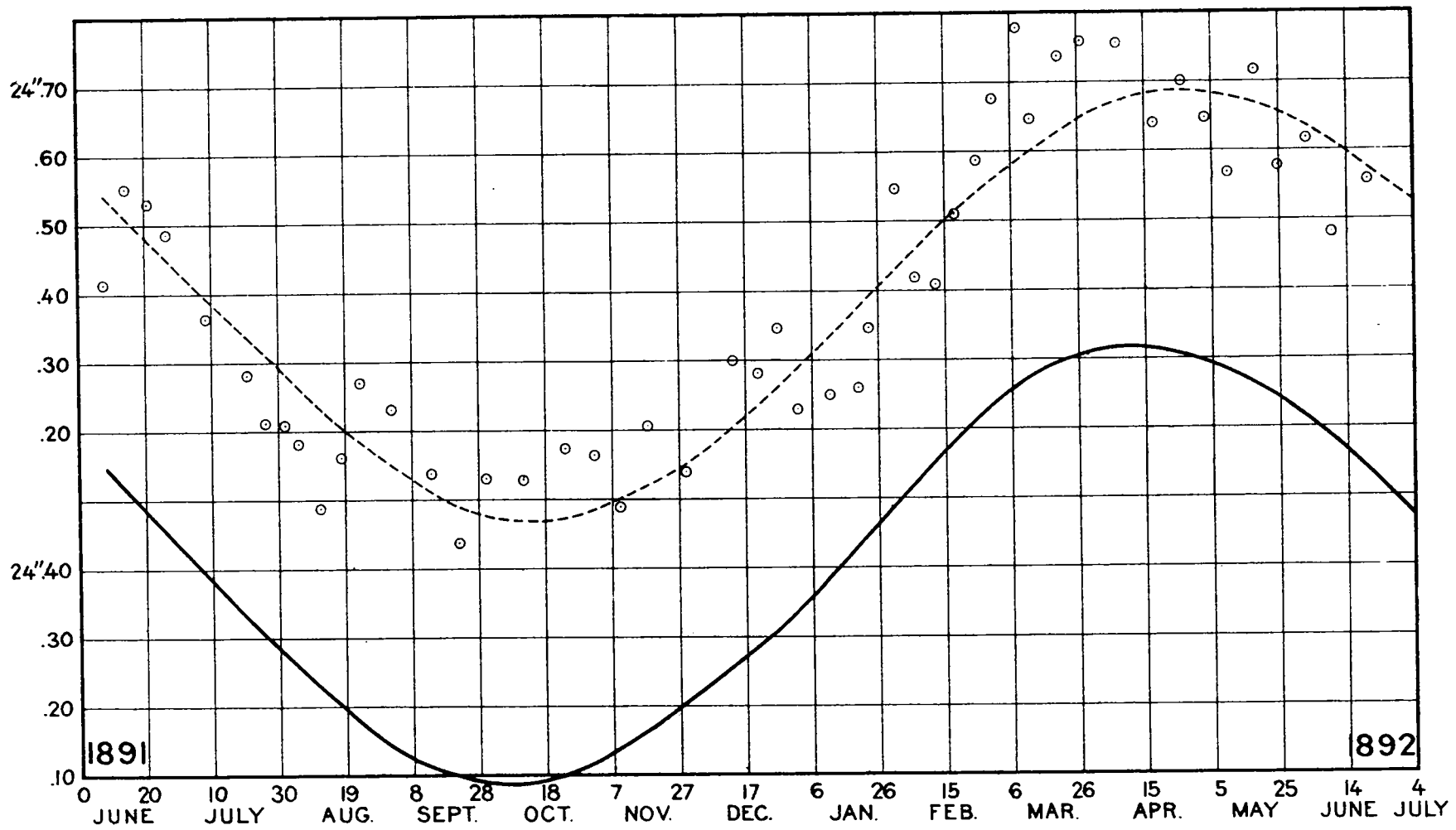
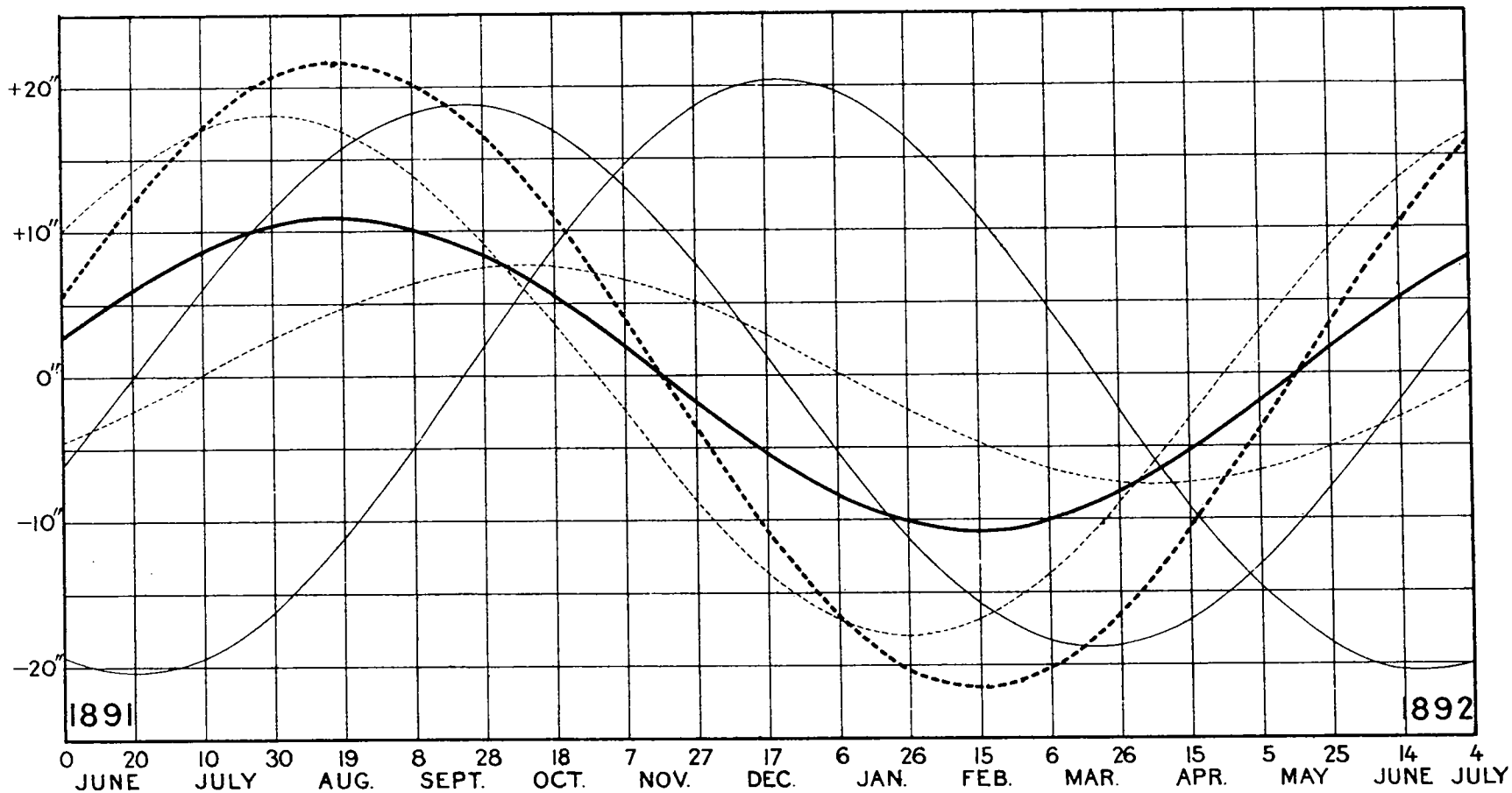


Plate No. 2

PERIODIC EFFECT
OF
TERMS DEPENDING ON ABERRATION

C and D ____ *Cc′ + Dd′ (both stars)* ------
Cc′ + Dd′ ------ *Latitude effect* ____



U. S. Coast and Geodetic Survey Report for 1896. Appendix No. 10

APPENDIX No. 11—1896.

COMPILATION OF THE MOST RECENT INFORMATION RELATIVE TO THE HARBORS, ANCHORAGES, AND DANGERS TO NAVIGATION IN THE VICINITY OF CHATHAM AND PERIL STRAITS AND COOKS INLET, ALASKA.

Arranged and compiled by Lieut. HUGH RODMAN, U. S. N., Assistant.

Prefatory note.—The following information is compiled from a survey made in the summer of 1895 by the Coast Survey steamer *Patterson* in Chatham and Peril straits, from Point Gardner to Killisnoo, thence through Peril Strait to Sergius Narrows, and from the notes of Prof. W. H. Dall, U. S. Geological Survey, made about the same time, in Cooks Inlet and to the westward.

It is very general in character, and that which relates to Chatham and Peril straits is preliminary to the charts and sailing directions which will be published, covering the same ground, in the near future.

In the territory around Cooks Inlet the charts are far from correct, but they are compiled from the most reliable sources, and it is hoped that in time this part of Alaska may be accurately charted.

The sailing directions and notes are taken from the reports of Lieut. Commander E. K. Moore, U. S. N., commanding the Coast Survey steamer *Patterson*, and cover the ground from Point Gardner, at the junction of Frederick Sound and Chatham Strait, to Povorotni Island, in Peril Strait. These notes were compiled during the season of 1895, from May to October, and are a very valuable addition to the scant information already existing in print on this part of Alaska.

This information has already been published as Bulletin No. 35.

On the eastern shore of Chatham Strait the mountains are not so abrupt or rugged as on the western side. The tops are nearly all rounded and bare, with the exception of grass and light underbrush. Owing to the prevalence of snow slides, no general rule can be given for the height of the timber line. The rest of the country is covered with a heavy growth of cedar, fir, spruce, maple, alder, and blueberry bushes, greatly impeding travel. The highest peak on the eastern shore is between Cha-ik and Whitewater bays, 3 241 feet, and is an irregular, solitary mountain with two principal peaks. On the southern shore of Whitewater Bay, and making a prominent landmark for it, is a mountain, 2 438 feet high, called Table Mountain, peculiarly eroded near the top. This is the only prominent peak between Whitewater Bay and Point Gardner, the country being composed of low, rolling hills, heavily timbered, lacking individuality, and containing no prominent features.

On the western shore, with the exception of the country between Point Thatcher and Point Lull, the country is much more rugged and broken, many of the peaks reaching altitudes of 4 000 feet, and apparently increasing in height to the southward. These peaks are nearly all bare and rocky and covered with snow until late in the summer, some of them perpetually. A few remnants of glaciers can be seen in some of the upper gulches. The timber line proper is much lower here than on the eastern side, and above it the underbrush is also much lighter. This is due probably to the later melting of the snow and the greater frequency of snow slides.

Chatham Strait, in the main, is a clear, honest sheet of water, most of the dangers to navigation lying well inshore, and generally inside of a line drawn from point to point. On the western shore from abreast Point Gardner to the southern point of Kelp Bay there are no outlying dangers, and the reefs in the small bights are nearly all visible at half tide. About two-thirds of a mile SE. ½ S. from Point Lull is a sunken rock, well marked by kelp, and from here to Point

Thatcher the shore should not be approached within half a mile, as there are several reefs extending well offshore, and the bottom is very irregular and foul. Although well marked by kelp, there may be some shoals undiscovered. Much of this kelp is attached to small rocks and bowlders, varying in size from a hen's egg to a brick, and under the influence of heavy seas or strong tidal currents a vessel is very liable to drag anchor.

On the western shore are three prominent waterfalls which make excellent landmarks. The first is 4 miles below the southern point of Kelp Bay, very high, and visible for a considerable distance to the northward, appearing as a white line or streak against the dark background of the hills. The second is a large but not particularly high waterfall at the head of Warm Spring Bay, which is visible from Chatham Strait for a short distance to the southward of the bay. The third is similar to the last in appearance, in an open bight which has received the local name of Cascade Bay. This waterfall is visible from vessels bound north in mid-channel up to a point one-half mile to the northward of a line drawn from Point Gardner at right angles to the general direction of the channel.

From Point Gardner to Point Wilson, the southern point of Wilson Cove, the shore is low, except in one place noted on the chart, with no reefs or dangers making off to any extent.

Wilson Cove, 8 miles above Point Gardner, is an open, shallow bight, about 1 mile deep, with a width at its entrance of 2 miles. At its head is an extensive flat. On its southern shore are two small wooded islands, the inner one being much higher and more heavily wooded of the two. In the entrance is an extensive reef, generally visible, but covered at the spring high waters, extending across the mouth for a distance of half a mile. The southern shore is very foul and rocky, and full of kelp, much of it being secured to small rocks and bowlders. On the northern shore are several caverns in the faces of the cliffs, which are from 75 to 100 feet in height. Wilson Cove should be avoided, as it affords no protection as an anchorage except from easterly winds, and is very foul, bottom showing in 4 or 5 fathoms in many places.

Point Caution, 14 miles above Point Gardner, and 5 miles above Wilson Cove, is the southern point of Whitewater Bay. Two and one-half miles south of it a shoal extends offshore one-third of a mile from a small wooded islet connected with the shore at low water. Otherwise the shore is free from dangers between Point Caution and Wilson Cove. Directly behind Point Caution is the mountain previously referred to as marking the entrance to Whitewater Bay.

One-sixth of a mile NW. from Point Caution is a low, rocky islet, bearing a single dead tree, from which it derives the name of Lone Tree Island.

One and three-quarter miles N. ½ W. from Point Caution is Woody Point, with a small rocky, wooded islet, one-third of a mile offshore. This is the northern point of Whitewater Bay.

Whitewater Bay extends in an easterly direction for a distance of 3 miles, terminating at its head in sand and gravel flats, and at high water connecting by a narrow passage with a lagoon about 1 mile in length by one-half mile in width, bare at low water.

One and one-quarter miles from Point Caution, nearly in the middle, but a little nearer the southern shore, is Healy Rock, low and bare, surrounded by rocky ledges of small extent, marked by kelp. On the northern shore, 1 mile SE. from Woody Point, is the Indian village of Neltushkin, and from the point immediately to the westward of the village a rocky ledge extends one-half mile in a SW. by W. direction, with a sunken rock one-quarter of a mile to the eastward of its seaward end, both well marked by kelp. In other particulars the description of this bay as given in the Pacific Coast Pilot, Alaska, Part I, is very good.

From the rocky islet off Woody Point, distant seven-eighths of a mile NW. by N., is Russian Reef. The position of this reef on the published charts is erroneous, as it has been placed much too far from shore, while in reality it is nearly on range between Point Caution and Distant Point. This reef extends three-quarters of a mile in a general WNW. direction, showing partially at low water, and is well marked by kelp. These rocks rise very abruptly from very deep water.

From Woody Point 2½ miles NE. ¾ E. is Rocky Point, the shore between being considerably indented by small open bights, with ledges extending well offshore at low water. There are also two small islands in this stretch, one close inshore, 1 mile S. ½ E. from Rocky Point, and the other one-half mile S. ½ E. from Rocky Point. From the latter island a rock, showing at half tide, lies NW., distant one-third mile. A larger island, distant 1 mile W. by N. from Rocky Point, has also a

ledge, distant one-quarter mile NW. by W., showing at about half tide. This island and the white cliffs 2¾ miles south of Distant point mark the entrance to a bay known by the Indians as Cha-ik, of which Village and Rocky points are the north and south points respectively. In a shallow bight, just inside Village Point, is an Indian village, off which, distant one-half mile SE. by E., is an extensive ledge surrounding a small, low, bare, rocky island, and with a narrow channel between it and the shore.

This bay is about 3½ miles in length, and opens into an extensive flat at its head. On the north shore, 2 miles from Village Point, is a bight 1 mile in length, in which is the anchorage. A low, wooded island, with a rock visible at half tide and distant 300 yards in a SW. direction from it, marks the southern point of the bight. In the middle of the bay, 1¼ miles E. by N. from the rock off the Indian village, is a low, wooded island with extensive ledges on the seaward side, and some detached rocks showing at low water on the inshore end. Between this island, and a little nearer the southern shore, are two rocks, connected at low water. Beyond the island and these rocks, toward the head of the bay, the bottom is very irregular, and visible in many places at a depth of 4 to 5 fathoms, and there is also an abundance of kelp. There are several small islands and rocks near the head of the bay, and vessels are recommended to avoid passing beyond the island off the southern point of the anchorage, the island in the center, and the two rocks near the southern shore.

In the inlet on the northern shore excellent holding ground in 12 fathoms, sticky bottom, may be had, and, although open to the southwest, it affords good protection from all other directions, and it is doubtful if it would blow home in southeasterly weather, the only wind which could draw in.

Distant Point is 3½ miles NNW. ½ W. from Village Point and 4½ miles SE. from Point Samuel. It marks the southern point of Hootz Bay, and directly behind it are two hills which lie between Cha-ik and Hootz bays. The lower and more northern one lies directly behind the point, and from some points of view appears as a double peak of about 1 000 feet elevation. The larger mountain is about 2 200 feet in height, and is a single mountain rounded on top. Two and a half miles to the southward of Distant Point a spur of this mountain runs toward the water, and terminates abruptly in a whitish cliff 800 feet high, which has been previously referred to.

Kenasnow Island is low, and at its western end is about 300 feet high and heavily wooded. Much of the timber on the eastern end has been logged. Killisnoo, the location of the Alaska Oil and Guano Company, and the United States post-office, is situated on the northern and eastern end. Point Samuel is the western point of the island and the northern point of Hootz Bay.

From the entrance, Hootz Bay is about 11 miles long to the head of the southern arm, and about 10 miles to the head of the northern arm. In the entrance are numerous rocks and reefs, those visible lying close to the eastern shore and parallel to it for a distance of 2 miles, with a clear but narrow channel between them and the shore. Five-eighths of a mile N. ½ E. from Distant Point, and fully one-third of a mile offshore, is a sunken rock well marked by kelp, and care should be taken in rounding this point, either in entering or leaving, to give it a good berth.

Five miles inside on the northern shore is a low, wooded peninsula, off which, in mid-channel, are three rocks showing at low water. Two are comparatively small and close together, and about 300 yards nearer the entrance than the larger one, which covers at nearly high water. The bight to the northward of the peninsula is small and full of rocks and reefs. Several houses and shacks are located here. In proceeding up the bay the channel lies between the rocks and the southern shore. One and one-quarter miles farther in on the northern shore, and distant offshore some 300 yards, are two rocks, visible at low water. One-half mile beyond, the bay divides in two arms, a small, bare, rocky island lying about 200 yards off the dividing point. A ledge, connected with the shore at low water, makes off for a short distance from a point just inside the north arm on its northern shore, but otherwise this arm is clear and affords an anchorage in 15 to 20 fathoms, soft bottom, at its head. The southern arm is also free from dangers, and gives an anchorage at its head in 15 to 20 fathoms, soft bottom.

Table Island, low and sandy, with extensive reefs bare at low water, lies three-eighths of a mile south of Kenasnow Island. A clear channel is between it and Kenasnow Island, leading to the anchorage off Killisnoo. The ledges off the southeastern point of Kenasnow Island are marked by a beacon, and Lone Rock, visible at half-tide, is marked by a second-class nun buoy, painted red.

Sand Island, 1 mile E. by S. from Table Island, is the northern point of the reefs and ledges extending along the eastern shore previously referred to. Between it and Table Island is a clear channel with 7 fathoms, leading to the anchorage off Killisnoo. The directions in the published sailing directions call for no changes, except as regards the buoy on Lone Rock.

From Point Gardner to Point Samuel the eastern shore of Chatham Strait is remarkable for many tide rips. On a calm night the noise of them is heard distinctly at a distance of a mile. These tide rips occur off nearly all the points and reefs, being particularly noticeable in the vicinity of Cha-ik Bay, Russian Reef, Point Caution, the reef in the entrance to Wilson Cove, and the point to the southward. They frequently extend a mile offshore, and at spring tides show much broken, white water. On the western shore of Chatham Strait between Point Thatcher and Point Lull there are no prominent indentations. Between Point Lull and South Point is Kelp Bay, which consists of a basin from which extend in different directions three arms. The northern one begins 3½ miles from Point Lull, and runs in a westerly direction for 3½ miles. At its head is an extensive flat that runs through, and at high water, spring tides, connects with a similar flat in Hanus Bay, in Peril Strait. At the highest tides there are probably from 3 to 4 feet of water on this flat, judging from the height of the seaweed and driftwood, but on the ordinary high waters there are but a few inches. At low water, from the head of this arm to Hanus Bay is a distance of 1¾ miles. Considerable logging has been done near the head, a large amount of cedar having been cut and rafted during this season. A short distance inside the entrance, close to the northern shore and connected with it at low water, is a small, low, wooded island. One and one-quarter miles farther in is another wooded island connected with the northern shore at low water, with several bare rocks close to its eastern end. Abreast this island on the southern shore a ledge makes off some 300 yards. Otherwise there is a clear channel to the head. An anchorage is not recommended in this arm, except for small craft that will find fair holding ground in from 8 to 10 fathoms. Scant swinging room will prevent its use by large vessels.

Off the point, separating this arm from the next one to the southward, ledges visible at low water extend 150 yards. This arm is clear from its entrance to its head, where it opens out into a moderate-sized flat. It is about 5 miles in length, and curves slightly toward the southward. With the exception of a shallow open bight, about 1½ miles inside on the southern shore, containing an extensive sand flat, this arm is devoid of any particular feature of interest. It affords a good anchorage near the head in from 12 to 18 fathoms, soft bottom.

The southern arm extends 3½ miles in a southerly direction, curving slightly to the southeastward. Two hundred yards off its eastern point is a sunken rock marked by kelp, clear of a midchannel course, although the western shore should be slightly favored in entering. On the eastern shore, one-half mile from the entrance, are several small, wooded islets, connected with the shore at low water. A small open bight is one-half mile beyond them on the eastern shore. Abreast the islands and on the northern shore are several landslides on the face of a steep hill which shows plainly from Chatham Strait. Two miles from the head a point extending from the northern shore constricts the channel to a width of less than a quarter of a mile, beyond which it expands to a width of two-thirds of a mile, terminating at its head in extensive flats. The anchorage is at the head in 10 to 15 fathoms, soft bottom.

Five hundred yards SE. ½ E. from Portage Point is a sunken rock. One mile S. by W. from Portage Point is Plover Rock, small, but prominent, bare, with ledges of small extent. Near it are two rocks covered at one-third tide. The first is distant 200 yards ENE. ½ E., and the second is distant 750 yards S. by E. ½ E. from Plover Rock.

From the southern point of the south arm to South Point the shore forms a bight 1½ miles deep and 3½ miles wide from point to point. Across the entrance of this bight, and affording protection as an anchorage, extend several islands, the largest one lying close to shore near South Point, and a group of three lying off its western end, with a narrow channel between. These islands are all low and wooded, the large one containing two small lakes. Opposite the entrance to this narrow channel, on the north shore 2 miles from Point Lull, is a prominent whitish cliff, 800 feet high. Several sunken rocks were found in this channel. Three-quarters of a mile from North Point, NW. by W. ¼ W., is a sunken rock with a 4-fathom shoal between it and the point.

The shores of Kelp Bay are very abrupt and steep, and the northern shore is practically

straight. From Point Caution, in Chatham Strait, a line down through the portage in the northern arm passes nearly through Broad Island, in Peril Strait, and the head of Hooniah Sound, a clear line 55 miles in length. Immediately to the westward of Point Lull is a narrow bight extending in a northwesterly direction for three-quarters of a mile. This is full of kelp, open to the southward, and affords temporary shelter for small craft only.

Between Pond Island and the south shore is a narrow passage full of rocks and kelp. This is navigable by small boats, but should not be attempted by large vessels.

One and one-half miles to the southward of South Point a narrow inlet extends for 1½ miles to the westward. A small, rocky, wooded islet lies close to its northern point, connecting at low tide. Two hundred yards southeast is a bare rock with a ledge extending 150 yards to the southward. The entrance to the bight is from the southward, and it affords good shelter for small vessels, but is too narrow to give swinging room for vessels of any size.

For a distance of a mile below this bight the shore is straight, but from there to Ta-Katz Bay, a distance of 4 miles, the shore is much broken by bights, with several wooded islands and bare rocks lying close to shore. The cliffs are very precipitous, and several large waterfalls were noticed, one of which is very prominent and has been referred to as one of the landmarks in this vicinity.

Ta-Katz Bay extends in a westerly direction, curving slightly to the southward for 2 miles, and then turns abruptly to the northward for another mile, terminating in a flat formed by a mountain stream emptying into it as a waterfall. This stream is evidently fed by a glacier, as the low water on ebb tide is milky at the entrance of the bay.

Point Turbot is the northern point, off which, at a distance of 75 yards, is a large white rock. SE. ½ S. from this rock, distant 250 yards, is a rock, bare at half tide. Off the southern point of the bay are four bare rocks, whitish in appearance and about 25 feet above water. On a line from Point Turbot to the southern point are two of them close together and distant from the southern point 300 yards, with reefs between them and the point, showing at low water. The other two rocks are 600 yards to the westward.

The southern shore of the bay is formed by a peninsula, which also forms the northern shore of a bight to the southward, with a group of small islands in its entrance. This bight does not appear to afford either shelter or an anchorage, the water being deep and kelp fairly abundant. Off the southern point of the bight, and to the southward of the group of islands, is a rock, bare at low water, 400 yards from shore.

Ta-Katz Bay affords a good anchorage in 20 fathoms, soft bottom, in the basin that opens out just before the turn to the northward. Chatham Strait is shut out entirely from the anchorage by the southerly curve of the bay, and the high surrounding hills give complete protection from all winds.

Warm Spring Bay, 4 miles below Point Turbot, is the northern point of a small bay 2 miles in length, extending to the westward. At its entrance the bay is nearly a mile wide, but the channel is narrowed to a half mile by a peninsula projecting from the northern shore. Nearly halfway between the two entrance points, and one-quarter of a mile off the eastern point of the peninsula, is a small bare rock about 15 feet above water. On the southern shore are two small bights, and at the head of the bay a small lagoon to the left of the waterfall previously spoken of. This waterfall is the outlet of a lake several miles long, about 200 feet above sea level. Near this waterfall, and at some considerable height above it, are several warm mineral springs, frequented by Indians on account of their medicinal properties. This bay affords an anchorage in 25 fathoms, rocky bottom, beyond the peninsula and abreast the second bight on the southern shore. While affording fair shelter from northerly winds, in southerly weather the wind and sea draw in around the southern point. This, coupled with rather poor holding ground and deep water, renders it undesirable as an anchorage in bad weather.

Between this bay and a point opposite Point Gardner are two open bights, both unsuited for anchorages. The southern one is called Cascade Bay, from the very prominent waterfall at its head.

The hand lead is of little use to navigators in these waters in thick weather, 20 and 30 fathoms being frequently found within a few yards of the shore line, while a quarter of a mile from the beach depths of 100 to 200 fathoms are not at all unusual.

One almost universal feature which exists in these waters is the occurrence of sand and gravel flats, with one or more small streams at the head of all bights and inlets. The slope, from 8 to 10 fathoms to a few feet, is very abrupt, and in approaching the head of an inlet at high water care should be exercised in anchoring to give the flats sufficient berth to avoid grounding at low water. Nearly all afford good holding ground, in soft or sticky bottom, within a short distance of the head.

HOOTZNAHOO INLET.

Hootznahoo Inlet, comprising an area of about 15 square miles, is a group of lagoons and bays on the eastern shore of Chatham Strait, 2¾ miles above Killisnoo. It consists of five principal divisions, full of rocks, reefs, and shoals, connected by narrow channels through which the tide flows with great force, attaining at times a velocity of from 10 to 12 knots per hour.

The entrance to these lagoons is between Danger Point and Hootznahoo Head, and from the entrance the Inlet extends in a general easterly direction for 3½ miles, where it opens out into a small bay, called "Favorite Bay" by the Alaska Oil and Guano Company, who use it considerably as a fishing ground for herring.

One and one-half miles from the entrance, on the north shore, and extending to the northward, are two arms, the western one being almost straight, with the exception of a small bight on its western shore, and connecting with Mitchell Bay. The eastern arm joins the western at Point Pillsbury, above the end of Long Island, which lies between the arms. On the eastern shore of this arm is a small passage opening into a lagoon that at high water connects by a passage at its southeast end with Favorite Bay. At its northern end it connects by a narrow passage with a lagoon opening into Mitchell Bay.

Mitchell Bay, the largest of the divisions of this inlet, is about 4½ miles in length by an average width of 1½ miles. At its southwest end it is connected with a lagoon so full of rocks, reefs, and shallow water that soundings were considered unnecessary. At its southeast end it is connected by Davis Creek to Kanalkoo Bay and Lighter Creek. At its northern end it is connected by a lagoon, impassable except at high water by small boats, which is said to connect with a series of lakes in the interior of Admiralty Island.

It is impossible to give more than a general description of this mixed-up mass of islands, rocks, and water, as a much better idea can be obtained from the charts.

The general character of the country is low and rather heavily wooded, except where otherwise noted, and the absence of prominent features renders it impossible to give ranges that would be of much service to the navigator. The names have been taken from the description of this place written by Captain Meade, U. S. N., who navigated these channels in 1869 in the U. S. S. *Saginaw*, and his description is apparently very full and complete.

At the present time there seems to be little to induce a vessel to enter these waters. The indications of coal, or, more properly, lignite, are numerous, but the mines have not been worked for a number of years, and any subsequent development of them would not depend upon these waters as a means of disposing of their output, since a short railway system of a few miles would lead directly to Chatham Strait abreast of Killisnoo.

SAILING DIRECTIONS FOR HOOTZNAHOO INLET.

On the north side of Danger Point is the narrow entrance to an extensive system of inlets and lagoons, called by the Indians "Hootznahoo."

The entrance is about one-half of a mile wide, gradually narrowing, but free from obstructions, until Village Rock is reached. This is a large low-water ledge making out from an Indian village on the south shore toward Turn Point on the north shore.

This ledge obstructs more than one-half the channel, and the strength of the tide causes a very strong current, running at times probably as high as 8 knots, with large swirls where the current impinges upon the larger and slower moving body of water.

Beyond Village Rock, to the eastward, the channel is clear on the south side well in toward the shore line, but on the north side it is obstructed by a ledge marked by kelp at slack water making out from Turn Point, terminating in a large round-top rock, which covers at high water and upon which a spindle has been placed by the Alaska Oil and Guano Company.

One-quarter of a mile beyond this rock begins a series of rocks, uncovered at low water, extending to the unbroken shore line on the south side of the channel leading into Favorite Bay, in a line with this shore, the spindle, and Turn Point. At the spindle rock the channel branches in three directions. One branch continues to the eastward past Sullivans' Point, which has been prospected for coal, and leads into Favorite Bay, a large lagoon filled with herring during the season. The other two go to the northward and eastward on either side of a large wooded island.

The eastern of these passages is obstructed at the south end except for small boats, and at the north end of the island divides, one branch reuniting at Point Pillsbury with the main passage leading into Mitchell Bay, the other going through a very narrow channel into a large lagoon full of rocks and reefs, and unnavigable except for small craft. This lagoon is connected at its southeast corner by a high-water passage with Favorite Bay, and on its northeast side past a series of islands and broken reefs with Mitchell Bay.

From the spindle on Rose Rock the westernmost branch turns sharply to the westward along the reef making out from Turn Point, thence to the northward and eastward for 5 miles, when it opens into Mitchell Bay. One and one-quarter miles above Turn Point this channel runs between a ledge of rock making off to the southward from Point Pillsbury and a round, bluff, high-water island; thence for one-half mile between reefs to Point Bridge, where it runs between a reef on the west side and a bold bank on the east side into a narrow channel with steep bold shores on either hand.

Three-quarters of a mile above Point Bridge the channel broadens to a width of one-quarter mile until near the entrance to Mitchell Bay, when it is again confined between a ledge making off to the southward from North Point and a system of high-water islands to the eastward. Beyond North Point is Mitchell Bay, which extends to the northward and eastward a distance of 4½ miles, with a width of 1½ miles at its south side to narrow channels at the north, and leading over rapids into a system of lagoons fed by a large stream, said to have its source in lakes near the middle of the island. At the southeast angle of this bay is a narrow passage called Davis Creek, which, after running in a southeast direction through a very foul channel, turns back upon itself and widens into a clear open basin, called Kanalkoo Bay, at the head of which are two large streams. One-half mile from the north end of Davis Creek, Lighter Creek makes off, having from 2½ fathoms to 5 fathoms of water at high tide.

The south shore of Mitchell Bay is very foul, and while there is an ebb and flow of tide from Hootznahoo Head to Mitchell Bay, to the eastward of the main passage there is no channel for any sort of craft larger than rowboats and canoes. Near the west side of Mitchell Bay and 1¼ miles from the entrance to Diamond Island is a long narrow island, sparsely wooded, with a large timber fall. To the eastward of this island, and in a line parallel with the south shore of the bay, are two islands, one, a small, round, high-water island, without timber, the other larger and covered with a dense growth of timber.

To the northward of these islands there is a larger island with a confined channel to the west of it. At the entrance to Davis Creek is a high-water island, called by Captain Meade "Passage Islet." A large stream empties into Davis Creek at its north end, near which, in Mitchell Bay, a good anchorage may be had in from 10 to 20 fathoms of water.

The tides in this system of lagoons continue to run from one hour to one and one-half hours after the change at Hootznahoo head, or even longer. Slack water will be found at Village Rock, in the narrows, at Points Pillsbury and Bridge, at North Point, and at the south entrance to the middle lagoon, from one hour to one and one-half hours after the change of tide at Hootznahoo Head. Slack water at the north end of Davis Creek occurs half an hour after high or low water in Mitchell Bay.

Vessels rounding Rose Rock at slack water would carry slack water all the way to Mitchell Bay. At Village Rock the currents run from 5 to 8 knots; at Point Bridge as high as 10 knots, and at Passage Islet as high as 7 knots.

Coal has been found in small quantities about the entrance to Davis and Lighter creeks, at the southeast corner of Kanalkoo Bay, and in the middle lagoon.

Several abandoned tunnels and shafts appear about Davis and Lighter creeks.

PERIL STRAIT.

Peril Strait is one of the most important waterways in southeastern Alaska, rivaling Wrangell Narrows in the amount of its commerce, and is the only connection between the inland channels and Sitka. It is used by small sloops and schooners, by small steamers employed in the interest of various canneries, sawmills, and mines, by the regular mail steamers throughout the year, and during this last season by two steamers running in opposition to the Pacific Coast Steamship Company from Puget Sound to these waters.

An excellent reconnaissance of the narrows from Suloia Bay to Pogibshi Point, including also the steamer track from that point to Broad Island, was made by the officers of the U. S. S. *Adams*, under Commander J. B. Coglan, United States Navy, in 1884, and but few changes were found by the present survey.

The north shore of Peril Strait from Point Craven to the head of the northern arm of Hooniah Sound is steep and bold, and after passing Lindenberg Head is practically a straight line, with no dangers except an occasional flat of small extent making off the mouth of a stream. The shore can be approached with safety to within a quarter of a mile. The mountains are covered with a moderate growth of timber and underbrush, their tops being generally bare and rocky except where noted on the sheet.

McClellan Rock, marked by a spindle immediately off Lindenberg Head and a sunken rock off a small open bight 2 miles to the eastward of Lindenberg Head, are the only dangers from this point to Point Craven. The principal landmarks in Peril Strait are Fairway Island, in the eastern entrance; Lindenberg Head; the point at which Peril Strait changes direction; a series of bare, rocky hills and cliffs 2½ miles above Lindenberg Head, and Broad Island, lying three-quarters of a mile off the northern shore at the western end of the strait. Several landslides will be referred to later. The southern shore of Peril Strait is much indented by small bights, coves, and inlets, and although the mountains back of the shore line are in many instances higher than those of the northern side, the slopes are generally less abrupt.

Point Craven is the western point of a narrow inlet known as Sitkoh Bay, about 6½ miles in length, that extends in a general northerly direction. The point consists of an outlying rock about 10 feet in height, with a larger and higher rock nearly halfway between it and the shore, connected by ledges showing at low water. A small steep bluff is on the rounded point of the shore behind the rocks. Deep water can be carried close up to these rocks.

The eastern point of Sitkoh Bay is Point Hayes, distant from Point Craven 1¼ miles N. by E. ¾ E., and bearing SSE. ½ E., distant 1½ miles, from Peninsular Point, in Chatham Strait. This portion of the shore is extremely foul and dangerous, the bottom is irregular, and kelp is particularly thick. From Point Hayes, extending toward Point Craven across the mouth of Sitkoh Bay for a distance of half a mile, are numerous reefs and ledges, some of which are visible at low water only. Two small islands and a rock lie a short distance off the point. A first-class can buoy, painted black, is moored 1⅞ miles NE. by E. ½ E. from Point Craven and 2⅞ miles N. by W. ¼ W. from Point Thatcher. Between this and Point Hayes is very foul and dangerous ground, and no vessel should attempt to pass to the northward of the buoy under any circumstances. On line between the buoy and Peninsular Point is an extensive reef, usually well marked by kelp, which shows partially at low water and runs in a generally northern direction. A line from the outer rock of Point Craven drawn through the small bare rock off Point Hayes passes nearly through the centre of this ledge. To avoid this ledge, in entering Chatham Strait from Peril Strait, with the buoy close aboard, a NE. ½ E. course should be held until the prominent white rock to the northward of Peninsular Point is well open before hauling to the northward. Sitkoh Bay for the first 2 miles is about 1 mile in width, though the channel at the entrance is constricted to half that distance by the ledges and reefs making off to the westward from Point Hayes. Two miles above Point Hayes, from the eastern shore, projects a low, heavily wooded point, which forms a bight, affording an anchorage in 20 fathoms, hard bottom, and excellent protection from the northerly gales, which are the severe winter winds. Behind the point is a small lagoon, bare at low water. Extending to the southward from the point is a reef about 200 yards in length, visible at low water. By favoring the Point Craven shore for a distance of a mile, and then heading for the middle of the bight, all danger will

be avoided. Beyond this point the bay is but one-third of a mile wide for a distance of 4½ miles, the last mile of which is bare at low tide. Seven-eighths of a mile above the point a reef extends into the channel for a distance of 300 yards from the eastern shore, with a small sand flat, and an Indian house on the western shore a little farther in. A mid-channel course clears both the reef and the flat, and should be held for 1¾ miles farther, when the eastern shore should be favored to avoid an extensive flat making out from the western shore. This flat is well marked by a low mound 100 yards off the western shore, covered by stunted trees and bushes. A small stream empties just to the northward of this mound. The anchorage is one-half mile beyond this mound, in 15 fathoms, soft bottom. A small cove, with low sandy shores, 3½ miles NE. ¾ E. from Point Craven, does not afford good anchorage, and this fact, coupled with the sunken rock off its entrance, recommends that it be not used.

Lindenberg Harbor, 5½ miles SW. ¾ W. from Point Craven, is formed by the projection of a point with a knoll 250 feet in height, on which is an extensive windfall. The harbor is protected from the northward and eastward, but is rather small, with indifferent holding ground. It has been used considerably in northerly weather by the regular steamers, but apparently on account of lack of information regarding Sitkoh Bay.

McClellan Rock, marked by a spindle, is 350 yards off the point toward mid-channel. This rock bares for considerable area at low water. There is a narrow passage between it and the point, with from 5 to 7 fathoms, but nothing is gained by its use.

These constitute the only anchorages on the northern shore of Peril Strait.

Point Thatcher, the southern entrance point to Peril Strait, is a low, heavily wooded point, terminating in three bare rocks, the inboard one connected with the shore. These rocks extend toward Point Craven, and a rock, bare at low water, surrounded by kelp, lies 100 yards N. ½ E. from the outer one. The Coleman Reef, described in the sailing directions as extending 1 mile northeast from Point Thatcher, with a width of one-quarter of a mile, apparently has no existence. One and one-third miles west from Point Thatcher are Traders Islands, connected at low water, low and heavily wooded. One and one-half miles NW. ½ W. from Point Thatcher is Midway Reef, visible except at high water, and extending 750 yards in a general northwesterly direction.

Fairway Island, the prominent landmark for leaving or entering Peril Strait, lies 2 miles WNW. ½ W. from Point Thatcher and 1¼ miles SSE. from Point Craven. It is about 320 feet high, much rounded, and covered with a thick growth of trees.

From Point Thatcher to the eastern point of Hanus Bay the shore must be avoided by all large vessels. The bottom is very irregular, and there are numerous rocks and reefs, some of which show only at extreme low water, while the sunken rocks are but poorly indicated by kelp. Three-quarters of a mile SW. by W. ¼ W. from Fairway Island is a sunken rock marked by kelp. Two and one-half miles SW. ½ W. of Fairway Island and one-half mile WSW. ¼ W. from a small rocky islet with but few trees on it, lies a sunken rock nearly one-half mile off the southern shore. This is a pinnacle rock, and but one or two pieces of kelp marked its location at the time of its discovery. Small craft with local knowledge may find temporary shelter close inshore, but no anchorages are recommended. A course midway between Point Craven and Fairway Island laid to pass the spindle off Lindenberg Head five-eighths of a mile to the southward clears all dangers, and requires but one change for continuing up Peril Strait to Broad Island.

Hanus Bay, 6 miles from Point Thatcher on the southern shore, abreast of Lindenberg Head on the northern shore, is a broad, open bight, 2½ miles in width by 1¼ miles in depth. At its western end are two coves, the southern one nearly bare at low water, into which empties a small stream, the outlet of a small, narrow lake. This is quite a fishing station of the Indians during the summer months, when large quantities of salmon and trout are prepared and dried for the winter supply of food. The other cove, about one-half mile in depth, affords an anchorage for small craft. Two ledges, bare at low tide, lie off the points of these coves at a distance of about 80 yards, the outer one lying a little inside of the outer point. In the southeastern corner of Hanus Bay are two low, wooded islands, connected at low water with reefs and sand flats extending off their western end for about 200 yards. The eastern island has a large amount of standing dead timber, which attracts attention at a considerable distance. A shallow pocket behind these islands, with a ledge showing at half tide, connects at high water with the north arm of Kelp Bay. Four miles

farther to the westward on the southern shore is a small bay, known by the Indians as Sa-ook, 3 miles in length by about one-half mile in width, that affords the best anchorage between Fairway and Broad islands, especially in southeasterly weather. Its right entrance is marked by a point on which is a conspicuous windfall, and off this point, in Peril Strait, is a rock about 80 yards from shore 4 feet out of water at high tide. The left entrance is low and wooded. On the eastern shore of the inlet, three-quarters of a mile from the entrance, is a low, wooded island with a small reef on the channel side, distant 20 yards and generally visible. This is the first of a small group of islands and rocks which extend from it to a low, green, grassy knoll three-eighths of a mile beyond. On the west side, 1½ miles from the entrance, is a prominent ravine opening into an amphitheater in the surrounding hills. From it comes a small stream that makes a very extensive sand and gravel bar. This bar is much larger than would ordinarily be expected, and extends fully halfway across the inlet. Beyond it there are no obstructions until the flats at the head are reached, 1 mile beyond the ravine. A good-sized stream, noted for large numbers of trout, empties at the head. The anchorage is five-eighths of a mile beyond the bar, in the middle of the inlet, in 18 to 22 fathoms, soft green mud. Excellent water can be obtained from any of the numerous small streams that come in on each side of the anchorage, preferably at high water, when a better approach to them can be had. Peril Strait is entirely hidden from the anchorage.

Four and one-half miles farther, on the south shore, is the entrance to an inlet, Rodman Bay, which extends to the southward for 6 miles. Its western point is high and well wooded, with reefs extending offshore for about 100 yards. The eastern point is low, and between it and a small cove on the eastern shore are several rocks, bare at low water, but not generally visible. This inlet is 6½ miles from Broad Island and 8 miles from Lindenberg Head. At the entrance it is about 2 miles wide, but contracts in 1½ miles to five-eighths of a mile, a small wooded island lying off the eastern side, where it narrows. The soundings in the entrance are very irregular, and although no dangers were found care should be taken in entering. On the eastern shore, close to the entrance, is a small cove with an island in the middle of the entrance connected with the southern point by a sand spit covered at high water. The channel for entering is on the north side of the island. The cove has rocks and shoals, and affords an anchorage to small craft only. A stream empties at its head with very extreme flats.

On the western shore of the inlet, 2 miles from the entrance, a shoal extends offshore for about 125 yards, but otherwise the channel is clear to the head, where extensive sand and gravel flats make off from the southwest corner. On the eastern side, near the head, are two islands, connected at low water, and just beyond them, with a point on the eastern shore showing between, a good anchorage may be had in 10 to 12 fathoms, soft bottom. A large stream coming from the eastward through a narrow valley empties in this corner of the head with extensive sand and gravel flats.

Two miles west of Rodman Bay is Pestchani Point, low and wooded, on the eastern side of which a mountain stream empties, forming a very large sand and gravel bar. This flat extends into the channel for over a quarter of a mile, from one-half of a mile to the westward of the point to below the mouth of the stream. A close approach to the point should be avoided. Three-quarters of a mile west of Pestchani Point is Nismeni Point, low, covered with a thin growth of trees, bare and rocky at its seaboard end. Off this point are two ledges, bare at low water only, with a sunken rock halfway between them and the point. The first is distant 600 yards NE. ½ E. and the second is distant 800 yards NE. ½ E. from the point. To the eastward of the point is Nismeni Cove, about three-quarters of a mile in depth by less than one-half of a mile at its entrance. This gives shelter from southerly winds, the holding ground in the middle of the cove being fair in 18 to 22 fathoms. The course for entering lies toward the eastern point to avoid the ledges off Nismeni Point. This bight affords no shelter from northerly winds.

Beyond Nismeni Point and Broad Island, Peril Strait opens out into a considerably wider body of water, extending 7 miles to the southward to Point Pogibshi, the northern entrance to the narrows, and on its western side opening into three bays, the two northern ones being the most extensive and constituting Hooniah Sound. To the southward about 3½ miles, on the western shore, the third bay extends in a curve to the southward for 4 miles.

Poison Cove, near Point Pogibshi, is the only other indentation on this shore.

From Nismeni Point to Point Pogibshi the shore bends in a gentle curve to the southward,

the low-water line extending some considerable distance offshore. Several anchorages may be had along this shore, the best being near Point Pogibshi off the entrance of a small lagoon in a small grassy flat, in 22 fathoms, sandy bottom. A close approach to the shore should be avoided in anchoring, as an extensive sand and gravel bar makes out well into the bight.

One mile SW. by W. ½ W. from Nismeni Point is Otstoia Island, low and thickly wooded, and connected at low water with two bare rocks lying off its southwestern end. A sand and gravel bar, formed by mountain streams, makes off from the shore toward Otstoia Island, constricting the channel to a width of one-eighth of a mile. The outer point of the flat is marked by a second-class red can buoy, anchored in 8 fathoms. A clear channel, carrying 4 to 10 fathoms, generally used by the steamers, lies between the buoy and Otstoia Island, and a straight course from the buoy to Poverotni Island clears all dangers.

Three-quarters of a mile W. ¾ S. from Nismeni Point is the seaward end of Cozian Reef, a sunken ledge extending off Otstoia Island for nearly one-half mile. Its outer end is marked by a second-class can buoy, painted black. One-half mile SW. by W. ¾ W. from Nismeni Point, and lying 150 yards offshore, is a sunken rock poorly marked by kelp.

Five-eighths of a mile W. by S. from the southern end of Otstoia Island are Krugloi and Elevoi islands, connected at low water. These islands are small, low, and wooded. Between them and Otstoia Island is a clear channel with from 12 to 25 fathoms, which is apparently a better one than that between Otstoia Island and the shore, as it avoids Cozian Reef and the sunken rock between it and the shore.

One and one-half miles from Krugloi Island and nearly on range between it and the northern point of Ushk Bay is a reef nearly 150 yards long, baring only at spring low water. A little inshore, but nearly on range between Point Emmons and the north point of Poison Cove, is a reef of about the same extent as the last, distant 2⅝ miles S. ¼ E. from Point Emmons and 2½ miles SW. ½ W. from Krugloi Island. It is seven-eighths of a mile NE. ¾ N. from the southern point of the Ushk Bay, and bares at low water only. One and one-half miles SW. ¾ S. of Krugloi Island and 2½ miles N. from Poverotni Island is the center of a group of reefs, with shallow water between, covering an area of one-half mile square. The largest of these is about 300 yards long by from 50 to 100 yards in width, composed of sand, gravel, and bowlders. This covers only at the highest spring tides. Four hundred yards to the southward of this are two low rocks, covered at ordinary high water. To the westward of the sandy island about one-quarter of a mile are three ledges, covering at about half tide. The white sandy bottom between these ledges and extending off them for a distance varying from 50 to 150 yards is visible for a considerable distance on a bright day. Between these reefs and Poverotni Island there are no dangers, the water varying from 30 to 50 fathoms in depth.

Poison Cove, abreast Poverotni Island, is a small open bight, with low gravelly beaches, and flats at the head that uncover for a quarter of a mile at low water. It is free from dangers and affords an anchorage for small craft in 18 fathoms, soft bottom.

One and one-half miles to the northward is the entrance to Ushk Bay, which extends to the westward and southward for 4 miles, with an average width of three-quarters of a mile, narrowing to one-third at the point where it changes direction. It affords an anchorage at the head in from 18 to 20 fathoms, soft bottom. A peculiar formation of the hills is noticeable near the entrance on the southern shore, and a solitary round-topped hill, 1,800 feet high, with several landslides, marks its northern point and the southern entrance to Hooniah Sound.

Five miles N. by W. ¼ W. from Poverotni Island and 4 miles WSW. from Broad Island is Emmons Island, Point Emmons being its eastern extremity. This island was named in honor of Lieut. George Emmons, U. S. N., who has spent many years in these waters and furnished much valuable information in regard to them and the habits and customs of the Indians in this section of Alaska. The island is well wooded and has a small lake on its northern side. A ridge in the center, 600 feet high at its eastern end, has the appearance of a cone to vessels coming from Chatham Strait.

Off the western end of Emmons Island, distant one-half mile, is a group of small wooded islands, connected at low water, from which a reef, bare at half tide, extends to the northward for nearly one-half mile. The passage between the south shore of Hooniah Sound and Emmons Island

should not be attempted, as the water is shallow, and long sand spits, visible at low water, make well into the channel from the western end of Emmons Island and the small group of islands to the westward.

Two and one-half miles WNW. from Emmons Island a large island, 5 miles in length, 1½ miles wide at its eastern end and 1 mile wide at its western end, divides Hooniah Sound into two arms. A sand spit, one-quarter mile in length, covered at high water with a small, wooded, high-water island near its center, connects the large island with the shore at its western end. On its southwestern end is a prominent landslide. Off its eastern end a ledge makes off for 250 yards, and off its southeastern point is a ledge, distant 250 yards ESE., bare at high tide. One mile to the westward from its eastern end, and one-third mile off the northern shore, is a small bare rock, some 8 feet out of water at high tide. The northern shore is low, with sand and gravel beaches, which extend offshore 150 to 200 yards for a mile above the bare rock. The southern shore of the island is bold and steep.

Five and one-half miles beyond Emmons Island the south arm of Hooniah Sound is divided into a bay, 3 miles long, extending to the southward, and a smaller arm, 2 miles long, that connects with the northern arm at high water. Three and one-half miles above Emmons Island is a small bight, with flats at its head, bare at low water. Off its eastern point is a small, round, wooded island, connected with the shore at low water, from which a reef extends to the eastward for 200 yards. The southern shore should not be approached too closely, as the low-water line extends well out. The bay extending to the southward is clear except for the western shore, which is shoal, with several sand and gravel bars. The arm at the head connecting with the northern arm, in addition to extensive mud and sand flats, has a low grassy flat, covered here and there by small bushes, extending through on the left of a small wooded knoll to a similar flat 2½ miles above the junction of the north and south arms. In this small connecting arm, one-half mile NNW. ½ W. from the wooded island, on the sand spit, and in mid-channel, is a rock, bare at low water. This rock is about 2¼ miles above the southern point of the arm.

The northern arm of Hooniah Sound is comparatively clear, until one-eighth of a mile to the southward of the small island on the northern shore, where, in mid-channel, is a rock, bare at low water. This rock is not quite abreast of a prominent waterfall on the north shore. At the head of the northern arm are two streams, both small, entering from low valleys, one extending in the same general direction as Hooniah Sound and the other having a more southerly trend. A wooded island, with a reef extending one-quarter mile to the eastward, lies off the point of the ridge dividing the two valleys and is connected at low water with the shore by the flats at the head.

SAILING DIRECTIONS FOR CHATHAM STRAIT, POINT GARDNER TO POINT SAMUEL.

If coming up the strait from the sea, keep a mid-channel course, about NW. by N. It is safe, however, to approach a line drawn half a mile from one prominent point to the same distance from the next, as all dangers will lie inshore of this line. In coming from Frederick Sound give Point Gardner a berth of 1 mile, because to the south of it has not been surveyed, and the strong currents and heavy tide rips in its vicinity indicate irregular bottom. With Point Gardner abeam NE. by E., the course is NW. ¾ N. to clear Point Caution 1 mile, where there are also heavy tide rips. If bound up the strait, continue this course, which will probably carry to Point Marsden, by making due allowance for tidal currents. If bound for Killisnoo, having run 15 miles and Point Caution bearing E., change course to N. by W. ½ W. If bound up Peril Strait, run 27 miles, when Fairway Island should bear SW. by W., north of Midway Reef; then change to WSW., keeping in mid-channel north of Fairway Island.

Wilson Cove is not recommended for an anchorage, but should it be necessary, stand in parallel to the south shore, about N. by E. ½ E., midway between the reef in the mouth of the cove and the south shore, keeping clear of the kelp, and anchor in 8 to 10 fathoms.

Whitewater Bay.—The directions in the Pacific Coast Pilot, part 1, p. 157, are good.

Cha-ik Bay.—Stand on until the bay is wide open between the two low, flat islands in its mouth, not wooded, one off Rocky Point and the other inside of Village Point, when stand in about NE. by E., heading for a low, wooded island in the middle of the bay. When halfway

between the island off Village Point and the low, wooded island an arm will open to the northward. Steer for the mouth of it, about NNE., and anchor in the middle, in 12 fathoms, sticky mud bottom. The south arm should be avoided, except by small vessels, on account of shoals, rocks, and kelp.

Hootz Bay.—From off Distant Point follow the shore on the south side, keeping about half a mile away to clear the sunken rock until the mouth of the inner bay opens, when steer for it about SE. by E. ½ E., favoring the southern shore to clear an island and some sunken rocks close to it, in the middle of the narrowest part. After passing the island keep in the middle until reaching the divide, when take the middle of either arm desired. It is spacious and easy of access, with anchorage anywhere in the north arm in 20 fathoms or less, and at the head of the south arm in 18 fathoms, with muddy bottom and good protection. From Killisnoo there is a good channel with plenty of water inside of the line of islands and reefs. Keep in the middle, steering about SE. by E. ⅜ E., avoiding kelp.

Cascade Bay.—Opposite Point Gardner, requires no special directions. Stand into the middle about WSW. until you can get bottom in about 25 fathoms, then anchor. It is not recommended except for small vessels unable to work up against a northerly wind. The cascade can be seen to Point Gardner.

Warm Spring Bay.—Open up the mouth of the bay, when stand in about SW. by W., midway between a white high-water rock in its center and the south shore, which is bold. A small vessel can anchor in either of the two small bays on the south side and have good protection from southerly winds. The western one is preferable because of shoaler water—12 to 15 fathoms. A large vessel must go near the cascade at the head to get 25 fathoms and yet have swinging room. This latter is not recommended, as the bottom is rocky and the current usually sets out, caused by the flow of water down the cascade from the large mountain lake at the head, making a vessel lie broadside to the south wind, which sucks in and caroms on the steep mountain side north of the bay, sheering her about very uncomfortably.

Ta-Katz Bay.—This is the best protected anchorage on this part of the coast, being entirely surrounded by high, rocky walls, but might be difficult to enter with heavy southerly sea. The anchorage is in the northern arm, and the entrance is not visible until close in to the southward of Point Turbot. When three-eighths of a mile ESE. from Point Turbot, steer SW. ½ W. for the middle of the entrance, between the high-bluff north shore and the high-water rocks off the high-wooded promontory which divides the bay. This clears the low-water rock 250 yards SE. from Point Turbot and the one inside of the promontory point near the north shore. When past the promontory point, favor the south shore to clear a sunken rock and kelp patch near the middle, though it can be left on either side. Anchor near the middle of the bay in its widest part in 20 fathoms, soft, sandy bottom. Or, if desired, round the second point and anchor in 10 fathoms, with plenty of swinging room. Do not pass a white lump of an island around the second bend, for there the sand flat begins. The south arm is not recommended. The water is deep, and the bottom is rocky and irregular, with occasional kelp patches.

Kelp Bay.—Open up the mouth and stand into the middle, about WNW. ½ W., giving Point Lull and North Point a berth of 1 mile to clear a reef making off from Point Lull to the SE. An anchorage can be had at the head of either of these arms, with soft bottom, in 18 to 24 fathoms, having a care not to approach too near the head at high tide, because of the flats. The only directions are to keep in the middle. The shores are bold, but ledges make out from some of the points which do not show at high water. The best anchorage is in the southeast corner of the basin, close under a high, bald knob. Stand in until clear of the sunken rock northwest of Crow Islands, when haul around the islands, favoring them, to clear a low-water rock not marked with kelp, about the middle. Course about SE. by S., keeping the bald knob open on the starboard bow, and anchor close under it in 20 to 24 fathoms. This affords excellent protection except from northwest.

There is a fair channel between Crow and Pond islands used by the Patterson. There are two sunken rocks in it surrounded by kelp. No directions can be given for it, except keep near mid-channel and clear of kelp.

Hootznahoo Inlet.—Round Danger Point buoy and steer a mid-channel course until the Indian

village on the south side shows clear of a bluff, when favor the north shore until past Turn Point, then steer to clear Rose Rock. Round Rose Rock, keeping it close aboard, and if bound for Favorite Bay stand well over for the coal mine on Sullivans Point, until midway between the unbroken shores of the channel leading into Favorite Bay. Keep in mid-channel until the fishing camp on the south shore is reached, when favor either shore to clear a rock in mid-channel, uncovered at low water and marked by a box on a tree on the south shore.

A good anchorage may be found in Favorite Bay anywhere to the westward of a high bluff on the south shore, marking the limits of extensive flats.

If bound for Mitchell Bay, round Rose Rock, keeping it close aboard, and stand close along the reef making out from Turn Point. When well clear of the south end of the island dividing the channels leading to the northward, steer for the entrance leading to the narrows at Point Pillsbury. Upon approaching the narrows, keep the island on the south side close aboard until in mid-channel beyond; there the course is mid-channel until near Point Bridge, when the eastern shore must be favored. Beyond Point Bridge the course is again mid-channel until within 1½ miles of the entrance to Mitchell Bay, when the timber fall on Diamond Island, kept in the middle of the opening between North Point and a small, low, round, high-water island on the south side, will carry clear of the reef on the west side and a rock on the east side. After entering Mitchell Bay follow the west shore and pass midway between Diamond Island and the shore. Beyond Diamond Island clear, open water will be found and a good anchorage in the southeast corner in 10 to 20 fathoms of water.

The passage from Mitchell to Kanalkoo Bay is so full of reefs and so devoid of permanent landmarks that could be used as ranges that no sailing directions can be given.

The navigation of Hootznahoo Inlet and its lagoons is such that it should not be attempted except by small vessels of short length and ready turning qualities—and then only at low water slack, at which time all dangers are exposed—unless a pilot with local knowledge can be obtained.

SAILING DIRECTIONS THROUGH PERIL STRAIT FROM POVEROTNI ISLAND TO CHATHAM STRAIT, COMING FROM THE SOUTHWARD.

The sailing directions from Sergius Narrows to Poverotni Island as given in the Pacific Coast Pilot, Alaska, Part I, are correct.

Poverotni Island may be passed to the northward at a distance of about 200 yards. There is a passage between Pogibshi Point and Poverotni Island, but is not recommended. When it bears abeam, steer for Otstoia Island, course NNE. The usual steamer track is to the eastward of the island, but there is a good passage to the westward, between it and Krugloi and Elevoi Islands. If passing it to the eastward, favor the island side, leaving the red buoy on starboard hand. After passing the black buoy on Cozian Rock, steer NE. ¼ E. for the easterly one of the two big landslides on northern shore until the northeast end of Broad Island bears W. by S.; then steer E. ⅝ S. until False Lindenberg Head is abeam; then E. by N. until McClellan Rock is abeam, and thence into Chatham Strait the course is NE. by E. This course will carry across Chatham Strait south of Kenasnow Island, making allowance for tides. If going to the westward of Otstoia Island, after passing the island do not steer to the eastward of a line joining the western side of Otstoia Island and the eastern side of Broad Island until the buoy on Cozian Rock is passed. This clears Cozian Rock and Shoal.

ANCHORAGES BETWEEN POVEROTNI ISLAND AND CHATHAM STRAIT.

Poison Cove is free from dangers and affords an anchorage for small craft in 18 to 20 fathoms. No special directions are necessary for entering.

Pogibshi Point.—On the north side, in broad, shallow bight, about two-thirds the distance from the point to a small stream, there is a good anchorage in about 22 fathoms, soft sandy bottom.

Favorite anchorage.—As described in Coast Pilot.

Nismeni Cove.—Favor the eastern shore to avoid the ledges off Nismeni Point, and anchor in the middle of the cove in 18 to 22 fathoms.

Lindenberg Harbor.—As described in Coast Pilot.

Sitkoh Bay.—Pass Point Craven at a distance of 200 yards, and favor the western shore for a mile, then steer for the middle of the bight on the eastern side, anchoring in 18 to 25 fathoms, hard bottom. A better anchorage can be had at the head of the left arm, in about 20 fathoms, soft bottom. No special directions are necessary. Keep in the middle.

Rodman Bay.—On entering, keep a mid-channel course about SW. ½ S. and anchor to the southward of two small islands at the head of the bay in 10 to 15 fathoms, soft, sandy bottom. The extreme western point on the eastern shore of the bay will show between the islands when on the anchorage.

Sa-ook Bay.—Keep a mid-channel course about SW. by S. until abreast of the first of a small group of small islands near the eastern shore; then favor the eastern shore, keeping at a distance of 100 yards, until past a stream on the western shore from which a sand spit makes out. The anchorage is about half a mile farther on in the middle of the inlet in 18 to 22 fathoms; soft, green mud.

Hanus Bay.—Is not recommended for large vessels. There are two coves at its western end which may be used by small craft.

Point Thatcher.—Inside of Point Thatcher there is an anchorage formerly used by the Russians, but it is not recommended, as it affords very little protection. Keep in mid-channel between Point Thatcher and Midway Reef until well inside the point and anchor in 15 to 20 fathoms, rocky bottom, midway between the two extreme points of the first bend in the shore line.

Hooniah Sound.—Needs no special directions. The north arm is clear until near its head, where there is a rock, bare at low water, in the middle, to be avoided by favoring the south shore. The entrance to the south arm from Peril Strait should be navigated with care, following the deep water as shown by the chart. An anchorage can be had at the head of either of the three arms in 15 to 20 fathoms, soft bottom, having a care at high tide not to get on the flats.

Ushk Bay.—Needs no special directions. Keep in the middle and anchor near the head. Better directions can be written when the chart is issued, so that courses can be taken and corrected soundings had.

TIDES AND CURRENTS.

In the vicinity of Killisnoo the currents are very irregular, but the means show that the last half of the ebb and the first part of the flood set in through Hootz Bay and set out to the westward through the north channel. The second half of the flood and the first half of the ebb set in to the eastward through the north channel and out into Hootz Bay.

The set is parallel to the axis of the channel, and the strength is not important, except in the narrow part of the north entrance. The current at the wharf is even more erratic than that in the channel, but is not so strong; sometimes, however, an eddy will be found, but not strong enough to interfere materially with making a landing. At Killisnoo the following data were obtained by observation:

Average time of high water after moon's meridian passage is	0h 24m
Average time of low water after moon's meridian passage is	6h 32m
Mean rise and fall is	11.5 feet.

Hootznahoo Inlet.—The currents are strong and various all through this place, and the uninitiated should not attempt to navigate it, except at slack water, and had better choose low slack, so that in case of grounding the benefit of a rising tide will be obtained. The flood current at the entrance sets in nearly parallel to the north shore and so continues until it reaches Village Rock, where it divides, one part going to the northward over what Meade calls "Hell's Acre," and the other continuing to the eastward south of Rose Rock, where it again divides. One part continues east into Favorite Bay, while the other turns short around the rock and divides again, one part going north, the other branch passing over "Hell's Acre."

The rapids begin at Village Rock and continue until well past Rose Rock.

The strongest current observed in the channel was 6.2 knots, but this is not the strongest. It probably reaches 8 knots at times.

It is slack at about one hour and thirty minutes after high and low water at Killisnoo.

The channel connecting Mitchell Bay with the lower part of the inlet commences at Point

Pillsbury. From this point to Point Bridge the current is very swift, probably reaching 10 knots, with much boiling and swirling, the worst place being at Point Bridge. This can only be passed at slack water, which lasts only a few minutes and occurs about one hour and fifty minutes after high and low water at Killisnoo.

Through all of the narrow channels leading into the various bays the currents run with great velocity, and they should not be attempted in any kind of a boat except at slack water.

Pogibshi Point.—At Pogibshi Point the following data were obtained by observation:

Average time of high water after moon's meridian passage	$0^h\ 29^m$
Average time of low water after moon's meridian passage	$6^h\ 42^m$
Mean rise and fall	12.4 feet.

Sergius Narrows.—From the observations made it is concluded that the flood current coming in through Salisbury Sound flows up through the Narrows and into the broader part of Peril Strait, north of Pogibshi Point, when it meets the flood that has come up through Chatham Strait and into the eastern end of Peril Strait. Just where in this broad part they meet is uncertain, but from the observations made it is concluded that both currents spread out and lose themselves.

The time of slack water in Sergius and Adams Narrows varies from one hour and thirty minutes before high and low water to two hours and thirty minutes, the average being about two hours. The slack high seems to come earlier than the slack low, and seldom comes less than two hours before high water, while the slack low seldom comes more than two hours before low water.

The duration of slack is only a few minutes, in fact, sometimes it ceases to run in one direction and immediately starts in the other, and is not half an hour as stated in the Sailing Directions. There is half an hour, however, when the current does not exceed two knots, and the surface is comparatively smooth, and vessels may go through with safety.

The strongest current observed was 8.2 knots. It is probable that it reaches 10 knots at spring tides, and boils and swirls in such a manner that navigation is unsafe from below Francis Rocks to Leisnoi Island.

COOK INLET AND TO THE WESTWARD.

The following information concerning Cook Inlet and the region to the westward is compiled from the notes of Prof. W. H. Dall, U. S. Geological Survey, made by him in the summer of 1895, and published in the March bulletin of the American Geographical Society, by whose permission it is used.

The changes suggested by him, as far as possible, have been made on Coast Survey charts Nos. 8500 and 8651, and will be made on the next edition of No. 8800.

The uncharted harbor on the north side of Cape Douglas, the southwest point of entrance to Cook Inlet, is included between the rounded low peninsula of Cape Douglas and a narrower cape on the west and north rising about 40 feet from the top of the steep beach. To the south three glaciers are visible, two coming down south of Cape Douglas, and one ending in a stream which discharges into the southern part of the bight. The southernmost glacier is the largest. The shore about Cape Douglas is defended by numerous rocks, and should not be approached too closely. Within the bay, anchorage may be had in 2 to 5 fathoms under the west cape, where the bottom appears to be clear. The south and east parts of the bay are more or less shoal and rocky and should be avoided. In entering, the navigator should keep the western shore aboard. Shelter may be had here in any wind except heavy northerly and northeasterly gales.

Leaving the cape, the northern slope of the mass of mountains behind it is seen to be snow covered, and with three very large snowy glaciers descending to the vicinity of the sea. The easternmost appears to be the largest, and shows an even snowy surface without lateral moraines. Northwest of the group of mountains is a space of comparatively low land crossing the peninsula behind the shoal and dangerous Kamishak Bay. Over these plains many caribou are said to range in summer.

Between Cape Douglas and Augustin Island, and about 6 or 8 miles from the latter, are the Sea Otter Rocks, a low group not definitely placed on the charts. We steamed a straight course NW. ½ W. (p. c.) from the cape in calm, clear weather, which, according to the latest charts, would

have carried us directly over the rocks, but in fact carried us about 2 miles west of them. At low water there were two low, flat table rocks, with a smaller pointed one between them, visible at a distance of 2 miles, the eye being 10 feet above the water. At high water they are said to be awash. We brought them in one with a high bluff, which we supposed to be Point Bede, on the east shore of the inlet, bearing NE. by E. These rocks constitute a serious danger to navigation.

Augustin Island (otherwise Black Fox or Chernobura) is a typical volcanic peak, with low borders of talus. At present, anchorage may be had in 3½ fathoms, sand, about a mile offshore, with the south point bearing SE. by S., the western point NW., and the peak NE. by E. ½ E. The south point is low and sandy, but the boat landing is best here, the beach running off very shoal north of it. The west point is composed of ashes and volcanic stones, forming low, bluff banks, and running off in flats, upon which the bowlders of volcanic rock, sometimes very large, are irregularly distributed. No chart of the island exists. There was formerly an excellent harbor for small craft on the west side, and the inner harbor still exists, but the entrance is now dry at low water. This change was brought about at the time of the last eruption, less than ten years ago. The peak has the regular volcanic form, the rim of the crater being somewhat broken away on the west and north. Steam issues in intermittent puffs from the crater and inner cone, and when these puffs rise vertically and spread out like a mushroom above the peak it is taken as an evidence by the natives of several days of calm weather, during which they do not hesitate to put out far from shore in their frail kyaks to hunt the sea otter. The peak is about 3,000 feet in height.

The upper two-thirds of the peak is largely snow covered; below, much is bare ashes and scattered lava blocks, then more or less herbage with stunted spruce, sparsely scattered, and low, creeping alders. The borders of the island to the south and west are low and hummocky, with many bogs and small pools. The south shore has bluffs of variable height; none very high. The passage west of the island is foul near the island shore, but has a navigable passage rather closer to the mainland shore.

Tuxedni Harbor, sometimes called Snug Harbor, lies between Chisick Island and the mainland. That a snug harbor is to be found here is noted on a sketch chart of the United States Hydrographic Office, but that the bay is 5 or 6 miles long, free from dangers, and forming a spacious anchorage, would hardly be supposed from the very imperfect indications given on the best charts. Chisick Island is narrow, and rises over 2,000 feet in height, with bluff shores, the water bold-to. There is a small, round, high, rocky islet outside of Chisick, which forms a convenient landmark for vessels feeling their way alongshore in a fog, which sometimes conceals the entrance. The southern end of Chisick is high and narrow, with no reef or rocks off it, as has been erroneously stated. The strata are somewhat inclined to the south near the entrance, but in the main are nearly horizontal, and composed of heavy beds of sandstone and conglomerate of varying hardness, so that the upper part of the island weathers into steps like terraces on a grand scale, offering a remarkable castellated appearance to the spectator. The scenery here is very fine and peculiar in its features. The splendid volcanic peak of Iliamna rises among the mountains SW. by W. from the harbor at a distance of some 15 miles. Its upper part is set with glaciers, but the conical form and scenic beauty of the peak can only be fully realized from a greater distance. The fairway of the harbor is nearly straight, with high and singularly weathered cliffs rising on either hand. Toward the head it widens a little. Here good holding ground may be had in 18 fathoms. At this point the vessel which carries down the product of the salmon canneries from the inlet is anchored for the summer. The canned salmon is brought to her by small light-draft steam tenders, which can cross the shallow water on the bars of the rivers at Kassiloff and Nenilchik, where the salmon are taken.

From Captain Hughes we learned that the spring tide in June was 36 feet; at ordinary times the range is about 24 feet. The northern end of the harbor is protected by reefs and foul ground beyond Chisick Island, where there is a large open bay. There may be a channel out this way, but until it is surveyed it would be imprudent to attempt the passage except with small craft. Into this bay a large river falls, fed by the glaciers of Iliamna and the drainage of the other mountains. The north end of Chisick shows high bluffs rising much above those on the main shore, and above to a magnificent castellated summit of curiously eroded almost horizontal beds of sandstone, limestone, and conglomerate, which can hardly be less than 2,000 feet in elevation. Near

the beaches the rocks are worn into caves, arches, and pillars, about which circle innumerable multitudes of sea birds. There is no bar or obstruction at the entrance of the harbor, but the great range of the tides and the narrow form of the harbor produce well-marked rips at certain stages of the tide, which might lead to the supposition that rocks or shoals exist. On the island side the shores are bold-to; on the mainland at the head of the harbor it is shoal for a long distance from the beach. Notwithstanding the absence of protection at the entrance, southerly winds do not blow home into the harbor on account of the highland on either side; but for the same reason wind from the land is often stronger in the harbor than out in the inlet. July 23, 1895, flood tide made shortly after 3 p. m.

All the navigation in the upper part of Cook Inlet is commonly carried on with reference to the tides; a sailing vessel can make no headway against them and it is the custom to anchor during the unfavorable tides, which can be done almost anywhere alongshore. Off the West Foreland there is a small village of Kootena Indians, and here the shore is of bluffs, apparently about 50 feet high, of gravel and sand, wooded above, with some high mountains distant in the interior. It was slack water here about 10 a. m. July 24. Between the two Forelands is a wide bay with shoal water and many scattered bowlders rising out of it along the shore. The land behind is very low in part, all heavily wooded with spruce, and a river carrying very muddy water comes in here. Near the North Foreland is a series of whitish gravel bluffs of very regular height, with a broad beach and shallow water for a mile off it, with scattered, sometimes very large, squarish rocks of whitish color irregularly distributed over the flats. There are Indian houses in the principal gap in this series of bluffs, but the largest settlement, Tyonek, is near the point of the Foreland, where a small gravel flat exists. Here the water off the beach for half a mile is shoal, but not foul. Off the Foreland southward, in the middle of the inlet, most charts show an area inclosed by a dotted line connected continuously with foul ground on the southeast shore of the inlet. This is an error, as there is a clear passage on each side of the central patch, which latter trends with the inlet and shows at low water large bare sand banks 8 or 10 feet high. East of North Foreland and between it and Point Possession, also in the middle of the inlet, is a flat or shoal not shown on the charts and which constitutes a serious danger. It is believed to be 5 or 6 miles long and not less than 4 miles wide. Its southern edge is about WSW. (mag.) from Point Possession.

The village of Tyonek is small, without a harbor, and the spot is inaccessible by sea in winter, as this part of the inlet freezes over. The tide is from 25 to 35 feet in range here, with a depth of 3½ fathoms half a mile off the beach. Turnagain Bay extends to the eastward from Point Possession and is the passageway to the placer mines, of which much has been said in the public press.*

Northeasterly from Point Possession, on the continent, the land is mostly low, formed by the delta of the Sushitna River. West of the river, at some distance inland, rises a noted landmark, a low but conspicuous peak known as Sushitna Mountain. Eastward from the Sushitna, another, the Knik or Fire River, enters the inlet north of Point Campbell. West of Point Campbell is a small high island called Fire Island, to which sufficient water for an ordinary schooner may be had at low tide, according to local navigators. Both at Point Campbell and Point Possession the land is low and wooded, but at about 12 miles eastward of the latter the mountains come to the water's edge, with narrow steep-sided ravines and canyons, in which are the streams where gold is washed. The land rises to about 2,000 feet; some of the peaks are higher, and the slopes are rather sparsely wooded. The rise and fall of the tide in Turnagain Bay is remarkable, and the middle of the passage, as well as much of its margin, is occupied by extensive flats, partially dry at low water, with a shallow channel at each side. To enter the bay and avoid the shoals, keep Point Possession well aboard and steer for the northern edge of the highland on the south side of the bay, keeping a little to the southward of a straight course between the two; keep the lead constantly going, as the shoals shift to some extent. Allow for a tide of 50 feet in range and select an anchorage in accordance with the circumstances of the case. The northern channel is not navigable eastward of Fire Island, and the island is nearer to Point Campbell and rather more southerly in position than indicated by the existing charts. The shoal in the center of the bay is elongated,

* The U. S. Geological Survey will publish a report by Dr. Becker on the mines of this region.

trending with the inlet, and not rounded as on the charts. These shoals are mostly hard sand, with a few scattered bowlders.

The following is a graphic description showing the strength of the tides in this vicinity:

We anchored under the lee of a small, high, conspicuous bluff, the first east of Point Possession, where the miners assured us there was always water enough to float our little tug. It is hardly necessary to repeat that here one can only move with a fair tide. At our anchorage, with the standard compass, we found Point Campbell bearing W. 40° N., the north edge of Point Possession W. 10° N., the SW. edge of Fire Island in one with Point Campbell, Mount Sushitna NW. ½ W., and the bluff point a cable's length to the east. We left North Foreland with the flood tide immediately after it turned at 2 a. m., July 25, and at 8 a. m. found high water at the bluff above mentioned, with 41 feet of water under us. There was a slack of about fifteen minutes. At 9.15 a. m. we put out the patent log to test the strength of the ebb, and found it to average 3¼ knots during the first half, though we were out of the strength of the tide. It was slack water at 3.30 p. m., and there was less than 2 feet of water under our bilge, showing a range for this day of 39 feet at this point. We were obliged to await the bore, helpless on the sand, and it did not keep us waiting long, but came in with a rush, in a wave 3 or 4 feet high, which whisked us a mile and a half up the inlet before we could get out another anchor; and here, with full steam ahead and both anchors down, we had all we could do to keep her from dragging. The log showed a 7-knot current, and the water, after the bore had passed, rose 6 feet in ten minutes. At extreme spring tides the ebb would leave this anchorage dry and for a mile or two seaward. The force of the current was such as to twist our main anchor, weighing 250 pounds and of good Swedish iron, in two different directions. It was a fit object for a museum when recovered.

Off the highland west of our anchorage is a small, high island, called "Haystack" by the miners. It rises out of the flats, which dry all around it at low water. Kachemak Bay, on the eastern shore of the inlet, is interesting on account of the presence of extensive deposits of brown coal, and because it is the finest harbor in the inlet, never obstructed by ice, and one of the finest on the whole Pacific Coast. It separates the comparatively level plateau of the Kenai Peninsula, west of its axial mountain range, from a spur of that range which comes down to the sea at Point Bede, in which there are several indentations affording anchorage.

These mountains are not very high, but from them descend several attractive glaciers not difficult to reach. The rocks on this side of the bay are mostly crystalline or eruptive, forming a marked contrast to the bluffs of nearly horizontal sandstone and clays, with conspicuous coal seams which border the opposite shore. The harbor is protected by a long, low spit of gravel, within which is good anchorage close to the shore, but the beach in front of the bluffs makes off shoal for 2 or, toward the head of the bay, fully 3 miles. The range of tide in the upper bay is 22 feet, but at springs the extreme range is said to be 30 in the upper part of the bay and somewhat less toward the entrance. Excepting a few buildings connected with the work of coal prospectors there is no settlement within the spit. In the lower bay, outside of the harbor, is a snug anchorage, Chesloknu of the natives, Seldovia or Herring Bay of the Russians. Here are two trading stations, and most of the inhabitants from Port Graham, where the harbor is less convenient, have migrated to Seldovia Village. There is quite a collection of houses and a Greek chapel. No chart has been published of this anchorage, except a small delineation from a Russian sketch which is included in the chart of Kachemak Bay, compiled by the Coast Survey, No. 8651. The bluff at the southeast head of the entrance is composed of two small rocky islets united to each other and to the mainland by a low spit, so that the land is not continuously high, as represented on the sketch alluded to. The entrance has rocky bottom clear across, with kelp growing in 5½ fathoms. The northern head is bluff and rocky; a rounded bowlder lies off it, visible at low water. There are also rocks above and below water about the opposite headland. Inside there are 7 and 8 fathoms, sandy bottom, off the village in mid-harbor, with protection from all winds except northwest, and at the head of the harbor complete shelter.

Amalik Harbor lies behind Takhli Island, on the south side of the Alaska Peninsula. We found excellent shelter from all winds, and anchorage in 10 fathoms, sand. A long inlet penetrates the land here, which has never been surveyed. The rocks are mostly coarse sandstones, pierced by volcanic dikes and contain seams of a superior quality of brown coal.

Coal Bay is a fine sheet of water, of which no charts exist and the indications on the general charts are very inaccurate. The entrance is partially obstructed by an area of foul ground with rocky islets and pinnacles extending to the southwest from the northeastern point of entrance for several miles. Another patch, separated by a clear passage, is nearly in the middle of the entrance. The Russian Hydrographic Chart of 1848 shows these with more accuracy than any of the later

maps, but rarely indicates the inner shores of the bay. Cape Yaklek forms the southwest headland, and is free from offshore dangers.

There is just within this cape a small spit of heavy shingle, with high, rocky bluffs behind it. Here anchorage may be had in good weather, and the camps of sea-otter hunters are often made. There is no settlement in the bay, which is divided into two arms by a high promontory near its head. The western arm terminates in low, flat land, behind which is a large lagoon, dry at low water, into which empties a rather large stream. The land at the head of the eastern arm is higher. Most of the topography about the bay is high and barren, the rocks lying in nearly horizontal heavy beds of sandstone and conglomerate, which weather into benches and offer scenery of much impressiveness. It somewhat recalls that at Chisick Island, but the mountain forms are more massive and simple, with long, even, talus slopes. Near the water the bluffs are curiously eroded by the sea and weather, and shelter myriads of sea fowl. Singularly enough, though the rocks inland appear brown or gray, the effect of them in distant masses was a marked brownish purple, giving the landscape a peculiarly chilly aspect, which well deserved the name applied to the bay. On the northeastern shore a stream comes in from a conspicuous valley, off which, on a gradually deepening flat, anchorage may be had in any depth desired. The water in most other parts of the bay is inconveniently deep. The shores near this place are of low bluffs of very massive light-gray limestone, which falls in enormous blocks, and these are worn by the sea into very remarkable spheroidal forms. From the high land about the bay in windy weather heavy gusts sweep down, but the holding ground is good and the anchorage at this point is sufficiently protected from the sea. The absence of trees gives an individuality to the landscape which is very striking when one comes from the densely forested slopes of eastern Alaska.

In Kialagvit Bay, farther west, we have another large uncharted sheet of water, defended from the sea by a long line of islets. The indications of the general charts are very inaccurate. The bay at the eastward, leading to the Becheroff village, is clear of dangers, except near the points of entrance, where foul ground extends well offshore, and near the village, where the water gradually shoals for two miles off the beach. There is no conspicuous mountain recognizable as the one on the charts near the village. The mountains resemble those of Cold Bay, but, as the strata are inclined more steeply, do not show horizontal benches.

The entrance to the inner bay is rather close to the outer islets, with 2 or 3 fathoms over a bar. Within there are no invisible dangers, and the water is mostly quite deep. There is a second entrance west of the first cluster of islets, with a clear passage and deep water, according to a local pilot. There are several visible rocks there, but no hidden dangers. The portage to the Ugaguk River, of the northern slope of the peninsula, begins in a valley near the western end of the inner bay. At the extreme southwestern end rises the Olai Volcano, from which, on its eastern flank, a large glacier descends, while on the seaward slope two others come down from the same masif. The mountains slope gradually toward the beach, covered with dense herbage.

Chignik Bay opens to the eastward, with no concealed dangers. Its south point of entrance is Tuliumnit Point, a remarkable headland, sometimes called Castle Point, which forms a landmark for navigators in this vicinity. The point is extremely narrow and composed of tertiary sandstones, forming a shallow syncline, the stratification being a conspicuous feature. North and west of the point is a deep indentation known as Castle Bay, unsurveyed, but which is said to afford anchorage on its northwest side. The grassy highlands west of the bay afford feeding grounds at times for the wild caribou, and by driving them to the narrow point (which at one place is only a few hundred feet wide) large numbers are said to be secured by hunters. The south shore of Chignik Bay, west of Castle Bay, is bluff and high, with four indentations, the two to the east being closed by bars of gravel, behind which shallow lagoons exist, while the two farther west afford anchorage. The westernmost, named Doris Cove, is a snug and perfectly protected harbor, and was surveyed by the United States Coast Survey in 1874. Here the vessel which serves the associated salmon canneries is anchored during the season. The extreme southwestern corner of the bay is marked by a high, round-topped, vertical bluff, at the foot of which is the entrance to Chignik Lagoon, protected by a long sand spit, with a navigable channel between it and the bluff. There is a least depth of 2 fathoms on the bar and 22 feet of water at high tide. The channel is moderately wide, and inside the entrance offers 3 to 5 fathoms over sandy bottom as far as the

canneries, beyond which the lagoon is shoa.. At high water a 3 or 4 foot channel leads to the head of the lagoon, where a river enters, at the mouth of which are the salmon weirs. A light-draft stern-wheel steamer affords transportation, and there is water enough in the river to permit the ascent of this boat several miles, to a point where a seam of brown coal is worked by the association for use in the canneries. It was high water in the lagoon about 1.30 p. m. on August 4. The river is bordered by vertical banks of tertiary rocks, 30 or 40 feet in average height. Two or three miles above the coal mine the river issues from a large lake, said to be 6 or 7 miles long, and connected with another, equally large, by a stream 5 or 6 miles in length. The topography is rolling, with low hills and a wide expanse of tundra, on which caribou find grazing.

An important centre of trade, fisheries for cod, and gold mining, are found in the Shumagin Islands at Delaroff Harbor, Unga, and Sand Point, a few miles above. The harbor at Delaroff Village has not been surveyed, though a small Russian sketch was printed many years ago. It consists of an outer roadstead surrounded with rocky cliffs, where vessels may lay to a mooring, and an inner lagoon, which has been stated to be silted up. It has been found, however, that good anchorage for vessels drawing not more than 12 feet may be had inside the entrance to the lagoon. This is important, as the outer bay is unsafe in southeast gales, and several wrecks have occurred there. The anchorage is in mid-channel in $3\frac{1}{2}$ to 5 fathoms, with a lee afforded by a reef and kelp patch on the south side of the entrance. A dangerous rock exists off the outer roadstead, which lies SE. by E. $\frac{3}{4}$ E. from the middle of the entrance to the lagoon. Going out the breakers are in line with the trend of the point at the south head of the outer bay. From the inner anchorage the visible south end of Nagai bore E. by S. $\frac{1}{2}$ S., the inner north headland E. by S., and the rock at the south headland SE. by S. $\frac{1}{4}$ S., by compass.

The long spit of ash and volcanic gravel which formerly connected the two volcanoes of Bogosloff and Grewingk, northwest of Unalaska, is now broken by a navigable passage directly over the spot where, for more than a century, Ship Rock of Cook towered in solitary majesty. The newer Grewingk Volcano gives out but little steam, and the peak which at first surmounted it has fallen in or crumbled away until the upper part of the island is approximately level, or appears so from the sea. From the southeastern side of the island a long, low, falciform spit extends, off which, in fair weather, protection may be had from westerly winds, and parties desiring to visit the volcano may, with care, effect a landing.

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APPENDIX No. 12—1896.

LOGARITHMS, THEIR NATURE, COMPUTATION, AND USES, WITH LOGARITHMIC TABLES OF NUMBERS AND CIRCULAR FUNCTIONS TO TEN PLACES OF DECIMALS—PART I.

By W. W. DUFFIELD, Superintendent.

HISTORY.

1. Logarithms were invented by John Napier, Baron of Merchiston, in 1614. This original system was an exceedingly complicated one and, in consequence, of little practical use. Most mathematical writers consider the natural system of logarithms, whose base is 2.718281828459045235360+ and whose modulus is +1, as that originally devised by Napier, and in the published tables these logarithms are called Napierian. This is a serious error. The natural system was invented by John Speidel, and his table of "New Logarithms" was published in London in 1619. As Baron Napier died April 4, 1617, he could not, by any possibility, have ever seen this system. The Napierian and Speidelian systems differ widely. In the Napierian the logarithms decrease as their corresponding numbers increase. The Napierian logarithm of 10^7 or 10 000 000 is zero. The logarithms of all numbers greater than 10^7 are negative; those of all numbers less than 10^7 are positive, and the modulus of the Napierian system is very nearly equal to −1. In the Speidelian system the logarithms increase as their corresponding numbers increase—the logarithm of 1 is zero and the modulus of the system is +1. As the Speidelian system is much used in the quadrature of the hyperbola, it is also called a system of hyperbolic logarithms, and its modulus being 1 it is also called a system of natural logarithms.

Baron Napier realized the complicated character of his system, and that a system of logarithms with 10 as a base would be much simpler and better adapted to ordinary calculations. He began the computation of a table of logarithms upon this base, but his death prevented its completion. At his request his friend, Henry Briggs, professor of mathematics at Gresham College, completed and published in 1618 the first table of logarithms whose base is 10. This system is called, after its inventor, the Briggsian, or, more frequently, the common system.

DESCRIPTION.

2. The logarithm of any number is the exponent of that power to which the base of the system must be raised in order to produce the given number.

Thus in the common system whose base is 10 we have $10^{\frac{1}{2}} = 10^{0.5000} = \sqrt{10}$, which is 3·1622777. Hence 0·5000000000 is the common logarithm of the mixed number 3·1622777. Again $10^{\frac{2}{3}} = 10^{0.6666+} = \sqrt[3]{10^2} = \sqrt[3]{100} = 4{\cdot}6415888$. Hence 0·6666666666 is the common logarithm of the mixed number 4·6415888.

3. Let B = the base of any system of logarithms, N = any number and x = the exponent of the power to which B must be raised, so that

$$B^x = N; \tag{1}$$

then will x be the logarithm of the number N.

Let x^1 = the logarithm of any other number N' then

$$B^{x'} = N' \qquad (2)$$

Then by the rules that govern exponential quantities, if we multiply equations (1) and (2), member by member, we have

$$B^{x+x'} = NN'.$$

Therefore the sum of two or more logarithms will be equal to the logarithm of the product of their corresponding numbers.

4. If we divide these equations, member by member, we have

$$B^{x-x'} = N/N': \text{ hence}$$

The difference of two logarithms will be equal to the logarithm of the quotient of the corresponding numbers.

5. If we raise equation (1) to the second power or square, we have

$$B^{x\times 2} = N^2: \text{ hence}$$

The product of a logarithm by any exponent will be the logarithm of that power of the corresponding number of which the exponent is the index.

6. If we extract the square root of equation (1) we have

$$B^{\frac{x}{2}} = \sqrt{N}: \text{ hence}$$

The quotient of a logarithm by any index will be the logarithm of that root of the corresponding number designated by such index.

7. It will be evident, therefore, that the use of logarithms simplifies arithmetical computations by substituting addition for multiplication, subtraction for division, multiplication for involution, and division for evolution.

8. The base of the common system of logarithms being 10, if we involve this base through all its successive powers we have:

$10=10^1$	hence 1 is the logarithm of 10
$10\times 10=10^2=100$	hence 2 is the logarithm of 100
$10\times 10\times 10=10^3=1000$	hence 3 is the logarithm of 1000
$10\times 10\times 10\times 10=10^4=10000$	hence 4 is the logarithm of 10000
&c.	&c.

Hence the logarithms of the integral or whole powers of 10 will be integral or whole numbers each equal to the exponent of the power.

9. If we evolve 10 through all its successive roots we have

$10/10=10^{1-1}=10^0=1$	hence 0 is the logarithm of 1
$10/100=10^{1-2}=10^{-1}=1/10$	hence -1 is the logarithm of 1/10
$10/1000=10^{1-3}=10^{-2}=1/100$	hence -2 is the logarithm of 1/100
$10/10000=10^{1-4}=10^{-3}=1/1000$	hence -3 is the logarithm of 1/1000
&c.	&c.

Hence the logarithms of the integral or whole roots of 10 are reciprocals with negative exponents.

10. The logarithms of all numbers greater than 1 and less than 10 will be greater than 0 and less than 1, that is, a proper fraction or decimal without an integer; the logarithms of all numbers greater than 10 and less than 100 will be greater than 1 and less than 2, that is, a mixed number whose integral portion will be 1.

The integral portion of a logarithm is called its *characteristic*, the decimal portion is called the *mantissa*.

11. The logarithm of any fraction may be expressed thus:

$$\text{Log } 3/10=\log(1/10\times 3)=\log 1/10+\log 3=-1+\cdot 4771212547$$
$$\text{Log } 3/100=\log(1/100\times 3)=\log 1/100+\log 3=-2+\cdot 4771212547$$

Hence in the logarithms of fractions the characteristic only is negative and the mantissa positive. In order to indicate that the negative sign affects only the characteristic, the logarithms of

fractions are written with the negative sign placed over the characteristic, and the positive sign, preceding the mantissa, omitted. Thus:

Log 3/10=$\bar{1}$·4771212547. Log 3/100=$\bar{2}$·4771212547.

12. Since shifting the decimal point to the right in any combination of numbers is equivalent to multiplying such combination by 10, and since the logarithms of the integral powers of 10 are integral or whole numbers (8), it is evident that the same combination of numbers will have the same mantissa and the characteristics only will change with the number of integral digits in that number. Thus:

Log 0·01234=$\bar{2}$·0913151597. Log 0·1234=$\bar{1}$·0913151597.
Log 1·234 =0·0913151597. Log 12·34 =1·0913151597.
Log 123·4 =2·0913151597. Log 1234 =3·0913151597.

Hence in logarithmic tables only the mantissæ are given. The characteristics can always be readily determined by the following rules.

13. Since the logarithm of 1 is 0, that of 10 is 1, that of 100 is 2, and that of 1000 is 3, (8), it is evident that the characteristic of an integer or mixed number is 1 less than the number of its integral digits; hence the

Rule.—To find the characteristic of any integral or mixed number. Subtract unity, or 1, from the number of integral or whole digits; the difference will be the characteristic of the given number.

Example.—What is the logarithm of 1093? The mantissa for 1093 is ·0386201619. There are four digits in 1093, and 4—1=3; hence the logarithm of 1093 is 3·0386201619.

Example.—What is the logarithm of 13·03? The mantissa for 13·03 is ·1149444157. There are two integral digits in 13·03 and 2—1=1; hence the logarithm of 13·03 is 1·1149444157.

14. Since the logarithm of 1/10 or 0·1 is —1, that of 1/100, or 0·01, is — 2, that of 1/1000, or 0·001, is — 3, and that of 1/10000, or 0.0001, is — 4, (9), it is evident that the negative characteristic of a decimal fraction is always unity or 1 greater than the number of intervening zeros between the decimal point and the first significant figure; hence the—

Rule.—To find the negative characteristic of any decimal fraction. Add unity, or 1, to the number of intervening zeros between the decimal point and the first significant figure, the sum will be the negative characteristic of the given decimal fraction.

Example.—What is the logarithm of 0·1193? The mantissa for 1193 is ·0766404437. There are no zeros between the decimal point and the first significant figure, and 0 + 1 = 1; hence the logarithm of 0·1193 is $\bar{1}$·0766404437.

Example.—What is the logarithm of 0·0001021? The mantissa for 1021 is ·0090257421. There are 3 zeros intervening between the decimal point and the first significant figure, and 3 + 1 = 4; hence the logarithm of 0·0001021 is $\bar{4}$·0090257421.

DESCRIPTION OF THE TABLES.

15. In the accompanying logarithmic tables all the mantissæ have been computed to twelve places of decimals, and whenever the eleventh and twelfth places exceeded 50 the tenth place has been increased by unity, or 1; but whenever the eleventh and twelfth places were 50 or less than that number the tenth place has not been increased.

When these computations were begun, I was not aware that Baron George von Vega had preceded me in his Thesaurus Logarithmorum Completus. But my own results have been carefully compared with those of Von Vega, and whenever any difference was detected the computation was made anew. In this way many serious errors (undoubtedly typographical) in Baron von Vega's tables have been discovered and corrected.

The arrangement of Baron von Vega's tables is not as convenient as that given in more modern tables, and therefore the accompanying tables are arranged in the same manner as the admirable tables published by Messrs. W. & R. Chambers, London and Edinburgh, 1885.

In the following tables the mantissæ are entered to ten places of decimals. In the first column on the left are entered, in consecutive order, the natural numbers beginning with 1000 and extending to 9999. In the horizontal line at the top of the page are entered, in consecutive order, the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. In the second column on the left headed 0, the mantissæ

are entered to the tenth place of decimals, and whenever the eleventh and twelfth places exceed 50 the tenth place is increased by unity, or 1. But in order to economize space and save repetition the columns headed 1, 2, 3, etc., contain only the last seven figures of their respective mantissæ. Hence, to complete the mantissæ taken from these columns, the first three figures must be taken from the column headed 0, either on the same horizontal line with the required mantissæ, or on one or more of the lines above such horizontal line and prefixed to the last seven figures of the mantissæ found in the columns headed 1, 2, 3, 4, etc. But whenever a black line is drawn over the last seven figures of any mantissæ found in the columns headed 1, 2, 3, 4, etc., the first three figures necessary to prefix to these seven figures of the required mantissa must be taken from the column headed 0 in the horizontal line immediately under or below that on which the mantissæ of the given numbers are found.

16. The ten columns on the right of the page, headed "Differences 0, 1, 2, 3, 4, etc.," are the differences between any two consecutive logarithms in the table and which will be found on the same horizontal line in juxtaposition with each other. Thus the difference between a logarithm in the column headed 0 and the logarithm on the same horizontal line in the column headed 1 will be found on the same horizontal line in the column of differences headed 0. And the difference between a logarithm in the column headed 1 and that on the same horizontal line in the column headed 2 will be found on the same horizontal line in the column of differences headed 1. The column of differences headed 0 contains the entire differences of six digits, but those headed 1, 2, 3, etc., contain only the last three figures of such difference, and to those must be prefixed the first three figures taken from the column of differences headed 0, either on the same horizontal line or above that line, unless a black line is drawn above the last three figures in any column of difference, when the three figures to be prefixed to the given difference must be taken from the horizontal line below or under such difference in the column headed 0.

Example.—What is the mantissa of 1001? As this mantissa will be the same (12) mantissa with 10010 it will be found on the same horizontal line with the number 1001, and in the vertical column headed 0. But only the last seven figures, viz, 4340775, are found in this column. But in the same column above this horizontal line are found the first three figures, 000, which must be prefixed to the seven already found, when the mantissa for 1001 becomes ·0004340775.

Example.—What is the mantissa of 10022? The last seven figures of this mantissa will be found on the same horizontal line with 1002 and in the vertical column headed 2, and are 9543984; to these must be prefixed the three figures found above this horizontal line in column headed 0, which are 000. The mantissa of 10022 will therefore be ·0009543984.

Example.—What is the mantissa of 10093? The last seven figures of this mantissa will be found on the same horizontal line with 1009 and in the vertical column headed 3, and will be 0202733. But a black line is drawn over these seven figures. The first three figures to be prefixed must on this account be taken from the horizontal line below that on which the last seven figures of the mantissa are found. These first three figures will be 004, and the mantissa for 10093 will be ·0040202733.

Example.—What is the difference between the mantissæ of 10020 and 10021? The mantissa of 10020 is ·0008677215 and that of 10021 is ·0009110621. Their difference will be 433406. On the same horizontal line with 1002 and in the vertical column of differences headed 0, the last three figures of this difference, or 406, are found. To these must be prefixed the first three figures found in the next line above in the vertical column of differences headed 0, which are 433. The required difference between the mantissæ of 10020 and 10021 will then be 433406.

Example.—What is the difference between the mantissæ of 10051 and 10052? The mantissa of 10051 is ·0022092730, and that of 10052 is ·0022524799. Their difference will be 432069. The three figures on the same horizontal line with 10051 and 10052 in the vertical column of differences head 0 are the last three figures of this difference 069, to which must be prefixed the first three figures in the vertical column of differences headed 0, but two lines above the horizontal line of the figures 10051 and 10052. These first three figures are 432. The difference between the mantissæ for 10051 and 10052 will therefore be 432069.

Example.—What is the difference between the mantissæ of 10053 and 10054? The mantissa of 10053 is ·0022956826 and that of 10054 is ·0023388809 and their difference will be 431983. On

the same horizontal line with these mantissæ in the column of differences headed 3, the last three figures of this difference are given as 983, but a black line being drawn over these figures, the first three figures to be prefixed must be taken from the horizontal line below that in which the mantissa is found, in the vertical column headed 0. These are found to be 431. The difference between the mantissæ of 10053 and 10054 will therefore be 431983.

TO FIND, BY THE TABLE, THE LOGARITHM OF A GIVEN NUMBER.

17. To find the logarithm of any number containing less than four digits.

Rule.—Annex the requisite number of zeros until it contains four digits. Look in the left-hand column for the number with zeros annexed, and on the same horizontal line in the column headed 0 the required mantissa will be found.

The zeros annexed will not change the mantissa (12).

The characteristics will be determined by rules already given (13, 14).

Example.—What is the logarithm of 4? Annexing three zeros this becomes 4000, and on the same horizontal line with this number and in the vertical column headed 0 the mantissa will be found and will be ·6020599913. The given number being integral with but one digit will have a characteristic of $1-1=0$. The logarithm of 4 will therefore be 0·6020599913.

Example.—What is the logarithm of 0·37? Annexing two zeros this number becomes 3700, and on the same horizontal line with this number, in the left-hand column, and in the vertical column headed 0 the mantissa will be found and will be ·5682017241. The number being a decimal fraction will have a negative characteristic of one more than the intervening zeros between the decimal point and the first significant figure. There being no intervening zeros, the negative characteristic will be $0+1=1$. Therefore, the logarithm of 0·37 will be $\bar{1}$·5682017241.

Example.—What is the logarithm of 0·0483? Annexing one zero this number becomes 4830, and on the same horizontal line with this number in the vertical column headed 0 the mantissa will be found to be ·6839471308. The number being a decimal fraction will have a negative characteristic of one more than the intervening zeros between the decimal point and the first significant figure. Therefore, the logarithm of 0·0483 will be $\bar{2}$·6839471308.

18. To find the logarithm of any number containing four digits.

Rule.—Look in the left-hand column headed "numbers" and on the same horizontal line with it, in the column headed 0, the required mantissa will be found.

The characteristic will be determined by the rules already given (13, 14).

Example.—What is the logarithm of 5723? On the same horizontal line with this number, in the vertical column headed 0, the mantissa will be found to be ·7576237459. There are four integral figures and the characteristic will be positive and $4-1=3$. Therefore, the logarithm of 5723 will be 3·7576237459.

Example.—What is the logarithm of 0·004732? On the same horizontal line with this number and in the vertical column headed 0, the mantissa will be found to be ·6750447360. The quantity is a decimal fraction and the characteristic will be negative (14). There are two intervening zeros between the decimal point and the first significant figure, and $2+1=3$. The characteristic will therefore be $\bar{3}$. The logarithm of 0·004732 will be $\bar{3}$·6750447360.

19. To find the logarithm of any number containing five figures.

Rule.—The mantissa will be found on the same horizontal line with the first four figures of the given number in the left-hand column of the page, but in the vertical column headed with the last figure.

The characteristic will be found by the rules already given (13, 14).

Example.—What is the logarithm of 574·32? On the same horizontal line with the first four figures, 5743, in the left-hand column, but in the vertical column headed 2, the required mantissa will be found to be ·7591539403. There are three integral figures in the number. The characteristic will be positive and $3-1=2$. The logarithm of 574·32 will be 2·7591539403.

Example.—What is the logarithm of 0·00075463? On the same horizontal line with 7546, but in the vertical column headed 3, the required mantissa will be found to be ·8777340664. The quantity is a decimal fraction and the characteristic will be negative. There are three zeros

between the decimal point and the first significant figure and 3 + 1 = 4. The characteristic will therefore be $\bar{4}$. The logarithm of 0·00075463 will be $\bar{4}$·8777340664.

20. To find the logarithm of any number containing *more than five* figures.

Rule.—Find the mantissa for the first five figures by the rule already given (19). Consider all figures after the fifth as decimals. Multiply this decimal portion of the number by the difference found in the table between the mantissa of the first five figures and the next higher mantissa in the table. Point off the requisite numbers of decimals in the product and add the integral portion of the product to the mantissa of the first five figures, and the sum will be the mantissa of the required number. If the figure in the first decimal place or tenths of the product exceeds five, add unity or 1 to the units of such product; but if the figure in the tenth place is less than five reject the decimal portion of the product and add only the integral portion.

The characteristic will be found by the rules already given (13, 14).

The above rule is based upon the following principle: The differences given in the table correspond with an increase of 1 in the fifth place of any number. Hence the sixth place of any number will correspond with the tenths of such difference, the seventh place with hundredths, and the eighth place with thousandths of such tabular differences; that is, all figures after the fifth place of any number will be decimals of the difference given in the table.

Example.—What is the logarithm of 45732275? The mantissa of 45732 is found in the same horizontal line with 4573, but in the vertical column headed 2, and is ·6602201948. The last three figures of the difference between the mantissæ of 45732 and 45733 are found in the column of differences headed 2 and on the same horizontal line with 4573, and will be 964, to which must be prefixed the first two figures found in the horizontal line above the last three figures, but in the vertical column of differences headed 0, and will be 94. The difference will therefore be 94964. Regarding the last three figures of the given number whose logarithm is required as decimals, and multiplying the difference by the decimal we have 94964 × 0·275 = 26115·100. Then adding the integral portion, we have

Mantissa of 45732=	·6602201948
Add integral portion of product	26115
Mantissa of 45732275=	·6602228063, sum.

The number contains 8 figures wholly integral; the characteristic will therefore be positive and 8 − 1 = 7. Therefore the logarithm of 45732275 will be 7·6602228063.

Example.—What is the logarithm of 0·000034572225? The mantissa of 34572 will be found in the same horizontal line with the number 3457, but in the vertical column headed 2, and will be ·5387245043. The last three figures of the difference between the mantissa of 34572 and 34573 will be found in the column of differences on the same horizontal line with 3457, but in the vertical column headed 2, and will be 619, to which must be prefixed the first three figures taken from the vertical column headed 0, above the horizontal line of the last three figures, and will be 125. The difference will be 125619. Regarding the last three figures of the given number whose logarithm is required as decimals and multiplying the difference by the decimal, we have 125619 × 0·225, or a product of 28264·275. Then adding the integral portion, we have

Mantissa of 34572=	·5387245043
Add integral portion of product	28264
Mantissa of 34572275=	·5387273307, sum.

The number is a decimal fraction with four intervening zeros between the decimal point and the first significant figure. The characteristic will therefore be negative and 4 + $\bar{1}$ = 5. The characteristic will therefore be $\bar{5}$. Therefore the logarithm of 0·000034572225 will be $\bar{5}$·5387273307.

21. To find the number corresponding with a given logarithm.

Rule.—Take from the table the next lower logarithm than the given one with its corresponding number of five places. Subtract the less logarithm from the greater and divide the remainder by the tabular difference of the logarithm given in the table and the next higher one, annexing zeros to the remainder for that purpose. Annex the quotient thus obtained to the number of five places taken from the table and this will be the required number.

The number of integral figures or of intervening zeros in such number will be determined by the characteristic of the given logarithm.

Example.—What is the number corresponding to the logarithm 7·6602228063? The nearest less mantissa in the table is ·6602201948, corresponding to the number 45732. The remainder of ·6602228063—·6602201948=26115. The tabular difference between the numbers 45732 and 45733 is 94964. Then 26115000/94964=275. The required number will be 45732275. The characteristic is positive and 7. There will therefore be eight integral numbers or the entire number will be integral and will be 45732275.

Example.—What is the number corresponding to the logarithm $\bar{5}$·5387273307? The nearest less mantissa in the table is ·5387245043, which corresponds to the number 34572. The remainder of ·5387273307—·5387245043=28264, and the tabular difference between the numbers 34572 and 34573 is 125619. Then 28264000/125619=225. The required number will therefore be 34572225. But the characteristic is negative and $\bar{5}$. There will therefore be four intervening zeros between the decimal point and the first significant figure. The required number will be 0·000034572225.

COMPUTATION OF NEGATIVE CHARACTERISTICS.

22. Computations of logarithms with negative characteristics are made in accordance with the rules of algebraic addition and subtraction, but it must be remembered that as the characteristics only are negative and the mantissæ positive (11) all numbers carried forward from the mantissæ are positive and must either be added to the positive characteristics or subtracted from the negative ones.

23. To add negative characteristics.

Rule.—Add them together and give the sum a negative sign; but if any numbers are carried forward from the mantissæ such numbers must be subtracted from either of the negative characteristics.

Example.—What is the product of 0·425 and 0·225?

The logarithm of 0·425 is	$\bar{1}$·6283889301
The logarithm of 0·225 is	$\bar{1}$·3521825181
The logarithm of 0·095625 is	$\bar{2}$·9805714482 sum.

No numbers being carried from the mantissæ, the characteristic of the sum is a negative quantity equal to the sum of the negative characteristics.

Example.—What is the product of 0·563 and 0·0725?

The logarithm of 0·563 is	$\bar{1}$·7505083949
The logarithm of 0·0725 is	$\bar{2}$·8603380066
The logarithm of 0·0408175 is	$\bar{2}$·6108464015 sum.

The +1 carried forward from the mantissæ reduces the $\bar{2}$ to $\bar{1}$ and the sum of −1 and −1 = −2.

24. To add positive and negative characteristics.

Rule.—Subtract the less from the greater and give to the difference the sign of the greater. If there are more than two factors in the numbers, add all the positive characteristics in one sum and all the negative characteristics in the other and subtract the less from the greater and give to the difference the sign of the greater; but if any numbers are carried forward from the mantissæ, such numbers must either be added to the positive characteristics or subtracted from the negative characteristics.

Example.—What is the product of 0·235 and 34·5?

The logarithm of 0·235 is	$\bar{1}$·3710678623
The logarithm of 34·5 is	1·5378190951
The logarithm of 8·1075 is	0·9088869574 sum.

There are no numbers carried over from the mantissæ and the +1 and −1 cancel each other, so that the characteristics +1 −1 = 0.

Example.—What is the product of 0·365 and 3·256?

The logarithm of 0·365 is	$\bar{1}$·5622928645
The logarithm of 3·256 is	0·5126843962
The logarithm of 1·18844 is	0·0749772607 sum.

The +1 carried from the mantissæ increases the 0 to 0+1=1 and +1−1=0, or the same +1 carried from the mantissæ reduces the −1 to 0 since +1−1=0.

Example.—What is the continued product of 356, 254, 0·0745, and 0·00643?

The logarithm of 356 is	2·5514499980
The logarithm of 254 is	2·4048337166
The logarithm of 0·0745 is	$\bar{2}$·8721562727
The logarithm of 0·00643 is	$\bar{3}$·8082109729
The logarithm of 43·31626084 is	1·6366509602 sum.

The positive 2 carried forward from the mantissæ will cancel the −2 in the characteristic. The sum of the positive indices are 2+2=4, and 4−3=1, which is the required characteristic. Also the +2 carried forward from the mantissæ may be added to the positive characteristics and 2+2+2=6. The sum of the negative characteristics are 2 and 3=−5 and 6−5=+1 as before.

25. To subtract a negative characteristic.

Rule.—Change its sign from− to + then add it by the preceding rules (23, 24); but if any numbers are borrowed in the mantissæ such numbers must be subtracted from a positive or added to a negative characteristic.

Example.—What is the quotient of 4·345 divided by 0·0245?

Logarithm of 4·345 is	0·6379897808
Logarithm of 0·0245 is	$\bar{2}$·3891660844
Logarithm of 177·3469 is	2·2488236964 difference.

The −2 by the above rule is changed to +2, and as nothing has been borrowed from the mantissæ the sum of 0+2=+2. The characteristic will therefore be +2.

Example.—What is the quotient of 2·445 divided by 0·0424?

Logarithm of 2·445 is	0·3882788635
Logarithm of 0·0424 is	$\bar{2}$·6273658566
Logarithm of 57.665 is	1·7609130069 difference.

The −2 is changed to +2 and the 1 borrowed from the mantissæ must be subtracted and +2−1=1. The characteristic is therefore +1.

26. To multiply a logarithm having a negative characteristic.

Rule.—Multiply both mantissa and negative characteristic by the given number. The latter product will be negative, and if any numbers are carried forward from the mantissa, subtract such numbers from the negative product.

Example.—What is the square of 0·25?

Logarithm of 0.25 is	$\bar{1}$·3979400087
Exponent of the square is	2
Logarithm of 0.0625 is	$\bar{2}$·7958800174 product.

No numbers are carried from the mantissa so that −1×2=−2, which is the characteristic.

Example.—What is the cube of 0·24?

Logarithm of 0·24 is	$\bar{1}$·3802112417
Exponent of the cube is	3
Logarithm of 0·013824 is	$\bar{2}$·1406337251 product.

27. To divide a logarithm having a negative characteristic.

Rule.—If the characteristic is divisible by the divisor without any remainder, write down the quotient of such division with a negative characteristic and divide the mantissa by the ordinary rule.

But if the characteristic is not divisible by the divisor without remainder, add such a negative number to the characteristic as will make it divisible without remainder and prefix an equal positive characteristic to the mantissa and divide the increased characteristic separately from the increased mantissa, the positive characteristic prefixed to the mantissa being considered a portion of such mantissa.

Example.—What is the square root of 0·0144?

Logarithm of 0·0144 is $\frac{\bar{2}\cdot1583624921}{2}$ $\quad 2\cdot\ 2\cdot1583624921$

Index of root is $\quad \bar{1}\cdot0791812460$

Logarithm of 0·12 is $\bar{1}\cdot0791812460$.

Example.—What is the cube root of 0·064?

The logarithm of 0·064 is $\frac{\bar{2}\cdot8061799740}{3} = \frac{\bar{2}\cdot+\bar{1}\cdot+1\cdot8061799740}{3}$ $\quad 3\,|\,\bar{3}+1\cdot8061799740$

Index of root is $\quad \cdot6\bar{1}020599913$

The logarithm of $0\cdot4+\bar{1}\cdot6020599913$.

The negative index $\bar{2}$ not being divisible by 3 requires 1 to be added and then becomes 3. An additional 1 must also be added to the mantissa and such mantissa divided as if the prefixed 1 formed part of the mantissa. These additions do not affect the value of the logarithm, since $1-1=0$.

POSITIVE CHARACTERISTICS.

28. The characteristic of a decimal fraction being negative and the mantissa positive (11) different portions of the same quantity are affected by opposite signs. This leads to confusion and error. If some method could be devised by which positive characteristics can be given to the logarithms of decimal fractions this confusion and error would be avoided. The arithmetical complement enables us to effect this change.

29. The arithmetical complement of any number is the difference between that number and the unit of the next higher order; that is, the difference between the given number and unity, or 1, with as many zeros annexed as there are digits in the given number. Thus the arithmetical complement of 6 is $10-6=4$; that of 18 is $100-18=82$, and that of 245 is $1000-245=755$.

30. To find the difference between two numbers the less must be subtracted from the greater and the remainder will be the difference. But the same result can be obtained by adding one number to the arithmetical complement of the other, and from their sum deducting the unit by which the arithmetical complement was obtained.

Thus, $25-6=19$, also, $25+4-10=19$;
again, $92-18=74$, also, $92+82-100=74$;
again, $350-245=105$, also, $350+755-1000=105$.

Hence by substituting the arithmetical complement of the negative characteristic of a decimal fraction for the negative characteristic of such decimal fraction we can change the sign of such characteristic from negative to positive.

31. This change can be effected by the following rule:

Rule.—Subtract the negative characteristic from 10, the difference will be the required arithmetical complement of such negative characteristic and will also be the positive characteristic required, or

Subtract the number of intervening zeros between the decimal point and the first significant figure from 9; the difference will be the required positive characteristic; and should such intervening zeros exceed 9 subtract such number of intervening zeros from 19. Any decimal fraction with 9 intervening zeros between the decimal point and the first significant figure, as 0·0000000001 is $\frac{1}{10000000000}$, or one ten thousand millionth part of unity or 1. This quantity is so very small that in all computations with logarithms of decimal fractions with positive characteristics it is usual to retain only the units and reject the tens of such positive characteristics.

Example.—What is the logarithm of 0·125 with a negative and also with a positive characteristic?

With a negative characteristic it is $\bar{1}$·0969100130
With a positive characteristic it is 9·0969100130

In both cases the mantissa is the same, but the characteristics are each the arithmetical complement of the other. The negative characteristic being (14) one more than the number of the intervening zeros between the decimal point and the first significant figure is $0+1=1$. The positive characteristic being the arithmetical complement of the negative characteristic (31) is $10-1=9$, and also being the difference between 9 and the number of the intervening zeros between (31) the decimal point and the first significant figure is $9-0=9$.

Example.—What is the logarithm of 0·000000000345 with a negative and also with a positive characteristic?

With a negative characteristic it is $\bar{10}$·5378190951
With a positive characteristic it is 0·5378190951

Both mantissæ are alike, and the characteristics only differ. There being 9 intervening zeros between the decimal point and the first significant figure, the negative characteristic will be $9+1=10$, and the positive characteristic will be $9-9=0$.

32. The arithmetical complement of the characteristic only of a logarithm, in order to change such characteristic from negative to positive, must not be confounded with the arithmetical complement of the entire logarithm. In the first case the arithmetical complement of the characteristic only is taken, the mantissa remaining unchanged, and in the second case the arithmetical complement of the entire logarithm, that is, of both characteristic and mantissa is taken.

33. The arithmetical complement of the entire logarithm of any number is the logarithm of the reciprocal of that number, or the logarithm of unity or 1 divided by the given number. If the number is integral or mixed and not fractional, such logarithm of a reciprocal will be that of a decimal fraction with a positive characteristic.

This arithmetical complement of an entire logarithm is often used in logarithmic computations, and is thus determined:

To find the arithmetical complement of an entire logarithm.

Rule.—Subtract the characteristic and mantissa of the given logarithm from 10; the difference will be the required arithmetical complement; or,

Beginning on the left, subtract the characteristic and each digit of the given logarithm, except the last significant digit, from 9, but subtract the last, or last significant digit, from 10; the difference will be the required arithmetical complement.

Example.—What is the arithmetical complement of the logarithm corresponding with the number 25?

From	10·0000000000
Subtract the logarithm of 25, which is	1·3979400087
Logarithm of 0·04 is	8·6020599913 difference.

The reciprocal of 25 is $1/25 = 0{\cdot}04$, a decimal fraction of which 8·6020599913 is the logarithm with a positive characteristic.

Example.—What is the arithmetical complement of the logarithm corresponding to the number 125?

From	10·0000000000
Subtract the logarithm of 125, which is	2·0969100130
Logarithm of 0·008 is	7·9030899870 difference.

The tenth or last figure on the right of the mantissa being zero, the subtraction begins with the next to the last or ninth figure of the mantissa.

The reciprocal of 125 is $1/125 = 0{\cdot}008$, a decimal fraction of which 7·9030899870 is the logarithm with a positive characteristic.

MULTIPLICATION BY LOGARITHMS.

34. Since the addition of logarithms is equivalent to the multiplication of their corresponding numbers (3), the product of two or more factors can be determined as follows:

Rule.—Find the logarithms of all factors, add these logarithms, and their sum will be the logarithm of the required product.

If any of these factors are decimal fractions, and their logarithms have negative characteristics, the algebraic sum of the characteristics must be taken, and any number carried over from the mantissæ must be added to the sum of the positive or subtracted from the sum of the negative characteristics (23, 24).

If any of these factors are decimal fractions, and their logarithms have positive characteristics, the units only of the sum of the characteristics must be retained and the tens rejected (31).

Example.—What is the continued product of 25, 45, and 48?

The logarithm of 25 is	1·3979400087
The logarithm of 45 is	1·6532125138
The logarithm of 48 is	1·6812412374
The logarithm of 54000 is	4·7323937599 sum.

Example.—What is the product of 22, 0·024, 0·0015, and 35?

First.—By negative characteristics.

The logarithm of 22 is	1·3424226808
The logarithm of 0·024 is	$\bar{2}$·3802112417
The logarithm of 0·0015 is	$\bar{3}$·1760912591
The logarithm of 35 is	1·5440680444
The logarithm of 0·0277200 is	$\bar{2}$·4427932260 sum.

Second.—The same, by positive characteristics.

The logarithm of 22 is	1·3424226808
The logarithm of 0·024 is	8·3802112417
The logarithm of 0·0015 is	7·1760912591
The logarithm of 35 is	1·5440680444
The logarithm of 0·0277200 is	8·4427932260 sum.

DIVISION BY LOGARITHMS.

35. Since the subtraction of logarithms is equivalent to the division of their numbers (4), division by logarithms is performed as follows:

Rule.—Subtract the logarithm of the divisor from the logarithm of the dividend; the difference will be the logarithm of the quotient.

If the logarithm of either divisor or dividend is that of a decimal fraction with a negative characteristic, change the sign of the characteristic of the divisor from plus to minus or from minus to plus and proceed as in addition (23, 24), and if any numbers are borrowed from the mantissæ such numbers must either be subtracted from the positive or added to the negative characteristic.

If any quantities are decimal fractions with positive characteristics, or if the characteristic of the divisor is less than the characteristic of the dividend, 10 must be borrowed for the characteristic of the dividend and the units of the characteristic of the difference only retained and the tens rejected.

Example.—Divide 144 by 12.

Logarithm of 144 is	2·1583624921
Logarithm of 12 is	1·0791812460
Logarithm of 12 is	1·0791812461 difference.

Example.—Divide 132 by 0·0033.

	Negative characteristics.	Positive characteristics.
Logarithm of 132 is	2·1205739312	2·1205739312
Logarithm of 0.0033 is	$\bar{3}$·5185139399	7·5185139399
Logarithm of 40000 is	4·6020599913 dif.	4·6020599913 difference.

Example.—Divide 0·125 by 0·5.

	Negative characteristics.	Positive characteristics.
Logarithm of 0·125 is	$\bar{1}$·0969100130	9·0969100130
Logarithm of 0·5 is	$\bar{1}$·6989700043	9·6989700043
Logarithm of 0·25 is	$\bar{1}$·3979400087 dif.	9·3979400087 difference.

36. Division can also be performed by the arithmetical complement.

Rule.—Add the arithmetical complement (33) of the logarithm of the divisor to the logarithm of the dividend; their sum will be the logarithm of the quotient if we retain only the units and reject the tens in the characteristic of the sum.

To show the same results we will use the same examples.

Example.—Divide, by arithmetical complement, 144 by 12.

Logarithm of 144 is	2·1583624921
Logarithm of 12 is 1·0791812460	
whose arithmetical complement is	8·9208187540
Logarithm of 12 is	1·0791812461 sum.

Example.—Divide by arithmetical complement 132 by 0·0033.

	Negative characteristics.
Logarithm of 132 is	2·1205739312
Logarithm of 0·0033 is $\bar{3}$.5185139399	
whose arithmetical complement is	2·4814860601
Logarithm of 40000 is	4·6020599913 sum.

	Positive characteristics.
Logarithm of 132 is	2·1205739312
Logarithm of 0·0033 is 7.5185139399	
whose arithmetical complement is	2·4814860601
Logarithm of 40000 is	4·6020599913 sum.

Example.—Divide by arithmetical complement 0·125 by 0·5.

	Negative characteristics.
Logarithm of 0·125 is	$\bar{1}$·0969100130
Logarithm of 0·5 is $\bar{1}$.6989700043	
whose arithmetical complement is	0·3010299957
Logarithm of 0·25 is	$\bar{1}$·3979400087 sum.

	Positive characteristics.
Logarithm of 0·125 is	9·0969100130
Logarithm of 0·5 is 9.6989700043	
whose arithmetical complement is	0·3010299957
Logarithm of 0·25 is	9·3979400087 sum.

PROPORTION BY LOGARITHMS.

37. When the first three terms of a proportion are given the fourth term can be determined by multiplying the second and third terms and dividing the product by the first term; the quotient will be the required fourth term. Hence the rule:

Rule.—Add the logarithms of the second and third terms by the rule already given (34), and from such sum subtract the logarithm of the first term by the rule already given (35); the difference will be the logarithm of the fourth term.

Example.—What is the fourth term in the proportion 24:72::36:?

The logarithm of	36 is	1·5563025008
The logarithm of	72 is	1·8573324964
The logarithm of	2592 is	3·4136349972 sum.
The logarithm of	24 is	1·3802112417
The logarithm of	108 is	2·0334237555 difference.

38. Proportion can also be solved by arithmetical complement by the following rule:

Rule.—Add the logarithm of the second and third terms to the arithmetical complement (33) of the first term (36); the sum will be the logarithm of the required fourth term, retaining only the units of the characteristic.

NOTE.—To reach like results the same example will be used.

Example.—What is the fourth term in the proportion 24:72::36:?

Logarithm of	36 is	1·5563025008
Logarithm of	72 is	1·8573324964
Logarithm of	24 is 1·3802112417 whose arithmetical complement is	8·6197887583
Logarithm of	108 is	2·0334237555

INVOLUTION BY LOGARITHMS.

39. Since the product of a logarithm by any exponent will be the logarithm of that power of the corresponding number of which the exponent is the index (5), we can perform involution by logarithms as follows:

Rule.—Multiply the logarithm of the given number by the exponent of the power. The product will be the logarithm of the required power.

If the given number is a decimal fraction and its logarithm has a negative characteristic, any number carried over from the mantissa must be subtracted from such negative characteristic after the same has been multiplied by the exponent of the power (26).

If the logarithm of the given number is that of a decimal fraction with a positive characteristic, the units only of the product of such characteristics must be retained and the tens rejected; or multiply the exponent of the power by 10 and from this product subtract the product of the positive characteristic, and from this difference again subtract 1. The last difference will be the number of intervening zeros between the decimal point and the first significant figure of the number corresponding to the involved logarithm.

Example.—What is the square or second power of 22?

The logarithm of	22 is	1·3424226808
The exponent of the second power is		2
The logarithm of	484 is	2·6848453616 product.

Example.—What is the fourth power of 0·9?

	Negative characteristics.	Positive characteristics.
The logarithm of 0·9 is	$\bar{1}$·9542425094	9·9542425094
The exponent of the power is	4	4
The logarithm of 0·6561 is	$\bar{1}$·8169700376	39·8169700376

Thus the characteristic of the involved logarithm will be 39, and ten times the exponent of the power will be $10 \times 4 = 40$. Then $40 - 39 = 1$, and $1 - 1 = 0$. So that there will be no intervening zero between the decimal point and the first significant figure of the number corresponding to the involved logarithm, which will therefore be 0·6561.

EVOLUTION BY LOGARITHMS.

40. If the logarithm of a number is divided by any number the quotient will be the logarithm of that root of the corresponding number of which the divisor is the index (6). Hence evolution can be performed by the following:

Rule.—Divide the logarithm of the given number by the index of the root; the quotient will be the logarithm of the required root.

If the given number is a decimal fraction and its logarithm has a negative characteristic not divisible by the index of the required root, add to the negative characteristic such a number as will make it a multiple of the given index of the root, and prefix to the mantissa a like positive number to that added to the negative characteristic, and divide the negative characteristic and the mantissa with the positive number prefixed by the index of the required root; the quotient will be the logarithm of the required root.

If the given number is a decimal fraction and its logarithm has a positive characteristic, subtract unity or 1 from the given index of the root and prefix the difference to the positive characteristic and divide by the index of the required root. The quotient will be the logarithm of the required root (27).

Example.—What is the cube root of 226981?

The logarithm of 226981 is 5·3559895050. The index of the root is 3. $\frac{5\cdot3559895050}{3} = 1\cdot7853298350.$ The logarithm of 61 is 1·7853298350.

Example.—What is the cube root of 0·000658503, performing the operation both with negative and positive characteristics?

BY NEGATIVE CHARACTERISTICS.

The logarithm of $0\cdot000658503 = \bar{4}\cdot8185577579$. The index of the root is 3, of which the negative characteristic $\bar{4}$ is not a multiple. But by adding $\bar{2}$ to $\bar{4}$ this negative characteristic becomes $\bar{6}$, which is a multiple of 3. We must also prefix a similar positive number (+2) to the mantissa. The logarithm then becomes $\bar{6} + 2.8185577579$ and $\frac{\bar{6}+2\cdot8185577579}{3} = \bar{2}\cdot9395192526.$

The logarithm of 0·087 is $\bar{2}\cdot9395192526$.

BY POSITIVE CHARACTERISTICS.

The logarithms of 0·000658503 is 6·8185577579. The index of the root is 3; the prefix required will be $3-1=2$. Then with this prefix the dividend becomes $\frac{26\cdot8185577579}{3} = 8\cdot9395192526.$

The logarithm of 0·087 is 8·9395192526.

COMPUTATION OF LOGARITHMS.

41. By a careful examination of the equation (1), in article 3,

$$B^x = N,$$

in which x is the logarithm of any number N and B the base of the system (2), it is evident that

(*a*) The logarithm of a number consists of two factors, one of which depends on the number itself and the other on the base of the system in which the logarithm is taken; that

(*b*) The factor depending on the base is called the modulus of the system of logarithms, and that

(*c*) The logarithms of the same number in two different systems are to each other as the moduli of those systems; and the modulus of the common system is equal to the common logarithm of any number divided by the natural logarithm of the same number.

If we designate the logarithm of any number of the common system by log and of the natural system by $\log^1$ and the modulus of the common system by M, we have

$$M = \frac{\log}{\log^1}$$

42. In the natural system of logarithms the modulus is unity or 1, the base is 2·71828128, and the logarithm of 10 is 2·30258509299404568401799l; hence

$$M=\frac{\log}{\log^1}=\frac{1}{2\cdot30258509299404568401799l}=0\cdot434294481903251827651128+\cdot$$

On account of the importance of the modulus M, its value has been calculated with great exactness and is

M=0·434294481903251827651128918916605082294397005804.

43. The following formula is the most convenient for computing logarithms where the number is small and great accuracy is requisite: Log (P+1)=Log $P+\frac{2A}{2P+1}+\frac{B}{3(2P+1)^2}+\frac{3C}{5(2P+1)^2}+\frac{5D}{7(2P+1)^2}+\frac{7E}{9(2P+1)^2}+\frac{9F}{11(2P+1)^2}+\frac{11G}{13(2P+1)^2}+\frac{13H}{15(2P+1)^2}+\frac{15I}{17(2P+1)^2}+\frac{17J}{19(2P+1)^2}+\frac{19K}{21(2P+1)^2}+\frac{21L}{23(2P+1)^2}+\frac{23M}{25(2P+1)^2}+\frac{25N}{27(2P+1)^2}+\frac{27O}{29(2P+1)^2}$

In the above formula P=any number: A=modulus of the system which in the common or Briggs system is 0·434294481903251827651+. Each member of the formula is determined by the preceding member: Thus B, the numerator of the third member, is determined by the preceding or second member, $B=\frac{2A}{2P+1}$, $C=\frac{B}{3(2P+1)^2}$, and $D=\frac{3C}{5(2P+1)^2}$

The coefficients of both numerator and denominator are odd numbers in every term after the third, and in each succeeding term both numerator and denominator are increased by two: Thus in the fourth term the coefficient of the numerator is 3, that of the denominator is 5, and in the fifth term the coefficient of the numerator is 5 and that of the denominator is 7.

Then knowing any number and its logarithm, or P and Log P, we can determine the logarithms of the next number in numerical order, or Log (P+1).

When the number exceeds 1 500, the correct logarithm to the twelfth place of decimals in the mantissa may be determined by using only the first three terms of the formula.

Example.—What is the mantissa of 2 to fifteen places of decimals?

P=1. 2P=2. 2P+1=(2×1)+1=2+1=3. $(2P+1)^2=3\times3=9$.

Log P=1=·000000000000000

$$B=\frac{2A}{2P+1}=\frac{2\times0\cdot434294481903252}{2\times1+1}=\frac{0\cdot868588963806504}{3}=\cdot289529654602168$$

$$C=\frac{B}{3(2P+1)^2}=\frac{0\cdot289529654602168}{3\times9}=\frac{0\cdot289529654602168}{27}=\cdot010723320540821$$

$$D=\frac{3C}{5(2P+1)^2}=\frac{3\times0\cdot010723320540821}{5\times9}=\frac{0\cdot032169961622463}{45}=\cdot000714888036055$$

$$E=\frac{5D}{7(2P+1)^2}=\frac{5\times0\cdot000714888036055}{7\times9}=\frac{0\cdot003574440180275}{63}=\cdot000056737145718$$

$$F=\frac{7E}{9(2P+1)^2}=\frac{7\times0\cdot000056737145718}{9\times9}=\frac{0\cdot000397160020026}{81}=\cdot000004903210124$$

$$G=\frac{9F}{11(2P+1)^2}=\frac{9\times0\cdot000004903210124}{11\times9}=\frac{0\cdot000044128891116}{99}=\cdot000000445746375$$

$$H=\frac{11G}{13(2P+1)^2}=\frac{11\times0\cdot000000445746375}{13\times9}=\frac{0\cdot000004903210125}{117}=\cdot000000041907779$$

$$I=\frac{13H}{15(2P+1)^2}=\frac{13\times0\cdot000000041907779}{15\times9}=\frac{0\cdot000000544801127}{135}=\cdot000000004035564$$

$$J=\frac{15I}{17(2P+1)^2}=\frac{15\times0\cdot000000004035564}{17\times9}=\frac{0\cdot000000060533460}{153}=\cdot000000000395644$$

$$K=\frac{17J}{19(2P+1)^2}=\frac{17\times 0{\cdot}000000000395644}{19\times 9}=\frac{0{\cdot}000000006725948}{171}=\cdot 000000000039333$$

$$L=\frac{19K}{21(2P+1)^2}=\frac{19\times 0{\cdot}000000000039333}{21\times 9}=\frac{0{\cdot}000000000747327}{189}=\cdot 000000000003954$$

$$M=\frac{21L}{23(2P+1)^2}=\frac{21\times 0{\cdot}000000000003954}{23\times 9}=\frac{0{\cdot}000000000083034}{207}=\cdot 000000000000401$$

$$N=\frac{23M}{25(2P+1)^2}=\frac{23\times 0{\cdot}000000000000401}{25\times 9}=\frac{0{\cdot}000000000009223}{225}=\cdot 000000000000041$$

$$O=\frac{25N}{27(2P+1)^2}=\frac{25\times 0{\cdot}000000000000041}{27\times 9}=\frac{0{\cdot}000000000001025}{243}=\cdot 000000000000004$$

Logarithm of $2=\text{Log } 1+B+C+D+E+F+G+H+I+J+K+L+M+N+O=\cdot 301029995663981$

Example.—What is the mantissa of 1523 to twelve places of decimals?

$P=1522.\quad P+1=1522+1=1523.\quad 2P+1=3044+1=3045.\quad (2P+1)^2=9272025.$

$$\text{Log } P=1522=\cdot 182414652508$$

$$B=\frac{2A}{2P+1}=\frac{2\times 0{\cdot}434294481903}{2\times 1522+1}=\frac{0{\cdot}868588963806}{3045}=\cdot 000285250891$$

$$C=\frac{B}{3(2P+1)^2}=\frac{0{\cdot}000285250891}{3\times 9272025}=\frac{0{\cdot}000285250891}{27816075}=\cdot 000000000012$$

Logarithm of $1523=\text{Log } 1522+B+C=\cdot 182699903411$

INTERPOLATION OF SERIES.

44. When numbers are calculated by formula and arranged in regular series (as they are in a table of logarithms of numbers) the logarithm of any intermediate number may be found by interpolation of series. This method is as follows:

Take from the logarithmic table the logarithms of four consecutive numbers in regular series, the two which precede and the two which follow that of the required number. From these logarithms find the three first differences, the two second differences, and the mean of the second differences as shown in the subjoined table. The required logarithm can be determined by the following formula, in which L= the required logarithm, l= the logarithm of the nearest less number in the table, f= the fractional interval exceeding the nearest less number, d= the second or central one of the three first differences, and d^1= the mean of the two second differences. Then

$$L=l+f\left(d+\frac{f-1}{2}d^1\right)$$

Example.—Having in the table of logarithms the consecutive numbers 1034, 1035, 1036, and 1037, it is required to find the logarithm of 1035·5.

Numbers.	Logarithms.	First differences.	Second differences.	Mean differences.
1034	3·0145205388			
1035	3·0149403498	0·0004198110		
1036	3·0153597554	0·0004194056	—0·0000004054	
1037	3·0157787564	0·0004190010	—0·0000004046	—0·0000004050

l=logarithm of nearest less number $=1035=3{\cdot}0149403498.$

f=fractional interval $=0{\cdot}5$, $d=0{\cdot}0004194056$, $f-1=-0{\cdot}5$ and $d^1=-0{\cdot}0000004050.$

$$L=3{\cdot}0149403498+0{\cdot}5(0{\cdot}0004194056+\frac{-0{\cdot}5}{2}\times -0{\cdot}0000004050)=3{\cdot}0149403498+0{\cdot}0002097534250$$

$$=3{\cdot}015150103225.$$

45. In a table of logarithms of numbers the logarithms of the prime numbers only need be computed. The logarithms of composite numbers can be found by adding the logarithms of their factors. Then the logarithm of any number being known, we can determine all its powers (39) and also its reciprocal (33).

Indeed we can go further, and since the mantissæ of the same arrangement of numbers, whether integral or fractional, are the same (12) we can find the mantissæ of other numbers. Thus, knowing the mantissa of the number 2, we can also find that of 4, since 4 is the square of 2. We can also find the mantissa of 5, since $2/4=0{\cdot}5$. The mantissa of 0·5 is found by subtracting the logarithm of 4 from that of 2, the difference will be the mantissa of 5. We can also find 5 as a reciprocal, $1/2=0{\cdot}5$, so that the arithmetical complement of the mantissa of 2 will be the mantissa of 0·5 (33).

Thus the mantissa of 2 being ·3010299957 and $2\times{\cdot}3010299957={\cdot}6020599914$ is the mantissa of 4; also ·3010299957 − ·6020599914 = ·6989700043, rejecting the characteristic, is the mantissa of 5. We also have determined the mantissa of 5 as a reciprocal, since $1/5=0{\cdot}2$. Hence 10·0000000000 − ·3010299957, rejecting the characteristic, becomes ·6989700043, which is the mantissa of 5.

COMPUTATION OF NUMBERS CORRESPONDING TO GIVEN LOGARITHMS.

46. The foregoing formulæ determine the required logarithm for any given number. It is also necessary to determine the required number corresponding to any given logarithm. In the exponential formula

$$e^x = 1+\frac{x}{1}+\frac{x^2}{1\cdot2}+\frac{x^3}{1\cdot2\cdot3}+\frac{x^4}{1\cdot2\cdot3\cdot4}+\frac{x^5}{1\cdot2\cdot3\cdot4\cdot5}+\cdots\cdots$$

if we substitute N for e^x, then $x = \log \mathrm{N}$, and the formula becomes

$$\mathrm{N}=1+\frac{\log \mathrm{N}}{1}+\frac{(\log \mathrm{N})^2}{1\cdot2}+\frac{(\log \mathrm{N})^3}{1\cdot2\cdot3}+\frac{(\log \mathrm{N})^4}{1\cdot2\cdot3\cdot4}+\frac{(\log \mathrm{N})^5}{1\cdot2\cdot3\cdot4\cdot5}+\cdots\cdots$$

which can be adapted to the common system of logarithms by multiplying by the modulus of that system or $\mathrm{M}=0{\cdot}4342944819$.

47. This series, however, converges too slowly for practical computation. This complicated problem has been solved by Dr. Artemas Martin, a distinguished mathematician of the United States Coast and Geodetic Survey, and his very full discussion of this problem will be found in Volume II, number (No. 11) of the Mathematical Magazine on pages 237–240 of that number. Dr. Martin's formula is as follows:

Let a be the given logarithm, N the required number, and M the modulus (41, b) of the common system. Then

Log $\mathrm{N}=a$; assuming $\mathrm{N}=10^m(1+x)$, we find

$$\mathrm{N}=10^m\left[1+\left(\frac{a-m}{\mathrm{M}}\right)+\frac{1}{1\cdot2}\left(\frac{a-m}{\mathrm{M}}\right)^2+\frac{1}{1\cdot2\cdot3}+\left(\frac{a-m}{\mathrm{M}}\right)^3+\frac{1}{1\cdot2\cdot3\cdot4}+\left(\frac{a-m}{\mathrm{M}}\right)^4+\right.$$
$$\left.\frac{1}{1\cdot2\cdot3\cdot4\cdot5}+\left(\frac{a-m}{\mathrm{M}}\right)^5\cdots\cdots\right]$$ this becomes

$$\mathrm{N}=10^m\left[1+\left(\frac{a-m}{\mathrm{M}}\right)+\frac{1}{2}\left(\frac{a-m}{\mathrm{M}}\right)^2+\frac{1}{6}\left(\frac{a-m}{\mathrm{M}}\right)^3+\frac{1}{24}\left(\frac{a-m}{\mathrm{M}}\right)^4+\frac{1}{120}\left(\frac{a-m}{\mathrm{M}}\right)^5+\frac{1}{720}\left(\frac{a-m}{\mathrm{M}}\right)^6+\cdots\right]$$

Example.—What number corresponds with the logarithm 2·1003242176? Since the characteristic is 2, we know that the number will be greater than 100 and less than 1000 (13); therefore

$m=2$. $10^m=10^2=100$, and $\frac{a-m}{\mathrm{M}}=\frac{2{\cdot}1003242176-2{\cdot}0000000000}{0{\cdot}4342944819}=0{\cdot}2310050479$; therefore

$$\mathrm{N}=100\left[1+0{\cdot}2310050479+\frac{1}{2}(0{\cdot}2310050479)^2+\frac{1}{6}(0{\cdot}2310050479)^3+\frac{1}{24}(0{\cdot}2310050479)^4+\right.$$
$$\left.\frac{1}{120}(0{\cdot}2310050479)^5+\frac{1}{720}(0{\cdot}2310050479)^6+\right]=125{\cdot}98656$$

The required number for the given logarithm 2·1003242176 is 125·98656.
This result can be verified by the tables, as follows:

Logarithm of 125·98 is	2·1003016040
Difference 344719 × 0·656 is	226136

Therefore 125·98656 is the number corresponding to logarithm 2·1003242176

CIRCULAR FUNCTIONS.

48. Angles are measured by the arc of a circle inclosed between their sides, the angular point being at the center of the circle. Thus (Fig. 1) the angle D C E is measured by the arc A B, whose center is at the angular point C.

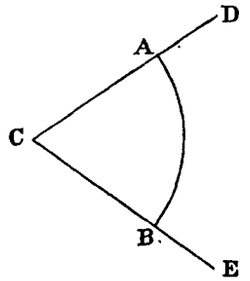

Fig. 1.

For the measurement of angles the entire circumference of the circle is divided into 360 degrees, each degree into 60 minutes, and each minute into 60 seconds. If two diameters of a circle are drawn at right angles to each other they will divide the circle into four equal parts, each of which will be $\frac{360°}{4} = 90°$. Hence every right angle is measured by an arc of 90°.

49. The *complement* of any angle is the difference between that angle and 90°. Thus the complement of 35° is $90° - 35° = 55°$, and that of 25° is $90° - 25° = 65°$, and that of 75° is $90° - 75° = 15°$.

50. The *supplement* of any angle is the difference between that angle and 180°. Thus the supplement of 48° is $180° - 48° = 132°$, and that of 76° is $180° - 76° = 104°$.

51. The sides of plane triangles are straight lines, and are therefore determined and compared by linear measure whose unit is the foot or metre. The angles of such triangles are measured by arcs of circles, and therefore compared by circular measure whose unit is the degree. There is no common standard to which the foot or metre and degree can be referred and by which they can be compared. Mathematicians are therefore compelled to refer the angles of plane triangles to certain straight lines which are functions of circular arcs by which angles are measured, and are hence called circular functions. As these lines are absolutely necessary in the computations of triangles, they are also called trigonometrical functions.

There are six circular or trigonometrical functions, namely: The sine, the cosine, the tangent, the cotangent, the secant, and the cosecant.

The cosine, cotangent, and cosecant are complements (49) of the sine, tangent, and secant, the prefix co being an abbreviation of the word complement.

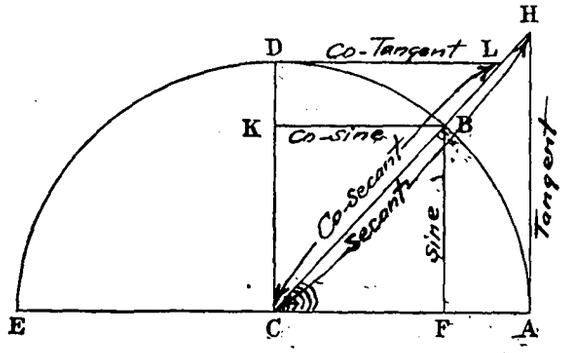

Fig. 2.

52. From D (fig. 2) let fall the perpendicular DC upon the line AE, and from the point of intersection C describe the semicircumference ABDE. Then the arc ABDE will be one of 180°, the arcs DE and AD will each be a quadrant or quarter of a circle, and the angles ACD and ECD will each be a right angle. Also the arc AB will be the complement of the arc BD (49). The arc AB will also be the supplement (50) of the arc BDE.

53. The sine of an arc or an angle is the perpendicular let fall from one extremity of that arc upon the diameter drawn through the other extremity. Thus BF (fig. 2), is the sine of the arc AB or of the angle BCA.

54. The cosine of an arc is the sine of its complement; therefore, as BD (fig. 2) is the complement of AB (49), BK the sine of BD is the cosine of the arc AB or of the angle ACB. But BK = CF. Hence the cosine of an arc is the line drawn from the center of the circle to the foot of the sine or CF.

55. The tangent of an arc or angle is a line drawn from one extremity of an arc at right angles to the diameter drawn through such extremity, and continued thence until it intersects the

line drawn from the center of the circle through the other extremity of such arc. Thus AH is the tangent of the arc AB (fig. 2) and DL the tangent of the arc BD.

56. The cotangent of an arc is the tangent of the complement of that arc. Thus DL (fig. 2), which is the tangent of the arc DB, is the cotangent of the arc AB.

57. The secant of an arc is the line drawn from the center of the circle through one extremity of the arc until it intersects the tangent touching the other extremity. Thus CH (fig. 2) is the secant of AB and CL is the secant of BD.

58. The cosecant of an arc is the secant of the complement of that arc. Thus CL (fig. 2), which is the secant of the arc BD, is the cosecant of the arc AB.

59. From the preceding definitions we deduce the following obvious results, viz:

(*a*) Between 0° and 90° the sine, tangent, and secant increase as the arcs increase, and the cosine, cotangent, and cosecant decrease as the arcs increase.

(*b*) When the arc is one-eighth of a circle or 45°, the sine and cosine are equal, the tangent and cotangent are equal, and the secant and cosecant are also equal. The tangent and cotangent of 45° are also each equal to the radius.

(*c*) When the arc is 0°, its cosecant and cotangent are each infinite, its sine and tangent are each zero, and its secant and cosine are each equal to the radius.

(*d*) When the arc is a quadrant or 90°, its sine and cosecant are each equal to the radius, its tangent and secant are infinite, and its cosine and cotangent are each zero.

60. The triangles BCF and ACH (fig. 2) being equiangular, are similar and their homologous sides proportional. Thus BF:CF::HA:CA or Sine: Cosine::Tangent: Radius. Making radius equal to unity or 1, we eliminate that quantity and the equation becomes

$$\text{Tangent}=\frac{\text{Sine}}{\text{Cosine}},\ \text{Cosine}\times\text{Tangent}=\text{Sine},\ \text{and}\ \text{Cosine}=\frac{\text{Sine}}{\text{Tangent}}.$$

Hence if the logarithmic cosine is subtracted from the logarithmic sine of any arc the difference will be the logarithmic tangent of that arc.

61. In the triangles CDL and ACH we have CA:AH::DL:DC, or Radius:Tangent::Cotangent:Radius. Making radius equal to unity or 1, we have

$$\text{Tangent}=\frac{1}{\text{Cotangent}}\ \text{and}\ \text{Cotangent}=\frac{1}{\text{Tangent}}.$$

Hence the tangent and cotangent are reciprocals of each other, and the logarithm of one is the arithmetical complement of the other (33).

62. In the triangles CBF and ACH (fig. 2) we have CF:CA::CB:CH or Cosine:Radius::Radius:Secant. Making radius unity or 1, we have

$$\text{Cosine}=\frac{1}{\text{Secant}}\ \text{and}\ \text{Secant}=\frac{1}{\text{Cosine}}.$$

Hence cosine and secant are reciprocals of each other and the logarithm of one is the arithmetical complement of the other.

63. In the triangles CDL and CBF (fig. 2), we have BF:BC::DC:CL, or Sine:Radius::Radius:Cosecant. Making radius equal to unity or 1, we have

$$\text{Sine}=\frac{1}{\text{Cosecant}}\ \text{and}\ \text{Cosecant}=\frac{1}{\text{Sine}}.$$

Hence the sine and cosecant are reciprocals of each other and the logarithm of one is the arithmetical complement of the other.

64. Therefore, when the sine and cosine of any arc are known the remaining functions of that arc can be determined by the above formulæ.

DESCRIPTION OF TABLE OF CIRCULAR FUNCTIONS.

65. In most tables of logarithmic circular functions the radius of the measuring circle is assumed at 10^{10} or 10 000 000 000, for the purpose of dispensing with negative characteristics. But as in all other formulæ relative to the circle, the radius is assumed as unity or 1, and as in

determining the natural circular functions the radius of the measuring circle is also unity or 1, this new value of the radius is apt to mislead.

Nor is this new value of radius necessary, since the radius of the measuring circle can be assumed as unity or 1, provided all natural functions less than unity or 1 are regarded as decimal fractions whose logarithms have positive characteristics (31).

This table contains the logarithmic value of all the natural functions from 0° to 90°, the radius of the measuring circle being unity or 1, and for every natural function less than unity or 1 the logarithm given in this table is that of a decimal fraction with a positive characteristic. Thus the natural sine of 0° 6′ 8″ to a radius of unity or 1, is 0·0017841134, whose logarithm, with a negative characteristic is $\bar{3}$·2514224550, but with a positive characteristic this becomes 7·2514224550. Hence the logarithmic sine of 0° 6′ 8″ is 7·2514224550.

The natural cosecant of 0° 1′ is 3437·7468, whose logarithm is 3·5362738891. Hence, the logarithmic cosecant of 0° 1′ is 3·5362738891. The natural secant of 39° 30′ is 1·295967, whose logarithm is 0·1125939445. Hence, the logarithmic secant of 39° 30′ is 0·1125939445.

The natural tangent of 2° 1′ is 0·0352120154, whose logarithm with a negative characteristic is $\bar{2}$·5466908831, but with a positive characteristic this becomes 8·5466908831. Hence, the logarithmic tangent of 2° 1′ is 8·5466908831.

In these tables the logarithmic secant and cosecant are given as well as the logarithmic sine, cosine, tangent, and cotangent.

66. In the following table the logarithmic functions are given to the nearest second for all arcs less than 2° and greater than 88°, and to the nearest 10 seconds for all arcs greater than 2° and less than 88°. For all arcs from 0° to 45° the name of the function will be found at the top of the page and the minutes and seconds in the column on the left, which must be read from the top downward. For all arcs from 45° to 90° the name of the function will be found at the bottom of the page and the minutes and seconds in the columns on the right which must be read from the bottom upward.

67. The sine and cosecant, tangent and cotangent, secant and cosine, being each the reciprocal of the other (61, 62, 63) the logarithm of each will be the arithmetical complement of the other (33) and their respective differences for 1 second will also be equal. These differences for 1 second being common to both functions are therefore placed between the columns containing these respective functions.

Whenever the name of the given function is found at the head of the page and the column under that name is read downward, the difference for 1 second between the nearest logarithmic function found in the table and the next greater or less logarithmic function found in the table in the column of differences for 1 second, will be found on the same horizontal line with the nearest logarithmic function found in the table.

But whenever the name of the given function is found at the bottom of the page and the column above that name is read upward the difference for 1 second, between the nearest logarithmic function found in the table and the next greater or less logarithmic function found in the table will be found in the column of differences for 1 second on the next horizontal line above that of the nearest logarithmic function found in the table.

In the following table the logarithmic circular functions of all arcs from 0° to 90° can be found.

68. To find the logarithmic function of an arc, when such arc can be found in the table.

When the arc is less than 45°.

Rule.—Find the given degrees at the top of the page and the given minutes and seconds in the first two columns on the left of the page. On the same horizontal line with such minutes and seconds, and in the vertical column bearing *at its head* the appropriate designation, the required logarithmic function will be found.

When the arc is 45° or greater than 45°.

Rule.—Find the given degrees at the bottom of the page and the given minutes and seconds in the last two columns on the right of the page. On the same horizontal line with such minutes and seconds, and in the vertical column bearing *at its foot* the appropriate designation, the required logarithmic function will be found.

When the arc is greater than 90°.

Rule.—Find the supplement of such arc (50) and the logarithmic function of such supplement can be found by the rules above given, and this will be the logarithmic function of the given arc.

Example.—What is the logarithmic sine of 22° 43′ 20″?

This arc being less than 45° we find 22° at the top of the page and 43′ 20″ in the first two columns on the left of the page, and on the same horizontal line with 43′ 20″ in the vertical column *headed* with the name sine, the required logarithmic sine of 22° 43′ 20″ is found to be 9·5868840318.

Example.—What is the logarithmic cotangent of 48° 34′ 40″?

This arc being greater than 45°, we find 48° at the bottom of the page, and the minutes and seconds, 34′ 40″, in the last two columns on the right, and on the same horizontal line with 34′ 40″, in the vertical column with the name cotangent *at its foot* the required logarithmic cotangent of 48° 34′ 40″ is found to be 9·9456202843.

Example.—What is the logarithmic tangent of 120° 24′ 50″?

This arc being greater than 90°, we must find its supplement (50), which is 180° 00′ 00″ — 120° 24′ 50″ = 59° 35′ 10″. This being greater than 45°, we find 59° at the bottom of the page, and the minutes and seconds, 35′ 10″, in the last two columns on the right, and on the same horizontal line with 35′ 10″ in the vertical column with the name tangent *at its foot* the required logarithmic tangent is found to be 0·2313453205.

This is the logarithmic tangent of 59° 35′ 10″, and also of its supplement, 120° 24′ 50″.

69. To find the logarithmic function of an arc when such arc can not be found in the table.

When the required logarithmic function is a sine, tangent, or secant.

Rule.—Find the logarithmic function for the nearest less arc given in the table by the rule already given (68). Subtract the nearest less arc found in the table from the given arc. Take the difference for 1 second found in the nearest column of differences for 1 second on the same horizontal line with the nearest less logarithmic function and multiply it by the difference in seconds of the arc; point off the decimals and add the integral portion of such product to the nearest less logarithmic function found in the table, and the sum will be the required logarithmic function.

When the required logarithmic function is a cosine, cotangent, or cosecant.

Rule.—Find the logarithmic function for the next greater arc given in the table by the rule already given (68). Subtract the given arc from the next greater one whose logarithmic function has been taken. Take the difference for 1 second found in the nearest column of differences for 1 second on the same horizontal line with the next greater logarithmic function and multiply it by the difference in seconds of the arc; point off the decimals and subtract the integral portion of such product from the greater logarithmic function found in the table, and the difference will be the required logarithmic function.

Example.—What is the logarithmic tangent of 24° 22′ 24″?

The nearest less arc in the table is 25° 22′ 20″, whose logarithmic function is 9·6561323998, and whose difference for 1 second is 56012·4. The difference between 25° 22′ 20″ and 25° 22′ 24″ is 4″, and 56012·4 × 4 = 224049·6.

Log tangent of 24° 22′ 20″ is	9·6561323998
Difference for 4″ is	224050
Log tangent for 24° 22′ 24″ is	9·6561548048 sum.

Example.—What is the logarithmic cosine of 48° 32′ 18″?

The next greater arc in the table is 48° 32′ 20″, whose logarithmic cosine is 9·8209311639 and whose difference for 1 second is 23830·0. The difference between 48° 32′ 20″ and 48° 32′ 18″ is 2″, and 23830·0 × 2 = 47660·0.

Log cosine of 48° 32′ 20″ is	9·8209311639
Difference for 2 seconds is	47660
Log cosine for 48° 32′ 18″ is	9·8209263979 difference.

70. To find the degrees, minutes, and seconds corresponding to any logarithmic function when such function can be found in the table.

Rule.—If the name of the function of the column in which the given logarithmic function is found stands at the top of the page, the degrees must also be taken from the top of such page, and the minutes and seconds from the first two columns on the left on the horizontal line with the given logarithmic function.

But if the name of the function of the column in which the logarithmic function is found stands at the bottom of the page, the degrees must also be taken from the bottom of the page and the minutes and seconds from the last two columns on the right on the same horizontal line with the given logarithmic function.

Example.—What are the degrees, minutes, and seconds corresponding with the logarithmic sine 9.5868840318?

The column in which the logarithm is found has cosine on the bottom and sine at the top of the page. The degrees must therefore be taken from the top of the page, and are 22°. On the same horizontal line with this logarithmic sine in the columns on the left are found 43′ 20″. The required arc therefore is 22° 43′ 20″.

Example.—What are the degrees, minutes, and seconds corresponding to the logarithmic cotangent 9·9456202843?

The column in which the logarithm is found has tangent at the top and cotangent at the bottom. The degrees must therefore be taken from the bottom of the page, and are 48°. On the same horizontal line with this logarithmic cotangent in the columns on the right of the page are found 34′ 40″. The required arc therefore is 48° 34′ 40″.

71. To find the degrees, minutes, and seconds corresponding to any logarithmic function when such function can not be found in the table.

When the logarithmic function is either a sine, a tangent, or a secant.

Rule.—Find the degrees, minutes, and seconds of the nearest less logarithmic function given in the table by the rule already given (70). Subtract the nearest less logarithmic function from the given logarithmic function and divide this difference by the difference for 1 second found in the nearest column of differences for 1 second on the same horizontal line with the nearest less logarithmic function; the quotient will be the seconds of arc, to be added to the nearest less arc taken from the table, and the sum will be the required arc for the given logarithmic function.

When the logarithmic function is either a cosine, cotangent, or a cosecant.

Rule.—Find the degrees, minutes, and seconds corresponding to the nearest less logarithmic function given in the table by the rule already given (70). Subtract this nearest less logarithmic function from the given logarithmic function and divide the difference by the difference for 1 second found in the nearest column of differences for 1 second on the same horizontal line with the nearest less logarithmic function; the quotient will be the seconds of arc to be subtracted from the arc corresponding to the nearest less logarithmic function taken from the table; the difference will be the required arc for the given logarithmic function.

Example.—What are the degrees, minutes, and seconds corresponding to the logarithmic tangent 9.6561548048?

Given logarithmic tangent	9. 6561548048
Nearest less logarithmic function corresponding to 24° 22′ 20″	9. 6561323998
	224050 difference.

The difference for 1 second on the same horizontal line with the nearest less logarithmic function found in the table is 56012.4 and $\frac{224050.0}{56012.4} = 4''$. Then $24° 22' 20'' + 4'' = 24° 22' 24''$.

Example.—What are the degrees, minutes, and seconds corresponding to the logarithmic cotangent 0.0966998618?

Given logarithmic cotangent	0. 0966998618
Nearest less logarithmic cotangent corresponding to arc 38° 40′ 30″	0. 0966739667
	258951 difference.

The difference for 1 second on same horizontal line with nearest less logarithmic cotangent is 43157.6 and $\frac{258951.0}{43157.6} = 6''$ and $38° 40' 30'' - 6'' = 38° 40' 24''$.

CONVERSION OF LOGARITHMS.

72. Since the logarithms of the same number in two different systems are to each other as the moduli of those systems (41, *c*) the logarithm of any number in one system can be converted into that of any other.

The annexed tables for such conversion are based on this principle.

To convert the logarithms of different systems.

Rule.—Divide the given logarithm of one system into periods of two digits, and take from the appropriate table the corresponding numbers for the other, having due regard to their value as decimals. Their sum will be the required corresponding logarithms of the other system.

Example.—What is the natural logarithm corresponding to the common logarithm 0·8876454273?

Common logarithms.	Natural logarithms.
·88	2·026274881835
·0076	·1749964670675
·000045	·103616329185
·00000042	·96708573906
·0000000073	·1680887118
·8876454273 sum.	2·0438791287654524 sum.

or to ten places of decimals, 2·0438791288

Example.—What is the common logarithm corresponding to the natural logarithm 2·0438791288?

Natural logarithms.	Common logarithms.
2·	·8685889638
·043	·186746627218
·00087	·377836199256
·0000091	·395207978532
·000000028	·121602454933
·0000000008	·3474355185
2·0438791288 sum.	·8876454273085223318 sum

or to ten places of decimals 0·8876454273.

73. The corresponding logarithms of two different systems are the logarithms of the same number (41, *c*). Thus in the above example the common logarithm 0·8876454273 and the natural logarithm 2·0438791288 are the logarithms of the same number 7·7205. Hence knowing the common logarithm of any number we can determine the natural logarithm of that number, or knowing the natural logarithm of any number we can also determine that number by the following rules:

74. To find the natural logarithm of any number.

Rule.—Find from the table the common logarithm of the given number by the rule already given (18), convert such common logarithm to its corresponding natural logarithm (72), and this will be the natural logarithm of the given number.

Example.—What is the natural logarithm of the number 9221?

The common logarithm of 9221 is 3·9647780220, which must be converted into its corresponding natural logarithm as follows:

Common logarithm.	Natural logarithm.
3·	6·9077552790
·96	2·210481689274
·0047	·1082214993707
·000078	·1796016372535
·0000000220	·506568720
3·9647780220 sum.	9·1292387705051955 sum.

or to ten places of decimals the natural logarithm is 9·1292387705.

75. To find the number corresponding to a given natural logarithm,

Rule.—Convert the given natural logarithm into its corresponding common logarithm by the rule already given (72). Then find from the table of common logarithms the number corresponding to the common logarithm thus found by the rule already given (21), and this will be the number corresponding to the given natural logarithm.

Example.—What is the number corresponding to the natural logarithm 9.1292387705?

Natural logarithm.	Common logarithm.
9·	3·9086503371
·12	52115337828
·0092	399550923351
·000038	165031903123
·00000077	334406751065
·0000000005	21714724095
9·1292387705 sum.	3·96477802197572060595 sum.

or for ten places of decimals, 3.9647780220 whose corresponding number is 9221, which is the required number.

Reduction of common logarithms to natural logarithms.

Common logarithms.	Natural logarithms.	Common logarithms.	Natural logarithms.	Common logarithms.	Natural logarithms.	Common logarithms.	Natural logarithms.
1	2·3025850930	26	59·8672124178	51	117·4318397427	76	174·9964670675
2	4·6051701860	27	62·1697975108	52	119·7344248357	77	177·2990521605
3	6·9077552790	28	64·4723826038	53	122·0370099287	78	179·6016372535
4	9·2103403720	29	66·7749676968	54	124·3395950217	79	181·9042223465
5	11·5129254650	30	69·0775527898	55	126·6421801147	80	184·2068074395
6	13·8155105580	31	71·3801378828	56	128·9447652077	81	186·5093925325
7	16·1180956510	32	73·6827229758	57	131·2473503007	82	188·8119776255
8	18·4206807440	33	75·9853080688	58	133·5499353937	83	191·1145627185
9	20·7332658369	34	78·2878931618	59	135·8525204866	84	193·4171478115
10	23·0258509299	35	80·5904782548	60	138·1551055796	85	195·7197329045
11	25·3284360229	36	82·8930633478	61	140·4576906726	86	198·0223179975
12	27·6310211159	37	85·1956484408	62	142·7602757656	87	200·3249030905
13	29·9336062089	38	87·4982335338	63	145·0628608586	88	202·6274881835
14	32·2361913019	39	89·8008186268	64	147·3654459516	89	204·9300732765
15	34·5387763949	40	92·1034037198	65	149·6680310446	90	207·2326583695
16	36·8413614879	41	94·4059888128	66	151·9706161376	91	209·5352434625
17	39·1439465809	42	96·7085739057	67	154·2732012306	92	211·8378285554
18	41·4465316739	43	99·0111589987	68	156·5757863236	93	214·1404136484
19	43·7491167669	44	101·3137440917	69	158·8783714166	94	216·4429987414
20	46·0517018599	45	103·6163291847	70	161·1809565096	95	218·7455838344
21	48·3542869529	46	105·9189142777	71	163·4835416026	96	221·0481689274
22	50·6568720459	47	108·2214993707	72	165·7861266956	97	223·3507540204
23	52·9594571389	48	110·5240844637	73	168·0887117886	98	225·6533391134
24	55·2620422319	49	112·8266695567	74	170·3912968816	99	227·9559242064
25	57·5646273248	50	115·1292546497	75	172·6938819745	100	230·2585092994

Reduction of natural logarithms to common logarithms.

Natural logarithms.	Common logarithms.	Natural logarithms.	Common logarithms.	Natural logarithms.	Common logarithms.	Natural logarithms.	Common logarithms.
1	0·4342944819	26	11·2916565295	51	22·1490185771	76	33·0063806246
2	0·8685889638	27	11·7259510114	52	22·5833130590	77	33·4406751065
3	1·3028834457	28	12·1602454933	53	23·0176075409	78	33·8749695884
4	1·7371779276	29	12·5945399752	54	23·4519020228	79	34·3092640704
5	2·1714724095	30	13·0288344571	55	23·8861965047	80	34·7435585523
6	2·6057668914	31	13·4631289390	56	24·3204909866	81	35·1778530342
7	3·0400613733	32	13·8974234209	57	24·7547854685	82	35·6121475161
8	3·4743558552	33	14·3317179028	58	25·1890799504	83	36·0464419980
9	3·9086503371	34	14·7660123847	59	25·6233744323	84	36·4807364799
10	4·3429448190	35	15·2003068666	60	26·0576689142	85	36·9150309618
11	4·7772393009	36	15·6346013485	61	26·4919633961	86	37·3493254437
12	5·2115337828	37	16·0688958304	62	26·9262578780	87	37·7836199256
13	5·6458282647	38	16·5031903123	63	27·3605523599	88	38·2179144075
14	6·0801227466	39	16·9374847942	64	27·7948468418	89	38·6522088894
15	6·5144172285	40	17·3717792761	65	28·2291413237	90	39·0865033713
16	6·9487117105	41	17·8060737580	66	28·6634358056	91	39·5207978532
17	7·3830061924	42	18·2403682399	67	29·0977302875	92	39·9550923351
18	7·8173006743	43	18·6746627218	68	29·5320247694	93	40·3893868170
19	8·2515951562	44	19·1089572037	69	29·9663192513	94	40·8236812989
20	8·6858896381	45	19·5432516856	70	30·4006137332	95	41·2579757808
21	9·1201841200	46	19·9775461675	71	30·8349082151	96	41·6922702627
22	9·5544786019	47	20·4118406494	72	31·2692026970	97	42·1265647446
23	9·9887730838	48	20·8461351314	73	31·7034971789	98	42·5608592265
24	10·4230675657	49	21·2804296133	74	32·1377916608	99	42·9951537084
25	10·8573620476	50	21·7147240952	75	32·5720861427	100	43·4294481903

NATURAL FUNCTIONS.

76. When the radius of the measuring circle is unity or 1, the functions are called natural functions. The radius of the table of logarithmic circular functions annexed hereto being also unity or 1 (65), the various quantities given in that table are the logarithms of the natural functions.

Hence the natural functions of any arc can be found by the following

Rule.—Take from the table the logarithmic circular function for the given arc by the rules already given (68, 69). Find the number corresponding to such logarithm by the rule already given (21), and such number will be the natural function of the given arc.

77. In the application of the rule it must be remembered that—

(*a*) When the arc is 90°, its sine, being equal to radius, (59 *d*) is unity or 1, and the sines of all arcs less than 90° are less than unity or 1 and are, therefore, decimal fractions.

(*b*) When the arc is 0°, its cosine, being equal to radius (59 *c*), is unity or 1, and the cosines of all arcs greater than 0° are less than unity or 1 and are, therefore, decimal fractions.

(*c*) When the arc is 45°, its tangent, being equal to radius (59 *b*), is unity or 1, and the tangents of all arcs greater than 45° are greater than unity or 1, or mixed numbers, and the tangents of all arcs less than 45° are less than unity or 1 and are, therefore, decimal fractions.

(*d*) When the arc is 45°, its cotangent, being equal to radius (59 *b*), is unity or 1, and the cotangents of all arcs less than 45° are greater than unity or 1, or mixed numbers, and the cotangents of all arcs greater than 45° are less than unity or 1 and are, therefore, decimal fractions.

(*e*) When the arc is 0°, its secant, being equal to radius (59 *c*), is unity or 1, and the secants of all arcs greater than 0° are greater than unity or 1, or mixed numbers.

(*f*) When the arc is 90°, its cosecant, being equal to radius (59 *d*), is unity or 1, and the cosecants of all arcs less than 90° are greater than unity or 1, or mixed numbers.

Example.—What is the natural sine of 0° 1′ 2″?

6·4779665497 is the logarithmic sine of 0° 1′ 2″

·4779600801 is the nearest less logarithm and its corresponding number is 30058.

64696

The difference of these logarithms is 64696, and the tabular difference is 144483, and $\frac{64696}{144483} = 447776$. The mantissa ·4779665497 corresponds with the number 30058447776. This sine being less than 90°, is less than unity or 1 (77 *a*). The logarithm of this sine is, therefore,

that of a decimal fraction with a positive characteristic (65). The positive characteristic 6, therefore, by reversing the rule already given (31), requires three intervening zeros between the decimal point and the first significant figure, since $9 - 6 = 3$. The natural sine of 0° 1′ 2″ will therefore be 0·00030058447776.

Example.—What is the natural cosine of 89° 48′ 8″?

7·5380539979 is the logarithmic cosine of 89° 48′ 8″,
·5380456244 is the nearest less logarithm and its corresponding number is 34518.

83735

The difference of these logarithms is 83735, and the tabular difference is 125815, and $\frac{83735}{125815} = 665541$. The mantissa ·5380539979 corresponds with the number 34518665541. This cosine being greater than 0°, is less than unity or 1 (77 *b*). The logarithm of this cosine is, therefore, that of a decimal fraction with a positive characteristic (65). The positive characteristic 7, therefore, reversing the rule already given (31), requires two intervening zeros between the decimal point and the first significant figure, since $9 - 7 = 2$. The natural cosine of 89° 48′ 8″ will, therefore, be 0·0034518665541.

Example.—What is the natural tangent of 5° 16′ 10″?

8·9648690880 is the logarithmic tangent of 5° 16′ 10″,
·9648674998 is the nearest less logarithm and its corresponding number is 92229.

15882

The difference of these logarithms is 15882, and the tabular difference is 47088, and $\frac{15882}{47088} = 337283$. The mantissa ·9648690880 corresponds with the number 92229337283. This tangent being less than 45° is less than unity or 1 (77, *c*). The logarithm of this tangent is, therefore, that of a decimal fraction with a positive characteristic (65). The positive characteristic 8, therefore, by reversing the rule already given (31), requires one intervening zero between the decimal point and the first significant figure, since $9 - 8 = 1$. The natural tangent of 5° 16′ 10″ will, therefore, be 0·092229337283.

Example.—What is the natural cotangent of 28° 22′ 20″?

0·2975486631 is the logarithmic cotangent of 28° 22′ 20″,
·2975416678 is the nearest less logarithm and its corresponding number is 19840.

69953

The difference of these logarithms is 69953, and the tabular difference is 218893, and $\frac{69953}{218893} = 319576$. The mantissa ·2975486631 corresponds with the number 19840319576. This cotangent being less than 45° is greater than unity or 1 (77, *a*). The logarithm of this cotangent, therefore, is that of a mixed number, and, by reversing the rule already given (13), one must be added to the characteristic to find the number of integral digits in the corresponding number and $0° + 1 = 1$. The natural contangent of 28° 22′ 20″ is, therefore, 1·9840319576.

Example.—What is the natural secant of 8° 5′ 20″?

0·0043424493 is the logarithmic secant of 8° 5′ 20″,
·0043213738 is the nearest less logarithm and its corresponding number is 10100.

210755

The difference of these logarithms is 210755 and the tabular difference is 429973 and $\frac{210755}{429973} = 490158$. The mantissa ·0043424493 corresponds with the number 10100490158. This secant being greater than 0° is greater than unity or 1 (77 *e*). The logarithm of this secant therefore is that of a mixed number, and by reversing the rule already given (13) 1 must be added to the characteristic to find the number of integral digits in the corresponding number and $0 + 1 = 1$. The natural secant of 8° 5′ 20″ is, therefore, 1·0100490158.

Example.—What is the natural cosecant of 25° 32′ 40″?

0·3653100639 is the logarithmic cosecant of 25° 32′ 40″,
·3653007486 is the nearest less logarithm and its corresponding number is 23190.

93153

The difference of the logarithms is 93153 and the tabular difference is 187273 and $\frac{93153}{187273}$ = 497418. The mantissa ·3653100639 corresponds with the number 23190497418. This cosecant being less than 90° is greater than unity or 1 (77 *f*). The logarithm of this cosecant therefore is that of a mixed number, and, by reversing the rule already given (13), one must be added to the characteristic to find the number of integral digits in the corresponding number and 0 + 1 = 1. The natural cosecant of 25° 32′ 40″ is, therefore, 2·3190497418.

Logarithms of quantities frequently used in computation.

	Symbol.	Number.	Logarithms.	
			Positive characteristic.	Negative characteristic.
Ratio of circumference to diameter of circle Area of circle to radius 1 Circumference of circle to diameter 1 Surface of sphere to diameter 1	π	3·1415926536	0·4971498727	
Area of circle to diameter 1	$\frac{\pi}{4}$	0·7853981634	9·8950898814	$\bar{1}$·8950898814
Volume of sphere to diameter 1	$\frac{\pi}{6}$	0·5235987756	9·7189986223	$\bar{1}$·7189986223
Volume of sphere to radius 1	$\frac{4\pi}{3}$	4·1887902048	0·6220886093	
Diameter of circle to area 1	$\sqrt{\frac{4}{\pi}}$	1·1283791671	0·0524550593	
Diameter of sphere to volume 1	$\sqrt[3]{\frac{6}{\pi}}$	1·2407009818	0·0936671259	
Square root of ratio circumference to diameter	$\sqrt{\pi}$	1·7724538509	0·2485749363	
Square of ratio circumference to diameter	π^2	9·8696044011	0·9942997454	
Reciprocal of ratio circumference to diameter	$\frac{1}{\pi}$	0·3183098862	9·5028501273-10	$\bar{1}$·5028501273
Reciprocal of square of ratio circumference to diameter	$\frac{1}{\pi^2}$	0·1013211836	9·0057002546	$\bar{1}$·0057002546
Arc equal radius expressed in degrees		57·295779513	1·7581226324	
Arc equal radius expressed in minutes		3 437·74677078	3·5362738828	
Arc equal radius expressed in seconds		206 264·806247	5·3144251332	
Length of 1 degree in parts of radius		0·0174532925	8·2418773676	$\bar{2}$·2418773676
Length of 1 minute in parts of radius		0·0002908882	6·4637261172	$\bar{4}$·4637261172
360 degrees expressed in minutes		21 600·	4·3344537512	
360 degrees expressed in seconds		1 296 000·	6·1126050015	
24 hours expressed in minutes of time		1 440·	3·1583624921	
24 hours expressed in seconds of time		86 400·	4·9365137425	
12 hours expressed in minutes of time		720·	2·8573324964	
12 hours expressed in seconds of time		43 200·	4·6354837468	
Number of feet in 1 mile (statute)		5 280·	3·7226339225	
Number of feet in 1 mile (geographic)		6 080·	3·7839035793	
Sidereal year in mean solar days		365·256374417	2·5625978039	
Sidereal rotation of earth in mean solar seconds		86 164·09966888	4·9353263545	
Equatorial radius of the earth in feet		20 923 600·	7·3206364089	
Polar radius of the earth in feet		20 853 657·	7·3191822259	
One degree of latitude at the Equator, in feet		362 748·33	5·5596054217	
One degree of latitude at 45 in feet		364 571·77	5·5617830368	
Velocity of falling bodies at the end of the first second:				
at London		32·19078	1·5077315000	
at Paris		32·18255	1·5076204526	
at New York		32·15949	1·5073091529	

NOTE.—The logarithmic tables of circular functions to ten places of decimals will be given in a subsequent appendix.

Nos. 1000 to 9999.

Numbers 10000–10609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1000	0000000000	0434273	0868502	1302688	1736831	2170930	2604985
1	4340775	4774614	5208409	5642162	6075871	6509536	6943159
2	8677215	9110621	9543984	9977304	0410580	0843813	1277003
3	0013009330	3442304	3875235	4308123	4740967	5173768	5606526
4	7337128	7769671	8202170	8634627	9067040	9499411	9931738
5	0021660618	2092730	2524799	2956826	3388809	3820749	4252647
6	5979807	6411490	6843130	7274727	7706281	8137792	8569261
7	0030294706	0725960	1157171	1588340	2019465	2450548	2881588
8	4605321	5036147	5466931	5897672	6328370	6759025	7189638
9	8911662	9342062	9772418	0202733	0633004	1063233	1493419
1010	0043213738	3643711	4073642	4503530	4933375	5363179	5792939
11	7511556	7941104	8370609	8800072	9229493	9658871	0088207
12	0051805125	2234249	2663330	3092368	3521365	3950319	4379231
13	6094454	6523154	6951811	7380427	7809000	8237530	8666019
14	0060379550	0807827	1236062	1664255	2092405	2520514	2948580
15	4660422	5088278	5516091	5943862	6371591	6799277	7226922
16	8937079	9364514	9791906	0219256	0646564	1073830	1501054
17	0073209529	3636543	4063515	4490445	4917333	5344179	5770983
18	7477780	7904374	8330927	8757438	9183906	9610333	0036718
19	0081741840	2168016	2594150	3020242	3446293	3872301	4298268
1020	0086001718	6427476	6853192	7278867	7704499	8130091	8555640
21	0090257421	0682762	1108061	1533319	1958535	2383710	2808843
22	4508958	4933883	5358766	5783608	6208408	6633167	7057884
23	8756337	9180847	9605315	0029741	0454126	0878470	1302772
24	0102999566	3423661	3847715	4271727	4695698	5119627	5543515
25	7238654	7662335	8085975	8509574	8933131	9356647	9780122
26	0111473608	1896876	2320103	2743289	3166434	3589537	4012599
27	5704436	6127292	6550107	6972881	7395614	7818305	8240956
28	9931147	0353591	0775995	1198358	1620680	2042960	2465200
29	0124153748	4575782	4997775	5419728	5841639	6263510	6685339
1030	0128372247	8793872	9215455	9636998	0058500	0479961	0901381
31	0132586653	3007869	3429043	3850177	4271271	4692323	5113335
32	6796973	7217781	7638547	8059273	8479959	8900603	9321207
33	0141003215	1423615	1843975	2264294	2684572	3104810	3525007
34	5205388	5625381	6045334	6465247	6885119	7304950	7724741
35	9403498	9823086	0242633	0662140	1081606	1501032	1920418
36	0153597554	4016737	4435880	4854982	5274043	5693064	6112045
37	7787564	8206343	8625081	9043779	9462437	9881054	0299631
38	0161973535	2391910	2810245	3228540	3646795	4065009	4483183
39	6155476	6573448	6991381	7409273	7827125	8244937	8662708
1040	0170333393	0750964	1168494	1585985	2003435	2420845	2838216
41	4507295	4924465	5341594	5758684	6175733	6592743	7009712
42	8677190	9093959	9510688	9927378	0344027	0760636	1177206
43	0182843084	3259454	3675784	4092074	4508324	4924534	5340704
44	7004987	7420958	7836889	8252780	8668632	9084443	9500215
45	0191162904	1578477	1994011	2409504	2824958	3240372	3655746
46	5316845	5732021	6147157	6562253	6977310	7392327	7807304
47	9466817	9881596	0296335	0711035	1125696	1540316	1954898
48	0203612826	4027210	4441554	4855858	5270123	5684348	6098534
49	7754882	8168870	8582819	8996729	9410599	9824429	0238220
1050	0211892991	2306585	2720140	3133655	3547131	3960567	4373965
51	6027160	6440361	6853522	7266644	7679727	8092770	8505774
52	0220157398	0570206	0982975	1395704	1808394	2221045	2633657
53	4283712	4696128	5108504	5520842	5933140	6345399	6757620
54	8406109	8818133	9230119	9642065	0053972	0465841	0877670
55	0232524596	2936230	3347825	3759381	4170898	4582376	4993815
56	6639182	7050426	7461632	7872798	8283925	8695014	9106064
57	0240749873	1160728	1571545	1982322	2393061	2803760	3214421
58	4856677	5267144	5677572	6087961	6498312	6908624	7318897
59	8959601	9369680	9779721	0189723	0599686	1009610	1419496
1060	0253058653	3468345	3877999	4287614	4697191	5106729	5516228

OF NUMBERS. Logarithms .000000000-0256744494.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3038998	3472967	3906892	434273	229	186	143	099	055	013	969	925	883
7376738	7810274	8243766	433839	795	753	709	665	623	579	536	492	449
1710149	2143253	2576313	406	363	320	276	233	190	146	104	060	017
6039241	6471913	6904542	432974	931	888	844	801	758	715	672	629	586
0364023	0796264	1228462	543	499	457	413	371	327	285	241	198	156
4684501	5116313	5548081	112	069	027	983	940	898	854	812	768	726
9000686	9432069	9863409	431683	640	597	554	511	469	425	383	340	297
3312586	3743540	4174452	254	211	169	125	083	040	998	954	912	869
7620208	8050736	8481220	430826	784	741	698	655	613	570	528	484	442
1923563	2353664	2783722	400	356	315	271	229	186	144	101	058	016
6222657	6652332	7081965	429973	931	888	845	804	760	718	675	633	591
0517500	0946751	1375959	548	505	463	421	378	336	293	251	208	166
4808100	5236927	5665711	124	081	038	997	954	912	869	827	784	743
9094465	9522869	9951231	428700	657	616	573	530	489	446	404	362	319
3376604	3804585	4232525	277	235	193	150	109	066	024	981	940	897
7654525	8082085	8509603	427856	813	771	729	686	645	603	560	518	476
1928236	2355375	2782473	435	392	350	308	266	224	182	139	098	056
6197745	6624465	7051144	014	972	930	888	846	804	762	720	679	636
0463062	0889363	1315622	426594	553	511	468	427	385	344	301	259	218
4724193	5150076	5575918	176	134	092	051	008	967	925	883	842	800
8981148	9406614	9832038	425758	716	675	632	592	549	508	466	424	383
3233934	3658983	4083992	341	299	258	216	175	133	091	049	009	966
7482559	7907194	8331786	424925	883	842	800	759	717	675	635	592	551
1727033	2151252	2575430	510	468	426	385	344	302	261	219	178	136
5967362	6391167	6814931	095	054	012	971	929	888	847	805	764	723
0203555	0626947	1050298	423681	640	599	557	516	475	433	392	351	310
4435620	4858600	5281539	268	227	186	145	103	062	021	980	939	897
8663565	9086133	9508661	422856	815	774	733	691	651	609	568	528	486
2887398	3309556	3731672	444	404	363	322	280	240	198	158	116	076
7107127	7528875	7950581	034	993	953	911	871	829	788	748	706	666
1322760	1744099	2165396	421625	583	543	502	461	420	379	339	297	257
5534305	5955235	6376125	216	174	134	094	052	012	970	930	890	848
9741770	0162293	0582774	420808	766	726	686	644	604	563	523	481	441
3945163	4365278	4785353	400	360	319	278	238	197	156	115	075	035
8144491	8564200	8983869	419993	953	913	872	831	791	750	709	669	629
2339762	2759067	3178331	588	547	507	466	426	386	344	305	264	223
6530985	6949885	7368745	183	143	102	061	021	981	940	900	860	819
0718167	1136664	1555120	418779	738	698	658	617	577	536	497	456	415
4901316	5319410	5737463	375	335	295	255	214	174	133	094	053	013
9080440	9498131	9915782	417972	933	892	852	812	771	732	691	651	611
3255546	3672836	4090085	417571	530	491	450	410	371	330	290	249	210
7426642	7843531	8260380	170	129	090	049	010	969	930	889	849	810
1593735	2010225	2426675	416769	729	690	649	609	570	529	490	450	409
5756835	6172925	6588976	370	330	290	250	210	170	131	090	051	011
9915947	0331639	0747292	415971	931	891	852	811	772	732	692	653	612
4071080	4486375	4901630	573	534	493	454	414	374	334	295	255	215
8222242	8637140	9051998	176	136	096	057	017	977	938	898	858	819
2369439	2783941	3198404	414779	739	700	661	620	582	541	502	463	422
6512680	6926787	7340854	384	344	304	265	225	186	146	107	067	028
0651972	1065684	1479357	413988	949	910	870	830	791	752	712	673	634
4787323	5200641	5613920	413594	555	515	476	436	398	358	318	279	240
8918739	9331665	9744551	201	161	122	083	043	004	965	926	886	847
3046229	3458763	3871257	412808	769	729	690	651	612	572	534	494	455
7169801	7581942	7994045	416	376	338	298	259	221	181	141	103	064
1289460	1701211	2112923	024	986	946	907	869	829	790	751	712	673
5405216	5816577	6227899	411634	595	556	517	478	439	401	361	322	283
9517074	9928046	0338979	244	206	166	127	089	050	010	972	933	894
3625044	4035627	4446171	410855	817	777	739	699	661	623	583	544	506
7729131	8139326	8549483	467	428	389	351	312	273	234	195	157	118
1829343	2239152	2648922	079	041	002	963	924	886	847	809	770	731
5925689	6335111	6744494	409692	654	615	577	538	499	461	422	383	345

Numbers 10600–11209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1060	0253058653	3468345	3877999	4287614	4697191	5106729	5516228
61	7153839	7563145	7972413	8381642	8790833	9199985	9609099
62	0261245167	1654088	2062971	2471815	2880620	3289387	3698116
63	5332645	5741182	6149679	6558139	6966560	7374942	7783287
64	9416280	9824432	0232546	0640622	1048659	1456658	1864618
65	0273496078	3903847	4311578	4719270	5126924	5534541	5942118
66	7572047	7979434	8386782	8794092	9201364	9608598	0015793
67	0281644194	2051199	2458166	2865094	3271985	3678837	4085651
68	5712527	6119151	6525736	6932284	7338793	7745265	8151698
69	9777052	0183295	0589501	0995668	1401798	1807889	2213943
1070	0293837777	4243641	4649466	5055254	5461004	5866716	6272390
71	7894708	8300193	8705640	9111049	9516420	9921754	0327049
72	0301947854	2352960	2758029	3163060	3568053	3973009	4377926
73	5997220	6401949	6806640	7211294	7615910	8020488	8425028
74	0310042814	0447166	0851480	1255757	1659997	2064198	2468362
75	4084643	4488619	4892557	5296458	5700321	6104147	6507936
76	8122713	8526314	8929877	9333403	9736891	0140342	0543755
77	0322157033	2560259	2963447	3366598	3769712	4172788	4575827
78	6187609	6590460	6993275	7396052	7798792	8201494	8604160
79	0330214447	0616925	1019367	1421771	1824137	2226467	2628759
1080	0334237555	4639661	5041729	5443761	5845755	6247712	6649632
81	8256940	8658673	9060370	9462030	9863652	0265238	0666786
82	0342272608	2673970	3075296	3476584	3877836	4279050	4680228
83	6284566	6685558	7086513	7487431	7888313	8289157	8689964
84	0350292822	0693444	1094029	1494578	1895089	2295564	2696001
85	4297382	4697635	5097851	5498030	5898172	6298278	6698347
86	8298253	8698137	9097985	9497795	9897569	0297307	0697007
87	0362295441	2694957	3094437	3493880	3893287	4292656	4691989
88	6288954	6688103	7087216	7486292	7885331	8284334	8683300
89	0370278798	0677580	1076327	1475036	1873709	2272346	2670946
1090	0374264979	4663396	5061777	5460121	5858428	6256699	6654934
91	8247506	8645558	9043573	9441552	9839494	0237400	0635270
92	0382226384	2624071	3021722	3419337	3816915	4214456	4611962
93	6201619	6598943	6996230	7393481	7790696	8187874	8585016
94	0390173220	0570180	0967104	1363992	1760844	2157659	2554438
95	4141192	4537790	4934351	5330877	5727366	6123819	6520236
96	8105541	8501777	8897977	9294141	9690269	0086360	0482415
97	0402066276	2462151	2857989	3253792	3649559	4045289	4440984
98	6023401	6418915	6814394	7209836	7605242	8000613	8395947
99	9976924	0372079	0767197	1162280	1557326	1952337	2347312
1100	0413926852	4321647	4716406	5111130	5505817	5900469	6295085
1	7873190	8267626	8662027	9056392	9450721	9845015	0239272
2	0421815945	2210024	2604067	2998074	3392046	3785981	4179881
3	5755124	6148846	6542532	6936182	7329796	7723375	8116918
4	9690734	0084099	0477428	0870722	1263980	1657202	2050389
5	0433622780	4015789	4408762	4801700	5194602	5587469	5980300
6	7551270	7943923	8336541	8729124	9121671	9514183	9906659
7	0441476209	1868508	2260771	2652999	3045192	3437349	3829471
8	5397604	5789549	6181458	6573332	6965171	7356975	7748743
9	9315461	9707053	0098609	0490130	0881615	1273066	1664481
1110	0453229788	3621027	4012230	4403398	4794531	5185629	5576691
11	7140589	7531476	7922327	8313143	8703924	9094670	9485381
12	0461047872	1438407	1828907	2219372	2609802	3000197	3390556
13	4951643	5341828	5731977	6122091	6512170	6902214	7292223
14	8851908	9241742	9631541	0021305	0411034	0800728	1190387
15	0472748674	3138158	3527608	3917022	4306402	4695746	5085056
16	6641946	7031081	7420182	7809247	8198278	8587274	8976235
17	0480531731	0920518	1309270	1697988	2086670	2475318	2863931
18	4418036	4806475	5194879	5583249	5971584	6359884	6748150
19	8300865	8688957	9077015	9465038	9853026	0240979	0628898
1120	0492180227	2567972	2955683	3343360	3731002	4118609	4506181

OF NUMBERS. Logarithms 0253058653–0495668692.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5925689	6335111	6744494	409692	654	615	577	538	499	461	422	383	345
0018174	0427210	0836208	306	268	229	191	152	114	075	036	998	959
4106806	4515457	4924071	408921	883	844	805	767	729	690	651	614	574
8191592	8599860	9008089	537	497	460	421	382	345	305	268	229	191
2272541	2680425	3088270	152	114	076	037	999	960	923	884	845	808
6349658	6757159	7164622	407769	731	692	654	617	577	540	501	463	425
0422951	0830070	1237151	387	348	310	272	234	195	158	119	081	043
4492427	4899165	5305865	005	967	928	891	852	814	776	738	700	662
8558094	8964451	9370771	406624	585	548	509	472	433	396	357	320	281
2619958	3025936	3431875	243	206	167	130	091	054	015	978	939	902
6678027	7083625	7489186	405864	825	788	750	712	674	637	598	561	522
0732307	1137527	1542709	485	447	409	371	334	295	258	220	182	145
4782806	5187648	5592453	106	069	031	993	956	917	880	842	805	767
8829531	9233996	9638424	404729	691	654	616	578	540	503	465	428	390
2872489	3276578	3680629	352	314	277	240	201	164	127	089	051	014
6911686	7315399	7719075	403976	938	901	863	826	789	750	713	676	638
0947131	1350469	1753770	601	563	526	488	451	413	376	338	301	263
4978829	5381793	5784719	226	188	151	114	076	039	002	964	926	890
9006787	9409378	9811931	402851	815	777	740	702	666	627	591	553	516
3031014	3433231	3835412	478	442	404	366	330	292	255	217	181	143
7051515	7453360	7855168	402106	068	032	994	957	920	883	845	808	772
1068297	1469771	1871208	401733	697	660	622	586	548	511	474	437	400
5081368	5482471	5883537	362	326	288	252	214	178	140	103	066	029
9090734	9491467	9892163	400992	955	918	882	844	807	770	733	696	659
3096402	3496765	3897092	622	585	549	511	475	437	401	363	327	290
7098378	7498373	7898331	253	216	179	142	106	069	031	995	958	922
1096671	1496297	1895888	399884	848	810	774	738	700	664	626	591	553
5091285	5490545	5889768	516	480	443	407	369	333	296	260	223	186
9082229	9481122	9879978	149	113	076	039	003	966	929	893	856	820
3069509	3468036	3866526	398782	747	709	673	637	600	563	527	490	453
7053131	7451293	7849418	398417	381	344	307	271	235	197	162	125	088
1033103	1430900	1828660	052	015	979	942	906	870	833	797	760	724
5009431	5406863	5804260	397687	651	615	578	541	506	469	432	397	359
8982121	9379190	9776223	324	287	251	215	178	142	105	069	033	997
2951181	3347887	3744558	396960	924	888	852	815	779	743	706	671	634
6916616	7312961	7709269	598	561	526	489	453	417	380	345	308	272
0878435	1274418	1670365	236	200	164	128	091	055	020	983	947	911
4836642	5232264	5627851	395875	838	803	767	730	695	658	622	587	550
8791245	9186507	9581734	514	479	442	406	371	334	298	262	227	190
2742251	3137153	3532020	155	118	083	046	011	975	939	902	867	832
6689665	7084209	7478717	394795	759	724	687	652	616	580	544	508	473
0633494	1027680	1421831	436	401	365	329	294	257	222	186	151	114
4573746	4967574	5361367	079	043	007	972	935	900	865	828	793	757
8510426	8903897	9297333	393722	686	650	614	579	543	508	471	436	401
2443540	2836656	3229736	365	329	294	258	222	187	151	116	080	044
6373096	6765856	7158581	009	973	938	902	867	831	796	760	725	689
0299099	0691505	1083874	392653	618	583	547	512	476	440	406	369	335
4221557	4613608	5005624	299	263	228	193	157	122	086	051	016	980
8140475	8532173	8923835	391945	909	874	839	804	768	732	698	662	626
2055860	2447205	2838514	592	556	521	485	451	415	379	345	309	274
5967719	6358711	6749668	391239	203	168	133	098	062	028	992	957	921
9876057	0266697	0657302	390887	851	816	781	746	711	676	640	605	570
3780880	4171170	4561424	535	500	465	430	395	359	324	290	254	219
7682197	8072136	8462039	185	149	114	079	044	009	974	939	903	869
1580011	1969600	2359155	389834	799	764	729	694	659	624	589	555	519
5474331	5863571	6252776	484	450	414	380	344	310	275	240	205	170
9365161	9754053	0142909	135	101	065	031	996	961	926	892	856	822
3252509	3641053	4029562	388787	752	718	682	648	613	578	544	509	474
7136381	7524577	7912738	439	404	370	335	300	266	231	196	161	127
1016782	1404632	1792446	092	058	023	988	953	919	884	850	814	781
4893719	5281223	5668692	387745	711	677	642	607	572	538	504	469	434

Numbers 11200–11809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1120	0492180227	2567972	2955683	3343360	3731002	4118609	4506181
21	6056126	6443526	6830891	7218222	7605518	7992779	8380006
22	9928569	0315624	0702644	1089629	1476580	1863497	2250379
23	0503797563	4184272	4570948	4957589	5344195	5730768	6117305
24	7663112	8049478	8435810	8822107	9208369	9594598	9980792
25	0511525224	1911247	2297235	2683189	3069108	3454993	3840844
26	5383905	5769585	6155230	6540841	6926418	7311961	7697469
27	9239160	9624498	0009801	0395070	0780305	1165506	1550672
28	0523090996	3475992	3860954	4245881	4630775	5015634	5400459
29	6939419	7324074	7708695	8093281	8477834	8862353	9246837
1130	0530784435	1168749	1553030	1937276	2321488	2705667	3089811
31	4626049	5010024	5393965	5777871	6161744	6545583	6929388
32	8464269	8847904	9231505	9615073	9998607	0382107	0765573
33	0542299099	2682395	3065658	3448888	3832083	4215245	4598372
34	6130546	6513504	6896429	7279321	7662178	8045002	8427792
35	9958615	0341237	0723824	1106379	1488899	1871386	2253839
36	0553783314	4165598	4547849	4930067	5312251	5694401	6076517
37	7604647	7986595	8368510	8750391	9132239	9514053	9895834
38	0561422621	1804233	2185813	2567359	2948871	3330350	3711795
39	5237241	5618519	5999763	6380974	6762151	7143295	7524406
1140	0569048513	9429457	9810367	0191243	0572086	0952896	1333672
41	0572856444	3237054	3617630	3998173	4378682	4759158	5139601
42	6661039	7041315	7421558	7801768	8181944	8562087	8942197
43	0580462304	0842248	1222158	1602035	1981879	2361689	2741467
44	4260245	4639856	5019434	5398979	5778491	6157970	6537416
45	8054867	8434147	8813393	9192607	9571788	9950935	0330050
46	0591846176	2225125	2604041	2982924	3361774	3740591	4119374
47	5634179	6012798	6391383	6769936	7148455	7526942	7905396
48	9418881	9797169	0175425	0553648	0931838	1309995	1688119
49	0603200287	3578246	3956173	4334067	4711928	5089756	5467551
1150	0606978404	7356034	7733633	8111198	8488730	8866230	9243697
51	0610753236	1130539	1507809	1885047	2262251	2639423	3016562
52	4524791	4901766	5278709	5655619	6032496	6409341	6786152
53	8293073	8669721	9046337	9422920	9799471	0175989	0552474
54	0622058088	2434410	2810700	3186957	3563181	3939373	4315532
55	5819842	6195839	6571802	6947733	7323632	7699498	8075332
56	9578341	9954012	0329650	0705256	1080830	1456371	1831880
57	0633333590	3708936	4084250	4459531	4834780	5209997	5585181
58	7085594	7460616	7835606	8210563	8585489	8960381	9335242
59	0640834360	1209058	1583725	1958359	2332960	2707530	3082067
1160	0644579892	4954268	5328611	5702922	6077201	6451448	6825662
61	8322197	8696251	9070272	9444260	9818217	0192141	0566034
62	0652061281	2435012	2808711	3182378	3556013	3929616	4303186
63	5797147	6170557	6543935	6917281	7290595	7663876	8037126
64	9529803	9902892	0275949	0648975	1021968	1394929	1767858
65	0663259254	3632023	4004760	4377465	4750138	5122779	5495388
66	6985504	7357954	7730371	8102756	8475110	8847431	9219721
67	0670708560	1080691	1452789	1824855	2196890	2568892	2940863
68	4428428	4800239	5172019	5543767	5915483	6287167	6658820
69	8145112	8516605	8888067	9259497	9630895	0002261	0373596
1170	0681858617	2229793	2600938	2972050	3343131	3714180	4085198
71	5568951	5939810	6310637	6681433	7052197	7422929	7793630
72	9276117	9646659	0017170	0387650	0758098	1128514	1498898
73	0692980121	3350348	3720543	4090707	4460839	4830939	5201008
74	6680969	7050881	7420760	7790609	8160426	8530211	8899965
75	0700378666	0748263	1117828	1487362	1856864	2226335	2595774
76	4073217	4442500	4811751	5180970	5550158	5919315	6288441
77	7764628	8133597	8502534	8871440	9240315	9609158	9977970
78	0711452905	1821560	2190184	2558777	2927338	3295869	3664368
79	5138051	5506394	5874705	6242985	6611234	6979452	7347639
1180	8820073	9188104	9556103	9924071	0292008	0659914	1027789

OF NUMBERS. Logarithms 0292180227–0722131226.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4893719	5281223	5668692	387745	711	677	642	607	572	538	504	469	434
8767199	9154357	9541480	400	365	331	296	261	227	193	158	123	089
2637226	3024040	3410818	055	020	985	951	917	882	847	814	778	745
6503809	6890278	7276712	386709	676	641	606	573	537	504	469	434	400
0366951	0753077	1139168	366	332	297	262	229	194	159	126	091	056
4226661	4612443	4998191	023	988	954	919	885	851	817	782	748	714
8082943	8468383	8853789	385680	645	611	577	543	508	474	440	406	371
1935804	2320903	2705967	338	303	269	235	201	166	132	099	064	029
5785250	6170007	6554730	384996	962	927	894	859	825	791	757	723	689
9631288	0015704	0400086	655	621	586	553	519	484	451	416	382	349
3473922	3857998	4242041	384314	281	246	212	179	144	111	076	043	008
7313159	7696896	8080599	383975	941	906	873	839	805	771	737	703	670
1149005	1532403	1915768	635	601	568	534	500	466	432	398	365	331
4981466	5364527	5747553	296	263	230	195	162	127	094	061	026	993
8810549	9193271	9575960	382958	925	892	857	824	790	757	722	689	655
2636258	3018643	3400995	622	587	555	520	487	453	419	385	352	319
6458600	6840649	7222665	284	251	218	184	150	116	083	049	016	982
0277581	0659294	1040974	381948	915	881	848	814	781	747	713	680	647
4093206	4474585	4855930	612	580	546	512	479	445	411	379	345	311
7905483	8286526	8667537	278	244	211	177	144	111	077	043	011	976
1714415	2095125	2475801	380944	910	876	843	810	776	743	710	676	643
5520011	5900387	6280730	610	576	543	509	476	443	410	376	343	309
9322274	9702317	0082327	276	243	210	176	143	110	077	043	010	977
3121211	3500922	3880600	379944	910	877	844	810	778	744	711	678	645
6916828	7296208	7675554	611	578	545	512	479	446	412	380	346	313
0709131	1088179	1467194	280	246	214	181	147	115	081	048	015	982
4498125	4876843	5255527	378949	916	883	850	817	783	751	718	684	652
8283816	8662204	9040559	619	585	553	519	487	454	420	388	355	322
2066211	2444269	2822294	288	256	223	190	157	124	092	058	025	993
5845314	6223043	6600740	377959	927	894	861	828	795	763	729	697	664
9621131	9998532	0375901	377630	599	565	532	500	467	434	401	369	335
3393668	3770742	4147783	303	270	238	204	172	139	106	074	041	008
7162932	7539678	7916392	376975	943	910	877	845	811	780	746	714	681
0928926	1305346	1681734	648	616	583	551	518	485	452	420	388	354
4691658	5067752	5443813	322	290	257	224	192	159	126	094	061	029
8451133	8826901	9202637	375997	963	931	899	866	834	801	768	736	704
2207356	2582800	2958211	671	638	606	574	541	509	476	444	411	379
5960333	6335452	6710539	346	314	281	249	217	184	152	119	087	055
9710070	0084865	0459629	022	990	957	926	892	861	828	795	764	731
3456572	3831044	4205484	374698	667	634	601	570	537	505	472	440	408
7199844	7573994	7948112	374376	343	311	279	247	214	182	150	118	085
0939894	1313721	1687517	054	021	988	957	924	893	860	827	796	764
4676725	5050231	5423705	373731	699	667	635	603	570	539	506	474	442
8410343	8783529	9156682	410	378	346	314	281	250	217	186	153	121
2140755	2513620	2886453	089	057	026	993	961	929	897	865	833	801
5867965	6240510	6613023	372769	737	705	673	641	609	577	545	513	481
9591979	9964204	0336398	450	417	385	354	321	290	258	225	194	162
3312802	3684709	4056584	131	098	066	035	002	971	939	907	875	844
7030440	7402029	7773586	371811	780	748	716	684	653	620	589	557	526
0744899	1116170	1487409	493	462	430	398	366	335	303	271	239	208
4456184	4827138	5198060	371176	145	112	081	049	018	986	954	922	891
8164299	8534937	8905543	370859	827	796	764	732	701	669	638	606	574
1869252	2239573	2609863	542	511	480	448	416	384	354	321	290	258
5571046	5941052	6311026	227	195	164	132	100	069	038	006	974	943
9269688	9639379	0009038	369912	879	849	817	785	754	723	691	659	628
2965182	3334559	3703904	597	565	534	502	471	439	408	377	345	313
6657535	7026597	7395628	283	251	219	188	157	126	094	062	031	000
0346751	0715500	1084218	368969	937	906	875	843	812	781	749	718	687
4032835	4401272	4769677	655	624	593	561	531	499	467	437	405	374
7715794	8083918	8452011	343	311	280	249	218	187	155	124	093	062
1395632	1763445	2131226	031	999	968	937	906	875	843	813	781	750

Numbers 12400–13009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1240	0934216852	4567075	4917270	5267437	5617576	5967686	6317768
41	7717815	8067756	8417669	8767554	9117410	9467239	9817039
42	0941215958	1565618	1915249	2264852	2614427	2963974	3313493
43	4711286	5060665	5410015	5759336	6108630	6457896	6807134
44	8203804	8552901	8901970	9251011	9600024	9949009	0297966
45	0951693514	2042331	2391120	2739881	3088614	3437319	3785996
46	5180423	5528960	5877469	6225950	6574403	6922828	7271226
47	8664535	9012792	9361022	9709223	0057397	0405543	0753661
48	0962145853	2493832	2841782	3189705	3537600	3885467	4233306
49	5624384	5972084	6319756	6667400	7015016	7362605	7710165
1250	0969100130	9447552	9794946	0142312	0489650	0836961	1184243
51	0972573097	2920241	3267357	3614446	3961506	4308539	4655545
52	6043289	6390155	6736994	7083806	7430589	7777345	8124074
53	9510710	9857300	0203862	0550397	0896904	1243383	1589835
54	0982975365	3321678	3667964	0984014223	0984360453	0984706657	5052832
55	6437258	6783296	7129306	7475288	7821243	8167170	8513070
56	9896394	0242156	0587891	0933598	1279277	1624929	1970554
57	0993352777	3698264	4043723	4389156	4734560	5079937	5425287
58	6806411	7151624	7496808	7841966	8187096	8532199	8877274
59	1000257301	0602239	0947150	1292034	1636890	1981718	2326520
1260	1003705451	4050116	4394753	4739363	5083945	5428500	5773028
61	7150866	7495257	7839621	8183957	8528267	8872549	9216803
62	1010593549	0937667	1281758	1625822	1969859	2313868	2657850
63	4033506	4377351	4721170	5064961	5408726	5752463	6096172
64	7470739	7814313	8157860	8501379	8844872	9188337	9531775
65	1020905255	1248557	1591832	1935080	2278301	2621495	2964662
66	4337057	4680088	5023092	5366069	5709019	6051941	6394837
67	7766149	8108909	8451642	8794349	9137028	9479680	9822305
68	1031192535	1535025	1877489	2219925	2562334	2904716	3247071
69	4616221	4958441	5300634	5642801	5984940	6327052	6669137
1270	1038037210	8379160	8721084	9062981	9404851	9746694	0088510
71	1041455506	1797187	2138842	2480470	2822071	3163645	3505192
72	4871113	5212526	5553912	5895272	6236604	6577910	6919189
73	8284037	8625181	8966299	9307391	9648455	9989493	0330504
74	1051694280	2035157	2376007	2716831	3057628	3398398	3739141
75	5101848	5442457	5783041	6123597	6464127	6804629	7145106
76	8506744	8847087	9187403	9527692	9867955	0208191	0548401
77	1061908973	2249049	2589099	2929122	3269118	3609088	3949031
78	5308538	5648348	5988132	6327889	6667620	7007324	7347001
79	8705445	9044989	9384507	9723999	0063464	0402902	0742314
1280	1072099696	2438976	2778229	3117455	3456655	3795828	4134975
81	5491297	5830312	6169300	6508261	6847197	7186105	7524987
82	8880252	9219002	9557725	9896423	0235093	0573738	0912356
83	1082266564	2605050	2943509	3281943	3620350	3958730	4297084
84	5650237	5988460	6326656	6664826	7002969	7341086	7679177
85	9031277	9369236	9707169	0045075	0382956	0720810	1058638
86	1092409686	2747382	3085052	3422696	3760314	4097905	4435471
87	5785469	6122903	6460311	6797693	7135048	7472377	7809680
88	9158630	9495802	9832948	0170068	0507161	0844229	1181270
89	1102529174	2866084	3202968	3539827	3876659	4213465	4550245
1290	1105897103	6233752	6570376	6906973	7243544	7580089	7916608
91	9262423	9598811	9935174	0271510	0607821	0944105	1280363
92	1112625137	2961265	3297367	3633443	3969493	4305518	4641516
93	5985249	6321117	6656959	6992776	7328566	7664331	8000069
94	9342763	9678372	0013955	0349512	0685043	1020548	1356027
95	1122697684	3033034	3368357	3703655	4038927	4374173	4709393
96	6050015	6385106	6720171	7055210	7390224	7725211	8060173
97	9399761	9734593	0069400	0404181	0738936	1073665	1408369
98	1132746925	3081499	3416048	3750571	4085068	4419540	4753985
99	6091511	6425828	6760119	7094384	7428624	7762838	8097027
1300	9433523	9767583	0101617	0435625	0769608	1103565	1437497

OF NUMBERS.

Logarithms 0934216852–1142439137.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6667822	7017848	7367846	350223	195	167	139	110	082	054	026	998	969
0166811	0516555	0866271	349941	913	885	856	829	800	772	744	716	687
3662983	4012446	4361880	660	631	603	575	547	519	490	463	434	406
7156343	7505525	7854678	379	350	321	294	266	238	209	182	153	126
0646895	0995796	1344669	097	069	041	013	985	957	929	901	873	845
4134644	4483265	4831858	348817	789	761	733	705	677	648	621	593	565
7619595	7967936	8316249	537	509	481	453	425	398	369	341	313	286
1101751	1449813	1797847	257	230	201	174	146	118	090	062	034	006
4581117	4928901	5276656	347979	950	923	895	867	839	811	784	755	728
8057698	8405203	8752681	700	672	644	616	589	560	533	505	478	449
1531498	1878726	2225925	347422	394	366	338	311	282	255	228	199	172
5002522	5349472	5696394	144	116	089	060	033	006	977	950	922	895
8470774	8817447	9164092	346866	839	812	783	756	729	700	673	645	618
1936259	2282655	2629024	590	562	535	507	479	452	424	396	369	341
5398980	5745100	6091193	313	286	259	230	204	175	148	120	093	065
8858943	9204787	9550604	038	010	982	955	927	900	873	844	817	790
2316151	2661720	3007262	345762	735	707	679	652	625	597	569	542	515
5770609	6115904	6461171	487	459	433	404	377	350	322	295	267	240
9222322	9567342	9912335	213	184	158	130	103	075	048	020	993	966
2671294	3016040	3360759	344938	911	884	856	828	802	774	746	719	692
6117528	6462001	6806447	344665	637	610	582	555	528	500	473	446	419
9561031	9905231	0249404	391	364	336	310	282	254	228	200	173	145
3001805	3345732	3689632	118	091	064	037	009	982	955	927	900	874
6439855	6783510	7127138	343845	819	791	765	737	709	683	655	628	601
9875186	0218569	0561926	574	547	519	493	465	438	411	383	357	329
3307801	3650913	3993999	302	275	248	221	194	167	139	112	086	058
6737705	7080547	7423361	031	004	977	950	922	896	868	842	814	788
0164903	0507474	0850018	342760	733	707	679	652	625	598	571	544	517
3589399	3931700	4273974	490	464	436	409	382	355	328	301	274	247
7011196	7353227	7695232	220	193	167	139	112	085	059	031	005	978
0430299	0772062	1113797	341950	924	897	870	843	816	789	763	735	709
3846713	4188206	4529673	681	655	628	601	574	547	521	493	467	440
7260441	7601666	7942865	413	386	360	332	306	279	252	225	199	172
0671488	1012445	1353376	144	118	092	064	038	011	984	957	931	904
4079858	4420548	4761211	340877	850	824	797	770	743	717	690	663	637
7485555	7825978	8166374	609	584	556	530	502	477	449	423	396	370
0888584	1228740	1568870	343	316	289	263	236	210	183	156	130	103
4288948	4628838	4968701	076	050	023	996	970	943	917	890	863	837
7686652	8026276	8365874	339810	784	757	731	704	677	651	624	598	571
1081699	1421058	1760391	544	518	492	465	438	412	385	359	333	305
4474095	4813189	5152257	339280	253	226	200	173	147	120	094	068	040
7863843	8202672	8541475	015	988	961	936	908	882	856	829	803	777
1250947	1589513	1928051	338750	723	698	670	645	618	591	566	538	513
4635412	4973713	5311989	486	459	434	407	380	354	328	301	276	248
8017241	8355279	8693291	223	196	170	143	117	091	064	038	012	986
1396439	1734214	2071963	337959	933	906	881	854	828	801	775	749	723
4773010	5110522	5448009	696	670	644	618	591	566	539	512	487	460
8146957	8484208	8821432	434	408	382	355	329	303	277	251	224	198
1518285	1855274	2192237	172	146	120	093	068	041	015	989	963	937
4886998	5223726	5560428	336910	884	859	832	806	780	753	728	702	675
8253101	8589567	8926008	336649	624	597	571	545	519	493	466	441	415
1616596	1952802	2288982	388	363	336	311	284	258	233	206	180	155
4977488	5313434	5649355	128	102	076	050	025	998	972	946	921	894
8335781	8671468	9007129	335868	842	817	790	765	738	712	687	661	634
1691480	2026907	2362309	609	583	557	531	505	479	453	427	402	375
5044588	5379756	5714899	350	323	298	272	246	220	195	168	143	116
8395108	8730018	9064903	091	065	039	014	987	962	935	910	885	858
1743046	2077698	2412324	334832	807	781	755	729	704	677	652	626	601
5088405	5422800	5757168	574	549	523	497	472	445	420	395	368	343
8431189	8765326	9099438	317	291	265	240	214	189	162	137	112	085
1771402	2105282	2439137	060	034	008	983	957	932	905	880	855	829

Numbers 13000–13609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1300	1139433523	9767583	0101617	0435625	0769608	1103565	1437497
1	1142772966	3106769	3440546	3774298	4108024	4441724	4775399
2	6109842	6443389	6776910	7110406	7443875	7777320	8110738
3	9444157	9777448	0110713	0443953	0777167	1110355	1443518
4	1152775914	3108949	3441959	3774943	4107901	4440834	4773742
5	6105117	6437897	6770651	7103380	7436084	7768762	8101414
6	9431769	9764295	0096794	0429268	0761717	1094141	1426539
7	1162755876	3088147	3420392	3752612	4084806	4416975	4749119
8	6077440	6409457	6741448	7073414	7405355	7737270	8069160
9	9396466	9728229	0059966	0391679	0723366	1055028	1386664
1310	1172712957	3044466	3375951	3707410	4038844	4370253	4701636
11	6026917	6358174	6689406	7020612	7351793	7682949	8014080
12	9338350	9669355	0000334	0331288	0662217	0993121	1323999
13	1182647261	2978013	3308741	3639443	3970120	4300771	4631398
14	5953652	6284153	6614629	6945079	7275504	7605904	7936279
15	9257528	9587778	9918002	0248201	0578375	0908524	1238648
16	1192558893	2888891	3218865	3548813	3878736	4208634	4538508
17	5857750	6187498	6517220	6846918	7176591	7506239	7835862
18	9154103	9483600	9813073	0142521	0471944	0801341	1130714
19	1202447955	2777203	3106426	3435624	3764797	4093946	4423069
1320	1205739312	6068311	6397284	6726233	7055157	7384055	7712929
21	9028176	9356926	9685650	0014350	0343025	0671675	1000300
22	1212314551	2643052	2971528	3299979	3628406	3956807	4285184
23	5598442	5926694	6254922	6583125	6911303	7239456	7567585
24	8879851	9207856	9535835	9863791	0191721	0519626	0847507
25	1222158783	2486540	2814272	3141980	3469663	3797321	4124954
26	5435241	5762751	6090236	6417696	6745132	7072543	7399930
27	8709229	9036492	9363730	9690944	0018133	0345298	0672437
28	1231980750	2307767	2634759	2961726	3288669	3615587	3942481
29	5249809	5576580	5903326	6230048	6556744	6883417	7210064
1330	1238516410	8842935	9169435	9495911	9822362	0148789	0475191
31	1241780555	2106834	2433089	2759320	3085526	3411708	3737865
32	5042248	5368283	5694293	6020279	6346240	6672177	6998089
33	8301494	8627284	8953050	9278791	9604508	9930200	0255868
34	1251558296	1883842	2209363	2534860	2860333	3185781	3511205
35	4812657	5137959	5463237	5788490	6113719	6438924	6764104
36	8064581	8389640	8714674	9039684	9364670	9689631	0014568
37	1261314073	1638888	1963679	2288446	2613189	2937907	3262601
38	4561134	4885707	5210255	5534780	5859280	6183755	6508207
39	7805770	8130100	8454406	8778688	9102946	9427179	9751389
1340	1271047984	1372072	1696136	2020176	2344192	2668183	2992151
41	4287779	4611625	4935448	5259246	5583020	5906770	6230496
42	7525158	7848764	8172345	8495902	8819435	9142944	9466428
43	1280760127	1083491	1406831	1730147	2053440	2376708	2699952
44	3992687	4315811	4638911	4961986	5285038	5608066	5931069
45	7222843	7545727	7868586	8191422	8514233	8837021	9159785
46	1290450599	0773243	1095862	1418458	1741030	2063577	2386101
47	3675957	3998361	4320742	4643098	4965430	5287739	5610023
48	6898922	7221087	7543228	7865345	8187438	8509508	8831553
49	1300119497	0441423	0763325	1085204	1407058	1728889	2050696
1350	1303337685	3659373	3981037	4302677	4624293	4945885	5267454
51	6553490	6874940	7196366	7517768	7839146	8160500	8481831
52	9766916	0088128	0409316	0730480	1051621	1372738	1693831
53	1312977966	3298940	3619891	3940818	4261721	4582601	4903457
54	6186643	6507381	6828095	7148785	7469451	7790094	8110713
55	9392952	9713453	0033930	0354383	0674813	0995219	1315602
56	1322596895	2917160	3237400	3557618	3877811	4197981	4518127
57	5798477	6118505	6438510	6758491	7078449	7398383	7718293
58	8997699	9317492	9637261	9957007	0276729	0596428	0916103
59	1332194567	2514125	2833659	3153169	3472656	3792119	4111559
1360	5389084	5708406	6027705	6346981	6666233	6985461	7304666

OF NUMBERS. Logarithms 1139433523-1338262141.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1771402	2105282	2439137	334060	034	008	983	957	932	905	880	855	829
5109048	5442672	5776270	333803	777	752	726	700	675	649	624	598	572
8444131	8777499	9110841	547	521	496	469	445	418	393	368	342	316
1776655	2109767	2442853	291	265	240	214	188	163	137	112	086	061
5106624	5439480	5772311	035	010	984	958	933	908	882	856	831	806
8434041	8766643	9099219	332780	754	729	704	678	652	627	602	576	550
1758911	2091258	2423580	526	499	474	449	424	398	372	347	322	296
5081237	5413330	5745398	271	245	220	194	169	144	118	093	068	042
8401024	8732863	9064677	017	991	966	941	915	890	864	839	814	789
1718275	2049861	2381421	331763	737	713	687	662	636	611	586	560	536
5032994	5364327	5695635	331509	485	459	434	409	383	358	333	308	282
8345185	8676266	9007321	257	232	206	181	156	131	105	081	055	029
1654852	1985680	2316483	005	979	954	929	904	878	853	828	803	778
4961999	5292575	5623126	330752	728	702	677	651	627	601	576	551	526
8266629	8596954	8927254	501	476	450	425	400	375	350	325	300	274
1568747	1898821	2228869	250	224	199	174	149	124	099	074	048	024
4868356	5198179	5527977	329998	974	948	923	898	874	848	823	798	773
8165459	8495032	8824580	748	722	698	673	648	623	597	573	548	523
1460062	1789385	2118683	497	473	448	423	397	373	348	323	298	272
4752167	5081240	5410289	248	223	198	173	149	123	098	073	049	023
8041778	8370603	8699402	328999	973	949	924	898	874	849	825	799	774
1328900	1657475	1986026	750	724	700	675	650	625	600	575	551	525
4613535	4941862	5270165	501	476	451	427	401	377	351	327	303	277
7895689	8223768	8551822	252	228	203	178	153	129	104	079	054	029
1175363	1503194	1831001	005	979	956	930	905	881	856	831	807	782
4452563	4780147	5107706	327757	732	708	683	658	633	609	584	559	535
7727291	8054628	8381941	510	485	460	436	411	387	361	337	313	288
0999553	1326643	1653709	263	238	214	189	165	139	116	090	066	041
4269350	4596194	4923014	017	992	967	943	918	894	869	844	820	795
7536688	7863286	8189860	326771	746	722	696	673	647	624	598	574	550
0801569	1127922	1454251	326525	500	476	451	427	402	378	353	329	304
4063997	4390106	4716189	279	255	231	206	182	157	132	109	083	059
7323977	7649841	7975680	035	010	986	961	937	912	888	864	839	814
0581512	0907131	1232726	325790	766	741	717	692	668	644	619	595	570
3836605	4161980	4487331	546	521	497	473	448	424	400	375	351	326
7089260	7414391	7739499	302	278	253	229	205	180	156	131	108	082
0339481	0664369	0989233	059	034	010	986	961	937	913	888	864	840
3587271	3911916	4236537	324815	791	767	743	718	694	670	645	621	597
6832634	7157037	7481416	573	548	525	500	475	452	427	403	379	354
0075574	0399735	0723871	330	306	282	258	233	210	185	161	136	113
3316094	3640013	3963908	324088	064	040	016	991	968	943	919	895	871
6554198	6877875	7201529	323846	823	798	774	750	726	702	677	654	629
9789889	0113326	0436738	606	581	557	533	509	484	461	437	412	389
3023172	3346368	3669539	364	340	316	293	268	244	220	196	171	148
6254049	6577004	6899936	124	100	075	052	028	003	980	955	932	907
9482524	9805240	0127931	322884	859	836	811	788	764	739	716	691	668
2708601	3031077	3353529	644	619	596	572	547	524	500	476	452	428
5932284	6254520	6576733	404	381	356	332	309	284	261	236	213	189
9153575	9475573	9797547	165	141	117	093	070	045	022	998	974	950
2372479	2694238	3015973	321926	902	879	854	831	807	783	759	735	712
5588999	5910520	6232017	321688	664	640	616	592	569	545	521	497	473
8803138	9124421	9445680	450	426	402	378	354	331	307	283	259	236
2014900	2335946	2656968	212	188	164	141	117	093	069	046	022	998
5224289	5545098	5865882	320974	951	927	903	880	856	832	809	784	761
8431308	8751880	9072428	738	714	690	666	643	619	595	572	548	524
1635961	1956296	2276607	501	477	453	430	406	383	359	335	311	288
4838250	5158349	5478425	265	240	218	193	170	146	123	099	076	052
8038180	8358043	8677883	028	005	981	958	934	910	887	863	840	816
1235754	1555382	1874986	319793	769	746	722	699	675	651	628	604	581
4430975	4750368	5069738	558	534	510	487	463	440	416	393	370	346
7623848	7943006	8262141	322	299	276	252	228	205	182	158	135	111

Numbers 13600–14209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1360	1335389084	5708406	6027705	6346981	6666233	6985461	7304666
61	8581252	8900340	9219404	9538445	9857463	0176457	0495427
62	1341771076	2089929	2408759	2727566	3046350	3365109	3683846
63	4958558	5277178	5595774	5914347	6232897	6551423	6869926
64	8143703	8462089	8780452	9098791	9417107	9735400	0053669
65	1351326514	1644667	1962796	2280902	2598985	2917045	3235081
66	4506993	4824913	5142810	5460683	5778533	6096360	6414164
67	7685146	8002833	8320497	8638138	8955756	9273350	9590921
68	1360860974	1178429	1495861	1813270	2130655	2448017	2765357
69	4034481	4351705	4668905	4986082	5303235	5620366	5937473
1370	1367205672	7522663	7839632	8156577	8473500	8790399	9107275
71	1370374548	0691308	1008046	1324760	1641451	1958119	2274764
72	3541114	3857643	4174150	4490633	4807094	5123531	5439946
73	6705372	7021671	7337948	7654201	7970431	8286638	8602822
74	9867327	0183396	0499442	0815465	1131465	1447442	1763396
75	1383026982	3342821	3658637	3974430	4290200	4605947	4921671
76	6184339	6499949	6815535	7131099	7446639	7762157	8077652
77	9339403	9654783	9970140	0285475	0600786	0916075	1231341
78	1392492176	2807327	3122456	3437562	3752644	4067704	4382742
79	5642662	5957585	6272485	6587362	6902217	7217048	7531857
1380	1398790864	9105559	9420231	9734880	0049506	0364110	0678691
81	1401936786	2251253	2565697	2880118	3194517	3508893	3823246
82	5080430	5394670	5708886	6023080	6337251	6651400	6965525
83	8221801	8535813	8849803	9163769	9477713	9791635	0105533
84	1411360901	1674686	1988449	2302189	2615906	2929601	3243273
85	4497734	4811293	5124829	5438342	5751833	6065301	6378747
86	7632303	7945635	8258945	8572232	8885497	9198739	9511959
87	1420764611	1077717	1390801	1703863	2016902	2329918	2642912
88	3894661	4207542	4520401	4833237	5146050	5458841	5771609
89	7022457	7335113	7647746	7960357	8272945	8585511	8898054
1390	1430148003	0460433	0772842	1085228	1397591	1709932	2022250
91	3271300	3583506	3895690	4207851	4519990	4832107	5144201
92	6392353	6704335	7016294	7328231	7640146	7952038	8263908
93	9511164	9822922	0134658	0446371	0758062	1069730	1381377
94	1442627738	2939272	3250784	3562274	3873741	4185186	4496609
95	5742076	6053387	6364676	6675942	6987186	7298408	7609608
96	8854183	9165271	9476337	9787380	0098401	0409400	0720377
97	1451964061	2274927	2585770	2896591	3207389	3518166	3828920
98	5071714	5382357	5692978	6003577	6314153	6624707	6935239
99	8177145	8487566	8797965	9108341	9418696	9729028	0039338
1400	1461280357	1590556	1900733	2210888	2521021	2831132	3141220
1	4381353	4691331	5001286	5311220	5621132	5931021	6240888
2	7480136	7789893	8099628	8409340	8719031	9028699	9338346
3	1470576710	0886246	1195760	1505252	1814722	2124170	2433595
4	3671078	3980393	4289687	4598958	4908208	5217435	5526641
5	6763242	7072338	7381411	7690463	7999492	8308499	8617485
6	9853207	0162082	0470936	0779768	1088577	1397365	1706131
7	1482940974	3249630	3558264	3866877	4175467	4484035	4792582
8	6026548	6334985	6643400	6951793	7260164	7568513	7876841
9	9109931	9418149	9726345	0034519	0342672	0650802	0958911
1410	1492191127	2499126	2807103	3115059	3422993	3730905	4038795
11	5270138	5577919	5885678	6193415	6501131	6808825	7116497
12	8346967	8654530	8962072	9269591	9577089	9884565	0192019
13	1501421618	1728964	2036288	2343590	2650870	2958128	3265365
14	4494095	4801223	5108329	5415414	5722477	6029518	6336537
15	7564399	7871310	8178199	8485067	8791913	9098737	9405540
16	1510632534	0939228	1245901	1552552	1859181	2165789	2472375
17	3698502	4004980	4311437	4617871	4924284	5230676	5537045
18	6762308	7068570	7374810	7681029	7987226	8293401	8599555
19	9823955	0130001	0436025	0742028	1048009	1353969	1659907
1420	1522883444	3189274	3495083	3800870	4106636	4412381	4718103

OF NUMBERS. Logarithms 133538908$\frac{4}{5}$-152563514$\frac{3}{5}$.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7623848	7943006	8262141	319322	299	276	252	228	205	182	158	135	111
0814375	1133298	1452199	088	064	041	018	994	970	948	923	901	877
4002559	4321249	4639915	318853	830	807	784	759	737	713	690	666	643
7188405	7506861	7825294	620	596	573	550	526	503	479	456	433	409
0371915	0690138	1008338	386	363	339	316	293	269	246	223	200	176
3553094	3871084	4189050	153	129	106	083	060	036	013	990	966	943
6731944	7049701	7367435	317920	897	873	850	827	804	780	757	734	711
9908469	0225994	0543496	687	664	641	618	594	571	548	525	502	478
3082673	3399965	3717235	455	432	409	385	362	340	316	292	270	246
6254558	6571619	6888657	224	200	177	153	131	107	085	061	038	015
9424128	9740958	0057764	316991	969	945	923	899	876	853	830	806	784
2591386	2907985	3224561	760	738	714	691	668	645	622	599	576	553
5756337	6072705	6389050	529	507	483	461	437	415	391	368	345	322
8918982	9235120	9551235	299	277	253	230	207	184	160	138	115	092
2079327	2395235	2711120	069	046	023	000	977	954	931	908	885	862
5237373	5553051	5868707	315839	816	793	770	747	724	702	678	656	632
8393124	8708573	9023999	610	586	564	540	518	495	472	449	426	404
1546584	1861804	2177001	380	357	335	311	289	266	243	220	197	175
4697756	5012747	5327716	151	129	106	082	060	038	014	991	969	946
7846643	8161406	8476146	314923	900	877	855	831	809	786	763	740	718
0993249	1307784	1622296	314695	672	649	626	604	581	558	535	512	490
4137576	4451883	4766168	467	444	421	399	376	353	330	307	285	262
7279628	7593709	7907766	240	216	194	171	149	125	103	081	057	035
0419409	0733263	1047093	012	990	966	944	922	898	876	854	830	808
3556922	3870549	4184153	313785	763	740	717	695	672	649	627	604	581
6692170	7005570	7318948	559	536	513	491	468	446	423	400	378	355
9825156	0138330	0451482	332	310	287	265	242	220	197	174	152	129
2955883	3268832	3581758	106	084	062	039	016	994	971	949	926	903
6084355	6397078	6709779	312881	859	836	813	791	768	746	723	701	678
9210575	9523073	9835549	656	633	611	588	566	543	521	498	476	454
2334547	2646820	2959071	312430	409	386	363	341	318	297	273	251	229
5456272	5768322	6080348	206	184	161	139	117	094	071	050	026	005
8575756	8887581	9199384	311982	959	937	915	892	870	848	825	803	780
1693000	2004602	2316181	758	736	713	691	668	647	623	602	579	557
4808009	5119387	5430743	534	512	490	467	445	423	400	378	356	333
7920785	8231940	8543073	311	289	266	244	222	200	177	155	133	110
1031331	1342264	1653174	088	066	043	021	999	977	954	933	910	887
4139652	4450361	4761049	310866	843	821	798	777	754	732	709	688	665
7245749	7556236	7866702	643	621	599	576	554	532	510	487	466	443
0349626	0659892	0970135	421	399	376	355	332	310	288	266	243	222
3451287	3761331	4071353	310199	177	155	133	111	088	067	044	022	000
6550733	6860556	7170357	309978	955	934	912	889	867	845	823	801	779
9647970	9957572	0267152	757	735	712	691	668	647	624	602	580	558
2742999	3052381	3361740	536	514	492	470	448	425	404	382	359	338
5835824	6144986	6454125	315	294	271	250	227	206	183	162	139	117
8926448	9235390	9544309	096	073	052	029	007	986	963	942	919	898
2014875	2323596	2632296	308875	854	832	809	788	766	744	721	700	678
5101106	5409609	5718089	656	634	613	590	568	547	524	503	480	459
8185146	8493430	8801691	437	415	393	371	349	328	305	284	261	240
1266997	1575062	1883105	218	196	174	153	130	109	086	065	043	022
4346663	4654510	4962335	307999	977	956	934	912	890	868	847	825	803
7424147	7731776	8039382	781	759	737	716	694	672	650	629	606	585
0499452	0806862	1114251	563	542	519	498	476	454	433	410	389	367
3572580	3879773	4186945	346	324	302	280	258	237	215	193	172	150
6643535	6950511	7257466	128	106	085	063	041	019	998	976	955	933
9712321	0019080	0325818	306911	889	868	846	824	803	781	759	738	716
2778939	3085482	3392003	694	673	651	629	608	586	564	543	521	499
5843394	6149720	6456025	478	457	434	413	392	369	349	326	305	283
8905687	9211798	9517887	262	240	219	197	175	154	132	111	089	068
1965823	2271718	2577592	046	024	003	981	960	938	916	895	874	852
5023805	5329484	5635143	305830	809	787	766	745	722	702	679	659	636

Numbers 14200–14809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1420	1522883444	3189274	3495083	3800870	4106636	4412381	4718103
21	5940779	6246394	6551988	6857560	7163111	7468640	7774148
22	8995964	9301364	9606743	9912100	0217436	0522751	0828044
23	1532049001	2354187	2659351	2964494	3269615	3574715	3879793
24	5099893	5404864	5709814	6014743	6319650	6624536	6929400
25	8148643	8453401	8758137	9062851	9367545	9672216	9976867
26	1541195255	1499799	1804321	2108822	2413302	2717760	3022197
27	4239731	4544061	4848370	5152658	5456924	5761169	6065393
28	7282074	7586192	7890287	8194362	8498415	8802447	9106458
29	1550322288	0626192	0930075	1233937	1537778	1841597	2145395
1430	1553360375	3664066	3967737	4271386	4575015	4878621	5182207
31	6396338	6699817	7003276	7306713	7610129	7913524	8216897
32	9430180	9733447	0036694	0339919	0643123	0946306	1249468
33	1562461904	2764960	3067995	3371009	3674001	3976973	4279923
34	5491513	5794358	6097182	6399984	6702766	7005526	7308265
35	8519011	8821644	9124257	9426849	9729419	0031968	0334497
36	1571544399	1846822	2149224	2451605	2753965	3056303	3358621
37	4567681	4869894	5172085	5474256	5776405	6078534	6380641
38	7588860	7890863	8192844	8494805	8796744	9098662	9400560
39	1580607939	0909732	1211503	1513254	1814984	2116692	2418380
1440	1583624921	3926504	4228066	4529607	4831127	5132626	5434104
41	6639808	6941182	7242535	7543866	7845177	8146467	8447736
42	9652604	9953768	0254912	0556035	0857137	1158218	1459279
43	1592663311	2964267	3265202	3566116	3867010	4167882	4468734
44	5671932	5972680	6273407	6574112	6874798	7175462	7476105
45	8678471	8979010	9279529	9580027	9880504	0180960	0481396
46	1601682930	1983261	2283572	2583862	2884131	3184380	3484608
47	4685311	4985435	5285539	5585621	5885683	6185724	6485744
48	7685619	7985535	8285431	8585307	8885161	9184995	9484809
49	1610683855	0983565	1283254	1582922	1882570	2182197	2481803
1450	1613680022	3979525	4279008	4578470	4877911	5177331	5476731
51	6674124	6973421	7272697	7571953	7871187	8170402	8469595
52	9666164	9965254	0264324	0563374	0862402	1161411	1460398
53	1622656143	2955028	3253892	3552736	3851559	4150361	4449143
54	5644065	5942744	6241403	6540041	6838659	7137256	7435832
55	8629933	8928407	9226861	9525293	9823706	0122098	0420469
56	1631613750	1912019	2210267	2508495	2806703	3104890	3403056
57	4595518	4893582	5191626	5489649	5787652	6085634	6383596
58	7575240	7873100	8170939	8468758	8766556	9064335	9362092
59	1640552919	0850575	1148210	1445825	1743419	2040993	2338547
1460	1643528558	3826010	4123441	4420852	4718243	5015613	5312963
61	6502159	6799408	7096635	7393843	7691030	7988197	8285343
62	9473726	9770771	0067796	0364800	0661784	0958748	1255691
63	1652443261	2740103	3036925	3333726	3630507	3927268	4224008
64	5410767	5707406	6004025	6300624	6597202	6893760	7190298
65	8376247	8672684	8969100	9265496	9561872	9858228	0154563
66	1661339703	1635937	1932152	2228346	2524520	2820673	3116807
67	4301138	4597171	4893183	5189175	5485147	5781099	6077031
68	7260556	7556387	7852197	8147988	8443758	8739509	9035239
69	1670217958	0513587	0809197	1104786	1400355	1695904	1991433
1470	1673173347	3468776	3764184	4059572	4354940	4650288	4945616
71	6126727	6421955	6717162	7012350	7307517	7602664	7897792
72	9078100	9373127	9668134	9963121	0258088	0553035	0847961
73	1682027468	2322295	2617102	2911889	3206655	3501402	3796129
74	4974835	5269462	5564069	5858655	6153222	6447769	6742296
75	7920203	8214630	8509037	8803424	9097791	9392138	9686466
76	1690863575	1157802	1452010	1746198	2040365	2334513	2628641
77	3804953	4098981	4392990	4686978	4980947	5274896	5568824
78	6744341	7038170	7331979	7625769	7919539	8213289	8507019
79	9681740	9975371	0268982	0562573	0856144	1149695	1443226
1480	1702617154	2910586	3203999	3497391	3790764	4084117	4377450

OF NUMBERS. Logarithms 1522883444-1705257331.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5023805	5329484	5635143	305830	809	787	766	745	722	702	679	659	636
8079634	8385099	8690542	615	594	572	551	529	508	486	465	443	422
1133315	1438565	1743794	400	379	357	336	315	293	271	250	229	207
4184850	4489886	4794900	186	164	143	121	100	078	057	036	014	993
7234243	7539065	7843865	304971	950	929	907	886	864	843	822	800	778
0281496	0586104	0890690	758	736	714	694	671	651	629	608	586	565
3326612	3631007	3935380	544	522	501	480	458	437	415	395	373	351
6369595	6673776	6977936	330	309	288	266	245	224	202	181	160	138
9410447	9714415	0018362	118	095	075	053	032	011	989	968	947	926
2449172	2752927	3056662	303904	883	862	841	819	798	777	755	735	713
5485772	5789315	6092837	303691	671	649	629	606	586	565	543	522	501
8520250	8823581	9126891	479	459	437	416	395	373	353	331	310	289
1552609	1855728	2158827	267	247	225	204	183	162	141	119	099	077
4582852	4885761	5188647	056	035	014	992	972	950	929	909	886	866
7610983	7913680	8216356	302845	824	802	782	760	739	718	697	676	655
0637004	0939490	1241955	633	613	592	570	549	529	507	486	465	444
3660918	3963193	4265448	423	402	381	360	338	318	297	275	255	233
6682727	6984793	7286837	213	191	171	149	129	107	086	066	044	023
9702436	0004291	0306126	003	981	961	939	918	898	876	855	835	813
2720047	3021692	3323317	301793	771	751	730	708	688	667	645	625	604
5735562	6036998	6338414	301583	562	541	520	499	478	458	436	416	394
8748985	9050212	9351418	374	353	331	311	290	269	249	227	206	186
1760318	2061336	2362334	164	144	123	102	081	061	039	018	998	977
4769565	5070375	5371164	300956	935	914	894	872	852	831	810	789	768
7776728	8077330	8377911	748	727	705	686	664	643	623	602	581	560
0781810	1082204	1382577	539	519	498	477	456	436	414	394	373	353
3784815	4085001	4385166	331	311	290	269	249	228	207	186	165	145
6785744	7085723	7385681	124	104	082	062	041	020	000	979	958	938
9784601	0084373	0384124	299916	896	876	854	834	814	792	772	751	731
2781389	3080954	3380499	710	689	668	648	627	606	586	565	545	523
5776110	6075469	6374807	299503	483	462	441	420	400	379	359	338	317
8768768	9067921	9367052	297	276	256	234	215	193	173	153	131	112
1759365	2058312	2357238	090	070	050	028	009	987	967	947	926	905
4747904	5046645	5345365	298885	864	844	823	802	782	761	741	720	700
7734388	8032924	8331439	679	659	638	618	597	576	556	536	515	494
0718820	1017150	1315460	474	454	432	413	392	371	351	330	310	290
3701202	3999328	4297433	269	248	228	208	187	166	146	126	105	085
6681538	6979459	7277360	064	044	023	003	982	962	942	921	901	880
9659830	9957546	0255243	297860	839	819	798	779	757	738	716	697	676
2636080	2933593	3231086	656	635	615	594	574	554	533	513	493	472
5610293	5907602	6204891	297452	431	411	391	370	350	330	309	289	268
8582470	8879575	9176661	249	227	208	187	167	146	127	105	086	065
1552614	1849517	2146399	045	025	004	984	964	943	923	903	882	862
4520728	4817428	5114108	296842	822	801	781	761	740	720	700	680	659
7486816	7783313	8079790	639	619	599	578	558	538	518	497	477	457
0450879	0747174	1043448	437	416	396	376	356	335	316	295	274	255
3412920	3709013	4005086	234	215	194	174	153	134	113	093	073	052
6372942	6668834	6964705	033	012	992	972	952	932	911	892	871	851
9330949	9626639	9922308	295831	810	791	770	751	730	710	690	669	650
2286942	2582430	2877899	629	610	589	569	549	529	509	488	469	448
5240924	5536212	5831480	295429	408	388	368	348	328	308	288	268	247
8192899	8487986	8783053	228	207	188	167	147	128	107	087	067	047
1142868	1437755	1732622	027	007	987	967	947	926	907	887	867	846
4090835	4385522	4680189	294827	807	787	766	747	727	706	687	667	646
7036802	7331289	7625756	627	607	586	567	547	527	506	487	467	447
9980773	0275060	0569327	427	407	387	367	347	328	307	287	267	248
2922749	3216837	3510905	227	208	188	167	148	128	108	088	068	048
5862733	6156622	6450491	028	009	988	969	949	928	909	889	869	850
8800729	9094419	9388089	293829	809	790	770	750	730	710	690	670	651
1736738	2030230	2323702	631	611	591	571	551	531	512	492	472	452
4670764	4964057	5257331	432	413	392	373	353	333	314	293	274	254

Numbers 14800–15409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1480	1702617154	2910586	3203999	3497391	3790764	4084117	4377450
81	5550585	5843819	6137034	6430228	6723403	7016558	7309693
82	8482036	8775073	9068089	9361086	9654063	9947020	0239958
83	1711411510	1704349	1997168	2289967	2582747	2875507	3168247
84	4339009	4631651	4924273	5216875	5509457	5802019	6094562
85	7264537	7556981	7849406	8141811	8434196	8726561	9018907
86	1720188094	0480342	0772570	1064778	1356966	1649135	1941285
87	3109685	3401736	3693768	3985779	4277772	4569744	4861697
88	6029312	6321167	6613002	6904818	7196613	7488390	7780147
89	8946978	9238636	9530275	9821895	0113495	0405076	0696636
1490	1731862684	2154147	2445591	2737015	3028419	3319804	3611169
91	4776435	5067702	5358950	5650179	5941388	6232577	6523747
92	7688231	7979304	8270357	8561390	8852404	9143398	9434373
93	1740598077	0888955	1179813	1470651	1761470	2052269	2343049
94	3505975	3796657	4087321	4377965	4668589	4959194	5249779
95	6411927	6702415	6992884	7283333	7573763	7864174	8154565
96	9315935	9606229	9896504	0186759	0476995	0767212	1057409
97	1752218003	2508104	2798184	3088246	3378288	3668311	3958314
98	5118134	5408040	5697927	5987795	6277644	6567473	6857283
99	8016328	8306042	8595735	8885410	9175065	9464701	9754317
1500	1760912591	1202111	1491611	1781093	2070555	2359998	2649421
1	3806922	4096250	4385557	4674846	4964115	5253365	5542596
2	6699327	6988461	7277576	7566672	7855749	8144807	8433845
3	9589806	9878748	0167671	0456575	0745459	1034324	1323170
4	1772478363	2767113	3055843	3344555	3633248	3921921	4210575
5	5364999	5653557	5942096	6230616	6519117	6807598	7096061
6	8249719	8538085	8826433	9114761	9403070	9691360	9979631
7	1781132523	1420698	1708854	1996991	2285109	2573208	2861288
8	4013415	4301399	4589365	4877310	5165237	5453145	5741034
9	6892398	7180191	7467965	7755720	8043457	8331174	8618872
1510	1789769473	0057076	0344659	0632224	0919770	1207296	1494804
11	1792644643	2932056	3219449	3506823	3794179	4081515	4368832
12	5517912	5805134	6092337	6379522	6666687	6953833	7240961
13	8389280	8676313	8963326	9250321	9537296	9824253	0111191
14	1801258752	1545595	1832418	2119223	2406010	2692777	2979525
15	4126328	4412982	4699617	4986232	5272829	5559407	5845966
16	6992013	7278477	7564923	7851350	8137758	8424146	8710517
17	9855808	0142084	0428340	0714578	1000797	1286997	1573179
18	1812717716	3003803	3289871	3575920	3861951	4147963	4433955
19	5577739	5863637	6149517	6435378	6721221	7007044	7292849
1520	1818435879	8721590	9007282	9292955	9578609	9864245	0149862
21	1821292141	1577663	1863167	2148653	2434119	2719567	3004996
22	4146524	4431860	4717176	5002474	5287753	5573013	5858255
23	6999033	7284181	7569310	7854421	8139513	8424586	8709640
24	9849670	0134631	0419573	0704496	0989401	1274287	1559154
25	1832698437	2983211	3267966	3552703	3837421	4122120	4406800
26	5545336	5829924	6114492	6399042	6683574	6968086	7252580
27	8390371	8674772	8959154	9243518	9527863	9812189	0096497
28	1841233542	1517757	1801953	2086131	2370290	2654431	2938552
29	4074854	4358883	4642893	4926885	5210859	5494813	5778749
1530	1846914308	7198152	7481976	7765783	8049570	8333339	8617090
31	9751907	0035565	0319204	0602825	0886428	1170011	1453577
32	1852587653	2871126	3154580	3438016	3721433	4004832	4288212
33	5421549	5704836	5988106	6271357	6554589	6837803	7120999
34	8253596	8536699	8819784	9102850	9385898	9668928	9951939
35	1861083798	1366717	1649617	1932499	2215363	2498208	2781034
36	3912157	4194892	4477608	4760306	5042985	5325646	5608289
37	6738675	7021226	7303758	7586272	7868767	8151244	8433703
38	9563355	9845722	0128070	0410400	0692712	0975006	1257281
39	1872386198	2668382	2950547	3232694	3514822	3796932	4079024
1540	5207208	5489209	5771191	6053154	6335100	6617027	6898935

OF NUMBERS. Logarithms 1702617154-1877744552.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4670764	4964057	5257331	293432	413	392	373	353	333	314	293	274	254
7602809	7895904	8188980	234	215	194	175	155	135	116	095	076	056
0532876	0825774	1118652	037	016	997	977	957	938	918	898	878	858
3460967	3753667	4046348	292839	819	799	780	760	740	720	700	681	661
6387085	6679589	6972072	642	622	602	582	562	543	523	504	483	465
9311234	9603540	9895827	444	425	405	385	365	346	327	306	287	267
2233414	2525524	2817615	248	228	208	188	169	150	129	110	091	070
5153630	5445544	5737438	051	032	011	993	972	953	933	914	894	874
8071884	8363601	8655299	291855	835	816	795	777	757	737	717	698	679
0988178	1279699	1571202	658	639	620	600	581	560	542	521	503	482
3902515	4193841	4485147	291463	444	424	404	385	365	346	326	306	288
6814897	7106028	7397140	267	248	229	209	189	170	150	131	112	091
9725328	0016264	0307180	073	053	033	014	994	975	955	936	916	897
2633810	2924551	3215273	290878	858	838	819	799	780	761	741	722	702
5540345	5830892	6121419	682	664	644	624	605	585	566	547	527	508
8444937	8735289	9025622	488	469	449	430	411	391	372	352	333	313
1347587	1637745	1927884	294	275	255	236	217	197	178	158	139	119
4248298	4538263	4828208	101	080	062	042	023	003	984	965	945	926
7147073	7436844	7726596	289906	887	868	849	829	810	790	771	752	732
0043915	0333493	0623051	714	693	675	655	636	616	598	578	558	540
2938825	3228210	3517576	289520	500	482	462	443	423	404	385	366	346
5831808	6121000	6410173	328	307	289	269	250	231	212	192	173	154
8722864	9011864	9300845	134	115	096	077	058	038	019	000	981	961
1611997	1900805	2189593	288942	923	904	884	865	846	827	808	788	770
4499210	4787825	5076422	750	730	712	693	673	654	635	615	597	577
7384504	7672928	7961333	558	539	520	501	481	463	443	424	405	386
0267883	0556115	0844329	366	348	328	309	290	271	252	232	214	194
3149348	3437390	3725412	175	156	137	118	099	080	060	042	022	003
6028903	6316754	6604585	287984	966	945	927	908	889	869	851	831	813
8906550	9194210	9481851	793	774	755	737	717	698	678	660	641	622
1782292	2069762	2357212	287603	583	565	546	526	508	488	470	450	431
4656131	4943410	5230670	413	393	374	356	336	317	299	279	260	242
7528069	7815158	8102229	222	203	185	165	146	128	108	089	071	051
0398109	0685009	0971890	033	013	995	975	957	938	918	900	881	862
3266254	3552964	3839656	286843	823	805	787	767	748	729	710	692	672
6132506	6419027	6705530	654	635	615	597	578	559	540	521	503	483
8996868	9283200	9569513	464	446	427	408	388	371	351	332	313	295
1859341	2145485	2431610	276	256	238	219	200	182	162	144	125	106
4719929	5005885	5291821	087	068	049	031	012	992	974	956	936	918
7578635	7864402	8150150	285898	880	861	843	823	805	786	767	748	729
0435459	0721039	1006599	285711	692	673	654	636	617	597	580	560	542
3290406	3575798	3861170	522	504	486	466	448	429	410	392	372	354
6143477	6428681	6713867	336	316	298	279	260	242	222	204	186	166
8994675	9279692	9564691	148	129	111	092	073	054	035	017	999	979
1844003	2128833	2413644	284961	942	923	905	886	867	849	830	811	793
4691462	4976106	5260730	774	755	737	718	699	680	662	644	624	606
7537056	7821513	8105951	588	568	550	532	512	494	476	457	438	420
0380786	0665057	0949309	401	382	364	345	326	308	289	271	252	233
3222656	3506740	3790807	215	196	178	159	141	121	104	084	067	047
6062667	6346566	6630446	029	010	992	974	954	936	918	899	880	862
8900822	9184536	9468231	283844	824	807	787	769	751	732	714	695	676
1737124	2020652	2304162	658	639	621	603	583	566	547	528	510	491
4571574	4854917	5138242	473	454	436	417	399	380	362	343	325	307
7404176	7687334	7970474	287	270	251	232	214	196	177	158	140	122
0234931	0517905	0800861	103	085	066	048	030	011	992	974	956	937
3063843	3346633	3629404	282919	900	882	864	845	826	809	790	771	753
5890913	6173519	6456106	735	716	698	679	661	643	624	606	587	569
8716144	8998566	9280969	551	532	514	495	477	459	441	422	403	386
1539538	1821776	2103997	367	348	330	312	294	275	257	238	221	201
4361098	4643153	4925190	184	165	147	128	110	092	074	055	037	018
7180826	7462698	7744552	001	982	963	946	927	908	891	872	854	835

Numbers 15400–16009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1540	1875207208	5489209	5771191	6053154	6335100	6617027	6898935
41	8026387	8308204	8590003	8871784	9153546	9435291	9717016
42	1880843737	1125372	1406988	1688586	1970166	2251727	2533270
43	3659261	3940713	4222146	4503562	4784959	5066338	5347699
44	6472960	6754230	7035481	7316714	7597930	7879126	8160305
45	9284838	9565925	9846995	0128046	0409079	0690094	0971091
46	1892094896	2375802	2656689	2937559	3218410	3499243	3780058
47	4903137	5183861	5464567	5745255	6025925	6306577	6587210
48	7709563	7990106	8270631	8551138	8831626	9112097	9392549
49	1900514178	0794539	1074883	1355209	1635516	1915806	2196077
1550	1903316982	3597163	3877326	4157470	4437597	4717706	4997796
51	6117978	6397978	6677961	6957925	7237871	7517799	7797709
52	8917169	9196989	9476791	9756575	0036341	0316088	0595818
53	1911714557	1994197	2273819	2553422	2833008	3112576	3392126
54	4510145	4789604	5069046	5348470	5627876	5907264	6186634
55	7303934	7583214	7862476	8141720	8420946	8700154	8979345
56	1920095927	0375027	0654110	0933175	1212221	1491250	1770261
57	2886126	3165047	3443950	3722836	4001704	4280553	4559385
58	5674533	5953276	6232000	6510707	6789395	7068066	7346719
59	8461152	8739715	9018261	9296789	9575299	9853791	0132265
1560	1931245984	1524369	1802736	2081085	2359416	2637730	2916026
61	4029031	4307237	4585426	4863597	5141750	5419886	5698003
62	6810295	7088324	7366335	7644328	7922303	8200260	8478200
63	9589780	9867631	0145464	0423279	0701076	0978856	1256618
64	1942367487	2645160	2922816	3200453	3478073	3755675	4033259
65	5143419	5420914	5698392	5975852	6253295	6530720	6808126
66	7917577	8194896	8472196	8749479	9026745	9303992	9581222
67	1950689965	0967106	1244230	1521336	1798424	2075495	2352548
68	3460583	3737548	4014495	4291425	4568336	4845230	5122107
69	6229436	6506224	6782995	7059747	7336483	7613200	7889900
1570	1958996524	9273136	9549730	9826307	0102866	0379407	0655931
71	1961761850	2038286	2314704	2591105	2867488	3143854	3420201
72	4525417	4801677	5077919	5354144	5630351	5906541	6182713
73	7287226	7563311	7839377	8115427	8391458	8667472	8943469
74	1970047280	0323189	0599081	0874954	1150811	1426650	1702471
75	2805581	3081315	3357031	3632730	3908411	4184075	4459721
76	5562132	5837690	6113232	6388756	6664262	6939751	7215222
77	8316933	8592317	8867684	9143033	9418365	9693679	9968976
78	1981069989	1345198	1620390	1895565	2170722	2445862	2720985
79	3821300	4096335	4371353	4646354	4921337	5196302	5471251
1580	1986570870	6845731	7120575	7395401	7670210	7945002	8219776
81	9318699	9593387	9868057	0142709	0417345	0691963	0966563
82	1992064792	2339305	2613802	2888281	3162743	3437187	3711614
83	4809149	5083489	5357812	5632118	5906406	6180677	6454931
84	7551773	7825940	8100090	8374222	8648337	8922435	9196516
85	2000292666	0566660	0840637	1114596	1388539	1662464	1936371
86	3031830	3305651	3579455	3853242	4127012	4400764	4674500
87	5769268	6042916	6316548	6590163	6863760	7137340	7410902
88	8504981	8778457	9051917	9325359	9598784	9872192	0145582
89	2011238972	1512277	1785564	2058834	2332087	2605323	2878541
1590	2013971243	4244376	4517491	4790589	5063671	5336734	5609781
91	6701796	6974757	7247701	7520628	7793537	8066430	8339305
92	9430634	9703423	9976196	0248951	0521689	0794410	1067114
93	2022157758	2430376	2702977	2975561	3248128	3520678	3793211
94	4883171	5155618	5428048	5700461	5972857	6245236	6517598
95	7606874	7879150	8151410	8423652	8695877	8968085	9240276
96	2030328870	0600976	0873065	1145136	1417191	1689229	1961249
97	3049161	3321097	3593015	3864917	4136801	4408668	4680519
98	5767750	6039515	6311263	6582995	6854709	7126406	7398086
99	8484637	8756233	9027811	9299372	9570917	9842444	0113955
1600	2041199827	1471252	1742661	2014052	2285427	2556785	2828126

OF NUMBERS.

Logarithms 1875207208–2043642046.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7180826	7462698	7744552	282001	982	963	946	927	908	891	872	854	835
9998724	0280413	0562084	281817	799	781	762	745	725	708	689	671	653
2814795	3096302	3377790	635	616	598	580	561	543	525	507	488	471
5629042	5910366	6191672	452	433	416	397	379	361	343	324	306	288
8441465	8722608	9003732	270	251	233	216	196	179	160	143	124	106
1252069	1533030	1813972	087	070	051	033	015	997	978	961	942	924
4060855	4341634	4622395	280906	887	870	851	833	815	797	779	761	742
6867826	7148423	7429002	724	706	688	670	652	633	616	597	579	561
9672984	9953400	0233798	543	525	507	488	471	452	435	416	398	380
2476330	2756566	3036783	361	344	326	307	290	271	253	236	217	199
5277869	5557923	5837960	280181	163	144	127	109	090	073	054	037	018
8077601	8357475	8637331	000	983	964	946	928	910	892	874	856	838
0875530	1155224	1434900	279820	802	784	766	747	730	712	694	676	657
3671657	3951171	4230667	640	622	603	586	568	550	531	514	496	478
6465986	6745320	7024636	459	442	424	406	388	370	352	334	316	298
9258517	9537672	9816808	280	262	244	226	208	191	172	155	136	119
2049254	2328229	2607186	100	083	065	046	029	011	993	975	957	940
4838199	5116995	5395773	278921	903	886	868	849	832	814	796	778	760
7625354	7903971	8182570	743	724	707	688	671	653	635	617	599	582
0410722	0689160	0967581	563	546	528	510	492	474	457	438	421	403
3194304	3472564	3750806	278385	367	349	331	314	296	278	260	242	225
5976103	6254185	6532249	206	189	171	153	136	117	100	082	064	046
8756122	9034026	9311912	029	011	993	975	957	940	922	904	886	868
1534362	1812088	2089796	277851	833	815	797	780	762	744	726	708	691
4310826	4588374	4865905	673	656	637	620	602	584	567	548	531	514
7085516	7362887	7640241	495	478	460	443	425	406	390	371	354	336
9858434	0135629	0412806	319	300	283	266	247	230	212	195	177	159
2629583	2906601	3183601	141	124	106	088	071	053	035	018	000	982
5398965	5675807	5952630	276965	947	930	911	894	877	858	842	823	806
8166583	8443247	8719895	788	771	752	736	717	700	683	664	648	629
0932437	1208926	1485397	276612	594	577	559	541	524	506	489	471	453
3696532	3972844	4249139	436	418	401	383	366	347	331	312	295	278
6458868	6735005	7011124	260	242	225	207	190	172	155	137	119	102
9219448	9495410	9771354	085	066	050	031	014	997	979	962	944	926
1978275	2254061	2529830	275909	892	873	857	839	821	804	786	769	751
4735350	5010961	5286555	734	716	699	681	664	646	629	611	594	577
7490676	7766113	8041532	558	542	524	506	489	471	454	437	419	401
0244255	0519517	0794762	384	367	349	332	314	297	279	262	245	227
2996090	3271177	3546247	209	192	175	157	140	123	105	087	070	053
5746181	6021095	6295991	035	018	001	983	965	949	930	914	896	879
8494533	8769272	9043995	274861	844	826	809	792	774	757	739	723	704
1241146	1515712	1790261	688	670	652	636	618	600	583	566	549	531
3986024	4260416	4534791	513	497	479	462	444	427	410	392	375	358
6729167	7003386	7277588	340	323	306	288	271	254	236	219	202	185
9470579	9744625	0018654	167	150	132	115	098	081	063	046	029	012
2210262	2484135	2757991	273994	977	959	943	925	907	891	873	856	839
4948217	5221918	5495601	821	804	787	770	752	736	717	701	683	667
7684448	7957976	8231487	648	632	615	597	580	562	546	528	511	494
0418955	0692312	0965650	476	460	442	425	408	390	373	357	338	322
3151742	3424926	3698093	305	287	270	253	236	218	201	184	167	150
5882811	6155823	6428818	273133	115	098	082	063	047	030	012	995	978
8612163	8885004	9157827	272961	944	927	909	893	875	858	841	823	807
1339801	1612470	1885123	789	773	755	738	721	704	687	669	653	635
4065726	4338225	4610706	618	601	584	567	550	533	515	499	481	465
6789942	7062270	7334580	447	430	413	396	379	362	344	328	310	294
9512450	9784607	0056747	276	260	242	225	208	191	174	157	140	123
2233253	2505239	2777209	106	089	071	055	038	020	004	986	970	952
4952352	5224168	5495968	271936	918	902	884	867	851	833	816	800	782
7669750	7941396	8213025	765	748	732	714	697	680	664	646	629	612
0385448	0656925	0928384	596	578	561	545	527	511	493	477	459	443
3099449	3370756	3642046	425	409	391	375	358	341	323	307	290	273

Numbers 16000–16609. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1600	2041199827	1471252	1742661	2014052	2285427	2556785	2828126
1	3913319	4184575	4455814	4727036	4998242	5269430	5540601
2	6625117	6896204	7167274	7438327	7709363	7980382	8251384
3	9335224	9606141	9877042	0147926	0418793	0689643	0960476
4	2052043639	2314388	2585120	2855835	3126533	3397214	3667879
5	4750367	5020947	5291511	5562057	5832586	6103099	6373595
6	7455409	7725821	7996216	8266594	8536955	8807299	9077626
7	2060158768	0429011	0699237	0969447	1239640	1509816	1779975
8	2860444	3130519	3400578	3670619	3940644	4210652	4480644
9	5560441	5830348	6100239	6370113	6639970	6909810	7179634
1610	2068258760	8528500	8798223	9067929	9337619	9607292	9876948
11	2070955404	1224977	1494532	1764071	2033593	2303098	2572587
12	3650375	3919780	4189168	4458540	4727895	4997233	5266555
13	6343674	6612912	6882133	7151338	7420526	7689697	7958852
14	9035304	9304375	9573430	9842468	0111489	0380494	0649481
15	2081725267	1994171	2263059	2531931	2800785	3069624	3338445
16	4413564	4682303	4951024	5219729	5488418	5757089	6025745
17	7100199	7368771	7637327	7905865	8174388	8442893	8711382
18	9785173	0053579	0321968	0590341	0858698	1127037	1395361
19	2092468488	2736728	3004952	3273159	3541349	3809523	4077681
1620	2095150145	5418220	5686278	5954320	6222345	6490354	6758346
21	7830148	8098058	8365951	8633827	8901687	9169530	9437357
22	2100508499	0776243	1043971	1311682	1579377	1847055	2114716
23	3185198	3452778	3720340	3987887	4255416	4522930	4790426
24	5860249	6127664	6395062	6662443	6929808	7197157	7464489
25	8533653	8800903	9068137	9335354	9602554	9869738	0136906
26	2111205413	1472498	1739567	2006620	2273656	2540676	2807680
27	3875529	4142451	4409356	4676244	4943117	5209972	5476812
28	6544006	6810763	7077504	7344229	7610937	7877629	8144305
29	9210843	9477437	9744014	0010575	0277120	0543648	0810160
1630	2121876044	2142474	2408888	2675285	2941667	3208031	3474380
31	4539610	4805877	5072128	5338362	5604580	5870781	6136966
32	7201544	7467648	7733735	7999806	8265861	8531899	8797922
33	9861847	0127788	0393713	0659621	0925513	1191388	1457247
34	2132520522	2786300	3052062	3317807	3583536	3849249	4114946
35	5177570	5443185	5708785	5974367	6239934	6505485	6771019
36	7832993	8098446	8363883	8629304	8894708	9160096	9425468
37	2140486794	0752085	1017360	1282618	1547861	1813087	2078297
38	3138974	3404103	3669216	3934313	4199393	4464457	4729505
39	5789536	6054503	6319454	6584389	6849308	7114210	7379096
1640	2148438480	8703286	8968076	9232849	9497606	9762347	0027072
41	2151085811	1350455	1615083	1879695	2144291	2408871	2673434
42	3731528	3996011	4260478	4524929	4789364	5053782	5318185
43	6375634	6639956	6904263	7168552	7432826	7697084	7961326
44	9018132	9282293	9546439	9810568	0074681	0338778	0602859
45	2161659023	1923024	2187008	2450977	2714930	2978866	3242787
46	4298309	4562149	4825974	5089782	5353574	5617350	5881111
47	6935992	7199672	7463336	7726984	7990616	8254233	8517833
48	9572074	9835594	0099098	0362586	0626059	0889515	1152955
49	2172206556	2469917	2733261	2996590	3259902	3523199	3786479
1650	2174839442	5102643	5365828	5628997	5892150	6155287	6418408
51	7470733	7733774	7996799	8259809	8522803	8785780	9048742
52	2180100430	0363312	0626178	0889029	1151863	1414682	1677484
53	2728536	2991259	3253966	3516657	3779333	4041992	4304636
54	5355052	5617616	5880165	6142697	6405214	6667715	6930200
55	7979981	8242387	8504777	8767151	9029509	9291851	9554177
56	2190603324	0865572	1127803	1390019	1652218	1914402	2176570
57	3225084	3487173	3749246	4011304	4273345	4535371	4797381
58	5845262	6107193	6369108	6631007	6892891	7154759	7416610
59	8463860	8725633	8987390	9249132	9510858	9772567	0034262
1660	2201080880	1342496	1604095	1865679	2127247	2388799	2650336

OF NUMBERS.

Logarithms 2041199827-2203434851.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3099449	3370756	3642046	271425	409	391	375	358	341	323	307	290	273
5811756	6082893	6354014	256	239	222	206	188	171	155	137	121	103
8522369	8793338	9064289	087	070	053	036	019	002	985	969	951	935
1231292	1502091	1772874	270917	901	884	867	850	833	816	799	783	765
3938526	4209157	4479771	749	732	715	698	681	665	647	631	614	596
6644074	6914536	7184981	580	564	546	529	513	496	479	462	445	428
9347937	9618231	9888508	412	395	378	361	344	327	311	294	277	260
2050118	2320243	2590352	243	226	210	193	176	159	143	125	109	092
4750618	5020576	5290517	075	059	041	025	008	992	974	958	941	924
7449441	7719231	7989004	269907	891	874	857	840	824	807	790	773	756
0146587	0416209	0685815	269740	723	706	690	673	656	639	622	606	589
2842059	3111514	3380953	573	555	539	522	505	489	472	455	439	422
5535859	5805148	6074419	405	388	372	355	338	322	304	289	271	255
8227990	8497111	8766216	238	221	205	188	171	155	138	121	105	088
0918453	1187407	1456345	071	055	038	021	005	987	972	954	938	922
3607250	3876038	4144809	268904	888	872	854	839	821	805	788	771	755
6294383	6563005	6831610	739	721	705	689	671	656	638	622	605	589
8979855	9248311	9516750	572	556	538	523	505	489	473	456	439	423
1663667	1931957	2200231	406	389	373	357	339	324	306	290	274	257
4345822	4613946	4882054	240	224	207	190	174	158	141	124	108	091
7026321	7294280	7562223	268075	058	042	025	009	992	975	959	943	925
9705167	9972961	0240738	267910	893	876	860	843	827	810	794	777	761
2382362	2649990	2917603	744	728	711	695	678	661	646	628	613	595
5057907	5325371	5592818	580	562	547	529	514	496	481	464	447	431
7731805	7999104	8266387	415	398	381	365	349	332	316	299	283	266
0404057	0671192	0938311	250	234	217	200	184	168	151	135	119	102
3074667	3341637	3608592	085	069	053	036	020	004	987	970	955	937
5743635	6010441	6277232	266922	905	888	873	855	840	823	806	791	774
8410964	8677607	8944233	757	741	725	708	692	676	659	643	626	610
1076655	1343135	1609598	594	577	561	545	528	512	495	480	463	446
3740712	4007028	4273327	266430	414	397	382	364	349	332	316	299	283
6403135	6669288	6935424	267	251	234	218	201	185	169	153	136	120
9063928	9329917	9595890	104	087	071	055	038	023	006	989	973	957
1723090	1988917	2254728	265941	925	908	892	875	859	843	827	811	794
4380626	4646290	4911938	778	762	745	729	713	697	680	664	648	632
7036537	7302039	7567524	615	600	582	567	551	534	518	502	485	469
9690824	9956164	0221487	453	437	421	404	388	372	356	340	323	307
2343490	2608668	2873829	291	275	258	243	226	210	193	178	161	145
4994537	5259553	5524552	129	113	097	080	064	048	032	016	999	984
7643967	7908821	8173659	264967	951	935	919	902	886	871	854	838	821
0291781	0556474	0821150	264806	790	773	757	741	725	709	693	676	661
2937982	3202513	3467029	644	628	612	596	580	563	548	531	516	499
5582571	5846942	6111296	483	467	451	435	418	403	386	371	354	338
8225552	8489761	8753955	322	307	289	274	258	242	226	209	194	177
0866924	1130973	1395006	161	146	129	113	097	081	065	049	033	017
3506691	3770580	4034452	001	984	969	953	936	921	904	889	872	857
6144855	6408583	6672295	263840	825	808	792	776	761	744	728	712	697
8781417	9044985	9308537	680	664	648	632	617	600	584	568	552	537
1416379	1679788	1943180	520	504	488	473	456	440	424	409	392	376
4049744	4312993	4576225	361	344	329	312	297	280	265	249	232	217
6681513	6944602	7207675	263201	185	169	153	137	121	105	089	073	058
9311688	9574618	9837532	041	025	010	994	977	962	946	930	914	898
1940271	2203042	2465797	262882	866	851	834	819	802	787	771	755	739
4567264	4829876	5092472	723	707	691	676	659	644	628	612	596	580
7192669	7455122	7717560	564	549	532	517	501	485	469	453	438	421
9816488	0078783	0341061	406	390	374	358	342	326	311	295	278	263
2438722	2700859	2962979	248	231	216	199	184	168	152	137	120	105
5059375	5321353	5583315	089	073	058	041	026	010	994	978	962	947
7678447	7940267	8202071	261931	915	899	884	868	851	837	820	804	789
0295940	0557603	0819249	773	757	742	726	709	695	678	663	646	631
2911857	3173362	3434851	616	599	584	568	552	537	521	505	489	474

Numbers 16600–17209. **LOGARITHMS**

Number.	Mantissæ.						
	0	1	2	3	4	5	6
1660	2201080880	1342496	1604095	1865679	2127247	2388799	2650336
61	3696325	3957782	4219224	4480651	4742061	5003456	5264835
62	6310194	6571495	6832780	7094049	7355302	7616540	7877762
63	8922492	9183636	9444763	9705875	9966971	0228052	0489117
64	2211533220	1794206	2055177	2316132	2577071	2837995	3098903
65	4142378	4403208	4664022	4924821	5185603	5446370	5707122
66	6749971	7010644	7271301	7531943	7792569	8053180	8313775
67	9355998	9616515	9877016	0137502	0397972	0658426	0918865
68	2221960463	2220824	2481169	2741498	3001812	3262110	3522392
69	4563367	4823571	5083760	5343934	5604092	5864234	6124361
1670	2227164711	7424760	7684793	7944811	8204813	8464800	8724771
71	9764499	0024392	0284270	0544132	0803978	1063809	1323625
72	2232362731	2622469	2882191	3141898	3401589	3661264	3920924
73	4959410	5218992	5478559	5738111	5997646	6257167	6516672
74	7554537	7813964	8073376	8332772	8592153	8851519	9110869
75	2240148114	0407386	0666643	0925885	1185111	1444322	1703517
76	2740143	2999261	3258363	3517450	3776522	4035578	4294618
77	5330626	5589589	5848537	6107470	6366387	6625288	6884175
78	7919565	8178374	8437168	8695946	8954708	9213456	9472188
79	2250506961	0765616	1024256	1282880	1541488	1800082	2058660
1680	2253092817	3351318	3609804	3868274	4126729	4385168	4643592
81	5677134	5935482	6193813	6452130	6710431	6968717	7226987
82	8259915	8518108	8776286	9034449	9292597	9550729	9808846
83	2260841160	1099200	1357225	1615234	1873228	2131207	2389171
84	3420872	3678759	3936630	4194486	4452327	4710153	4967964
85	5999052	6256786	6514505	6772208	7029896	7287569	7545226
86	8575703	8833284	9090850	9348400	9605935	9863455	0120960
87	2271150826	1408254	1665667	1923065	2180448	2437815	2695167
88	3724423	3981699	4238959	4496205	4753435	5010650	5267849
89	6296496	6553619	6810728	7067821	7324898	7581961	7839009
1690	2278867046	9124018	9380974	9637915	9894840	0151751	0408646
91	2281436076	1692895	1949700	2206489	2463263	2720021	2976765
92	4003587	4260255	4516907	4773544	5030167	5286774	5543365
93	6569581	6826097	7082598	7339084	7595554	7852010	8108450
94	9134060	9390425	9646774	9903108	0159428	0415732	0672021
95	2291697025	1953239	2209437	2465620	2721788	2977941	3234079
96	4258479	4514542	4770589	5026621	5282638	5538640	5794627
97	6818423	7074335	7330231	7586112	7841978	8097830	8353666
98	9376859	9632620	9888365	0144096	0399812	0655512	0911197
99	2301933789	2189399	2444994	2700574	2956139	3211689	3467224
1700	2304489214	4744674	5000118	5255548	5510963	5766363	6021747
1	7043136	7298446	7553740	7809020	8064285	8319534	8574769
2	9595557	9850717	0105862	0360991	0616106	0871206	1126291
3	2312146480	2401489	2656484	2911464	3166429	3421379	3676314
4	4695904	4950764	5205610	5460440	5715255	5970056	6224841
5	7243833	7498544	7753240	8007921	8262586	8517237	8771873
6	9790268	0044830	0299376	0553908	0808424	1062926	1317413
7	2322335211	2589623	2844021	3098403	3352771	3607124	3861461
8	4878664	5132927	5387175	5641409	5895628	6149831	6404020
9	7420627	7674742	7928841	8182926	8436996	8691051	8945092
1710	2329961104	0215070	0469021	0722957	0976879	1230785	1484677
11	2332500095	2753913	3007716	3261503	3515277	3769035	4022778
12	5037603	5291273	5544927	5798567	6052192	6305802	6559397
13	7573630	7827151	8080657	8334149	8587626	8841088	9094535
14	2340108176	0361549	0614908	0868251	1121580	1374895	1628194
15	2641244	2894469	3147680	3400876	3654057	3907224	4160376
16	5172835	5425913	5678976	5932025	6185059	6438078	6691082
17	7702952	7955882	8208798	8461699	8714586	8967457	9220314
18	2350231595	0484378	0737147	0989901	1242640	1495365	1748075
19	2758767	3011403	3264025	3516632	3769224	4021802	4274364
1720	5284469	5536959	5789433	6041893	6294339	6546770	6799186

OF NUMBERS. Logarithms 220108088o–2357556346.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2911857	3173362	3434851	261616	599	584	568	552	537	521	505	489	474
5526199	5787546	6048878	457	442	427	410	395	379	364	347	332	316
8138968	8400158	8661333	301	285	269	253	238	222	206	190	175	159
0750166	1011200	1272217	144	127	112	096	081	065	049	034	017	003
3359795	3620672	3881533	260986	971	955	939	924	908	892	877	861	845
5967857	6228577	6489282	830	814	799	782	767	752	735	720	705	689
8574354	8834918	9095466	673	657	642	626	611	595	579	564	548	532
1179288	1439695	1700087	517	501	486	470	454	439	423	407	392	376
3782659	4042911	4303147	361	345	329	314	298	282	267	252	236	220
6384472	6644567	6904647	204	189	174	158	142	127	111	095	080	064
8984726	9244666	9504590	260049	033	018	002	987	971	955	940	924	909
1583425	1843209	2102978	259893	878	862	846	831	816	800	784	769	753
4180569	4440198	4699812	738	722	707	691	675	660	645	629	614	598
6776161	7035635	7295094	582	567	552	535	521	505	489	474	459	443
9370203	9629522	9888826	427	412	396	381	366	350	334	319	304	288
1962697	2221861	2481010	272	257	242	226	211	195	180	164	149	133
4553643	4812653	5071647	118	102	087	072	056	040	025	010	994	979
7143045	7401901	7660740	258963	948	933	917	901	887	870	856	839	825
9730904	9989605	0248291	809	794	778	762	748	732	716	701	686	670
2317222	2575769	2834301	655	640	624	608	594	578	562	547	532	516
4902001	5160394	5418772	258501	486	470	455	439	424	409	393	378	362
7485242	7743481	8001706	348	331	317	301	286	270	255	239	225	209
0066947	0325033	0583104	193	178	163	148	132	117	101	086	071	056
2647119	2905052	3162969	040	025	009	994	979	964	948	933	917	903
5225759	5483538	5741303	257887	871	856	841	826	811	795	779	765	749
7802868	8060495	8318107	734	719	703	688	673	657	642	627	612	596
0378449	0635923	0893382	581	566	550	535	520	505	489	474	459	444
2952504	3209825	3467132	428	413	398	383	367	352	337	321	307	291
5525034	5782203	6039357	276	260	246	230	215	199	185	169	154	139
8096041	8353058	8610060	123	109	093	077	063	048	032	017	002	986
0665527	0922392	1179241	256972	956	941	925	911	895	881	865	849	835
3233493	3490206	3746904	819	805	789	774	758	744	728	713	698	683
5799942	6056504	6313050	668	652	637	623	607	591	577	562	546	531
8364875	8621285	8877680	516	501	486	470	456	440	425	410	395	380
0928295	1184553	1440797	365	349	334	320	304	289	274	258	244	228
3490202	3746309	4002402	214	198	183	168	153	138	123	107	093	077
6050598	6306555	6562497	063	047	032	017	002	987	971	957	942	926
8609487	8865292	9121083	255912	896	881	866	852	836	821	805	791	776
1166868	1422523	1678163	761	745	731	716	700	685	671	655	640	626
3722744	3978249	4233739	610	595	580	565	550	535	520	505	490	475
6277117	6532472	6787811	255460	444	430	415	400	384	370	355	339	325
8829989	9085193	9340383	310	294	280	265	249	235	220	204	190	174
1381360	1636415	1891455	160	145	129	115	100	085	069	055	040	025
3931234	4186139	4441029	009	995	980	965	950	935	920	905	890	875
6479612	6734367	6989108	254860	846	830	815	801	785	771	755	741	725
9026495	9281101	9535692	711	696	681	665	651	636	622	606	591	576
1571885	1826342	2080784	562	546	532	516	502	487	472	457	442	427
4115784	4370092	4624385	412	398	382	368	353	337	323	308	293	279
6658194	6912353	7166498	263	248	234	219	203	189	174	159	145	129
9199117	9453127	9707123	115	099	085	070	055	041	025	010	996	981
1738554	1992416	2246263	253966	951	936	922	906	892	877	862	847	832
4276507	4530220	4783919	818	803	787	774	758	743	729	713	699	684
6812977	7066543	7320094	670	654	640	625	610	595	580	566	551	536
9347967	9601385	9854788	521	506	492	477	462	447	432	418	403	388
1881479	2134748	2388003	373	359	343	329	315	299	285	269	255	241
4413513	4666635	4919742	225	211	196	181	167	152	137	122	107	093
6944071	7197046	7450006	078	063	049	034	019	004	989	975	960	946
9473157	9725984	9978797	252930	916	901	887	871	857	843	827	813	798
2000770	2253450	2506116	783	769	754	739	725	710	695	680	666	651
4526913	4779446	5031965	636	622	607	592	578	562	549	533	519	504
7051587	7303974	7556346	490	474	460	446	431	416	401	387	372	357

Numbers 17200–17809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1720	2355284469	5536959	5789433	6041893	6294339	6546770	6799186
21	7808703	8061046	8313374	8565688	8817986	9070270	9322540
22	2360331471	0583667	0835849	1088016	1340168	1592306	1844429
23	2852774	3104824	3356860	3608880	3860886	4112877	4364854
24	5372615	5624519	5876408	6128282	6380142	6631987	6883818
25	7890994	8142752	8394495	8646223	8897937	9149636	9401321
26	2370407914	0659526	0911123	1162705	1414273	1665827	1917366
27	2923376	3174842	3426293	3677730	3929153	4180560	4431954
28	5437381	5688702	5940008	6191299	6442576	6693839	6945087
29	7949933	8201108	8452269	8703415	8954546	9205664	9456766
1730	2380461031	0712061	0963077	1214078	1465064	1716036	1966994
31	2970679	3221564	3472434	3723290	3974132	4224959	4475771
32	5478877	5729617	5980343	6231054	6481751	6732433	6983101
33	7985627	8236223	8486804	8737370	8987922	9238460	9488983
34	2390490931	0741382	0991819	1242241	1492649	1743042	1993421
35	2994791	3245098	3495390	3745668	3995931	4246180	4496415
36	5497208	5747371	5997519	6247652	6497772	6747876	6997967
37	7998184	8248203	8498207	8748197	8998172	9248133	9498079
38	2400497721	0747596	0997456	1247302	1497133	1746950	1996753
39	2995820	3245551	3495267	3744970	3994657	4244331	4493990
1740	2405492483	5742070	5991643	6241202	6490746	6740276	6989792
41	7987711	8237155	8486585	8736000	8985401	9234788	9484160
42	2410481507	0730808	0980094	1229366	1478624	1727868	1977097
43	2973871	3223029	3472172	3721302	3970416	4219517	4468603
44	5464806	5713821	5962822	6211808	6460780	6709738	6958681
45	7954313	8203185	8452043	8700887	8949716	9198532	9447332
46	2420442394	0691123	0939839	1188540	1437227	1685900	1934558
47	2929050	3177637	3426210	3674769	3923314	4171844	4420360
48	5414283	5662728	5911159	6159576	6407978	6656366	6904741
49	7898095	8146398	8394687	8642961	8891222	9139468	9387700
1750	2430380487	0628648	0876795	1124928	1373047	1621151	1869241
51	2861461	3109480	3357486	3605477	3853454	4101417	4349365
52	5341018	5588896	5836760	6084610	6332445	6580266	6828074
53	7819161	8066897	8314620	8562328	8810022	9057702	9305368
54	2440295890	0543486	0791067	1038634	1286187	1533726	1781250
55	2771208	3018662	3266102	3513528	3760940	4008338	4255722
56	5245116	5492429	5739728	5987013	6234284	6481541	6728784
57	7717615	7964787	8211946	8459090	8706221	8953337	9200439
58	2450188707	0435739	0682757	0929761	1176751	1423727	1670688
59	2658395	2905286	3152164	3399027	3645876	3892712	4139533
1760	2455126678	5373429	5620167	5866890	6113599	6360294	6606975
61	7593560	7840171	8086768	8333351	8579920	8826475	9073016
62	2460059041	0305512	0551969	0798412	1044841	1291257	1537658
63	2523123	2769454	3015772	3262075	3508365	3754640	4000902
64	4985808	5232000	5478177	5724341	5970491	6216627	6462749
65	7447097	7693149	7939188	8185212	8431223	8677219	8923202
66	9906992	0152905	0398804	0644689	0890560	1136418	1382261
67	2472365495	2611269	2857029	3102775	3348507	3594225	3839929
68	4822607	5068241	5313862	5559469	5805062	6050642	6296207
69	7278329	7523825	7769307	8014775	8260229	8505670	8751096
1770	2479732664	9978021	0223364	0468694	0714009	0959311	1204599
71	2482185612	2430831	2676035	2921226	3166403	3411567	3656716
72	4637176	4882256	5127322	5372375	5617414	5862439	6107450
73	7087356	7332298	7577226	7822141	8067041	8311928	8556801
74	9536155	9780959	0025749	0270525	0515288	0760037	1004772
75	2491983574	2228240	2472892	2717531	2962155	3206766	3451364
76	4429614	4674143	4918657	5163158	5407645	5652118	5896578
77	6874278	7118669	7363046	7607409	7851758	8096094	8340416
78	9317566	9561820	9806059	0050285	0294497	0538695	0782880
79	2501759481	2003597	2247699	2491788	2735862	2979923	3223971
1780	4200023	4444002	4687967	4931918	5175856	5419780	5663690

OF NUMBERS.

Logarithms 2355284469–2506395339.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7051587	7303974	7556346	252490	474	460	446	431	416	401	387	372	357
9574795	9827035	0079260	343	328	314	298	284	270	255	240	225	211
2096537	2348631	2600710	196	182	167	152	138	123	108	094	079	064
4616816	4868764	5120697	050	036	020	006	991	977	962	948	933	918
7135634	7387435	7639222	251904	889	874	860	845	831	816	801	787	772
9652991	9904647	0156287	758	743	728	714	699	685	670	656	640	627
2168890	2420400	2671895	612	597	582	568	554	539	524	510	495	481
4683332	4934697	5186046	466	451	437	423	407	394	378	365	349	335
7196320	7447539	7698743	321	306	291	277	263	248	233	219	204	190
9707854	9958928	0209987	175	161	146	131	118	102	088	074	059	044
2217937	2468865	2719779	251030	016	001	986	972	958	943	928	914	900
4726569	4977353	5228122	250885	870	856	842	827	812	798	784	769	755
7233754	7484393	7735017	740	726	711	697	682	668	653	639	624	610
9739492	9989986	0240466	596	581	566	552	538	523	509	494	480	465
2243785	2494135	2744470	451	437	422	408	393	379	364	350	335	321
4746635	4996840	5247032	307	292	278	263	249	235	220	205	192	176
7248043	7498104	7748152	163	148	133	120	104	091	076	061	048	032
9748011	9997929	0247832	019	004	990	975	961	946	932	918	903	889
2246541	2496315	2746075	249875	860	846	831	817	803	788	774	760	745
4743635	4993265	5242881	731	716	703	687	674	659	645	630	616	602
7239293	7488780	7738253	249587	573	559	544	530	516	501	487	473	458
9733518	9982862	0232192	444	430	415	401	387	372	358	344	330	315
2226312	2475513	2724699	301	286	272	258	244	229	215	201	186	172
4717676	4966733	5215777	158	143	130	114	101	086	073	057	044	029
7207611	7456526	7705426	015	001	986	972	958	943	930	915	900	887
9696119	9944892	0193650	248872	858	844	829	816	800	787	773	758	744
2183202	2431832	2680448	729	716	701	687	673	658	644	630	616	602
4668862	4917350	5165824	587	573	559	545	530	516	502	488	474	459
7153100	7401446	7649778	445	431	417	402	388	375	359	346	332	317
9635918	9884122	0132311	303	289	274	261	246	232	218	204	189	176
2117317	2365379	2613427	248161	147	133	119	104	090	076	062	048	034
4597300	4845220	5093126	019	006	991	977	963	948	935	920	906	892
7075867	7323646	7571410	247878	864	850	835	821	808	793	779	764	751
9553020	9800657	0048281	736	723	708	694	680	666	652	637	624	609
2028761	2276257	2523740	596	581	567	553	539	524	511	496	483	468
4503091	4750447	4997788	454	440	426	412	398	384	369	356	341	328
6976013	7223228	7470428	313	299	285	271	257	243	229	215	200	187
9447527	9694601	9941661	172	159	144	131	116	102	088	074	060	046
1917636	2164569	2411489	032	018	004	990	976	961	948	933	920	906
4386340	4633134	4879913	246891	878	863	849	836	821	807	794	779	765
6853642	7100295	7346935	246751	738	723	709	695	681	667	653	640	625
9319543	9566057	9812556	611	597	583	569	555	541	527	514	499	485
1784045	2030418	2276778	471	457	443	429	416	401	387	373	360	345
4247149	4493383	4739602	331	318	303	290	275	262	247	234	219	206
6708857	6954951	7201031	192	177	164	150	136	122	108	094	080	066
9169170	9415125	9661066	052	039	024	011	996	983	968	955	941	926
1628090	1873906	2119707	245913	899	885	871	858	843	829	816	801	788
4085619	4331296	4576958	774	760	746	732	718	704	690	677	662	649
6541758	6787296	7032819	634	621	607	593	580	565	551	538	523	510
8996509	9241908	9487293	496	482	468	454	441	426	413	399	385	371
1449873	1695133	1940379	245357	343	330	315	302	288	274	260	246	233
3901852	4146973	4392081	219	204	191	177	164	149	136	121	108	095
6352447	6597430	6842400	080	066	053	039	025	011	997	983	970	956
8801660	9046506	9291337	244942	928	915	900	887	873	859	846	831	818
1249493	1494200	1738894	804	790	776	763	749	735	721	707	694	680
3695947	3940517	4185072	666	652	639	624	611	598	583	570	555	542
6141023	6385455	6629874	529	514	501	487	473	460	445	432	419	404
8584724	8829019	9073299	391	377	363	349	336	322	308	295	280	267
1027051	1271208	1515351	254	239	226	212	198	185	171	157	143	130
3468004	3712024	3956031	116	102	089	074	061	048	033	020	007	992
5907587	6151470	6395339	243979	965	951	938	924	910	897	883	869	856

Numbers 17800–18409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1780	2504200023	4444002	4687967	4931918	5175856	5419780	5663690
81	6639195	6883036	7126865	7370679	7614480	7858267	8102040
82	9076997	9320702	9564393	9808071	0051735	0295385	0539022
83	2511513432	1757000	2000555	2244096	2487623	2731137	2974637
84	3948500	4191932	4435350	4678755	4922146	5165523	5408886
85	6382204	6625500	6868782	7112050	7355304	7598545	7841773
86	8814546	9057705	9300850	9543982	9787101	0030205	0273297
87	2521245525	1488548	1731558	1974554	2217536	2460505	2703460
88	3675145	3918032	4160905	4403765	4646612	4889445	5132264
89	6103406	6346157	6588895	6831619	7074330	7317027	7559711
1790	2528530310	8772926	9015528	9258117	9500692	9743253	9985802
91	2530955858	1198339	1440806	1683259	1925699	2168125	2410538
92	3380053	3622398	3864730	4107048	4349352	4591643	4833921
93	5802896	6045106	6287302	6529485	6771654	7013810	7255953
94	8224387	8466462	8708523	8950571	9192606	9434627	9676634
95	2540644529	0886469	1128396	1370309	1612208	1854095	2095967
96	3063323	3305129	3546921	3788699	4030464	4272215	4513953
97	5480771	5722442	5964099	6205743	6447374	6688991	6930594
98	7896874	8138410	8379933	8621443	8862939	9104422	9345891
99	2550311633	0553036	0794424	1035800	1277161	1518510	1759845
1800	2552725051	2966319	3207574	3448815	3690043	3931257	4172458
1	5137128	5378262	5619383	5860490	6101584	6342665	6583732
2	7547866	7788867	8029854	8270827	8511787	8752734	8993667
3	9957267	0198134	0438987	0679827	0920653	1161467	1402266
4	2562365332	2606065	2846785	3087491	3328184	3568864	3809530
5	4772062	5012662	5253248	5493822	5734381	5974928	6215461
6	7177460	7417926	7658379	7898819	8139246	8379659	8620059
7	9581526	9821859	0062179	0302486	0542779	0783060	1023327
8	2571984261	2224462	2464649	2704823	2944984	3185131	3425265
9	4385669	4625736	4865791	5105832	5345860	5585874	5825876
1810	2576785749	7025684	7265606	7505514	7745409	7985292	8225160
11	9184503	9424306	9664095	9903871	0143634	0383384	0623120
12	2581581933	1821604	2061261	2300904	2540535	2780152	3019757
13	3978041	4217579	4457104	4696616	4936114	5175599	5415071
14	6372827	6612233	6851626	7091006	7330372	7569725	7809065
15	8766294	9005568	9244829	9484077	9723311	9962532	0201741
16	2591158442	1397584	1636713	1875829	2114932	2354022	2593099
17	3549273	3788284	4027281	4266266	4505237	4744195	4983140
18	5938789	6177668	6416534	6655387	6894227	7133054	7371868
19	8326991	8565739	8804473	9043195	9281904	9520599	9759282
1820	2600713880	0952497	1191100	1429691	1668268	1906833	2145384
21	3099458	3337944	3576416	3814876	4053322	4291756	4530176
22	5483726	5722081	5960423	6198752	6437067	6675370	6913659
23	7866687	8104911	8343122	8581320	8819505	9057676	9295835
24	2610248340	0486433	0724514	0962581	1200636	1438677	1676705
25	2628688	2866651	3104601	3342538	3580462	3818373	4056271
26	5007732	5245565	5483384	5721191	5958985	6196765	6434533
27	7385474	7623176	7860866	8098542	8336206	8573856	8811494
28	9761914	9999487	0237046	0474593	0712126	0949647	1187154
29	2622137055	2374497	2611927	2849344	3086747	3324138	3561516
1830	2624510897	4748210	4985510	5222797	5460071	5697332	5934580
31	6883443	7120626	7357797	7594954	7832099	8069230	8306349
32	9254693	9491747	9728788	9965816	0202831	0439833	0676822
33	2631624650	1861574	2098486	2335384	2572270	2809143	3046003
34	3993313	4230109	4466891	4703661	4940417	5177161	5413892
35	6360686	6597352	6834006	7070646	7307274	7543888	7780490
36	8726769	8963306	9199831	9436342	9672841	9909327	0145800
37	2641091563	1327972	1564367	1800750	2037120	2273478	2509822
38	3455071	3691351	3927618	4163872	4400113	4636342	4872558
39	5817292	6053444	6289583	6525708	6761821	6997922	7234009
1840	8178230	8414253	8650264	8886261	9122246	9358218	9594177

OF NUMBERS. Logarithms 2504200023–2650301977.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5907587	6151470	6395339	243979	965	951	938	924	910	897	883	869	856
8345800	8589546	8833278	841	829	814	801	787	773	760	746	732	719
0782645	1026254	1269850	705	691	678	664	650	637	623	609	596	582
3218123	3461596	3705055	568	555	541	527	514	500	486	473	459	445
5652236	5895573	6138895	432	418	405	391	377	363	350	337	322	309
8084986	8328186	8571373	296	282	268	254	241	228	213	200	187	173
0516374	0759438	1002488	159	145	132	119	104	092	077	064	050	037
2946401	3189329	3432244	023	010	996	982	969	955	941	928	915	901
5375070	5617862	5860641	242887	873	860	847	833	819	806	792	779	765
7802381	8045037	8287680	751	738	724	711	697	684	670	656	643	630
0228336	0470857	0713365	242616	602	589	575	561	549	534	521	508	493
2652937	2895323	3137695	481	467	453	440	426	413	399	386	372	358
5076185	5318435	5560672	345	332	318	304	291	278	264	250	237	224
7498081	7740197	7982299	210	196	183	169	156	143	128	116	102	088
9918628	0160609	0402576	075	061	048	035	021	007	994	981	967	953
2337827	2579672	2821505	241940	927	913	899	887	872	860	845	833	818
4755678	4997389	5239087	806	792	778	765	751	738	725	711	698	684
7172184	7413761	7655324	671	657	644	631	617	603	590	577	563	550
9587347	9828789	0070218	536	523	510	496	483	469	456	442	429	415
2001167	2242475	2483770	403	388	376	361	349	335	322	308	295	281
4413646	4654820	4895981	241268	255	241	228	214	201	188	174	161	147
6824785	7065826	7306853	134	121	107	094	081	067	053	041	027	013
9234587	9475494	9716387	001	987	973	960	947	933	920	907	893	880
1643053	1883826	2124586	240867	853	840	826	814	799	787	773	760	746
4050183	4290823	4531449	733	720	706	693	680	666	653	640	626	613
6455980	6696487	6936980	600	586	574	559	547	533	519	507	493	480
8860446	9100819	9341179	466	453	440	427	413	400	387	373	360	347
1263580	1503821	1744048	333	320	307	293	281	267	253	241	227	213
3665386	3905493	4145588	201	187	174	161	147	134	121	107	095	081
6065864	6305839	6545800	067	055	041	028	014	002	988	975	961	949
8465016	8704858	8944687	239935	922	908	895	883	868	856	842	829	816
0862843	1102553	1342250	803	789	776	763	750	736	723	711	697	683
3259347	3498925	3738490	671	657	643	631	617	605	590	578	565	551
5654530	5893976	6133408	538	525	512	498	485	472	459	446	432	419
8048392	8287706	8527006	406	393	380	366	353	340	327	314	300	288
0440936	0680118	0919286	274	261	248	234	221	209	195	182	168	156
2832162	3071212	3310249	142	129	116	103	090	077	063	050	037	024
5222072	5460991	5699896	011	997	985	971	958	945	932	919	905	893
7610668	7849455	8088230	238879	866	853	840	827	814	800	787	775	761
9997951	0236607	0475250	748	734	722	709	695	683	669	656	643	630
2383922	2622447	2860959	238617	603	591	577	565	551	538	525	512	499
4768583	5006977	5245358	486	472	460	446	434	420	407	394	381	368
7151936	7390199	7628449	355	342	329	315	303	289	277	263	250	238
9533981	9772114	0010233	224	211	198	185	171	159	146	133	119	107
1914721	2152723	2390712	093	081	067	055	041	028	016	002	989	976
4294156	4532027	4769886	237963	950	937	924	911	898	885	871	859	846
6672288	6910029	7147758	833	819	807	794	780	768	755	741	729	716
9049118	9286730	9524328	702	690	676	664	650	638	624	612	598	586
1424649	1662131	1899599	573	559	547	533	521	507	495	482	468	456
3798881	4036233	4273571	442	430	417	403	391	378	365	352	338	326
6171815	6409038	6646247	237313	300	287	274	261	248	235	223	209	196
8543454	8780547	9017627	183	171	157	145	131	119	105	093	080	066
0913799	1150762	1387712	054	041	028	015	002	989	977	963	950	938
3282850	3519684	3756505	236924	912	898	886	873	860	847	834	821	808
5650610	5887315	6124007	796	782	770	756	744	731	718	705	692	679
8017079	8253655	8490218	666	654	640	628	614	602	589	576	563	551
0382260	0618707	0855142	537	525	511	499	486	473	460	447	435	421
2746153	2982472	3218778	409	395	383	370	358	344	331	319	306	293
5108761	5344951	5581128	280	267	254	241	229	216	203	190	177	164
7470084	7706145	7942194	152	139	125	113	101	087	075	061	049	036
9830123	0066057	0301977	023	011	997	985	972	959	946	934	920	908

Numbers 18400–19009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1840	2648178230	8414253	8650264	8886261	9122246	9358218	9594177
41	2650537885	0773780	1009662	1245532	1481388	1717232	1953063
42	2896259	3132026	3367780	3603521	3839250	4074965	4310668
43	5253352	5488991	5724617	5960231	6195832	6431419	6666995
44	7609167	7844678	8080177	8315663	8551135	8786596	9022043
45	9963705	0199089	0434459	0669817	0905163	1140495	1375815
46	2662316967	2552223	2787466	3022697	3257915	3493120	3728312
47	4668954	4904083	5139199	5374302	5609393	5844471	6079536
48	7019669	7254670	7489659	7724635	7959598	8194549	8429487
49	9369112	9603986	9838848	0073697	0308533	0543357	0778167
1850	2671717284	1952031	2186766	2421488	2656198	2890894	3125578
51	4064188	4298808	4533416	4768011	5002594	5237164	5471721
52	6409823	6644317	6878799	7113267	7347723	7582167	7816597
53	8754193	8988561	9222915	9457257	9691587	9925904	0160208
54	2681097298	1331539	1565767	1799983	2034186	2268377	2502554
55	3439140	3673254	3907356	4141446	4375523	4609587	4843638
56	5779719	6013707	6247683	6481647	6715597	6949536	7183461
57	8119037	8352900	8586750	8820587	9054412	9288224	9522024
58	2690457097	0690833	0924557	1158269	1391968	1625654	1859328
59	2793898	3027509	3261107	3494693	3728266	3961827	4195375
1860	2695129442	5362928	5596400	5829861	6063308	6296744	6530166
61	7463731	7697091	7930439	8163773	8397096	8630406	8863703
62	9796766	0030001	0263223	0496433	0729630	0962814	1195986
63	2702128549	2361658	2594755	2827840	3060912	3293971	3527018
64	4459080	4692065	4925036	5157996	5390943	5623877	5856799
65	6788361	7021221	7254068	7486902	7719724	7952534	8185331
66	9116394	9349129	9581851	9814561	0047258	0279943	0512615
67	2711443179	1675789	1908387	2140972	2373545	2606105	2838653
68	3768719	4001204	4233677	4466138	4698586	4931022	5163445
69	6093014	6325375	6557724	6790060	7022384	7254695	7486994
1870	2718416065	8648302	8880527	9112739	9344938	9577125	9809300
71	2720737875	0969988	1202088	1434176	1666251	1898315	2130365
72	3058444	3290433	3522409	3754373	3986325	4218264	4450190
73	5377774	5609639	5841491	6073331	6305159	6536974	6768777
74	7695866	7927607	8159335	8391052	8622756	8854448	9086127
75	2730012721	0244338	0475943	0707536	0939117	1170685	1402241
76	2328340	2559835	2791316	3022786	3254243	3485687	3717120
77	4642726	4874097	5105455	5336802	5568135	5799457	6030766
78	6955879	7187127	7418362	7649585	7880796	8111994	8343180
79	9267801	9498926	9730038	9961138	0192225	0423300	0654364
1880	2741578493	1809494	2040483	2271460	2502425	2733378	2964318
81	3887956	4118834	4349701	4580555	4811397	5042227	5273044
82	6196191	6426947	6657691	6888422	7119142	7349849	7580544
83	8503200	8733834	8964455	9195064	9425661	9656245	9886818
84	2750808985	1039496	1269995	1500481	1730956	1961418	2191868
85	3113545	3343934	3574311	3804675	4035027	4265367	4495695
86	5416884	5647151	5877405	6107647	6337878	6568095	6798301
87	7719002	7949146	8179279	8409399	8639507	8869603	9099687
88	2760019900	0249922	0479933	0709931	0939918	1169892	1399854
89	2319579	2549480	2779369	3009246	3239110	3468963	3698803
1890	2764618042	4847821	5077588	5307343	5537086	5766817	5996536
91	6915288	7144946	7374592	7604226	7833847	8063456	8293053
92	9211321	9440857	9670381	9899894	0129394	0358882	0588358
93	2771506140	1735555	1964958	2194349	2423728	2653095	2882449
94	3799747	4029041	4258323	4487593	4716850	4946096	5175330
95	6092143	6321316	6550477	6779626	7008763	7237888	7467000
96	8383330	8612382	8841422	9070450	9299466	9528470	9757462
97	2780673309	0902240	1131160	1360067	1588962	1817846	2046717
98	2962081	3190892	3419691	3648477	3877252	4106015	4334765
99	5249647	5478338	5707016	5935682	6164337	6392979	6621609
1900	7536010	7764580	7993138	8221684	8450217	8678739	8907249

OF NUMBERS. Logarithms 2648178230–2789592707.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9830123	0066057	0301977	236023	011	997	985	972	959	946	934	920	908
2188881	2424686	2660479	235895	882	870	856	844	831	818	805	793	780
4546358	4782036	5017700	767	754	741	729	715	703	690	678	664	652
6902557	7138106	7373643	639	626	614	601	587	576	562	549	537	524
9257478	9492900	9728309	511	499	486	472	461	447	435	422	409	396
1611122	1846417	2081698	384	370	358	346	332	320	307	295	281	269
3963492	4198659	4433813	256	243	231	218	205	192	180	167	154	141
6314588	6549628	6784655	129	116	103	091	078	065	052	040	027	014
8664412	8899325	9134225	001	989	976	963	951	938	925	913	900	887
1012966	1247751	1482524	234874	862	849	836	824	810	799	785	773	760
3360250	3594908	3829554	234747	735	722	710	696	684	672	658	646	634
5706266	5940798	6175317	620	608	595	583	570	557	545	532	519	506
8051015	8285420	8519813	494	482	468	456	444	430	418	405	393	380
0394499	0628778	0863044	368	354	342	330	317	304	291	279	266	254
2736720	2970872	3205012	241	228	216	203	191	177	166	152	140	128
5077677	5311704	5545718	114	102	090	077	064	051	039	027	014	001
7417374	7651274	7885162	233988	976	964	950	939	925	913	900	888	875
9755811	9989585	0223347	863	850	837	825	812	800	787	774	762	750
2092989	2326638	2560274	736	724	712	699	686	674	661	649	636	624
4428911	4662434	4895944	611	598	586	573	561	548	536	523	510	498
6763576	6996974	7230359	233486	472	461	447	436	422	410	398	385	372
9096987	9330260	9563519	360	348	334	323	310	297	284	273	259	247
1429146	1662293	1895427	235	222	210	197	184	172	160	147	134	122
3760052	3993074	4226083	109	097	085	072	059	047	034	022	009	997
6089708	6322605	6555490	232985	971	960	947	934	922	909	897	885	871
8418115	8650887	8883647	860	847	834	822	810	797	784	772	760	747
0745275	0977922	1210557	735	722	710	697	685	672	660	647	635	622
3071188	3303711	3536221	610	598	585	573	560	548	535	523	510	498
5395856	5628254	5860640	485	473	461	448	436	423	411	398	386	374
7719280	7951554	8183816	361	349	336	324	311	299	286	274	262	249
0041462	0273612	0505750	232237	225	212	199	187	175	162	150	138	125
2362404	2594429	2826443	113	100	088	075	064	050	039	025	014	001
4682105	4914007	5145897	231989	976	964	952	939	926	915	902	890	877
7000568	7232346	7464112	865	852	840	828	815	803	791	778	766	754
9317794	9549448	9781091	741	728	717	704	692	679	667	654	643	630
1633784	1865315	2096834	617	605	593	581	568	556	543	531	519	506
3948540	4179948	4411343	495	481	470	457	444	433	420	408	395	383
6262063	6493347	6724619	371	358	347	333	322	309	297	284	272	260
8574354	8805515	9036664	248	235	223	211	198	186	174	161	149	137
0885414	1116453	1347479	125	112	100	087	075	064	050	039	026	014
3195246	3426161	3657064	231001	989	977	965	953	940	928	915	903	892
5503849	5734642	5965423	230878	867	854	842	830	817	805	793	781	768
7811226	8041896	8272554	756	744	731	720	707	695	682	670	658	646
0117378	0347926	0578461	634	621	609	597	584	573	560	548	535	524
2422306	2652731	2883144	511	499	486	475	462	450	438	425	413	401
4726011	4956314	5186605	389	377	364	352	340	328	316	303	291	279
7028494	7258676	7488845	267	254	242	231	217	206	193	182	169	157
9329758	9559818	9789865	144	133	120	108	096	084	071	060	047	035
1629803	1859741	2089666	022	011	998	987	974	962	949	938	925	913
3928631	4158447	4388250	229901	889	877	864	853	840	828	816	803	792
6226242	6455936	6685618	229779	767	755	743	731	719	706	694	682	670
8522638	8752211	8981772	658	646	634	621	609	597	585	573	561	549
0817821	1047273	1276712	536	524	513	500	488	476	463	452	439	428
3111792	3341122	3570440	415	403	391	379	367	354	343	330	318	307
5404551	5633761	5862958	294	282	270	257	246	234	221	210	197	185
7696101	7925189	8154266	173	161	149	137	125	112	101	088	077	064
9986442	0215410	0444365	052	040	028	016	004	992	980	968	955	944
2275576	2504423	2733258	228931	920	907	895	884	871	859	847	835	823
4563504	4792230	5020945	811	799	786	775	763	750	739	726	715	702
6850227	7078833	7307427	691	678	666	655	642	630	618	606	594	583
9135747	9364233	9592707	570	558	546	533	522	510	498	486	474	462

Numbers 19000–19609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1900	2787536010	7764580	7993138	8221684	8450217	8678739	8907249
1	9821169	0049618	0278056	0506482	0734896	0963297	1191687
2	2792105126	2333456	2561773	2790079	3018373	3246654	3474924
3	4387883	4616093	4844290	5072476	5300650	5528812	5756961
4	6669440	6897530	7125608	7353674	7581728	7809770	8037800
5	8949800	9177770	9405728	9633675	9861609	0089531	0317441
6	2801228963	1456814	1684652	1912479	2140293	2368096	2595887
7	3506930	3734662	3962381	4190088	4417783	4645466	4873138
8	5783704	6011315	6238915	6466503	6694079	6921643	7149195
9	8059284	8286776	8514257	8741726	8969182	9196627	9424060
1910	2810333672	0561046	0788407	1015757	1243094	1470420	1697734
11	2606871	2834125	3061367	3288598	3515817	3743024	3970218
12	4878879	5106015	5333139	5560250	5787350	6014438	6241514
13	7149700	7376717	7603722	7830715	8057696	8284666	8511623
14	9419334	9646233	9873119	0099993	0326856	0553707	0780546
15	2821687783	1914563	2141331	2368087	2594831	2821563	3048284
16	3955047	4181709	4408358	4634996	4861622	5088236	5314838
17	6221129	6447672	6674203	6900723	7127230	7353726	7580210
18	8486028	8712453	8938867	9165268	9391658	9618035	9844401
19	2830749747	0976054	1202350	1428633	1654905	1881165	2107413
1920	2833012287	3238476	3464654	3690819	3916973	4143115	4369245
21	5273649	5499720	5725780	5951828	6177864	6403888	6629901
22	7533833	7759787	7985729	8211659	8437578	8663485	8889380
23	9792842	0018679	0244503	0470316	0696117	0921906	1147684
24	2842050677	2276396	2502103	2727799	2953482	3179154	3404815
25	4307338	4532940	4758530	4984108	5209675	5435230	5660773
26	6562828	6788312	7013785	7239246	7464696	7690133	7915560
27	8817147	9042514	9267870	9493214	9718546	9943867	0169176
28	2851070296	1295546	1520785	1746013	1971228	2196432	2421624
29	3322276	3547410	3772532	3997643	4222742	4447829	4672905
1930	2855573090	5798107	6023113	6248107	6473089	6698060	6923019
31	7822738	8047638	8272528	8497405	8722271	8947125	9171967
32	2860071221	0296005	0520778	0745539	0970288	1195026	1419752
33	2318540	2543208	2767865	2992509	3217143	3441764	3666374
34	4564697	4789249	5013790	5238318	5462835	5687341	5911834
35	6809694	7034129	7258554	7482966	7707367	7931757	8156134
36	9053530	9277850	9502158	9726455	9950740	0175013	0399275
37	2871296207	1520411	1744604	1968785	2192954	2417112	2641258
38	3537727	3761816	3985892	4209958	4434011	4658053	4882084
39	5778091	6002064	6226025	6449975	6673913	6897839	7121754
1940	2878017299	8241157	8465002	8688837	8912660	9136471	9360270
41	2880255354	0479096	0702826	0926545	1150253	1373949	1597633
42	2492256	2715883	2939498	3163102	3386694	3610275	3833844
43	4728006	4951518	5175018	5398507	5621984	5845450	6068904
44	6962606	7186003	7409388	7632762	7856124	8079475	8302814
45	9196057	9419339	9642609	9865868	0089115	0312351	0535576
46	2891428359	1651526	1874682	2097826	2320959	2544081	2767190
47	3659515	3882568	4105609	4328639	4551657	4774663	4997659
48	5889525	6112463	6335390	6558305	6781209	7004101	7226982
49	8118391	8341215	8564027	8786828	9009617	9232395	9455162
1950	2900346114	0568823	0791521	1014208	1236883	1459546	1682199
51	2572694	2795289	3017873	3240446	3463007	3685556	3908094
52	4798133	5020615	5243084	5465543	5687990	5910425	6132850
53	7022433	7244800	7467156	7689501	7911834	8134156	8356466
54	9245594	9467847	9690089	9912320	0134540	0356748	0578944
55	2911467617	1689757	1911886	2134003	2356108	2578203	2800286
56	3688505	3910531	4132546	4354549	4576541	4798522	5020492
57	5908257	6130169	6352071	6573961	6795840	7017707	7239563
58	8126875	8348674	8570462	8792239	9014005	9235759	9457502
59	2920344360	0566046	0787721	1009385	1231037	1452678	1674308
1960	2560714	2782287	3003849	3225399	3446938	3668466	3889983

OF NUMBERS. Logarithms 2787536010–2924554465.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9135747	9364233	9592707	228570	558	546	533	522	510	498	486	474	462
1420065	1648431	1876784	449	438	426	414	401	390	378	366	353	342
3703182	3931427	4159661	330	317	306	294	281	270	258	245	234	222
5985099	6213225	6441339	210	197	186	174	162	149	138	126	114	101
8265818	8493824	8721818	090	078	066	054	042	030	018	006	994	982
0545340	0773226	1001101	227970	958	947	934	922	910	899	886	875	862
2823666	3051433	3279187	851	838	827	814	803	791	779	767	754	743
5100797	5328445	5556080	732	719	707	695	683	672	659	648	635	624
7376735	7604263	7831780	611	600	588	576	564	552	540	528	517	504
9651481	9878890	0106287	492	481	469	456	445	433	421	409	397	385
1925036	2152326	2379604	227374	361	350	337	326	314	302	290	278	267
4197402	4424573	4651732	254	242	231	219	207	194	184	171	159	147
6468579	6695631	6922672	136	124	111	100	088	076	065	052	041	028
8738569	8965502	9192424	017	005	993	981	970	957	946	933	922	910
1007373	1234188	1460991	226899	886	874	863	851	839	827	815	803	792
3274992	3501689	3728374	780	768	756	744	732	721	708	697	685	673
5541429	5768007	5994574	662	649	638	626	614	602	591	578	567	555
7806682	8033143	8259592	543	531	520	507	496	484	472	461	449	436
0070756	0297098	0523429	425	414	401	390	377	366	355	342	331	318
2333649	2559873	2786086	307	296	283	272	260	248	236	224	213	201
4595364	4821470	5047565	226189	178	165	154	142	130	119	106	095	084
6855901	7081890	7307868	071	060	048	036	024	013	000	989	978	965
9115263	9341135	9566994	225954	942	930	919	907	895	883	872	859	848
1373450	1599204	1824946	837	824	813	801	789	778	766	754	742	731
3630463	3856100	4081725	719	707	696	683	672	661	648	637	625	613
5886304	6111824	6337332	602	590	578	567	555	543	531	520	508	496
8140974	8366376	8591767	484	473	461	450	437	427	414	402	391	380
0394474	0619759	0845033	367	356	344	332	321	309	298	285	274	263
2646805	2871974	3097131	250	239	228	215	204	192	181	169	157	145
4897968	5123021	5348061	134	122	111	099	087	076	063	053	040	029
7147966	7372901	7597825	225017	006	994	982	971	959	947	935	924	913
9396798	9621617	9846425	224900	890	877	866	854	842	831	819	808	796
1644467	1869169	2093861	784	773	761	749	738	726	715	702	692	679
3890972	4115559	4340134	668	657	644	634	621	610	598	587	575	563
6136317	6360787	6585246	552	541	528	517	506	493	483	470	459	448
8380501	8604855	8829198	435	425	412	401	390	377	367	354	343	332
0623526	0847764	1071992	320	308	297	285	273	262	251	238	228	215
2865393	3089516	3313627	204	193	181	169	158	146	135	123	111	100
5106103	5330111	5554106	089	076	066	053	042	031	019	008	995	985
7345658	7569550	7793430	223973	961	950	938	926	915	904	892	880	869
9584059	9807835	0031600	223858	845	835	823	811	799	789	776	765	754
1821306	2044968	2268617	742	730	719	708	696	684	673	662	649	639
4057402	4280948	4504483	627	615	604	592	581	569	558	546	535	523
6292347	6515778	6739198	512	500	489	477	466	454	443	431	420	408
8526142	8749458	8972763	397	385	374	362	351	339	328	316	305	294
0758789	0981991	1205181	282	270	259	247	236	225	213	202	190	178
2990289	3213376	3436451	167	156	144	133	122	109	099	087	075	064
5220643	5443615	5666576	053	041	030	018	006	996	984	972	961	949
7449852	7672710	7895556	222938	927	915	904	892	881	870	858	846	835
9677917	9900661	0123393	824	812	801	789	778	767	755	744	732	721
1904840	2127469	2350087	222709	698	687	675	663	653	641	629	618	607
4130621	4353137	4575641	595	584	573	561	549	538	527	516	504	492
6355263	6577664	6800054	482	469	459	447	435	425	413	401	390	379
8578765	8801053	9023329	367	356	345	333	322	310	299	288	276	265
0801130	1023304	1245466	253	242	231	220	208	196	186	174	162	151
3022358	3244418	3466467	140	129	117	105	095	083	072	060	049	038
5242450	5464397	5686332	026	015	003	992	981	970	958	947	935	925
7461408	7683242	7905064	221912	902	890	879	867	856	845	834	822	811
9679233	9900953	0122662	799	788	777	766	754	743	731	720	709	698
1895926	2117533	2339129	686	675	664	652	641	630	618	607	596	585
4111488	4332982	4554465	573	562	550	539	528	517	505	494	483	472

Numbers 19600-20209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
1960	2922560714	2782287	3003849	3225399	3446938	3668466	3889983
61	4775937	4997397	5218846	5440283	5661710	5883125	6104528
62	6990030	7211378	7432714	7654039	7875352	8096654	8317945
63	9202996	9424231	9645454	9866666	0087867	0309056	0530234
64	2931414835	1635956	1857067	2078166	2299255	2520331	2741397
65	3625547	3846556	4067555	4288542	4509517	4730482	4951435
66	5835135	6056032	6276918	6497792	6718655	6939507	7160348
67	8043599	8264384	8485157	8705920	8926671	9147410	9368139
68	2940250941	0471613	0692275	0912925	1133564	1354191	1574808
69	2457161	2677722	2898271	3118809	3339336	3559851	3780356
1970	2944662262	4882710	5103147	5323573	5543988	5764392	5984785
71	6866243	7086579	7306905	7527219	7747522	7967814	8188095
72	9069106	9289331	9509545	9729747	9949939	0170119	0390288
73	2951270853	1490966	1711068	1931159	2151239	2371307	2591365
74	3471483	3691485	3911476	4131455	4351424	4571381	4791327
75	5671000	5890890	6110769	6330637	6550494	6770340	6990175
76	7869403	8089182	8308950	8528706	8748452	8968187	9187910
77	2960066693	0286361	0506018	0725664	0945298	1164922	1384534
78	2262873	2482429	2701975	2921510	3141034	3360546	3580047
79	4457942	4677388	4896823	5116247	5335659	5555061	5774451
1980	2966651903	6871238	7090562	7309875	7529177	7748467	7967747
81	8844755	9063980	9283193	9502395	9721587	9940767	0159936
82	2971036501	1255615	1474718	1693810	1912890	2131960	2351018
83	3227142	3446145	3665138	3884119	4103089	4322048	4540996
84	5416678	5635571	5854453	6073324	6292184	6511032	6729870
85	7605111	7823894	8042665	8261426	8480175	8698914	8917642
86	9792442	0011114	0229776	0448426	0667065	0885694	1104311
87	2981978671	2197234	2415785	2634325	2852855	3071373	3289881
88	4163801	4382253	4600695	4819125	5037545	5255953	5474351
89	6347831	6566174	6784506	7002826	7221136	7439435	7657723
1990	2988530764	8748997	8967219	9185430	9403630	9621819	9839997
91	2990712600	0930724	1148836	1366937	1585028	1803107	2021176
92	2893341	3111355	3329358	3547350	3765331	3983301	4201260
93	5072987	5290891	5508785	5726668	5944539	6162400	6380250
94	7251540	7469335	7687119	7904893	8122655	8340406	8558147
95	9429000	9646686	9864361	0082026	0299679	0517321	0734953
96	3001605370	1822946	2040513	2258068	2475612	2693145	2910668
97	3780649	3998117	4215574	4433020	4650455	4867880	5085293
98	5954839	6172198	6389546	6606884	6824210	7041526	7258831
99	8127941	8345192	8562431	8779660	8996878	9214085	9431281
2000	3010299957	0517098	0734229	0951350	1168459	1385557	1602645
1	2470886	2687920	2904942	3121954	3338954	3555944	3772923
2	4640731	4857656	5074570	5291474	5508366	5725248	5942118
3	6809493	7026310	7243115	7459910	7676694	7893468	8110230
4	8977172	9193880	9410578	9627265	9843941	0060606	0277260
5	3021143770	1360370	1576959	1793538	2010106	2226663	2443210
6	3309287	3525779	3742261	3958732	4175192	4391641	4608079
7	5473725	5690109	5906483	6122846	6339198	6555540	6771870
8	7637085	7853361	8069627	8285883	8502127	8718361	8934584
9	9799367	0015537	0231695	0447842	0663979	0880105	1096221
2010	3031960574	2176636	2392687	2608727	2824756	3040774	3256782
11	4120706	4336660	4552603	4768536	4984458	5200369	5416269
12	6279764	6495611	6711447	6927272	7143087	7358890	7574684
13	8437749	8653488	8869217	9084935	9300643	9516339	9732025
14	3040594662	0810295	1025916	1241527	1457128	1672717	1888296
15	2750505	2966030	3181545	3397049	3612542	3828025	4043497
16	4905278	5120696	5336104	5551501	5766888	5982263	6197629
17	7058982	7274294	7489595	7704885	7920165	8135434	8350692
18	9211619	9426824	9642018	9857202	0072375	0287537	0502689
19	3051363189	1578288	1793376	2008453	2223519	2438575	2653620
2020	3513694	3728686	3943668	4158638	4373598	4588548	4803487

OF NUMBERS.

Logarithms 2922560714-3055448239.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
41111488	4332982	4554465	221573	562	550	539	528	517	505	494	483	472
6325921	6547302	6768672	460	449	437	427	415	403	393	381	370	358
8539225	8760493	8981750	348	336	325	313	302	291	280	268	257	246
0751401	0972557	1193701	235	223	212	201	189	178	167	156	144	134
2962451	3183495	3404526	121	111	099	089	076	066	054	044	031	021
5172377	5393307	5614227	009	999	987	975	965	953	942	930	920	908
7381178	7601996	7822803	220897	886	874	863	852	841	830	818	807	796
9588856	9809562	0030257	785	773	763	751	739	729	717	706	695	684
1795413	2016007	2236590	672	662	650	639	627	617	605	594	583	571
4000849	4221331	4441802	561	549	538	527	515	505	493	482	471	460
6205166	6425536	6645895	220448	437	426	415	404	393	381	370	359	348
8408364	8628623	8848870	336	326	314	303	292	281	269	259	247	236
0610446	0830593	1050728	225	214	202	192	180	169	158	147	135	125
2811411	3031446	3251470	113	102	091	080	068	058	046	035	024	013
5011262	5231185	5451098	002	991	979	969	957	946	935	923	913	902
7209998	7429811	7649612	219890	879	868	857	846	835	823	813	801	791
9407623	9627324	9847014	779	768	756	746	735	723	713	701	690	679
1604135	1823726	2043305	668	657	646	634	624	612	601	591	579	568
3799538	4019017	4238485	556	546	535	524	512	501	491	479	468	457
5993831	6213199	6432556	446	435	424	412	402	390	380	368	357	347
8187016	8406273	8625520	219335	324	313	302	290	280	269	257	247	235
0379094	0598241	0817377	225	213	202	192	180	169	158	147	136	124
2570066	2789102	3008128	114	103	092	080	070	058	048	036	026	014
4759933	4978859	5197774	003	993	981	970	959	948	937	926	915	904
6948697	7167513	7386317	218893	882	871	860	848	838	827	816	804	794
9136358	9355064	9573758	783	771	761	749	739	728	716	706	694	684
1322918	1541513	1760098	672	662	650	639	629	617	607	595	585	573
3508377	3726863	3945337	563	551	540	530	518	508	496	486	474	464
5692737	5911113	6129478	452	442	430	420	408	398	386	376	365	353
7875999	8094265	8312520	343	332	320	310	299	288	276	266	255	244
0058165	0276321	0494466	218233	222	211	200	189	178	168	156	145	134
2239234	2457280	2675316	124	112	101	091	079	069	058	046	036	025
4419208	4637145	4855072	014	003	992	981	970	959	948	937	927	915
6598089	6815917	7033734	217904	894	883	871	861	850	839	828	817	806
8775877	8993595	9211303	795	784	774	762	751	741	730	718	708	697
0952573	1170183	1387782	686	675	665	653	642	632	620	610	599	588
3128179	3345680	3563170	576	567	555	544	533	523	511	501	490	479
5302696	5520088	5737469	468	457	446	435	425	413	403	392	381	370
7476125	7693408	7910680	359	348	338	326	316	305	294	283	272	261
9648466	9865640	0082804	251	239	229	218	207	196	185	174	164	153
1819721	2036787	2253842	217141	131	121	109	098	088	076	066	055	044
3989892	4206849	4423796	034	022	012	000	990	979	969	957	947	935
6158978	6375827	6592666	216925	914	904	892	882	870	860	849	839	827
8326982	8543723	8760453	817	805	795	784	774	762	752	741	730	719
0493904	0710537	0927158	708	698	687	676	665	654	644	633	621	612
2659745	2876270	3092784	600	589	579	568	557	547	535	525	514	503
4824507	5040924	5257330	492	482	471	460	449	438	428	417	406	395
6988190	7204499	7420797	384	374	363	352	342	330	320	309	298	288
9150796	9366997	9583188	276	266	256	244	234	223	212	201	191	179
1312325	1528419	1744502	170	158	147	137	126	116	104	094	083	072
3472779	3688766	3904741	216062	051	040	029	018	008	997	987	975	965
5632159	5848038	6063906	215954	943	933	922	911	900	890	879	868	858
7790466	8006238	8221999	847	836	825	815	803	794	782	772	761	750
9947701	0163365	0379019	739	729	718	708	696	686	676	664	654	643
2103864	2319422	2534969	633	621	611	601	589	579	568	558	547	536
4258958	4474409	4689849	525	515	504	493	483	472	461	451	440	429
6412983	6628327	6843660	418	408	397	387	375	366	354	344	333	322
8565940	8781177	8996403	312	301	290	280	269	258	248	237	226	216
0717830	0932961	1148080	205	194	184	173	162	152	141	131	119	109
2868655	3083679	3298692	099	088	077	066	056	045	035	024	013	002
5018415	5233332	5448239	214992	982	970	960	950	939	928	917	907	896

Numbers 20200–20809. **LOGARITHMS**

Numbers	Mantissæ.						
	0	1	2	3	4	5	6
2020	3053513694	3728686	3943668	4158638	4373598	4588548	4803487
21	5663135	5878021	6092896	6307760	6522614	6737457	6952289
22	7811513	8026292	8241061	8455819	8670566	8885303	9100029
23	9958828	0173501	0388163	0602815	0817457	1032087	1246707
24	3062105082	2319649	2534205	2748751	2963286	3177811	3392325
25	4250276	4464737	4679187	4893627	5108056	5322475	5536883
26	6394410	6608766	6823110	7037444	7251768	7466081	7680383
27	8537487	8751736	8965975	9180204	9394422	9608629	9822826
28	3070679507	0893650	1107784	1321907	1536019	1750120	1964211
29	2820470	3034509	3248536	3462554	3676560	3890557	4104542
2030	3074960379	5174312	5388234	5602146	5816048	6029938	6243818
31	7099234	7313062	7526879	7740685	7954481	8168267	8382042
32	9237036	9450758	9664470	9878172	0091862	0305543	0519212
33	3081373786	1587404	1801010	2014607	2228192	2441767	2655332
34	3509486	3722998	3936500	4149991	4363472	4576942	4790402
35	5644136	5857543	6070940	6284326	6497702	6711067	6924422
36	7777737	7991039	8204331	8417613	8630884	8844144	9057394
37	9910290	0123488	0336675	0549852	0763018	0976174	1189320
38	3092041797	2254890	2467973	2681045	2894107	3107158	3320199
39	4172258	4385246	4598225	4811192	5024150	5237097	5450033
2040	3096301674	6514558	6727432	6940296	7153149	7365991	7578823
41	8430047	8642827	8855597	9068356	9281104	9493843	9706570
42	3100557378	0770053	0982719	1195373	1408018	1620652	1833276
43	2683666	2896238	3108799	3321350	3533890	3746420	3958940
44	4808915	5021382	5233840	5446286	5658723	5871149	6083565
45	6933123	7145487	7357841	7570184	7782516	7994838	8207150
46	9056294	9268554	9480803	9693043	9905271	0117490	0329698
47	3111178427	1390583	1602729	1814864	2026990	2239104	2451209
48	3299523	3511576	3723618	3935650	4147672	4359683	4571684
49	5419584	5631533	5843472	6055401	6267319	6479227	6691124
2050	3117538611	7750456	7962292	8174117	8385932	8597736	8809530
51	9656604	9868346	0080078	0291800	0503512	0715213	0926904
52	3121773564	1985204	2196833	2408451	2620060	2831658	3043246
53	3889494	4101030	4312556	4524072	4735577	4947072	5158557
54	6004393	6215826	6427249	6638662	6850064	7061456	7272838
55	8118262	8329592	8540913	8752222	8963522	9174811	9386090
56	3130231103	0442331	0653548	0864755	1075952	1287138	1498315
57	2342917	2554042	2765156	2976261	3187355	3398439	3609512
58	4453704	4664727	4875739	5086740	5297732	5508713	5719684
59	6563466	6774386	6985296	7196195	7407084	7617963	7828832
2060	3138672204	8883021	9093828	9304625	9515412	9726189	9936955
61	3140779918	0990633	1201338	1412033	1622717	1833391	2044055
62	2886609	3097222	3307825	3518418	3729000	3939572	4150134
63	4992280	5202791	5413291	5623782	5834262	6044732	6255192
64	7096930	7307338	7517737	7728126	7938504	8148872	8359230
65	9200560	9410867	9621164	9831450	0041727	0251993	0462249
66	3151303172	1513377	1723572	1933757	2143932	2354096	2564251
67	3404766	3614870	3824963	4035046	4245119	4455182	4665235
68	5505344	5715346	5925338	6135320	6345291	6555252	6765203
69	7604907	7814807	8024697	8234578	8444448	8654307	8864157
2070	3159703455	9913254	0123042	0332821	0542590	0752348	0962097
71	3161800989	2010687	2220374	2430052	2639719	2849376	3059023
72	3897511	4107107	4316694	4526270	4735836	4945392	5154938
73	5993021	6202516	6412002	6621477	6830942	7040397	7249842
74	8087521	8296915	8506299	8715673	8925038	9134392	9343736
75	3170181010	0390304	0599587	0808861	1018124	1227377	1436620
76	2273492	2482684	2691867	2901040	3110202	3319354	3528497
77	4364965	4574057	4783139	4992211	5201273	5410325	5619366
78	6455432	6664424	6873405	7082376	7291337	7500288	7709230
79	8544893	8753784	8962665	9171536	9380396	9589247	9798088
2080	3180633350	0842140	1050920	1259691	1468451	1677201	1885942

OF NUMBERS. Logarithms 3053513694-3182512102.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5018415	5233332	5448239	214992	982	970	960	950	939	928	917	907	896
7167111	7381922	7596723	886	875	864	854	843	832	822	811	801	790
9314745	9529450	9744144	779	769	758	747	737	726	716	705	694	684
1461317	1675916	1890504	673	662	652	642	630	620	610	599	588	578
3606829	3821322	4035804	567	556	546	535	525	514	504	493	482	472
5751281	5965668	6180044	461	450	440	429	419	408	398	387	376	366
7894675	8108956	8323227	356	344	334	324	313	302	292	281	271	260
0037012	0251187	0465352	249	239	229	218	207	197	186	175	165	155
2178292	2392362	2606421	143	134	123	112	101	091	081	070	059	049
4318517	4532482	4746436	039	027	018	006	997	985	975	965	954	943
6457688	6671547	6885396	213933	922	912	902	890	880	870	859	849	838
8595806	8809560	9023303	828	817	806	796	786	775	764	754	743	733
0732872	0946520	1160159	722	712	702	690	681	669	660	648	639	627
2868886	3082430	3295963	618	606	597	585	575	565	554	544	533	523
5003851	5217290	5430718	512	502	491	481	470	460	449	439	428	418
7137766	7351100	7564424	407	397	386	376	365	355	344	334	324	313
9270634	9483863	9697082	302	292	282	271	260	250	240	229	219	208
1402455	1615579	1828693	198	187	177	166	156	146	135	124	114	104
3533229	3746249	3959259	093	083	072	062	051	041	030	020	010	999
5662959	5875874	6088780	212988	979	967	958	947	936	926	915	906	894
7791645	8004456	8217257	212884	874	864	853	842	832	822	811	801	790
9919288	0131995	0344691	780	770	759	748	739	727	718	707	696	687
2045889	2258492	2471084	675	666	654	645	634	624	613	603	592	582
4171449	4383948	4596437	572	561	551	540	530	520	509	499	489	478
6295970	6508365	6720749	467	458	446	437	426	416	405	395	384	374
8419452	8631743	8844023	364	354	343	332	322	312	302	291	280	271
0541896	0754083	0966260	260	249	240	228	219	208	198	187	177	167
2663303	2875387	3087460	156	146	135	126	114	105	094	084	073	063
4783674	4995655	5207624	053	042	032	022	011	001	990	981	969	960
6903011	7114888	7326754	211949	939	929	918	908	897	887	877	866	857
9021314	9233088	9444851	211845	836	825	815	804	794	784	774	763	753
1138585	1350255	1561915	742	732	722	712	701	691	681	670	660	649
3254823	3466390	3677947	640	629	618	609	598	588	577	567	557	547
5370031	5581495	5792949	536	526	516	505	495	485	474	464	454	444
7484209	7695571	7906921	433	423	413	402	392	382	371	362	350	341
9597359	9808617	0019865	330	321	309	300	289	279	269	258	248	238
1709481	1920636	2131782	228	217	207	197	186	177	166	155	146	135
3820576	4031629	4242672	125	114	105	094	084	073	064	053	043	032
5930645	6141596	6352536	023	012	001	992	981	971	961	951	940	930
8039690	8250538	8461376	210920	910	899	889	879	869	858	848	838	828
0147711	0358457	0569192	210817	807	797	787	777	766	756	746	735	726
2254709	2465353	2675986	715	705	695	684	674	664	654	644	633	623
4360686	4571227	4781759	613	603	593	582	572	562	552	541	532	521
6465642	6676081	6886510	511	500	491	480	470	460	450	439	429	420
8569578	8779915	8990243	408	399	389	378	368	358	348	337	328	317
0672495	0882731	1092956	307	297	286	277	266	256	246	236	225	216
2774395	2984529	3194653	205	195	185	175	164	155	144	134	124	113
4875278	5085310	5295332	104	093	083	073	063	053	043	032	022	012
6975144	7185075	7394996	002	992	982	971	961	951	941	931	921	911
9073997	9283826	9493645	209900	890	881	870	859	850	840	829	819	810
1171835	1381563	1591281	209799	788	779	769	758	749	738	728	718	708
3268660	3478287	3687904	698	687	678	667	657	647	637	627	617	607
5364474	5574000	5783515	596	587	576	566	556	546	536	526	515	506
7459277	7668701	7878116	495	486	475	465	455	445	435	424	415	405
9553069	9762393	9971707	394	384	374	365	354	344	333	324	314	303
1645853	1855076	2064289	294	283	274	263	253	243	233	223	213	203
3737629	3946751	4155863	192	183	173	162	152	143	132	122	112	102
5828398	6037419	6246431	092	082	072	062	052	041	032	021	012	001
7918161	8127082	8335992	208992	981	971	961	951	942	931	921	910	901
0006918	0215739	0424549	891	881	871	860	851	841	830	821	810	801
2094672	2303392	2512102	790	780	771	760	750	741	730	720	710	700

Numbers 20800–21409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2080	3180633350	0842140	1050920	1259691	1468451	1677201	1885942
81	2720802	2929492	3138172	3346842	3555502	3764152	3972792
82	4807252	5015842	5224421	5432991	5641551	5850101	6058641
83	6892699	7101189	7309669	7518139	7726598	7935048	8143488
84	8977146	9185536	9393916	9602285	9810645	0018995	0227334
85	3191060593	1268883	1477163	1685432	1893692	2101942	2310182
86	3143041	3351231	3559411	3767581	3975741	4183890	4392030
87	5224491	5432581	5640661	5848731	6056791	6264842	6472882
88	7304943	7512934	7720914	7928885	8136845	8344796	8552737
89	9384400	9592291	9800172	0008043	0215904	0423755	0631596
2090	3201462861	1670653	1878434	2086206	2293967	2501719	2709461
91	3540328	3748020	3955702	4163375	4371037	4578689	4786332
92	5616802	5824395	6031978	6239551	6447114	6654667	6862210
93	7692283	7899777	8107261	8314734	8522198	8729652	8937096
94	9766773	9974168	0181553	0388927	0596292	0803647	1010992
95	3211840273	2047569	2254854	2462130	2669396	2876652	3083898
96	3912783	4119980	4327166	4534343	4741510	4948667	5155815
97	5984305	6191402	6398490	6605568	6812637	7019695	7226743
98	8054839	8261838	8468827	8675806	8882776	9089735	9296685
99	3220124386	0331286	0538177	0745058	0951929	1158790	1365641
2100	3222192947	2399749	2606541	2813324	3020096	3226859	3433611
1	4260524	4467228	4673921	4880605	5087279	5293943	5500598
2	6327117	6533722	6740318	6946903	7153479	7360045	7566601
3	8392727	8599234	8805731	9012218	9218696	9425164	9631621
4	3230457355	0663764	0870163	1076552	1282931	1489301	1695661
5	2521002	2727312	2933613	3139905	3346186	3552458	3758719
6	4583668	4789881	4996084	5202278	5408461	5614635	5820798
7	6645356	6851471	7057576	7263672	7469757	7675833	7881899
8	8706065	8912083	9118090	9324088	9530075	9736054	9942022
9	3240765797	0971717	1177627	1383527	1589417	1795297	2001168
2110	3242824553	3030375	3236187	3441989	3647782	3853565	4059338
11	4882333	5088057	5293772	5499477	5705172	5910858	6116533
12	6939139	7144766	7350383	7555990	7761588	7967176	8172755
13	8994971	9200500	9406020	9611530	9817031	0022522	0228003
14	3251049830	1255262	1460685	1666098	1871501	2076895	2282279
15	3103717	3309052	3514378	3719694	3925000	4130297	4335583
16	5156634	5361872	5567101	5772319	5977529	6182728	6387918
17	7208580	7413722	7618853	7823975	8029087	8234190	8439283
18	9259558	9464602	9669637	9874662	0079678	0284683	0489679
19	3261309567	1514515	1719453	1924381	2129300	2334209	2539108
2120	3263358609	3563460	3768302	3973133	4177956	4382768	4587571
21	5406685	5611440	5816184	6020920	6225645	6430361	6635067
22	7453796	7658454	7863102	8067741	8272370	8476989	8681599
23	9499942	9704503	9909055	0113598	0318130	0522653	0727167
24	3271545124	1749589	1954045	2158491	2362927	2567354	2771771
25	3589344	3793713	3998072	4202422	4406762	4611093	4815414
26	5632602	5836875	6041138	6245392	6449636	6653871	6858095
27	7674899	7879076	8083243	8287401	8491549	8695688	8899816
28	9716236	9920317	0124389	0328450	0532503	0736545	0940578
29	3281756614	1960599	2164575	2368541	2572497	2776444	2980381
2130	3283796034	3999924	4203803	4407674	4611534	4815385	5019227
31	5834497	6038291	6242075	6445849	6649614	6853370	7057116
32	7872004	8075702	8279390	8483069	8686739	8890398	9094049
33	9908554	0112157	0315750	0519334	0722908	0926472	1130027
34	3291944151	2147658	2351156	2554644	2758122	2961591	3165051
35	3978794	4182205	4385608	4589001	4792384	4995758	5199122
36	6012484	6215800	6419107	6622405	6825693	7028972	7232241
37	8045222	8248443	8451655	8654858	8858051	9061234	9264408
38	3300077009	0280135	0483252	0686360	0889457	1092546	1295625
39	2107846	2310877	2513899	2716912	2919915	3122908	3325892
2140	4137733	4340670	4543597	4746515	4949423	5152322	5355211

OF NUMBERS. Logarithms 3180633350–3305963822.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2094672	2303392	2512102	208790	780	771	760	750	741	730	720	710	700
4181422	4390042	4598652	690	680	670	660	650	640	630	620	610	600
6267170	6475690	6684200	590	579	570	560	550	540	529	520	510	499
8351917	8560337	8768747	490	480	470	459	450	440	429	420	410	399
0435664	0643984	0852293	390	380	369	360	350	339	330	320	309	300
2518411	2726631	2934841	290	280	269	260	250	240	229	220	210	200
4600160	4808281	5016391	190	180	170	160	149	140	130	121	110	100
6680912	6888932	7096943	090	080	070	060	051	040	030	020	011	000
8760667	8968588	9176499	207991	980	971	960	951	941	930	921	911	901
0839427	1047248	1255060	891	881	871	861	851	841	831	821	812	801
2917192	3124914	3332626	207792	781	772	761	752	742	731	722	712	702
4993964	5201587	5409199	692	682	673	662	652	643	632	623	612	603
7069743	7277266	7484780	593	583	573	563	553	543	533	523	514	503
9144530	9351955	9559369	494	484	473	464	454	444	434	425	414	404
1218327	1425652	1632968	395	385	374	365	355	345	335	325	316	305
3291134	3498360	3705577	296	285	276	266	256	246	236	226	217	206
5362952	5570079	5777197	197	186	177	167	157	148	137	127	118	108
7433782	7640811	7847830	097	088	078	069	058	048	039	029	019	009
9503625	9710555	9917475	206999	989	979	970	959	950	940	930	920	911
1572482	1779314	1986136	900	891	881	871	861	851	841	832	822	811
3640354	3847087	4053811	206802	792	783	772	763	752	743	733	724	713
5707242	5913877	6120502	704	693	684	674	664	655	644	635	625	615
7773147	7979683	8186210	605	596	585	576	566	556	546	536	527	517
9838069	0044508	0250936	507	497	487	478	468	457	448	439	428	419
1902011	2108351	2314681	409	399	389	379	370	360	350	340	330	321
3964971	4171214	4377446	310	301	292	281	272	261	252	243	232	222
6026953	6233097	6439231	213	203	194	183	174	163	155	144	134	125
8087955	8294002	8500038	115	105	096	085	076	066	056	047	036	027
0147980	0353929	0559868	018	007	998	987	979	968	958	949	939	929
2207029	2412880	2618721	205920	910	900	890	880	871	861	851	841	832
4265101	4470855	4676599	205822	812	802	793	783	773	763	754	744	734
6322199	6527855	6733502	724	715	705	695	686	675	666	656	647	637
8378323	8583882	8789431	627	617	607	598	588	579	568	559	549	540
0433474	0638936	0844388	529	520	510	501	491	481	471	462	452	442
2487653	2693017	2898372	432	423	413	403	394	384	374	364	355	345
4540861	4746128	4951386	335	326	316	306	297	286	278	267	258	248
6593098	6798268	7003429	238	229	218	210	199	190	180	170	161	151
8644366	8849440	9054504	142	131	122	112	103	093	083	074	064	054
0694666	0899643	1104610	044	035	025	016	005	996	987	977	967	957
2743998	2948878	3153749	204948	938	928	919	909	899	890	880	871	860
4792364	4997147	5201921	204851	842	831	823	812	803	793	783	774	764
6839764	7044451	7249128	755	744	736	725	716	706	697	687	677	668
8886199	9090790	9295370	658	648	639	629	619	610	600	591	580	572
0931670	1136165	1340649	561	552	543	532	523	514	503	495	484	475
2976179	3180577	3384965	465	456	446	436	427	417	408	398	388	379
5019725	5224027	5428319	369	359	350	340	331	321	311	302	292	283
7062311	7266516	7470713	273	263	254	244	235	224	216	205	197	186
9103936	9308046	9512146	177	167	158	148	139	128	120	110	100	090
1144602	1348615	1552620	081	072	061	053	042	033	024	013	005	994
3184309	3388227	3592135	203985	976	966	956	947	937	928	918	908	899
5223059	5426881	5630694	203890	879	871	860	851	842	832	822	813	803
7260852	7464579	7668296	794	784	774	765	756	746	736	727	717	708
9297689	9501321	9704942	698	688	679	670	659	651	640	632	621	612
1333572	1537108	1740634	603	593	584	574	564	555	545	536	526	517
3368501	3571941	3775372	507	498	488	478	469	460	450	440	431	422
5402477	5605822	5809157	411	403	393	383	374	364	355	345	335	327
7435500	7638750	7841991	316	307	298	288	279	269	259	250	241	231
9467572	9670727	9873873	221	212	203	193	183	174	164	155	146	136
1498694	1701754	1904805	126	117	108	097	089	079	069	060	051	041
3528867	3731832	3934787	031	022	013	003	993	984	975	965	955	946
5558091	5760961	5963822	202937	927	918	908	899	889	880	870	861	851

Numbers 21400–22009. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2140	3304137733	4340670	4543597	4746515	4949423	5152322	5355211
41	6166673	6369515	6572347	6775170	6977983	7180787	7383582
42	8194665	8397412	8600150	8802878	9005597	9208306	9411006
43	3310221710	0424363	0627006	0829640	1032264	1234878	1437484
44	2247810	2450368	2652917	2855456	3057986	3260506	3463017
45	4272965	4475429	4677883	4880328	5082763	5285189	5487605
46	6297176	6499546	6701905	6904256	7106597	7308928	7511250
47	8320444	8522719	8724985	8927241	9129488	9331725	9533953
48	3320342770	0544951	0747122	0949284	1151437	1353580	1555714
49	2364155	2566242	2768319	2970387	3172445	3374495	3576534
2150	3324384599	4586592	4788575	4990549	5192514	5394469	5596415
51	6404104	6606003	6807892	7009772	7211643	7413504	7615356
52	8422670	8624475	8826271	9028057	9229834	9431601	9633359
53	3330440298	0642010	0843711	1045404	1247087	1448761	1650425
54	2456990	2658607	2860216	3061814	3263404	3464984	3666555
55	4472745	4674269	4875784	5077289	5278785	5480272	5681749
56	6487565	6688996	6890417	7091829	7293232	7494625	7696009
57	8501451	8702788	8904116	9105435	9306744	9508044	9709334
58	3340514403	0715647	0916882	1118107	1319323	1520530	1721727
59	2526423	2727574	2928715	3129848	3330970	3532084	3733188
2160	3344537512	4738569	4939617	5140656	5341686	5542706	5743718
61	6547669	6748633	6949589	7150535	7351471	7552399	7753317
62	8556896	8757768	8958630	9159483	9360327	9561161	9761987
63	3350565194	0765973	0966743	1167503	1368254	1568995	1769728
64	2572564	2773250	2973927	3174594	3375253	3575901	3776541
65	4579007	4779600	4980184	5180759	5381324	5581881	5782428
66	6584523	6785024	6985515	7185997	7386470	7586934	7787388
67	8589113	8789521	8989920	9190310	9390690	9591061	9791423
68	3360592779	0793094	0993401	1193698	1393986	1594265	1794534
69	2595520	2795744	2995958	3196163	3396358	3596545	3796722
2170	3364597338	4797470	4997591	5197704	5397808	5597902	5797987
71	6598235	6798273	6998303	7198324	7398335	7598337	7798330
72	8598209	8798156	8998094	9198022	9397941	9597851	9797752
73	3370597263	0797118	0996964	1196800	1396627	1596445	1796254
74	2595398	2795160	2994914	3194659	3394394	3594120	3793837
75	4592613	4792284	4991946	5191598	5391242	5590876	5790501
76	6588910	6788490	6988060	7187621	7387172	7586715	7786248
77	8584290	8783778	8983256	9182726	9382186	9581637	9781079
78	3380578754	0778150	0977537	1176915	1376283	1575643	1774993
79	2572302	2771607	2970902	3170189	3369466	3568734	3767992
2180	3384564936	4764149	4963353	5162548	5361734	5560910	5760077
81	6556656	6755778	6954890	7153994	7353088	7552173	7751249
82	8547463	8746493	8945514	9144527	9343530	9542524	9741509
83	3390537357	0736296	0935227	1134148	1333060	1531963	1730856
84	2526340	2725189	2924028	3122858	3321679	3520490	3719293
85	4514413	4713170	4911918	5110657	5309387	5508108	5706820
86	6501576	6700242	6898900	7097548	7296187	7494817	7693438
87	8487830	8686406	8884972	9083530	9282078	9480617	9679147
88	3400473177	0671661	0870137	1068604	1267061	1465509	1663949
89	2457616	2656010	2854395	3052771	3251137	3449495	3647844
2190	3404441148	4639452	4837746	5036032	5234308	5432575	5630833
91	6423776	6621989	6820192	7018387	7216573	7414750	7612918
92	8405498	8603621	8801734	8999839	9197934	9396020	9594098
93	3410386317	0584349	0782372	0980386	1178391	1376387	1574374
94	2366232	2564174	2762107	2960031	3157946	3355852	3553749
95	4345246	4543098	4740940	4938774	5136599	5334414	5532221
96	6323358	6521119	6718872	6916616	7114350	7312076	7509793
97	8300569	8498241	8695903	8893557	9091202	9288837	9486464
98	3420276881	0474463	0672035	0869599	1067154	1264700	1462236
99	2252294	2449785	2647268	2844742	3042207	3239663	3437110
2200	4226808	4424210	4621603	4818988	5016363	5213729	5411086

OF NUMBERS. Logarithms 3304137733-3426003104.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5558091	5760961	5963822	202937	927	918	908	899	889	880	870	861	851
7586367	7789142	7991908	842	832	823	813	804	795	785	775	766	757
9613696	9816377	0019048	747	738	728	719	709	700	690	681	671	662
1640080	1842666	2045243	653	643	634	624	614	606	596	586	577	567
3665518	3868010	4070492	558	549	539	530	520	511	501	492	482	473
5690012	5892410	6094798	464	454	445	435	426	416	407	398	388	378
7713563	7915866	8118160	370	359	351	341	331	322	313	303	294	284
9736171	9938380	0140580	275	266	256	247	237	228	218	209	200	190
1757838	1959953	2162059	181	171	162	153	143	134	124	115	106	096
3778565	3980585	4182597	087	077	068	058	050	039	031	020	012	002
5798351	6000278	6202196	201993	983	974	965	955	946	936	927	918	908
7817199	8019032	8220856	899	889	880	871	861	852	843	833	824	814
9835108	0036848	0238578	805	796	786	777	767	758	749	740	730	720
1852081	2053726	2255363	712	701	693	683	674	664	656	645	637	627
3868117	4069669	4271212	617	609	598	590	580	571	562	552	543	533
5883217	6084676	6286125	524	515	505	496	487	477	468	459	449	440
7897383	8098749	8300104	431	421	412	403	393	384	374	366	355	347
9910616	0111888	0313150	337	328	319	309	300	290	282	272	262	253
1922915	2124094	2325263	244	235	225	216	207	197	188	179	169	160
3934283	4135368	4336445	151	141	133	122	114	104	095	085	077	067
5944719	6145712	6346695	201057	048	039	030	020	012	001	993	983	974
7954226	8155125	8356015	200964	956	946	936	928	918	909	899	890	881
9962802	0163609	0364406	872	862	853	844	834	826	815	807	797	788
1970451	2171165	2371869	779	770	760	751	741	733	723	714	704	695
3977171	4177793	4378404	686	677	667	659	648	640	630	622	611	603
5982965	6183494	6384013	593	584	575	565	557	547	537	529	519	510
7987833	8188269	8388696	501	491	482	473	464	454	445	436	427	417
9991776	0192120	0392454	408	399	390	380	371	362	353	344	334	325
1994795	2195046	2395288	315	307	297	288	279	269	261	251	242	232
3996890	4197049	4397198	224	214	205	195	187	177	168	159	149	140
5998063	6198129	6398186	200132	121	113	104	094	085	076	066	057	049
7998313	8198288	8398253	038	030	021	011	002	993	983	975	965	956
9997644	0197526	0397399	199947	938	928	919	910	901	892	882	873	864
1996054	2195844	2395625	855	846	836	827	818	809	800	790	781	773
3993545	4193243	4392933	762	754	745	735	726	717	708	698	690	680
5990117	6189724	6389322	671	662	652	644	634	625	616	607	598	588
7985773	8185288	8384794	580	570	561	551	543	533	525	515	506	496
9980511	0179935	0379349	488	478	470	460	451	442	432	424	414	405
1974334	2173666	2372989	396	387	378	368	360	350	341	332	323	313
3967242	4166482	4365714	305	295	287	277	268	258	250	240	232	222
5959236	6158385	6357525	199213	204	195	186	176	167	159	149	140	131
7950316	8149374	8348423	122	112	104	094	085	076	067	058	049	040
9940484	0139451	0338409	030	021	013	003	994	985	975	967	958	948
1929741	2128617	2327483	198939	931	921	912	903	893	885	876	866	857
3918087	4116871	4315647	849	839	830	821	811	803	794	784	776	766
5905523	6104216	6302901	757	748	739	730	721	712	703	693	685	675
7892049	8090652	8289246	666	658	648	639	630	621	611	603	594	584
9877668	0076180	0274683	576	566	558	548	539	530	521	512	503	494
1862379	2060800	2259213	484	476	467	457	448	440	430	421	413	403
3846184	4044514	4242836	394	385	376	366	358	349	340	330	322	312
5829082	6027323	6225554	198304	294	286	276	267	258	249	241	231	222
7811076	8009226	8207367	213	203	195	186	177	168	158	150	141	131
9792166	9990225	0188276	123	113	105	095	086	078	068	059	051	041
1772352	1970321	2168281	032	023	014	005	996	987	978	969	960	951
3751636	3949515	4147385	197942	933	924	915	906	897	887	879	870	861
5730019	5927807	6125587	852	842	834	825	815	807	798	788	780	771
7707500	7905199	8102889	761	753	744	734	726	717	707	699	690	680
9684082	9881690	0079290	672	662	654	645	635	627	618	608	600	591
1659764	1857283	2054793	582	572	564	555	546	536	528	519	510	501
3634548	3831977	4029397	491	483	474	465	456	447	438	429	420	411
5608435	5805774	6003104	402	393	385	375	366	357	349	339	330	322

Numbers 22000–22609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2200	3424226808	4424210	4621603	4818988	5016363	5213729	5411086
1	6200426	6397738	6595041	6792336	6989621	7186898	7384166
2	8173146	8370369	8567583	8764788	8961984	9159171	9356349
3	3430144972	0342105	0539229	0736345	0933451	1130548	1327637
4	2115902	2312946	2509981	2707007	2904024	3101032	3298031
5	4085938	4282893	4479838	4676775	4873702	5070621	5267531
6	6055081	6251946	6448803	6645650	6842488	7039318	7236138
7	8023332	8220108	8416875	8613633	8810382	9007122	9203854
8	9990691	0187377	0384055	0580725	0777385	0974036	1170678
9	3441957159	2153757	2350346	2546926	2743497	2940059	3136612
2210	3443922737	4119246	4315746	4512237	4708719	4905192	5101657
11	5887426	6083846	6280257	6476659	6673053	6869437	7065813
12	7851226	8047558	8243880	8440193	8636498	8832794	9029081
13	9814139	0010382	0206615	0402840	0599056	0795263	0991461
14	3451776165	1972319	2168464	2364600	2560728	2756846	2952956
15	3737306	3933371	4129427	4325475	4521514	4717544	4913565
16	5697561	5893537	6089505	6285465	6481415	6677356	6873289
17	7656931	7852820	8048699	8244570	8440432	8636285	8832129
18	9615418	9811218	0007010	0202792	0398566	0594331	0790087
19	3461573022	1768734	1964437	2160132	2355817	2551494	2747161.
2220	3463529745	3725368	3920983	4116589	4312187	4507775	4703355
21	5485585	5681121	5876648	6072166	6267675	6463176	6658667
22	7440546	7635994	7831433	8026863	8222284	8417696	8613100
23	9394627	9589987	9785338	9980680	0176013	0371338	0566654
24	3471347829	1543101	1738364	1933618	2128864	2324101	2519329
25	3300153	3495337	3690513	3885679	4080837	4275986	4471126
26	5251600	5446696	5641784	5836863	6031933	6226995	6422047
27	7202170	7397179	7592179	7787171	7982153	8177127	8372092
28	9151865	9346786	9541699	9736603	9931498	0126384	0321262
29	3481100685	1295519	1490344	1685160	1879968	2074767	2269557
2230	3483048630	3243377	3438115	3632844	3827564	4022276	4216979
31	4995703	5190362	5385012	5579654	5774287	5968912	6163527
32	6941903	7136475	7331038	7525593	7720138	7914676	8109204
33	8887231	9081716	9276192	9470659	9665118	9859568	0054009
34	3490831688	1026086	1220475	1414855	1609227	1803590	1997944
35	2775275	2969586	3163888	3358181	3552466	3746742	3941009
36	4717992	4912216	5106431	5300638	5494836	5689025	5883206
37	6659841	6853978	7048107	7242226	7436337	7630440	7824534
38	8600822	8794872	8988914	9182947	9376971	9570987	9764994
39	3500540936	0734900	0928855	1122801	1316739	1510668	1704588
2240	3502480183	2674060	2867929	3061789	3255640	3449482	3643316
41	4418565	4612356	4806138	4999911	5193676	5387432	5581179
42	6356083	6549787	6743482	6937169	7130848	7324517	7518178
43	8292736	8486354	8679963	8873563	9067155	9260739	9454313
44	3510228526	0422057	0615580	0809095	1002600	1196097	1389586
45	2163453	2356899	2550335	2743764	2937183	3130594	3323996
46	4097519	4290878	4484229	4677571	4870904	5064229	5257545
47	6030724	6223997	6417262	6610518	6803765	6997004	7190234
48	7963069	8156256	8349435	8542605	8735766	8928919	9122063
49	9894554	0087656	0280748	0473833	0666908	0859975	1053033
2250	3521825181	2018197	2211203	2404202	2597192	2790173	2983145
51	3754950	3947880	4140801	4333714	4526618	4719513	4912400
52	5683862	5876706	6069541	6262368	6455187	6647997	6840798
53	7611917	7804676	7997426	8190167	8382900	8575624	8768340
54	9539117	9731790	9924454	0117110	0309758	0502396	0695027
55	3531465462	1658050	1850629	2043199	2235761	2428314	2620859
56	3390953	3583455	3775949	3968434	4160911	4353379	4545838
57	5315591	5508008	5700416	5892816	6085207	6277590	6469964
58	7239376	7431708	7624031	7816345	8008651	8200949	8393238
59	9162309	9354556	9546794	9739023	9931244	0123457	0315661
2260	3541084391	1276553	1468706	1660850	1852986	2045114	2237233

OF NUMBERS. Logarithms 342422680$8-354281353$8.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5608435	5805774	6003104	197402	393	385	375	366	357	349	339	330	322
7581424	7778674	7975915	312	303	295	285	277	268	258	250	241	231
9553518	9750678	9947829	223	214	205	196	187	178	169	160	151	143
1524717	1721787	1918849	133	124	116	106	097	089	080	070	062	053
3495021	3692002	3888975	044	035	026	017	008	999	990	981	973	963
5464432	5661324	5858207	196955	945	937	927	919	910	901	892	883	874
7432950	7629753	7826547	865	857	847	838	830	820	812	803	794	785
9400576	9597290	9793995	776	767	758	749	740	732	722	714	705	696
1367312	1563936	1760552	686	678	670	660	651	642	634	624	616	607
3333157	3529692	3726219	598	589	580	571	562	553	545	535	527	518
5298112	5494559	5690997	196509	500	491	482	473	465	455	447	438	429
7262179	7458537	7654886	420	411	402	394	384	376	366	358	349	340
9225359	9421628	9617888	332	322	313	305	296	287	278	269	260	251
1187651	1383831	1580003	243	233	225	216	207	198	190	180	172	162
3149057	3345148	3541231	154	145	136	128	118	110	101	091	083	075
5109577	5305580	5501575	065	056	048	039	030	021	012	003	995	986
7069213	7265128	7461034	195976	968	960	950	941	933	924	915	906	897
9027965	9223791	9419609	889	879	871	862	853	844	836	826	818	809
0985834	1181572	1377302	800	792	782	774	765	756	747	738	730	720
2942820	3138471	3334112	712	703	695	685	677	667	659	651	641	633
4898926	5094488	5290041	195623	615	606	598	588	580	571	562	553	544
6854150	7049624	7245090	536	527	518	509	501	491	483	474	466	456
8808495	9003881	9199258	448	439	430	421	412	404	395	386	377	369
0761961	0957259	1152548	360	351	342	333	325	316	307	298	289	281
2714548	2909759	3104960	272	263	254	246	237	228	219	211	201	193
4666258	4861381	5056495	184	176	166	158	149	140	132	123	114	105
6617091	6812126	7007153	096	088	079	070	062	052	044	035	027	017
8567049	8761996	8956935	009	000	992	982	974	965	957	947	939	930
0516131	0710991	0905842	194921	913	904	895	886	878	869	860	851	843
2464339	2659111	2853875	834	825	816	808	799	790	782	772	764	755
4411673	4606358	4801035	194747	738	729	720	712	703	694	685	677	668
6358134	6552732	6747322	659	650	642	633	625	615	607	598	590	581
8303724	8498235	8692737	572	563	555	545	538	528	520	511	502	494
0248442	0442866	0637281	485	476	467	459	450	441	433	424	415	407
2192290	2386627	2580955	398	389	380	372	363	354	346	337	328	320
4135268	4329518	4523759	311	302	293	285	276	267	259	250	241	233
6077377	6271541	6465695	224	215	207	198	189	181	171	164	154	146
8018619	8212695	8406763	137	129	119	111	103	094	085	076	068	059
9958993	0152982	0346963	050	042	033	024	016	007	999	989	981	973
1898500	2092403	2286298	193964	955	946	938	929	920	912	903	895	885
3837142	4030958	4224766	193877	869	860	851	842	834	826	816	808	799
5774918	5968648	6162370	791	782	773	765	756	747	739	730	722	713
7711831	7905474	8099109	704	695	687	679	669	661	653	643	635	627
9647879	9841437	0034986	618	609	600	592	584	574	566	558	549	540
1583066	1776537	1969999	531	523	515	505	497	489	480	471	462	454
3517390	3710775	3904151	446	436	429	419	411	402	394	385	376	368
5450853	5644152	5837442	359	351	342	333	325	316	308	299	290	282
7383456	7576669	7769873	273	265	256	247	239	230	222	213	204	196
9315199	9508326	9701444	187	179	170	161	153	144	136	127	118	110
1246083	1439124	1632157	102	092	085	075	067	058	050	041	033	024
3176109	3369065	3562012	193016	006	999	990	981	972	964	956	947	938
5105278	5298148	5491009	192930	921	913	904	895	887	878	870	861	853
7033590	7226375	7419150	844	835	827	819	810	801	792	785	775	767
8961047	9153746	9346436	759	750	741	733	724	716	707	699	690	681
0887648	1080261	1272866	673	664	656	648	638	631	621	613	605	596
2813395	3005923	3198442	588	579	570	562	553	545	536	528	519	511
4738289	4930731	5123165	502	494	485	477	468	459	451	442	434	426
6662330	6854687	7047036	417	408	400	391	383	374	366	357	349	340
8585519	8777791	8970054	332	323	314	306	298	289	281	272	263	255
0507856	0700043	0892222	247	238	229	221	213	204	195	187	179	169
2429343	2621445	2813538	162	153	144	136	128	119	110	102	093	085

Numbers 22600–23209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2260	3541084391	1276553	1468706	1660850	1852986	2045114	2237233
61	3005623	3197700	3389768	3581827	3773878	3965921	4157955
62	4926006	5117997	5309981	5501955	5693921	5885879	6077828
63	6845540	7037446	7229344	7421234	7613116	7804988	7996853
64	8764225	8956047	9147861	9339666	9531462	9723250	9915030
65	3550682063	0873801	1065530	1257250	1448962	1640665	1832360
66	2599055	2790708	2982352	3173988	3365615	3557234	3748844
67	4515201	4706769	4898329	5089880	5281423	5472957	5664483
68	6430502	6621986	6813461	7004928	7196386	7387836	7579277
69	8344959	8536358	8727749	8919131	9110505	9301871	9493228
2270	3560258572	0449887	0641193	0832491	1023781	1215062	1406335
71	2171342	2362573	2553795	2745009	2936214	3127412	3318600
72	4083270	4274417	4465555	4656685	4847806	5038919	5230023
73	5994357	6185420	6376474	6567519	6758557	6949585	7140606
74	7904604	8095582	8286552	8477514	8668467	8859412	9050348
75	9814010	0004904	0195790	0386668	0577538	0768398	0959251
76	3571722577	1913388	2104190	2294984	2485769	2676546	2867315
77	3630306	3821033	4011751	4202461	4393163	4583856	4774541
78	5537197	5727841	5918475	6109102	6299720	6490329	6680930
79	7443252	7633811	7824362	8014905	8205439	8395965	8586483
2280	3579348470	9538946	9729413	9919873	0110323	0300766	0491200
81	3581252853	1443245	1633629	1824005	2014372	2204731	2395082
82	3156401	3346710	3537010	3727303	3917586	4107862	4298129
83	5059115	5249340	5439558	5629767	5819967	6010159	6200343
84	6960996	7151138	7341272	7531398	7721515	7911624	8101725
85	8862044	9052103	9242154	9432196	9622230	9812256	0002274
86	3590762261	0952237	1142204	1332163	1522114	1712057	1901992
87	2661646	2851539	3041423	3231300	3421168	3611027	3800879
88	4560201	4750011	4939813	5129606	5319391	5509168	5698936
89	6457927	6647654	6837372	7027083	7216785	7406479	7596164
2290	3598354823	8544468	8734103	8923731	9113350	9302961	9492564
91	3600250892	0440453	0630006	0819551	1009088	1198616	1388136
92	2146133	2335612	2525082	2714544	2903998	3093443	3282881
93	4040547	4229943	4419331	4608711	4798082	4987445	5176799
94	5934136	6123449	6312754	6502051	6691340	6880620	7069892
95	7826899	8016130	8205352	8394567	8583773	8772971	8962161
96	9718837	9907986	0097126	0286258	0475382	0664498	0853605
97	3611609952	1799018	1988076	2177126	2366167	2555201	2744226
98	3500244	3689227	3878203	4067171	4256130	4445081	4634024
99	5389713	5578614	5767508	5956393	6145270	6334139	6523000
2300	3617278360	7467180	7655991	7844794	8033589	8222376	8411155
1	9166187	9354924	9543654	9732375	9921088	0109792	0298489
2	3621053193	1241848	1430496	1619135	1807766	1996389	2185003
3	2939380	3127953	3316519	3505076	3693625	3882166	4070699
4	4824748	5013239	5201723	5390198	5578666	5767125	5955575
5	6709297	6897707	7086109	7274503	7462888	7651266	7839635
6	8593030	8781358	8969678	9157990	9346294	9534589	9722877
7	3630475945	0664192	0852430	1040661	1228883	1417097	1605303
8	2358045	2546210	2734367	2922516	3110656	3298789	3486913
9	4239329	4427413	4615488	4803556	4991615	5179666	5367709
2310	3636119799	6307801	6495795	6683781	6871759	7059729	7247690
11	7999455	8187376	8375288	8563193	8751089	8938978	9126858
12	9878297	0066137	0253969	0441792	0629607	0817414	1005213
13	3641756328	1944086	2131836	2319578	2507312	2695038	2882756
14	3633546	3821223	4008892	4196554	4384206	4571851	4759488
15	5509954	5697550	5885138	6072718	6260290	6447853	6635409
16	7385551	7573066	7760573	7948072	8135563	8323045	8510520
17	9260338	9447772	9635198	9822616	0010026	0197428	0384822
18	3651134316	1321670	1509015	1696352	1883681	2071002	2258315
19	3007486	3194759	3382023	3569280	3756528	3943769	4131001
2320	4879849	5067041	5254225	5441400	5628568	5815728	6002879

OF NUMBERS. Logarithms 3541084391-3656564285.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2429343	2621445	2813538	192162	153	144	136	128	119	110	102	093	085
4349980	4541997	4734006	077	068	059	051	043	034	025	017	009	000
6269769	6461701	6653624	191991	984	974	966	958	949	941	932	923	916
8188708	8380556	8572395	906	898	890	882	872	865	855	848	839	830
0106801	0298564	0490318	822	814	805	796	788	780	771	763	754	745
2024047	2215725	2407394	738	729	720	712	703	695	687	678	669	661
3940446	4132040	4323625	653	644	636	627	619	610	602	594	585	576
5856001	6047510	6239010	568	560	551	543	534	526	518	509	500	492
7770710	7962135	8153551	484	475	467	458	450	441	433	425	416	408
9684577	9875917	0067249	399	391	382	374	366	357	349	340	332	323
1597600	1788856	1980103	191315	306	298	290	281	273	265	256	247	239
3509780	3700952	3892115	231	222	214	205	198	188	180	172	163	155
5421119	5612207	5803286	147	138	130	121	113	104	096	088	079	071
7331618	7522621	7713617	063	054	045	038	028	021	012	003	996	987
9241276	9432196	9623107	190978	970	962	953	945	936	928	920	911	903
1150095	1340931	1531758	894	886	878	870	860	853	844	836	827	819
3058075	3248827	3439571	811	802	794	785	777	769	760	752	744	735
4965218	5155886	5346546	727	718	710	702	693	685	677	668	660	651
6871523	7062108	7252684	644	634	627	618	609	601	593	585	576	568
8776992	8967493	9157986	559	551	543	534	526	518	509	501	493	484
0681626	0872043	1062452	190476	467	460	450	443	434	426	417	409	401
2585424	2775758	2966084	392	384	376	367	359	351	342	334	326	317
4488388	4678639	4868881	309	300	293	283	276	267	259	251	242	234
6390519	6580686	6770845	225	218	209	200	192	184	176	167	159	151
8291817	8481901	8671977	142	134	126	117	109	101	092	084	076	067
0192283	0382284	0572276	059	051	042	034	026	018	009	001	992	985
2091918	2281835	2471745	189976	967	959	951	943	935	926	917	910	901
3990722	4180557	4370383	893	884	877	868	859	852	843	835	826	818
5888696	6078448	6268192	810	802	793	785	777	768	760	752	744	735
7785841	7975510	8165171	727	718	711	702	694	685	677	669	661	652
9682158	9871744	0061322	189645	635	628	619	611	603	594	586	578	570
1577647	1767151	1956646	561	553	545	537	528	520	511	504	495	487
3472310	3661731	3851143	479	470	462	454	445	438	429	421	412	404
5366146	5555484	5744814	396	388	380	371	363	354	347	338	330	322
7259156	7448412	7637660	313	305	297	289	280	272	264	256	248	239
9151342	9340515	9529680	231	222	215	206	198	190	181	173	165	157
1042704	1231795	1420878	149	140	132	124	116	107	099	091	083	074
2933242	3122251	3311251	066	058	050	041	034	025	016	009	000	993
4822958	5011885	5200803	188983	976	968	959	951	943	934	927	918	910
6711852	6900696	7089532	901	894	885	877	869	861	852	844	836	828
8599925	8788687	8977441	188820	811	803	795	787	779	770	762	754	746
0487177	0675857	0864529	737	730	721	713	704	697	688	680	672	664
2373610	2562208	2750798	655	648	639	631	623	614	607	598	590	582
4259223	4447739	4636248	573	566	557	549	541	533	524	516	509	500
6144018	6332453	6520879	491	484	475	468	459	450	443	435	426	418
8027996	8216348	8404693	410	402	394	385	378	369	361	352	345	337
9911156	0099427	0287690	328	320	312	304	295	288	279	271	263	255
1793501	1981690	2169872	247	238	231	222	214	206	198	189	182	173
3675029	3863137	4051237	165	157	149	140	133	124	116	108	100	092
5555743	5743770	5931789	084	075	068	059	051	043	034	027	019	010
7435643	7623589	7811526	188002	994	986	978	970	961	953	946	937	929
9314730	9502594	9690450	187921	912	905	896	889	880	872	864	856	847
1193004	1380787	1568561	840	832	823	815	807	799	791	783	774	767
3070466	3258167	3445861	758	750	742	734	726	718	710	701	694	685
4947116	5134737	5322349	677	669	662	652	645	637	628	621	612	605
6822956	7010496	7198027	596	588	580	572	563	556	547	540	531	524
8697987	8885445	9072896	515	507	499	491	482	475	467	458	451	442
0572208	0759585	0946955	434	426	418	410	402	394	386	377	370	361
2445620	2632917	2820206	354	345	337	329	321	313	305	297	289	280
4318225	4505441	4692649	273	264	257	248	241	232	224	216	208	200
6190023	6377158	6564285	192	184	175	168	160	151	144	135	127	120

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2320	3654879849	5067041	5254225	5441400	5628568	5815728	6002879
21	6751405	6938516	7125619	7312714	7499801	7686880	7873951
22	8622154	8809185	8996207	9183222	9370228	9557227	9744217
23	3660492098	0679048	0865990	1052924	1239850	1426768	1613678
24	2361237	2548107	2734969	2921822	3108668	3295505	3482335
25	4229572	4416362	4603143	4789916	4976681	5163438	5350188
26	6097104	6283813	6470514	6657207	6843892	7030569	7217238
27	7963833	8150462	8337082	8523695	8710300	8896897	9083485
28	9829760	0016308	0202849	0389382	0575906	0762423	0948931
29	3671694885	1881354	2067814	2254267	2440711	2627148	2813576
2330	3673559210	3745599	3931979	4118352	4304716	4491073	4677421
31	5422735	5609044	5795344	5981637	6167921	6354198	6540466
32	7285461	7471690	7657910	7844123	8030327	8216524	8402713
33	9147388	9333537	9519678	9705810	9891935	0078052	0264161
34	3681008517	1194586	1380647	1566700	1752745	1938783	2124812
35	2868849	3054838	3240820	3426793	3612759	3798716	3984666
36	4728384	4914294	5100196	5286090	5471976	5657854	5843724
37	6587124	6772954	6958776	7144591	7330397	7516195	7701986
38	8445068	8630819	8816562	9002297	9188023	9373742	9559453
39	3690302218	0487889	0673553	0859208	1044856	1230495	1416127
2340	3692158574	2344166	2529750	2715326	2900894	3086455	3272007
41	4014137	4199650	4385154	4570651	4756140	4941621	5127094
42	5868907	6054341	6239766	6425184	6610594	6795996	6981389
43	7722886	7908240	8093587	8278925	8464256	8649579	8834893
44	9576073	9761349	9946616	0131876	0317127	0502371	0687607
45	3701428471	1613667	1798855	1984036	2169208	2354373	2539530
46	3280078	3465195	3650305	3835406	4020500	4205585	4390663
47	5130896	5315934	5500965	5685988	5871002	6056009	6241008
48	6980926	7165885	7350837	7535781	7720717	7905645	8090565
49	8830168	9015049	9199922	9384787	9569644	9754494	9939335
2350	3710678623	0863425	1048219	1233006	1417784	1602555	1787318
51	2526291	2711015	2895731	3080439	3265139	3449831	3634515
52	4373174	4557819	4742456	4927086	5111707	5296321	5480927
53	6219272	6403838	6588397	6772948	6957491	7142026	7326554
54	8064585	8249073	8433554	8618026	8802491	8986948	9171397
55	9909115	0093525	0277927	0462321	0646707	0831086	1015456
56	3721752861	1937193	2121517	2305833	2490141	2674441	2858733
57	3595825	3780079	3964324	4148562	4332792	4517014	4701228
58	5438008	5622183	5806350	5990510	6174662	6358806	6542942
59	7279409	7463506	7647595	7831677	8015751	8199817	8383875
2360	3729120030	9304049	9488060	9672064	9856060	0040048	0224028
61	3730959871	1143812	1327745	1511671	1695589	1879499	2063401
62	2798933	2982796	3166652	3350500	3534340	3718172	3901996
63	4637216	4821002	5004780	5188550	5372312	5556066	5739813
64	6474722	6658430	6842130	7025822	7209507	7393184	7576852
65	8311451	8495081	8678703	8862318	9045925	9229524	9413115
66	3740147403	0330955	0514500	0698037	0881567	1065088	1248602
67	1982579	2166054	2349522	2532981	2716433	2899877	3083313
68	3816981	4000378	4183768	4367150	4550524	4733891	4917249
69	5650607	5833927	6017240	6200544	6383841	6567130	6750412
2370	3747483460	7666703	7849938	8033165	8216385	8399597	8582801
71	9315540	9498705	9681863	9865013	0048155	0231290	0414417
72	3751146847	1329935	1513016	1696089	1879154	2062211	2245261
73	2977382	3160393	3343397	3526392	3709380	3892361	4075333
74	4807146	4990080	5173006	5355925	5538836	5721739	5904635
75	6636140	6818997	7001846	7184687	7367521	7550348	7733166
76	8464363	8647143	8829915	9012680	9195437	9378186	9560928
77	3760291817	0474520	0657216	0839904	1022584	1205256	1387921
78	2118503	2301129	2483748	2666359	2848962	3031558	3214145
79	3944420	4126970	4309512	4492046	4674572	4857091	5039603
2380	5769571	5952043	6134509	6316966	6499416	6681858	6864293

OF NUMBERS. Logarithms 3654879849–3767411550.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6190023	6377158	6564285	187192	184	175	168	160	151	144	135	127	120
8061014	8248069	8435115	111	103	095	087	079	071	063	055	046	039
9931199	0118174	0305140	031	022	015	006	999	990	982	975	966	958
1800580	1987474	2174359	186950	942	934	926	918	910	902	894	885	878
3669156	3855970	4042775	870	862	853	846	837	830	821	814	805	797
5536929	5723662	5910387	790	781	773	765	757	750	741	733	725	717
7403898	7590551	7777196	709	701	693	685	677	669	660	653	645	637
9270066	9456639	9643203	629	620	613	605	597	588	581	573	564	557
1135432	1321924	1508409	548	541	533	524	517	508	501	492	485	476
2999997	3186409	3372814	469	460	453	444	437	428	421	412	405	396
4863762	5050094	5236419	186389	380	373	364	357	348	341	332	325	316
6726727	6912980	7099224	309	300	293	284	277	268	261	253	244	237
8588894	8775066	8961231	229	220	213	204	197	189	181	172	165	157
0450262	0636355	0822440	149	141	132	125	117	109	101	093	085	077
2310833	2496846	2682852	069	061	053	045	038	029	021	013	006	997
4170607	4356541	4542467	185989	982	973	966	957	950	941	934	926	917
6029586	6215440	6401286	910	902	894	886	878	870	862	854	846	838
7887768	8073543	8259310	830	822	815	806	798	791	782	775	767	758
9745157	9930852	0116539	751	743	735	726	719	711	704	695	687	679
1601751	1787366	1972974	671	664	655	648	639	632	624	615	608	600
3457551	3643088	3828616	185592	584	576	568	561	552	544	537	528	521
5312559	5498017	5683466	513	504	497	489	481	473	465	458	449	441
7166775	7352154	7537524	434	425	418	410	402	393	386	379	370	362
9020200	9205499	9390790	354	347	338	331	323	314	307	299	291	283
0872834	1058054	1243266	276	267	260	251	244	236	227	220	212	205
2724678	2909819	3094953	196	188	181	172	165	157	148	141	134	125
4575733	4760795	4945850	117	110	101	094	085	078	070	062	055	046
6426000	6610983	6795958	038	031	023	014	007	999	992	983	975	968
8275478	8460382	8645279	184959	952	944	936	928	920	913	904	897	889
0124169	0308995	0493813	881	873	865	857	850	841	834	826	818	810
1972073	2156820	2341560	184802	794	787	778	771	763	755	747	740	731
3819192	4003860	4188521	724	716	708	700	692	684	677	668	661	653
5665525	5850115	6034697	645	637	630	621	614	606	598	590	582	575
7511073	7695585	7880089	566	559	551	543	535	528	519	512	504	496
9355838	9540271	9724697	488	481	472	465	457	449	441	433	426	418
1199819	1384174	1568522	410	402	394	386	379	370	363	355	348	339
3043018	3227295	3411564	332	324	316	308	300	292	285	277	269	261
4885435	5069634	5253825	254	245	238	230	222	214	207	199	191	183
6727070	6911191	7095304	175	167	160	152	144	136	128	121	113	105
8567925	8751968	8936003	097	089	082	074	066	058	050	043	035	027
0408000	0591965	0775922	184019	011	004	996	988	980	972	965	957	949
2247296	2431183	2615062	183941	933	926	918	910	902	895	887	879	871
4085813	4269622	4453423	863	856	848	840	832	824	817	809	801	793
5923552	6107283	6291006	786	778	770	762	754	747	739	731	723	716
7760514	7944167	8127813	708	700	692	685	677	668	662	653	646	638
9596699	9780275	9963843	630	622	615	607	599	591	584	576	568	560
1432108	1615606	1799097	552	545	537	530	521	514	506	498	491	482
3266741	3450162	3633575	475	468	459	452	444	436	428	421	413	406
5100600	5283944	5467279	397	390	382	374	367	358	351	344	335	328
6933685	7116951	7300210	320	313	304	297	289	282	273	266	259	250
8765997	8949186	9132367	183243	235	227	220	212	204	196	189	181	173
0597536	0780647	0963751	165	158	150	142	135	127	119	111	104	096
2428303	2611337	2794363	088	081	073	065	057	050	042	034	026	019
4258298	4441255	4624204	011	004	995	988	981	972	965	957	949	942
6087522	6270403	6453275	182934	926	919	911	903	896	887	881	872	865
7915977	8098780	8281575	857	849	841	834	827	818	811	803	795	788
9743662	9926388	0109106	780	772	765	757	749	742	734	726	718	711
1570578	1753227	1935869	703	696	688	680	672	665	657	649	642	634
3396726	3579298	3761863	626	619	611	603	596	587	581	572	565	557
5222106	5404602	5587090	550	542	534	526	519	512	503	496	488	481
7046719	7229139	7411550	472	466	457	450	442	435	426	420	411	404

Numbers 23800–24409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2380	3765769571	5952043	6134509	6316966	6499416	6681858	6864293
81	7593954	7776350	7958739	8141120	8323493	8505858	8688216
82	9417571	9599891	9782203	9964507	0146804	0329093	0511374
83	3771240423	1422667	1604902	1787130	1969350	2151563	2333768
84	3062511	3244677	3426836	3608988	3791132	3973268	4155396
85	4883834	5065924	5248007	5430082	5612149	5794209	5976261
86	6704393	6886407	7068414	7250412	7432404	7614387	7796363
87	8524190	8706128	8888058	9069980	9251895	9433803	9615702
88	3780343225	0525086	0706940	0888786	1070625	1252456	1434280
89	2161497	2343283	2525061	2706831	2888594	3070349	3252096
2390	3783979009	4160719	4342421	4524115	4705801	4887480	5069152
91	5795761	5977395	6159020	6340638	6522249	6703852	6885447
92	7611753	7793311	7974860	8156403	8337937	8519464	8700984
93	9426986	9608468	9789942	9971408	0152867	0334318	0515762
94	3791241461	1422866	1604265	1785655	1967038	2148414	2329782
95	3055178	3236508	3417830	3599145	3780452	3961752	4143044
96	4868137	5049392	5230638	5411878	5593109	5774333	5955550
97	6680340	6861519	7042690	7223854	7405010	7586158	7767299
98	8491788	8672891	8853986	9035075	9216155	9397228	9578293
99	3800302480	0483507	0664528	0845540	1026545	1207543	1388533
2400	3802112417	2293369	2474314	2655251	2836181	3017103	3198018
1	3921601	4102477	4283347	4464209	4645063	4825910	5006749
2	5730031	5910832	6091626	6272413	6453192	6633963	6814727
3	7537708	7718434	7899153	8079865	8260568	8441265	8621953
4	9344633	9525284	9705928	9886564	0067193	0247814	0428428
5	3811150807	1331383	1511952	1692513	1873066	2053612	2234151
6	2956230	3136731	3317225	3497711	3678189	3858660	4039124
7	4760903	4941329	5121747	5302158	5482562	5662958	5843347
8	6564826	6745177	6925521	7105857	7286185	7466507	7646820
9	8368000	8548276	8728545	8908806	9089060	9269306	9449545
2410	3820170426	0350627	0530821	0711008	0891187	1071358	1251522
11	1972104	2152230	2332350	2512461	2692566	2872663	3052752
12	3773035	3953087	4133131	4313168	4493198	4673220	4853235
13	5573219	5753196	5933166	6113129	6293084	6473032	6652972
14	7372658	7552560	7732456	7912344	8092224	8272097	8451963
15	9171351	9351179	9531000	9710814	9890620	0070418	0250209
16	3830969299	1149053	1328800	1508539	1688271	1867995	2047711
17	2766504	2946184	3125856	3305520	3485178	3664828	3844470
18	4562965	4742571	4922168	5101759	5281342	5460917	5640485
19	6358684	6538215	6717738	6897254	7076763	7256264	7435758
2420	3838153660	8333117	8512566	8692008	8871443	9050870	9230290
21	9947894	0127277	0306652	0486020	0665381	0844734	1024079
22	3841741388	1920697	2099998	2279292	2458578	2637857	2817129
23	3534141	3713376	3892603	4071823	4251036	4430241	4609438
24	5326155	5505316	5684469	5863615	6042753	6221885	6401008
25	7117429	7296516	7475596	7654668	7833732	8012790	8191840
26	8907965	9086978	9265984	9444982	9623973	9802957	9981933
27	3850697763	0876703	1055634	1234559	1413476	1592386	1771288
28	2486824	2665690	2844548	3023399	3202242	3381078	3559907
29	4275148	4453940	4632725	4811502	4990272	5169034	5347789
2430	3856062736	6241454	6420165	6598869	6777565	6956254	7134936
31	7849588	8028233	8206871	8385501	8564124	8742739	8921347
32	9635706	9814277	9992841	0171398	0349947	0528489	0707024
33	3861421089	1599587	1778078	1956561	2135037	2313506	2491967
34	3205739	3384164	3562581	3740991	3919394	4097789	4276177
35	4989656	5168007	5346351	5524688	5703017	5881339	6059654
36	6772840	6951118	7129389	7307652	7485908	7664157	7842399
37	8555292	8733497	8911695	9089885	9268068	9446244	9624412
38	3870337013	0515145	0693269	0871387	1049497	1227599	1405695
39	2118003	2296062	2474114	2652158	2830195	3008224	3186247
2440	3898263	4076249	4254228	4432199	4610163	4788120	4966069

OF NUMBERS. Logarithms 3765769571–3875499874.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7046719	7229139	7411550	182472	466	457	450	442	435	426	420	411	404
8870567	9052909	9235244	396	389	381	373	365	358	351	342	335	327
0693648	0875914	1058173	320	312	304	297	289	281	274	266	259	250
2515965	2698154	2880336	244	235	228	220	213	205	197	189	182	175
4337517	4519630	4701736	166	159	152	144	136	128	121	113	106	098
6158306	6340342	6522372	090	083	075	067	060	052	045	036	030	021
7978331	8160292	8342245	014	007	998	992	983	976	968	961	953	945
9797594	9979479	0161355	181938	930	922	915	908	899	892	885	876	870
1616096	1797904	1979704	861	854	846	839	831	824	816	808	800	793
3433836	3615568	3797293	786	778	770	763	755	747	740	732	725	716
5250815	5432472	5614120	181710	702	694	686	679	672	663	657	648	641
7067035	7248616	7430188	634	625	618	611	603	595	588	581	572	565
8882496	9064000	9245497	558	549	543	534	527	520	512	504	497	489
0697198	0878626	1060047	482	474	466	459	451	444	436	428	421	414
2511142	2692495	2873840	405	399	390	383	376	368	360	353	345	338
4324329	4505606	4686875	330	322	315	307	300	292	285	277	269	262
6136759	6317960	6499154	255	246	240	231	224	217	209	201	194	186
7948433	8129559	8310677	179	171	164	156	148	141	134	126	118	111
9759351	9940402	0121444	103	095	089	080	073	065	058	051	042	036
1569515	1750490	1931457	027	021	012	005	998	990	982	975	967	960
3378925	3559824	3740716	180952	945	937	930	922	915	907	899	892	885
5187581	5368405	5549222	876	870	862	854	847	839	832	824	817	809
6995484	7176233	7356974	801	794	787	779	771	764	757	749	741	734
8802635	8983308	9163975	726	719	712	703	697	688	682	673	667	658
0609034	0789632	0970224	651	644	636	629	621	614	606	598	592	583
2414682	2595205	2775722	576	569	561	553	546	539	531	523	517	508
4219580	4400028	4580469	501	494	486	478	471	464	456	448	441	434
6023728	6204101	6384467	426	418	411	404	396	389	381	373	366	359
7827126	8007425	8187716	351	344	336	328	322	313	306	299	291	284
9629777	9810000	9990217	276	269	261	254	246	239	232	223	217	209
1431679	1611828	1791970	180201	194	187	179	171	164	157	149	142	134
3232834	3412908	3592975	126	120	111	105	097	089	082	074	067	060
5033242	5213242	5393234	052	044	037	030	022	015	007	000	992	985
6832904	7012830	7192747	79977	970	963	955	948	940	932	926	917	911
8631821	8811672	8991515	902	896	888	880	873	866	858	851	843	836
0429993	0609769	0789538	828	821	814	806	798	791	784	776	769	761
2227421	2407123	2586817	754	747	739	732	724	716	710	702	694	687
4024105	4203732	4383353	680	672	664	658	650	642	635	627	621	612
5820046	5999599	6179145	606	597	591	583	575	568	561	553	546	539
7615245	7794724	7974196	531	523	516	509	501	494	487	479	472	464
9409702	9589107	9768504	179457	449	442	435	427	420	412	405	397	390
1203418	1382749	1562072	383	375	368	361	353	345	339	331	323	316
2996393	3175650	3354899	309	301	294	286	279	272	264	257	249	242
4788629	4967811	5146987	235	227	220	213	205	197	191	182	176	168
6580125	6759234	6938335	161	153	146	138	132	123	117	109	101	094
8370882	8549917	8728945	087	080	072	064	058	050	042	035	028	020
0160901	0339863	0518817	013	006	998	991	984	976	968	962	954	946
1950183	2129071	2307951	178940	931	925	917	910	902	895	888	880	873
3738728	3917542	4096349	866	858	851	843	836	829	821	814	807	799
5526537	5705277	5884010	792	785	777	770	762	755	748	740	733	726
7313610	7492277	7670936	178718	711	704	696	689	682	674	667	659	652
9099948	9278541	9457127	645	638	630	623	615	608	601	593	586	579
0885551	1064071	1242584	571	564	557	549	542	535	527	520	513	505
2670421	2848868	3027307	498	491	483	476	469	461	454	447	439	432
4454557	4632931	4811297	425	417	410	403	395	388	380	374	366	359
6237961	6416261	6594554	351	344	337	329	322	315	307	300	293	286
8020633	8198860	8377080	278	271	263	256	249	242	234	227	220	212
9802573	9980727	0158874	205	198	190	183	176	168	161	154	147	139
1583783	1761863	1939937	132	124	118	110	102	096	088	080	074	066
3364262	3542270	3720270	059	052	044	037	029	023	015	008	000	993
5144011	5321946	5499874	177986	979	971	964	957	949	942	935	928	920

Numbers 24400–25009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2440	3873898263	4076249	4254228	4432199	4610163	4788120	4966069
41	5677794	5855707	6033613	6211511	6389402	6567286	6745163
42	7456596	7634436	7812269	7990095	8167913	8345724	8523528
43	9234670	9412437	9590197	9767950	9945695	0123434	0301165
44	3881012016	1189710	1367398	1545078	1722750	1900416	2078074
45	2788635	2966257	3143871	3321479	3499079	3676672	3854257
46	4564527	4742076	4919618	5097153	5274681	5452201	5629714
47	6339694	6517170	6694640	6872102	7049557	7227005	7404445
48	8114135	8291539	8468936	8646326	8823708	9001084	9178452
49	9887851	0065183	0242508	0419825	0597135	0774438	0951734
2450	3891660844	1838103	2015355	2192600	2369838	2547068	2724292
51	3433113	3610300	3787480	3964652	4141818	4318976	4496127
52	5204658	5381773	5558881	5735981	5913075	6090161	6267239
53	6975482	7152525	7329560	7506588	7683609	7860623	8037630
54	8745584	8922554	9099518	9276474	9453423	9630364	9807299
55	3900514965	0691863	0868754	1045638	1222515	1399385	1576247
56	2283625	2460451	2637270	2814082	2990887	3167685	3344475
57	4051565	4228319	4405066	4581807	4758539	4935265	5111984
58	5818785	5995468	6172143	6348812	6525472	6702126	6878773
59	7585287	7761898	7938502	8115098	8291687	8468269	8644844
2460	3909351071	9527610	9704142	9880666	0057184	0233694	0410197
61	3911116137	1292604	1469064	1645517	1821963	1998401	2174832
62	2880486	3056881	3233270	3409651	3586025	3762392	3938751
63	4644118	4820442	4996759	5173068	5349371	5525666	5701954
64	6407035	6583287	6759532	6935770	7112001	7288225	7464441
65	8169236	8345417	8521591	8697757	8873916	9050069	9226214
66	9930723	0106832	0282934	0459029	0635117	0811198	0987272
67	3921691495	1867533	2043564	2219587	2395604	2571613	2747616
68	3451554	3627520	3803480	3979432	4155377	4331316	4507247
69	5210899	5386795	5562683	5738564	5914438	6090305	6266165
2470	3926969533	7145357	7321174	7496984	7672787	7848582	8024371
71	8727454	8903207	9078953	9254692	9430423	9606148	9781865
72	3930484664	0660346	0836021	1011689	1187349	1363003	1538649
73	2241164	2416774	2592378	2767975	2943565	3119147	3294722
74	3996953	4172493	4348026	4523551	4699070	4874581	5050086
75	5752033	5927502	6102964	6278418	6453866	6629307	6804740
76	7506403	7681802	7857193	8032577	8207953	8383323	8558686
77	9260066	9435393	9610713	9786027	9961333	0136632	0311923
78	3941013020	1188277	1363526	1538769	1714004	1889232	2064454
79	2765268	2940454	3115632	3290804	3465969	3641126	3816277
2480	3944516808	4691923	4867032	5042133	5217227	5392314	5567394
81	6267643	6442687	6617725	6792755	6967779	7142795	7317805
82	8017772	8192746	8367713	8542673	8717626	8892572	9067511
83	9767196	9942099	0116996	0291885	0466768	0641643	0816512
84	3951515915	1690748	1865574	2040394	2215206	2390011	2564809
85	3263931	3438694	3613449	3788198	3962940	4137675	4312402
86	5011243	5185936	5360621	5535300	5709971	5884636	6059293
87	6757853	6932475	7107090	7281699	7456300	7630894	7805481
88	8503760	8678312	8852857	9027396	9201927	9376451	9550968
89	3960248966	0423448	0597923	0772391	0946852	1121306	1295753
2490	3961993471	2167883	2342288	2516686	2691077	2865461	3039838
91	3737275	3911617	4085952	4260280	4434601	4608915	4783222
92	5480380	5654652	5828917	6003175	6177426	6351670	6525907
93	7222785	7396987	7571182	7745370	7919551	8093726	8267893
94	8964491	9138624	9312749	9486867	9660978	9835083	0009180
95	3970705500	0879562	1053617	1227666	1401707	1575742	1749770
96	2445810	2619803	2793789	2967767	3141739	3315704	3489662
97	4185424	4359347	4533263	4707172	4881074	5054969	5228857
98	5924340	6098194	6272040	6445880	6619712	6793538	6967356
99	7662561	7836345	8010122	8183892	8357655	8531411	8705160
2500	9400087	9573801	9747508	9921209	0094902	0268589	0442268

OF NUMBERS.

Logarithms 3873898263-3980963265.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5144011	5321946	5499874	177986	979	971	964	957	949	942	935	928	920
6923032	7100894	7278749	913	906	898	891	884	877	869	862	855	847
8701324	8879113	9056895	840	833	826	818	811	804	796	789	782	775
0478888	0656605	0834314	767	760	753	745	739	731	723	717	709	702
2255725	2433369	2611005	694	688	680	672	666	658	651	644	636	630
4031836	4209407	4386970	622	614	608	600	593	585	579	571	563	557
5807220	5984718	6162210	549	542	535	528	520	513	506	498	492	484
7581878	7759304	7936723	476	470	462	455	448	440	433	426	419	412
9355812	9533166	9710512	404	397	390	382	376	368	360	354	346	339
1129022	1306303	1483577	332	325	317	310	303	296	288	281	274	267
2901508	3078717	3255918	177259	252	245	238	230	224	216	209	201	195
4673271	4850407	5027536	187	180	172	166	158	151	144	136	129	122
6444311	6621375	6798432	115	108	100	094	086	078	072	064	057	050
8214629	8391621	8568606	043	035	028	021	014	007	999	992	985	978
9984226	0161146	0338059	176970	964	956	949	941	935	927	920	913	906
1753102	1929950	2106791	898	891	884	877	870	862	855	848	841	834
3521258	3698034	3874803	826	819	812	805	798	790	783	776	769	762
5288695	5465399	5642096	754	747	741	732	726	719	711	704	697	689
7055412	7232044	7408670	683	675	669	660	654	647	639	632	626	617
8821411	8997972	9174525	611	604	596	589	582	575	567	561	553	546
0586693	0763181	0939663	176539	532	524	518	510	503	496	488	482	474
2351257	2527674	2704083	467	460	453	446	438	431	425	417	409	403
4115104	4291449	4467787	395	389	381	374	367	359	353	345	338	331
5878235	6054509	6230775	324	317	309	303	295	288	281	274	266	260
7640651	7816853	7993048	252	245	238	231	224	216	210	202	195	188
9402352	9578482	9754606	181	174	166	159	153	145	138	130	124	117
1163338	1339398	1515450	109	102	095	088	081	074	066	060	052	045
2923611	3099599	3275580	038	031	023	017	009	003	995	988	981	974
4683170	4859087	5034997	175966	960	952	945	939	931	923	917	910	902
6442017	6617863	6793701	896	888	881	874	867	860	852	846	838	832
8200152	8375927	8551694	175824	817	810	803	795	789	781	775	767	760
9957576	0133279	0308975	753	746	739	731	725	717	711	703	696	689
1714288	1889921	2065546	682	675	668	660	654	646	639	633	625	618
3470291	3645852	3821406	610	604	597	590	582	575	569	561	554	547
5225583	5401073	5576557	540	533	525	519	511	505	497	490	484	476
6980167	7155586	7330998	469	462	454	448	441	433	427	419	412	405
8734041	8909390	9084731	399	391	384	376	370	363	355	349	341	335
0487208	0662486	0837757	327	320	314	306	299	291	285	278	271	263
2239668	2414875	2590075	257	249	243	235	228	222	214	207	200	193
3991420	4166557	4341686	186	178	172	165	157	151	143	137	129	122
5742466	5917532	6092591	175115	109	101	094	087	080	072	066	059	052
7492807	7667802	7842790	044	038	030	024	016	010	002	995	988	982
9242442	9417367	9592285	174974	967	960	953	946	939	931	925	918	911
0991373	1166227	1341075	903	897	889	883	875	869	861	854	848	840
2739600	2914384	3089161	833	826	820	812	805	798	791	784	777	770
4487123	4661837	4836543	763	755	749	742	735	727	721	714	706	700
6233944	6408587	6583223	693	685	679	671	665	657	651	643	636	630
7980062	8154635	8329201	622	615	609	601	594	587	581	573	566	559
9725478	9899981	0074477	552	545	539	531	524	517	510	503	496	489
1470193	1644626	1819052	482	475	468	461	454	447	440	433	426	419
3214208	3388570	3562926	174412	405	398	391	384	377	370	362	356	349
4957522	5131815	5306101	342	335	328	321	314	307	300	293	286	279
6700137	6874360	7048576	272	265	258	251	244	237	230	223	216	209
8442053	8616206	8790352	202	195	188	181	175	167	160	153	146	139
0183270	0357354	0531430	133	125	118	111	105	097	090	084	076	070
1923790	2097804	2271810	062	055	049	041	035	028	020	014	006	000
3663613	3837557	4011494	173993	986	978	972	965	958	951	944	937	930
5402738	5576613	5750480	923	916	909	902	895	888	881	875	867	860
7141168	7314973	7488770	854	846	840	832	826	818	812	805	797	791
8878902	9052637	9226365	784	777	770	763	756	749	742	735	728	722
0615941	0789607	0963265	714	707	701	693	687	679	673	666	658	652

Numbers 25000–25609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2500	3979400087	9573801	9747508	9921209	0094902	0268589	0442268
1	3981136917	1310562	1484200	1657831	1831455	2005072	2178682
2	2873054	3046629	3220198	3393759	3567314	3740862	3914402
3	4608496	4782002	4955501	5128994	5302479	5475957	5649429
4	6343245	6516682	6690112	6863535	7036951	7210360	7383762
5	8077302	8250670	8424030	8597384	8770731	8944071	9117404
6	9810667	9983965	0157256	0330541	0503819	0677089	0850353
7	3991543340	1716569	1889791	2063007	2236215	2409417	2582612
8	3275322	3448482	3621635	3794782	3967921	4141054	4314179
9	5006613	5179704	5352789	5525866	5698937	5872000	6045057
2510	3996737215	6910237	7083252	7256261	7429262	7602257	7775245
11	8467127	8640080	8813027	8985966	9158899	9331825	9504744
12	4000196351	0369235	0542113	0714983	0887847	1060704	1233554
13	1924886	2097702	2270510	2443312	2616107	2788896	2961677
14	3652733	3825480	3998221	4170954	4343680	4516400	4689112
15	5379894	5552572	5725244	5897908	6070566	6243217	6415861
16	7106368	7278977	7451580	7624176	7796765	7969347	8141923
17	8832155	9004697	9177231	9349758	9522279	9694792	9867299
18	4010557258	0729730	0902196	1074655	1247107	1419552	1591990
19	2281675	2454079	2626476	2798867	2971250	3143627	3315997
2520	4014005408	4177743	4350072	4522394	4694709	4867018	5039319
21	5728457	5900724	6072985	6245238	6417485	6589725	6761958
22	7450822	7623021	7795214	7967399	8139577	8311749	8483914
23	9172505	9344636	9516760	9688877	9860987	0033091	0205187
24	4020893506	1065568	1237624	1409673	1581715	1753750	1925779
25	2613825	2785819	2957807	3129787	3301761	3473728	3645689
26	4333462	4505389	4677308	4849221	5021127	5193026	5364918
27	6052419	6224277	6396129	6567974	6739812	6911643	7083467
28	7770696	7942486	8114270	8286047	8457817	8629580	8801336
29	9488293	9660016	9831731	0003440	0175142	0346837	0518526
2530	4031205212	1376866	1548514	1720155	1891789	2063416	2235037
31	2921452	3093038	3264618	3436191	3607758	3779317	3950870
32	4637013	4808532	4980045	5151550	5323048	5494540	5666025
33	6351898	6523349	6694794	6866231	7037662	7209086	7380504
34	8066105	8237489	8408866	8580236	8751599	8922956	9094305
35	9779637	9950953	0122262	0293564	0464860	0636149	0807431
36	4041492492	1663740	1834982	2006217	2177445	2348667	2519881
37	3204672	3375853	3547027	3718195	3889355	4060509	4231656
38	4916178	5087291	5258398	5429498	5600591	5771677	5942757
39	6627009	6798055	6969094	7140127	7311153	7482172	7653184
2540	4048337166	8508145	8679117	8850082	9021041	9191992	9362938
41	4050046651	0217562	0388467	0559365	0730256	0901140	1072018
42	1755462	1926306	2097144	2267975	2438799	2609616	2780427
43	3463602	3634379	3805149	3975913	4146670	4317420	4488163
44	5171070	5341780	5512483	5683179	5853869	6024552	6195228
45	6877867	7048510	7219146	7389775	7560398	7731014	7901623
46	8583993	8754569	8925138	9095700	9266256	9436805	9607347
47	4060289450	0459958	0630461	0800956	0971445	1141927	1312402
48	1994237	2164679	2335114	2505542	2675964	2846379	3016788
49	3698355	3868730	4039098	4209460	4379815	4550163	4720505
2550	4065401804	5572113	5742414	5912709	6082997	6253279	6423554
51	7104586	7274828	7445062	7615290	7785512	7955727	8125935
52	8806700	8976875	9147043	9317205	9487360	9657508	9827649
53	4070508148	0678256	0848358	1018452	1188540	1358622	1528697
54	2208929	2378971	2549006	2719034	2889055	3059070	3229078
55	3909045	4079020	4248988	4418950	4588905	4758853	4928795
56	5608495	5778403	5948305	6118200	6288089	6457971	6627846
57	7307280	7477122	7646958	7816786	7986608	8156424	8326233
58	9005401	9175177	9344946	9514708	9684464	9854213	0023956
59	4080702859	0872568	1042271	1211967	1381656	1551339	1721015
2560	2399653	2569296	2738932	2908562	3078185	3247802	3417412

OF NUMBERS. Logarithms 3979400087-4083926201.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0615941	0789607	0963265	173714	707	701	693	687	679	673	666	658	652
2352286	2525882	2699471	645	638	631	624	617	610	604	596	589	583
4087936	4261463	4434983	575	569	561	555	548	540	534	527	520	513
5822893	5996351	6169802	506	499	493	485	478	472	464	458	451	443
7557158	7730546	7903928	437	430	423	416	409	402	396	388	382	374
9290730	9464049	9637361	368	360	354	347	340	333	326	319	312	306
1023610	1196860	1370103	298	291	285	278	270	264	257	250	243	237
2755800	2928980	3102154	229	222	216	208	202	195	188	180	174	168
4487298	4660410	4833515	160	153	147	139	133	125	119	112	105	098
6218107	6391150	6564186	091	085	077	071	063	057	050	043	036	029
7948226	8121200	8294167	173022	015	009	001	995	988	981	974	967	960
9677656	9850561	0023459	172953	947	939	933	926	919	912	905	898	892
1406398	1579234	1752063	884	878	870	864	857	850	844	836	829	823
3134451	3307219	3479980	816	808	802	795	789	781	774	768	761	753
4861818	5034517	5207209	747	741	733	726	720	712	706	699	692	685
6588498	6761128	6933751	678	672	664	658	651	644	637	630	623	617
8314491	8487053	8659608	609	603	596	589	582	576	568	562	555	547
0039799	0212292	0384778	542	534	527	521	513	507	500	493	486	480
1764422	1936846	2109264	472	466	459	452	445	438	432	424	418	411
3488360	3660716	3833065	404	397	391	383	377	370	363	356	349	343
5211614	5383902	5556183	172335	329	322	315	309	301	295	288	281	274
6934184	7106404	7278617	267	261	253	247	240	233	226	220	213	205
8656072	8828223	9000368	199	193	185	178	172	165	158	151	145	137
0377277	0549360	0721436	131	124	117	110	104	096	090	083	076	070
2097800	2269815	2441823	062	056	049	042	035	029	021	015	008	002
3817642	3989589	4161529	171994	988	980	974	967	961	953	947	940	933
5536804	5708682	5880554	927	919	913	906	899	892	886	878	872	865
7255284	7427095	7598899	858	852	845	838	831	824	817	811	804	797
8973086	9144828	9316564	790	784	777	770	763	756	750	742	736	729
0690208	0861882	1033550	723	715	709	702	695	689	682	674	668	662
2406651	2578258	2749858	171654	648	641	634	627	621	614	607	600	594
4122416	4293955	4465488	586	580	573	567	559	553	546	539	533	525
5837504	6008975	6180440	519	513	505	498	492	485	479	471	465	458
7551914	7723318	7894715	451	445	437	431	424	418	410	404	397	390
9265648	9436985	9608314	384	377	370	363	357	349	343	337	329	323
0978706	1149975	1321237	316	309	302	296	289	282	275	269	262	255
2691089	2862290	3033485	248	242	235	228	222	214	208	201	195	187
4402797	4573930	4745057	181	174	168	160	154	147	141	133	127	121
6113830	6284896	6455956	113	107	100	093	086	080	073	066	060	053
7824190	7995189	8166181	046	039	033	026	019	012	006	999	992	985
9533876	9704807	9875732	170979	972	965	959	951	946	938	931	925	919
1242889	1413754	1584611	911	905	898	891	884	878	871	865	857	851
2951230	3122028	3292818	844	838	831	824	817	811	803	798	790	784
4658900	4829630	5000353	777	770	764	757	750	743	737	730	723	717
6365898	6536561	6707217	710	703	696	690	683	676	670	663	656	650
8072226	8242822	8413411	643	636	629	623	616	609	603	596	589	582
9777883	9948412	0118934	576	569	562	556	549	542	536	529	522	516
1482871	1653333	1823788	508	503	495	489	482	475	469	462	455	449
3187189	3357585	3527973	442	435	428	422	415	409	401	396	388	382
4890840	5061168	5231489	375	368	362	355	348	342	335	328	321	315
6593822	6764083	6934338	170309	301	295	288	282	275	268	261	255	248
8296136	8466331	8636519	242	234	228	222	215	208	201	195	188	181
9997784	0167912	0338033	175	168	162	155	148	141	135	128	121	115
1698765	1868826	2038881	108	102	094	088	082	075	068	061	055	048
3399080	3569075	3739063	042	035	028	021	015	008	002	995	988	982
5098730	5268658	5438580	169975	968	962	955	948	942	935	928	922	915
6797714	6967576	7137432	908	902	895	889	882	875	868	862	856	848
8496035	8665830	8835619	842	836	828	822	816	809	802	795	789	782
0193691	0363420	0533143	776	769	762	756	749	743	735	729	723	716
1890684	2060347	2230004	709	703	696	689	683	676	669	663	657	649
3587015	3756611	3926201	643	636	630	623	617	610	603	596	590	584

Numbers 25600–26209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2560	4082399653	2569296	2738932	2908562	3078185	3247802	3417412
61	4095785	4265361	4434932	4604495	4774052	4943602	5113146
62	5791254	5960765	6130269	6299766	6469257	6638741	6808218
63	7486062	7655506	7824944	7994375	8163800	8333218	8502629
64	9180208	9349587	9518959	9688324	9857682	0027034	0196379
65	4090873694	1043007	1212312	1381612	1550904	1720190	1889469
66	2566520	2735767	2905006	3074240	3243466	3412686	3581899
67	4258687	4427867	4597041	4766208	4935369	5104523	5273670
68	5950194	6119308	6288416	6457518	6626612	6795701	6964782
69	7641043	7810091	7979133	8148169	8317198	8486220	8655236
2570	4099331233	9500216	9669193	9838162	0007125	0176082	0345032
71	4101020766	1189684	1358594	1527498	1696396	1865287	2034171
72	2709643	2878494	3047339	3216177	3385009	3553834	3722653
73	4397862	4566648	4735427	4904200	5072966	5241726	5410479
74	6085426	6254146	6422860	6591567	6760268	6928962	7097649
75	7772334	7940989	8109637	8278278	8446914	8615542	8784164
76	9458587	9627176	9795759	9964335	0132905	0301468	0470025
77	4111144186	1312709	1481227	1649738	1818242	1986740	2155231
78	2829130	2997589	3166041	3334486	3502925	3671357	3839783
79	4513421	4681815	4850201	5018581	5186955	5355322	5523683
2580	4116197060	6365388	6533709	6702024	6870332	7038634	7206929
81	7880045	8048308	8216564	8384814	8553057	8721294	8889524
82	9562379	9730577	9898768	0066952	0235130	0403302	0571467
83	4121244062	1412194	1580320	1748440	1916552	2084659	2252759
84	2925093	3093161	3261221	3429276	3597324	3765365	3933400
85	4605474	4773477	4941473	5109462	5277445	5445421	5613391
86	6285205	6453143	6621074	6788998	6956916	7124827	7292732
87	7964287	8132160	8300026	8467885	8635738	8803585	8971425
88	9642720	9810528	9978329	0146123	0313912	0481693	0649468
89	4131320504	1488247	1655983	1823713	1991437	2159154	2326864
2590	4132997641	3165319	3332990	3500655	3668314	3835966	4003612
91	4674130	4841743	5009350	5176950	5344544	5512132	5679713
92	6349972	6517521	6685063	6852599	7020128	7187651	7355167
93	8025168	8192652	8360129	8527600	8695065	8862523	9029975
94	9699717	9867137	0034550	0201957	0369357	0536750	0704138
95	4141373622	1540977	1708325	1875667	2043003	2210332	2377655
96	3046881	3214172	3381456	3548733	3716005	3883269	4050528
97	4719496	4886722	5053942	5221155	5388362	5555562	5722756
98	6391467	6558629	6725784	6892933	7060076	7227212	7394341
99	8062795	8229892	8396983	8564068	8731146	8898218	9065283
2600	4149733480	9900513	0067540	0234560	0401574	0568581	0735582
1	4151403522	1570491	1737453	1904409	2071359	2238302	2405239
2	3072922	3239827	3406725	3573617	3740503	3907382	4074255
3	4741681	4908522	5075356	5242184	5409005	5575820	5742629
4	6409799	6576576	6743346	6910109	7076867	7243618	7410362
5	8077276	8243989	8410695	8577395	8744088	8910775	9077456
6	9744114	9910762	0077404	0244040	0410670	0577293	0743909
7	4161410312	1576896	1743475	1910046	2076612	2243171	2409724
8	3075871	3242391	3408906	3575414	3741915	3908411	4074899
9	4740791	4907248	5073699	5240143	5406580	5573012	5739437
2610	4166405073	6571467	6737853	6904234	7070608	7236975	7403337
11	8068718	8235048	8401371	8567687	8733998	8900302	9066599
12	9731726	9897992	0064251	0230504	0396751	0562991	0729225
13	4171394097	1560299	1726495	1892685	2058868	2225044	2391215
14	3055832	3221971	3388103	3554229	3720349	3886462	4052568
15	4716932	4883007	5049076	5215138	5381194	5547244	5713287
16	6377397	6543408	6709413	6875412	7041405	7207391	7373371
17	8037226	8203175	8369116	8535052	8700981	8866904	9032820
18	9696422	9862307	0028185	0194057	0359923	0525782	0691635
19	4181354984	1520806	1686621	1852429	2018232	2184028	2349818
2620	3012913	3178671	3344423	3510168	3675908	3841640	4007367

OF NUMBERS.

Logarithms 4082399653-4184504508.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3587015	3756611	3926201	169643	636	630	623	617	610	603	596	590	584
5282683	5452213	5621737	576	571	563	557	550	544	537	530	524	517
6977689	7147153	7316611	511	504	497	491	484	477	471	464	458	451
8672034	8841432	9010824	444	438	431	425	418	411	405	398	392	384
0365718	0535050	0704376	379	372	365	358	352	345	339	332	326	318
2058742	2228008	2397267	313	305	300	292	286	279	273	266	259	253
3751106	3920306	4089500	247	239	234	226	220	213	207	200	194	187
5442811	5611945	5781073	180	174	167	161	154	147	141	134	128	121
7133857	7302926	7471987	114	108	102	094	089	081	075	069	061	056
8824245	8993248	9162244	048	042	036	029	022	016	009	003	996	989
0513976	0682912	0851843	168983	977	969	963	957	950	944	936	931	923
2203049	2371920	2540784	918	910	904	898	891	884	878	871	864	859
3891465	4060271	4229070	851	845	838	832	825	819	812	806	799	792
5579225	5747965	5916699	786	779	773	766	760	753	746	740	734	727
7266330	7435005	7603672	720	714	707	701	694	687	681	675	667	662
8952780	9121389	9289991	655	648	641	636	628	622	616	609	602	596
0638575	0807118	0975655	589	583	576	570	563	557	550	543	537	531
2323715	2492194	2660665	523	518	511	504	498	491	484	479	471	465
4008203	4176615	4345022	459	452	445	439	432	426	420	412	407	399
5692037	5860384	6028725	394	386	380	374	367	361	354	347	341	335
7375218	7543500	7711776	168328	321	315	308	302	295	289	282	276	269
9057748	9225965	9394175	263	256	250	243	237	230	224	217	210	204
0739625	0907777	1075923	198	191	184	178	172	165	158	152	146	139
2420852	2588939	2757019	132	126	120	112	107	100	093	087	080	074
4101428	4269450	4437465	068	060	055	048	041	035	028	022	015	009
5781354	5949311	6117262	003	996	989	983	976	970	963	957	951	943
7460631	7628523	7796408	167938	931	924	918	911	905	899	892	885	879
9139258	9307085	9474906	873	866	859	853	847	840	833	827	821	814
0817237	0984999	1152755	808	801	794	789	781	775	769	762	756	749
2494568	2662265	2829956	743	736	730	724	717	710	704	697	691	685
4171251	4338884	4506510	167678	671	665	659	652	646	639	633	626	620
5847287	6014855	6182417	613	607	600	594	588	581	574	568	562	555
7522677	7690180	7857677	549	542	536	529	523	516	510	503	497	491
9197420	9364859	9532292	484	477	471	465	458	452	445	439	433	425
0871518	1038893	1206260	420	413	407	400	393	388	380	375	367	362
2544971	2712281	2879584	355	348	342	336	329	323	316	310	303	297
4217779	4385025	4552264	291	284	277	272	264	259	251	246	239	232
5889944	6057125	6224299	226	220	213	207	200	194	188	181	174	168
7561464	7728581	7895691	162	155	149	143	136	129	123	117	110	104
9232342	9399394	9566440	097	091	085	078	072	065	059	052	046	040
0902577	1069565	1236547	167033	027	020	014	007	001	995	988	982	975
2572170	2739094	2906011	166969	962	956	950	943	937	931	924	917	911
4241121	4407981	4574834	905	898	892	886	879	873	866	860	853	847
5909431	6076227	6243016	841	834	828	821	815	809	802	796	789	783
7577100	7743832	7910557	777	770	763	758	751	744	738	732	725	719
9244130	9410797	9577459	713	706	700	693	687	681	674	667	662	655
0910519	1077123	1243721	648	642	636	630	623	616	610	604	598	591
2576270	2742810	2909343	584	579	571	566	559	553	546	540	533	528
4241382	4407858	4574328	520	515	508	501	496	488	483	476	470	463
5905856	6072268	6238674	457	451	444	437	432	425	419	412	406	399
7569692	7736040	7902382	166394	386	381	374	367	362	355	348	342	336
9232891	9399175	9565454	330	323	316	311	304	297	292	284	279	272
0895453	1061674	1227889	266	259	253	247	240	234	228	221	215	208
2557379	2723536	2889688	202	196	190	183	176	171	164	157	152	144
4218669	4384763	4550851	139	132	126	120	113	106	101	094	088	081
5879324	6045354	6211379	075	069	062	056	050	043	037	030	025	018
7539344	7705311	7871272	011	005	999	993	986	980	973	967	961	954
9198730	9364634	9530531	165949	941	936	929	923	916	910	904	897	891
0857482	1023322	1189157	885	878	872	866	859	853	847	840	835	827
2515601	2681378	2847149	822	815	808	803	796	790	783	777	771	764
4173087	4338801	4504508	758	752	745	740	732	727	720	714	707	701

Numbers 26200-26809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2620	4183012913	3178671	3344423	3510168	3675908	3841640	4007367
21	4670209	4835904	5001593	5167275	5332951	5498620	5664284
22	6326874	6492505	6658131	6823750	6989362	7154969	7320569
23	7982906	8148474	8314037	8479593	8645142	8810685	8976222
24	9638307	9803812	9969312	0134804	0300291	0465771	0631245
25	4191293077	1458520	1623956	1789386	1954809	2120226	2285637
26	2947218	3112597	3277970	3443337	3608697	3774051	3939399
27	4600728	4766044	4931354	5096658	5261956	5427247	5592532
28	6253609	6418862	6584110	6749351	6914585	7079814	7245036
29	7905861	8071052	8236236	8401414	8566586	8731751	8896911
2630	4199557485	9722613	9887734	0052850	0217959	0383061	0548158
31	4201208481	1373546	1538605	1703657	1868704	2033744	2198777
32	2858849	3023852	3188848	3353838	3518821	3683799	3848770
33	4508591	4673531	4838464	5003391	5168312	5333227	5498135
34	6157706	6322583	6487454	6652319	6817177	6982029	7146875
35	7806195	7971010	8135818	8300620	8465416	8630206	8794989
36	9454059	9618811	9783557	9948296	0113030	0277757	0442477
37	4211101298	1265987	1430671	1595348	1760019	1924683	2089341
38	2747912	2912539	3077160	3241775	3406383	3570985	3735581
39	4393902	4558467	4723025	4887578	5052124	5216663	5381197
2640	4216039269	6203771	6368267	6532757	6697241	6861718	7026189
41	7684012	7848452	8012886	8177314	8341735	8506150	8670559
42	9328133	9492511	9656882	9821248	9985607	0149960	0314307
43	4220971631	1135947	1300256	1464560	1628857	1793147	1957432
44	2614508	2778762	2943009	3107250	3271485	3435714	3599936
45	4256764	4420955	4585140	4749319	4913492	5077659	5241819
46	5898399	6062528	6226651	6390768	6554879	6718983	6883082
47	7539413	7703480	7867542	8031596	8195645	8359688	8523724
48	9179808	9343813	9507812	9671805	9835792	9999773	0163747
49	4230819583	0983526	1147464	1311395	1475320	1639239	1803151
2650	4232458739	2622621	2786496	2950366	3114229	3278086	3441936
51	4097277	4261097	4424911	4588718	4752519	4916315	5080103
52	5735197	5898955	6062707	6226453	6390192	6553926	6717653
53	7372500	7536196	7699886	7863570	8027248	8190920	8354585
54	9009185	9172820	9336448	9500071	9663687	9827297	9990901
55	4240645254	0808827	0972394	1135955	1299509	1463058	1626600
56	2280707	2444218	2607724	2771223	2934716	3098202	3261683
57	3915544	4078994	4242438	4405875	4569307	4732732	4896151
58	5549766	5713154	5876537	6039913	6203283	6366647	6530004
59	7183373	7346700	7510021	7673336	7836644	7999947	8163243
2660	4248816366	8979632	9142891	9306144	9469392	9632633	9795867
61	4250448746	0611950	0775148	0938340	1101525	1264705	1427879
62	2080511	2243654	2406791	2569922	2733046	2896164	3059277
63	3711664	3874746	4037821	4200891	4363954	4527011	4690062
64	5342205	5505225	5668239	5831248	5994250	6157246	6320236
65	6972134	7135093	7298046	7460993	7623934	7786869	7949797
66	8601451	8764349	8927241	9090127	9253007	9415880	9578748
67	4260230157	0392994	0555825	0718650	0881468	1044281	1207087
68	1858252	2021028	2183798	2346562	2509320	2672071	2834817
69	3485738	3648453	3811162	3973865	4136561	4299252	4461936
2670	4265112614	5275268	5437916	5600558	5763193	5925823	6088447
71	6738880	6901473	7064060	7226641	7389216	7551785	7714348
72	8364538	8527070	8689597	8852117	9014631	9177139	9339641
73	9989588	0152059	0314525	0476984	0639437	0801884	0964325
74	4271614029	1776440	1938845	2101243	2263636	2426022	2588403
75	3237864	3400214	3562558	3724895	3887227	4049553	4211873
76	4861091	5023380	5185664	5347941	5510212	5672477	5834736
77	6483712	6645941	6808163	6970380	7132591	7294795	7456993
78	8105727	8267895	8430057	8592213	8754363	8916507	9078645
79	9727136	9889244	0051345	0213441	0375530	0537614	0699691
2680	4281347940	1509987	1672029	1834064	1996093	2158116	2320133

OF NUMBERS.

Logarithms 4183012913-4282806147.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4173087	4338801	4504508	165758	752	745	740	732	727	720	714	707	701
5829941	5995591	6161236	695	689	682	676	669	664	657	650	645	638
7486162	7651750	7817331	631	626	619	612	607	600	593	588	581	575
9141753	9307277	9472795	568	563	556	549	543	537	531	524	518	512
0796713	0962174	1127629	505	500	492	487	480	474	468	461	455	448
2451042	2616440	2781832	443	436	430	423	417	411	405	398	392	386
4104741	4270076	4435405	379	373	367	360	354	348	342	335	329	323
5757811	5923083	6088349	316	310	304	298	291	285	279	272	266	260
7410251	7575461	7740664	253	248	241	234	229	222	215	210	203	197
9062064	9227210	9392351	191	184	178	172	165	160	153	146	141	134
0713248	0878332	1043410	165128	121	116	109	102	097	090	084	078	071
2363805	2528826	2693841	065	059	052	047	040	033	028	021	015	008
4013734	4178693	4343645	003	996	990	983	978	971	964	959	952	946
5663037	5827933	5992823	164940	933	927	921	915	908	902	896	890	883
7311714	7476548	7641375	877	871	865	858	852	846	839	834	827	820
8959766	9124536	9289301	815	808	802	796	790	783	777	770	765	758
0607192	0771900	0936602	752	746	739	734	727	720	715	708	702	696
2253993	2418639	2583279	689	684	677	671	664	658	652	646	640	633
3900171	4064754	4229331	627	621	615	608	602	596	590	583	577	571
5545724	5710245	5874760	565	558	553	546	539	534	527	521	515	509
7190655	7355113	7519566	164502	496	490	484	477	471	466	458	453	446
8834962	8999358	9163749	440	434	428	421	415	409	403	396	391	384
0478647	0642981	0807309	378	371	366	359	353	347	340	334	328	322
2121710	2285982	2450248	316	309	304	297	290	285	278	272	266	260
3764152	3928362	4092566	254	247	241	235	229	222	216	210	204	198
5405973	5570121	5734263	191	185	179	173	167	160	154	148	142	136
7047174	7211260	7375339	129	123	117	111	104	099	092	086	079	074
8687754	8851778	9015796	067	062	054	049	043	036	030	024	018	012
0327715	0491677	0655633	005	999	993	987	981	974	968	962	956	950
1967057	2130958	2294852	163943	938	931	925	919	912	906	901	894	887
3605781	3769619	3933451	163882	875	870	863	857	850	845	838	832	826
5243886	5407663	5571433	820	814	807	801	796	788	783	777	770	764
6881374	7045089	7208797	758	752	746	739	734	727	721	715	708	703
8518244	8681898	8845544	696	690	684	678	672	665	659	654	646	641
0154498	0318090	0481675	635	628	623	616	610	604	597	592	585	579
1790136	1953666	2117189	573	567	561	554	549	542	536	530	523	518
3425158	3588626	3752088	511	506	499	493	486	481	475	468	462	456
5059564	5222971	5386372	450	444	437	432	425	419	413	407	401	394
6693356	6856701	7020040	388	383	376	370	364	357	352	345	339	333
8326533	8489817	8653095	327	321	315	308	303	296	290	284	278	271
9959096	0122319	0285535	163266	259	253	248	241	234	229	223	216	211
1591046	1754207	1917362	204	198	192	185	180	174	167	161	155	149
3222383	3385483	3548577	143	137	131	124	118	113	106	100	094	087
4853107	5016146	5179178	082	075	070	063	057	051	045	039	032	027
6483219	6646197	6809168	020	014	009	002	996	990	983	978	971	966
8112720	8275636	8438547	162959	953	947	941	935	928	923	916	911	904
9741609	9904465	0067314	898	892	886	880	873	868	861	856	849	843
1369888	1532682	1695470	837	831	825	818	813	806	801	794	788	782
2997556	3160290	3323017	776	770	764	758	751	746	739	734	727	721
4624615	4787287	4949954	715	709	703	696	691	684	679	672	667	660
6251064	6413676	6576281	162654	648	642	635	630	624	617	612	605	599
7876904	8039455	8202000	593	587	581	575	569	563	556	551	545	538
9502137	9664626	9827110	532	527	520	514	508	502	496	489	484	478
1126761	1289190	1451612	471	466	459	453	447	441	436	429	422	417
2750777	2913145	3075507	411	405	398	393	386	381	374	368	362	357
4374186	4536494	4698796	350	344	337	332	326	320	313	308	302	295
5996989	6159236	6321477	289	284	277	271	265	259	253	247	241	235
7619186	7781372	7943553	229	222	217	211	204	198	193	186	181	174
9240777	9402903	9565022	168	162	156	150	144	138	132	126	119	114
0861763	1023828	1185887	108	101	096	089	084	077	072	065	059	053
2482143	2644148	2806147	047	042	035	029	023	017	010	005	999	993

Numbers 26800–27409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2680	4281347940	1509987	1672029	1834064	1996093	2158116	2320133
81	2968140	3130127	3292107	3454082	3616050	3778013	3939970
82	4587735	4749661	4911582	5073496	5235404	5397306	5559203
83	6206727	6368593	6530453	6692307	6854154	7015996	7177832
84	7825115	7986921	8148720	8310514	8472301	8634083	8795859
85	9442900	9604646	9766385	9928118	0089846	0251567	0413282
86	4291060083	1221769	1383448	1545121	1706788	1868449	2030104
87	2676664	2838289	2999908	3161521	3323128	3484729	3646324
88	4292644	4454209	4615768	4777320	4938867	5100408	5261943
89	5908022	6069527	6231026	6392519	6554005	6715486	6876961
2690	4297522800	7684245	7845684	8007116	8168543	8329964	8491379
91	9136978	9298362	9459741	9621114	9782481	9943842	0105196
92	4300750556	0911880	1073199	1234512	1395819	1557120	1718415
93	2363534	2524799	2686058	2847311	3008558	3169799	3331034
94	3975914	4137119	4298318	4459511	4620698	4781879	4943054
95	5587695	5748840	5909980	6071113	6232240	6393362	6554477
96	7198879	7359964	7521044	7682117	7843185	8004246	8165302
97	8809465	8970490	9131510	9292524	9453532	9614534	9775529
98	4310419453	0580419	0741380	0902334	1063282	1224224	1385160
99	2028846	2189752	2350652	2511547	2672435	2833318	2994195
2700	4313637642	3798488	3959329	4120164	4280993	4441816	4602633
1	5245842	5406629	5567410	5728186	5888955	6049719	6210476
2	6853447	7014175	7174896	7335612	7496322	7657026	7817724
3	8460457	8621125	8781788	8942444	9103095	9263739	9424378
4	4320066873	0227482	0388085	0548682	0709273	0869858	1030437
5	1672694	1833244	1993788	2154325	2314857	2475383	2635903
6	3277923	3438413	3598897	3759375	3919848	4080314	4240775
7	4882558	5042989	5203414	5363833	5524246	5684653	5845054
8	6486600	6646972	6807338	6967697	7128051	7288399	7448741
9	8090050	8250363	8410669	8570970	8731265	8891553	9051836
2710	4329692909	9853162	0013409	0173651	0333887	0494116	0654340
11	4331295176	1455370	1615558	1775741	1935917	2096088	2256252
12	2896852	3056987	3217116	3377240	3537357	3697469	3857574
13	4497938	4658014	4818084	4978148	5138207	5298259	5458306
14	6098433	6258450	6418462	6578467	6738466	6898460	7058448
15	7698339	7858297	8018250	8178196	8338137	8498071	8658000
16	9297656	9457555	9617449	9777336	9937218	0097094	0256964
17	4340896384	1056225	1216059	1375888	1535711	1695528	1855339
18	2494524	2654306	2814081	2973851	3133615	3293373	3453126
19	4092076	4251799	4411516	4571227	4730932	4890632	5050325
2720	4345689040	5848704	6008363	6168015	6327662	6487302	6646937
21	7285418	7445023	7604623	7764217	7923805	8083387	8242963
22	8881209	9040756	9200296	9359832	9519361	9678884	9838402
23	4350476413	0635902	0795384	0954861	1114331	1273796	1433255
24	2071032	2230462	2389886	2549304	2708716	2868122	3027523
25	3665066	3824437	3983803	4143162	4302516	4461864	4621206
26	5258515	5417828	5577135	5736436	5895731	6055020	6214304
27	6851379	7010634	7169882	7329125	7488362	7647593	7806818
28	8443660	8602856	8762046	8921230	9080409	9239581	9398748
29	4360035357	0194495	0353626	0512752	0671872	0830986	0990095
2730	4361626470	1785550	1944623	2103691	2262753	2421809	2580859
31	3217001	3376022	3535038	3694047	3853051	4012049	4171040
32	4806950	4965913	5124870	5283821	5442767	5601706	5760640
33	6396317	6555222	6714121	6873014	7031901	7190782	7349658
34	7985102	8143949	8302790	8461625	8620454	8779277	8938095
35	9573307	9732095	9890878	0049655	0208426	0367191	0525951
36	4371160930	1319661	1478386	1637104	1795818	1954525	2113226
37	2747974	2906647	3065313	3223974	3382629	3541278	3699922
38	4334438	4493052	4651661	4810264	4968861	5127453	5286038
39	5920323	6078879	6237430	6395975	6554514	6713048	6871575
2740	7505628	7664127	7822620	7981107	8139588	8298064	8456534

OF NUMBERS.

Logarithms 4281347940-4378931909.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2482143	2644148	2806147	162047	042	035	029	023	017	010	005	999	993
4101920	4263864	4425803	161987	980	975	968	963	957	950	944	939	932
5721093	5882977	6044855	926	921	914	908	902	897	890	884	878	872
7339662	7501486	7663303	866	860	854	847	842	836	830	824	817	812
8957628	9119391	9281149	806	799	794	787	782	776	769	763	758	751
0574992	0736695	0898392	746	739	733	728	721	715	710	703	697	691
2191753	2353396	2515033	686	679	673	667	661	655	649	643	637	631
3807913	3969496	4131073	625	619	613	607	601	595	589	583	577	571
5423472	5584995	5746511	565	559	552	547	541	535	529	523	516	511
7038430	7199892	7361349	505	499	493	486	481	475	469	462	457	451
8652787	8814190	8975587	161445	439	432	427	421	415	408	403	397	391
0266545	0427888	0589225	384	379	373	367	361	354	349	343	337	331
1879703	2040986	2202263	324	319	313	307	301	295	288	283	277	271
3492263	3653486	3814703	265	259	253	247	241	235	229	223	217	211
5104224	5265387	5426544	205	199	193	187	181	175	170	163	157	151
6715586	6876690	7037787	145	140	133	127	122	115	109	104	097	092
8326351	8487395	8648433	085	080	073	068	061	056	049	044	038	032
9936519	0097503	0258481	025	020	014	008	002	995	990	984	978	972
1546091	1707015	1867933	160966	961	954	948	942	936	931	924	918	913
3155065	3315930	3476789	906	900	895	888	883	877	870	865	859	853
4763444	4924249	5085049	160846	841	835	829	823	817	811	805	800	793
6371228	6531973	6692713	787	781	776	769	764	757	752	745	740	734
7978416	8139103	8299783	728	721	716	710	704	698	692	687	680	674
9585010	9745637	9906258	668	663	656	651	644	639	632	627	621	615
1191010	1351578	1512139	609	603	597	591	585	579	573	568	561	555
2796416	2956924	3117426	550	544	537	532	526	520	513	508	502	497
4401229	4561678	4722121	490	484	478	473	466	461	454	449	443	437
6005450	6165839	6326223	431	425	419	413	407	401	396	389	384	377
7609077	7769408	7929732	372	366	359	354	348	342	336	331	324	318
9212113	9372384	9532650	313	306	301	295	288	283	277	271	266	259
0814558	0974770	1134976	160253	247	242	236	229	224	218	212	206	200
2416411	2576564	2736711	194	188	183	176	171	164	159	153	147	141
4017674	4177768	4337856	135	129	124	117	112	105	100	094	088	082
5618346	5778381	5938410	076	070	064	059	052	047	040	035	029	023
7218429	7378405	7538375	017	012	005	999	994	988	981	976	970	964
8817923	8977840	9137751	159958	953	946	941	934	929	923	917	911	905
0416828	0576686	0736538	899	894	887	882	876	870	864	858	852	846
2015144	2174943	2334736	841	834	829	823	817	811	805	799	793	788
3612872	3772613	3932347	782	775	770	764	758	753	746	741	734	729
5210013	5369694	5529370	723	717	711	705	700	693	688	681	676	670
6806566	6966189	7125806	159664	659	652	647	640	635	629	623	617	612
8402533	8562097	8721656	605	600	594	588	582	576	570	564	559	553
9997914	0157419	0316919	547	540	536	529	523	518	512	505	500	494
1592708	1752155	1911597	489	482	477	470	465	459	453	447	442	435
3186917	3346306	3505689	430	424	418	412	406	401	394	389	383	377
4780542	4939872	5099196	371	366	359	354	348	342	336	330	324	319
6373581	6532853	6692119	313	307	301	295	289	284	277	272	266	260
7966037	8125250	8284458	255	248	243	237	231	225	219	213	208	202
9557909	9717064	9876213	196	190	184	179	172	167	161	155	149	144
1149197	1308294	1467385	138	131	126	120	114	109	102	097	091	085
2739903	2898942	3057975	159080	073	068	062	056	050	044	039	033	026
4330027	4489007	4647981	021	016	009	004	998	991	987	980	974	969
5919568	6078490	6237406	158963	957	951	946	939	934	928	922	916	911
7508528	7667392	7826250	905	899	893	887	881	876	870	864	858	852
9096906	9255712	9414512	847	841	835	829	823	818	811	806	800	795
0684704	0843452	1002194	788	783	777	771	765	760	753	748	742	736
2271922	2430612	2589296	731	725	718	714	707	701	696	690	684	678
3858560	4017192	4175818	673	666	661	655	649	644	638	632	626	620
5444618	5603192	5761760	614	609	603	597	592	585	580	574	568	563
7030097	7188613	7347124	556	551	545	539	534	527	522	516	511	504
8614998	8773456	8931909	499	493	487	481	476	470	464	458	453	446

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2740	4377505628	7664127	7822620	7981107	8139588	8298064	8456534
41	9090355	9248796	9407231	9565661	9724084	9882502	0040914
42	4380674505	0832888	0991265	1149637	1308002	1466362	1624717
43	2258076	2416401	2574721	2733035	2891343	3049645	3207942
44	3841070	3999338	4157600	4315856	4474107	4632351	4790590
45	5423488	5581698	5739902	5898101	6056293	6214480	6372662
46	7005329	7163481	7321628	7479769	7637904	7796034	7954157
47	8586594	8744689	8902778	9060862	9218939	9377011	9535077
48	4390167284	0325321	0483353	0641379	0799399	0957413	1115422
49	1747398	1905378	2063352	2221321	2379283	2537240	2695191
2750	4393326938	3484861	3642777	3800688	3958593	4116493	4274387
51	4905904	5063769	5221628	5379482	5537329	5695171	5853008
52	6484296	6642103	6799905	6957701	7115492	7273276	7431055
53	8062114	8219864	8377609	8535348	8693081	8850808	9008530
54	9639359	9797052	9954740	0112421	0270097	0427767	0585431
55	4401216032	1373668	1531298	1688922	1846541	2004154	2161761
56	2792133	2949711	3107284	3264851	3422412	3579968	3737518
57	4367661	4525182	4682698	4840208	4997713	5155211	5312704
58	5942618	6100083	6257541	6414994	6572441	6729883	6887318
59	7517005	7674412	7831814	7989209	8146600	8303984	8461363
2760	4409090821	9248171	9405515	9562854	9720187	9877515	0034836
61	4410664066	0821360	0978647	1135929	1293205	1450476	1607740
62	2236742	2393979	2551209	2708434	2865653	3022867	3180075
63	3808849	3966029	4123202	4280370	4437533	4594689	4751840
64	5380387	5537510	5694626	5851738	6008843	6165943	6323037
65	6951356	7108422	7265482	7422536	7579585	7736628	7893665
66	8521758	8678767	8835770	8992767	9149759	9306746	9463726
67	4420091591	0248544	0405490	0562431	0719366	0876296	1033219
68	1660858	1817753	1974643	2131527	2288406	2445278	2602146
69	3229557	3386396	3543229	3700057	3856879	4013695	4170505
2770	4424797691	4954473	5111249	5268020	5424785	5581545	5738299
71	6365258	6521983	6678703	6835418	6992126	7148829	7305527
72	7932259	8088928	8245592	8402250	8558902	8715548	8872189
73	9498696	9655308	9811915	9968517	0125112	0281702	0438286
74	4431064567	1221123	1377674	1534219	1690758	1847292	2003819
75	2629875	2786374	2942868	3099357	3255840	3412317	3568788
76	4194618	4351061	4507499	4663931	4820357	4976778	5133193
77	5758798	5915184	6071566	6227942	6384312	6540676	6697035
78	7322414	7478745	7635070	7791389	7947703	8104011	8260314
79	8885468	9041742	9198011	9354274	9510532	9666784	9823030
2780	4440447959	0604177	0760390	0916597	1072798	1228994	1385184
81	2009889	2166051	2322207	2478358	2634503	2790643	2946777
82	3571257	3727362	3883463	4039557	4195647	4351730	4507808
83	5132063	5288113	5444157	5600196	5756229	5912256	6068278
84	6692309	6848303	7004291	7160274	7316251	7472222	7628188
85	8251995	8407933	8563865	8719792	8875713	9031628	9187538
86	9811121	9967002	0122879	0278749	0434615	0590474	0746328
87	4451369687	1525513	1681333	1837148	1992957	2148761	2304558
88	2927694	3083464	3239229	3394987	3550741	3706488	3862230
89	4485143	4640857	4796565	4952268	5107966	5263657	5419344
2790	4456042033	6197691	6353344	6508991	6664633	6820269	6975899
91	7598365	7753967	7909564	8065156	8220742	8376322	8531897
92	9154140	9309687	9465228	9620763	9776293	9931818	0087337
93	4460709357	0864848	1020334	1175814	1331288	1486757	1642220
94	2264018	2419453	2574883	2730308	2885726	3041140	3196547
95	3818122	3973502	4128876	4284245	4439608	4594966	4750318
96	5371671	5526995	5682314	5837627	5992935	6148237	6303533
97	6924664	7079932	7235196	7390453	7545705	7700952	7856193
98	8477102	8632315	8787523	8942725	9097921	9253112	9408298
99	4470028985	0184142	0339295	0494441	0649583	0804718	0959848
2800	1580313	1735416	1890513	2045604	2200690	2355770	2510845

OF NUMBERS. Logarithms 4377505628–4472976036.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8614998	8773456	8931909	158499	493	487	481	476	470	464	458	453	446
0199320	0357721	0516116	441	435	430	423	418	412	406	401	395	389
1783065	1941408	2099745	383	377	372	365	360	355	348	343	337	331
3366233	3524518	3682797	325	320	314	308	302	297	291	285	279	273
4948823	5107050	5265272	268	262	256	251	244	239	233	227	222	216
6530837	6689007	6847171	210	204	199	192	187	182	175	170	164	158
8112275	8270387	8428494	152	147	141	135	130	123	118	112	107	100
9693137	9851192	0009241	095	089	084	077	072	066	060	055	049	043
1273424	1431422	1589413	037	032	026	020	014	009	002	998	991	985
2853137	3011076	3169010	157980	974	969	962	957	951	946	939	934	928
4432274	4590157	4748033	157923	916	911	905	900	894	887	883	876	871
6010838	6168663	6326482	865	859	854	847	842	837	830	825	819	814
7588829	7746596	7904358	807	802	796	791	784	779	774	767	762	756
9166246	9323956	9481660	750	745	739	733	727	722	716	710	704	699
0743090	0900743	1058390	693	688	681	676	670	664	659	653	647	642
2319362	2476958	2634548	636	630	624	619	613	607	601	596	590	585
3895062	4052601	4210134	578	573	567	561	556	550	544	539	533	527
5470191	5627673	5785148	521	516	510	505	498	493	487	482	475	470
7044749	7202173	7359592	465	458	453	447	442	435	431	424	419	413
8618736	8776103	8933465	407	402	395	391	384	379	373	367	362	356
0192153	0349463	0506767	157350	344	339	333	328	321	317	310	304	299
1764999	1922253	2079500	294	287	282	276	271	264	259	254	247	242
3337277	3494473	3651664	237	230	225	219	214	208	202	196	191	185
4908985	5066125	5223259	180	173	168	163	156	151	145	140	134	128
6480125	6637208	6794285	123	116	112	105	100	094	088	083	077	071
8050697	8207723	8364743	066	060	054	049	043	037	032	026	020	015
9620701	9777670	9934634	009	003	997	992	987	980	975	969	964	957
1190137	1347050	1503957	156953	946	941	935	930	923	918	913	907	901
2759007	2915863	3072713	895	890	884	879	872	868	861	856	850	844
4327310	4484109	4640903	839	833	828	822	816	810	805	799	794	788
5895047	6051790	6208527	156782	776	771	765	760	754	748	743	737	731
7462218	7618904	7775585	725	720	715	708	703	698	691	686	681	674
9028824	9185454	9342078	669	664	658	652	646	641	635	630	624	618
0594865	0751438	0908006	612	607	602	595	590	584	579	573	568	561
2160342	2316858	2473369	556	551	545	539	534	527	523	516	511	506
3725254	3881714	4038169	499	494	489	483	477	471	466	460	455	449
5289603	5446007	5602405	443	438	432	426	421	415	410	404	398	393
6853388	7009736	7166078	386	382	376	370	364	359	353	348	342	336
8416611	8572902	8729188	331	325	319	314	308	303	297	291	286	280
9979271	0135506	0291735	274	269	263	258	252	246	241	235	229	224
1541369	1697548	1853721	156218	213	207	201	196	190	185	179	173	168
3102905	3259028	3415145	162	156	151	145	140	134	128	123	117	112
4663880	4819947	4976008	105	101	094	090	083	078	072	067	061	055
6224294	6380305	6536310	050	044	039	033	027	022	016	011	005	999
7784148	7940103	8096052	155994	988	983	977	971	966	960	955	949	943
9343442	9499340	9655233	938	932	927	921	915	910	904	898	893	888
0902176	1058019	1213856	881	877	870	866	859	854	848	843	837	831
2460351	2616138	2771919	826	820	815	809	804	797	793	787	781	775
4017967	4173698	4329423	770	765	758	754	747	742	737	731	725	720
5575024	5730699	5886369	714	708	703	698	691	687	680	675	670	664
7131524	7287143	7442757	155658	653	647	642	636	630	625	619	614	608
8687466	8843029	8998587	602	597	592	586	580	575	569	563	558	553
0242850	0398358	0553860	547	541	535	530	525	519	513	508	502	497
1797678	1953130	2108577	491	486	480	474	469	463	458	452	447	441
3351949	3507346	3662737	435	430	425	418	414	407	402	397	391	385
4905665	5061005	5216341	380	374	369	363	358	352	347	340	336	330
6458824	6614110	6769389	324	319	313	308	302	296	291	286	279	275
8011428	8166658	8321883	268	264	257	252	247	241	235	230	225	219
9563478	9718652	9873821	213	208	202	196	191	186	180	174	169	164
1114973	1270092	1425205	157	153	146	142	135	130	125	119	113	108
2665914	2820978	2976036	103	097	091	086	080	075	069	064	058	052

Numbers 28000–28609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2800	4471580313	1735416	1890513	2045604	2200690	2355770	2510845
1	31131088	3286135	3441177	3596213	3751243	3906268	4061287
2	4681309	4836301	4991287	5146268	5301243	5456213	5611177
3	6230978	6385914	6540845	6695770	6850690	7005604	7160513
4	7780093	7934974	8089850	8244720	8399584	8554443	8709297
5	9328656	9483482	9638302	9793117	9947927	0102730	0257529
6	4480876667	1031438	1186203	1340963	1495717	1650466	1805209
7	2424126	2578842	2733552	2888257	3042956	3197649	3352337
8	3971035	4125695	4280350	4435000	4589644	4744282	4898915
9	5517392	5671997	5826597	5981192	6135781	6290364	6444942
2810	4487063199	7217749	7372294	7526834	7681368	7835896	7990419
11	8608456	8762952	8917442	9071926	9226405	9380878	9535346
12	4490153163	0307604	0462039	0616469	0770893	0925311	1079724
13	1697322	1851707	2006087	2160462	2314831	2469195	2623553
14	3240931	3395262	3549587	3703907	3858221	4012530	4166833
15	4783992	4938268	5092538	5246803	5401063	5555317	5709565
16	6326505	6480726	6634942	6789152	6943356	7097556	7251749
17	7868470	8022636	8176797	8330953	8485103	8639247	8793386
18	9409888	9563999	9718106	9872206	0026302	0180392	0334476
19	4500950759	1104816	1258867	1412913	1566954	1720989	1875019
2820	4502491083	2645086	2799083	2953074	3107060	3261041	3415016
21	4030862	4184809	4338752	4492689	4646620	4800546	4954467
22	5570094	5723987	5877875	6031758	6185635	6339506	6493372
23	7108781	7262620	7416454	7570281	7724104	7877921	8031732
24	8646924	8800708	8954487	9108260	9262028	9415791	9569548
25	4510184522	0338251	0491976	0645695	0799408	0953116	1106819
26	1721575	1875251	2028921	2182585	2336244	2489898	2643546
27	3258085	3411706	3565322	3718932	3872537	4026136	4179730
28	4794051	4947618	5101179	5254735	5408286	5561831	5715370
29	6329475	6482987	6636494	6789996	6943492	7096983	7250468
2830	4517864355	8017813	8171266	8324714	8478156	8631592	8785023
31	9398694	9552098	9705496	9858889	0012277	0165660	0319037
32	4520932490	1085840	1239184	1392524	1545857	1699185	1852508
33	2465745	2619041	2772331	2925616	3078896	3232170	3385438
34	3998459	4151701	4304937	4458168	4611393	4764613	4917828
35	5530632	5683820	5837002	5990179	6143350	6296516	6449677
36	7062265	7215399	7368527	7521650	7674767	7827879	7980986
37	8593358	8746438	8899512	9052581	9205644	9358702	9511755
38	4530123911	0276937	0429957	0582972	0735982	0888986	1041984
39	1653925	1806897	1959863	2112824	2265780	2418730	2571675
2840	4533183400	3336318	3489231	3642138	3795040	3947936	4100827
41	4712337	4865201	5018060	5170913	5323761	5476604	5629441
42	6240736	6393546	6546351	6699151	6851945	7004734	7157517
43	7768597	7921353	8074105	8226850	8379591	8532326	8685056
44	9295921	9448623	9601321	9754013	9906700	0059381	0212057
45	4540822707	0975356	1128000	1280639	1433272	1585899	1738522
46	2348957	2501553	2654143	2806728	2959307	3111881	3264450
47	3874671	4027213	4179750	4332281	4484807	4637328	4789843
48	5399850	5552338	5704821	5857299	6009771	6162238	6314699
49	6924492	7076927	7229357	7381781	7534200	7686613	7839021
2850	4548448600	8600981	8753357	8905728	9058093	9210453	9362808
51	9972173	0124501	0276824	0429141	0581453	0733759	0886060
52	4551495212	1647486	1799755	1952019	2104278	2256531	2408779
53	3017717	3169938	3322153	3474364	3626569	3778769	3930963
54	4539688	4691856	4844018	4996175	5148327	5300473	5452615
55	6061126	6213240	6365349	6517453	6669552	6821645	6973733
56	7582031	7734092	7886148	8038199	8190244	8342284	8494319
57	9102404	9254412	9406415	9558412	9710404	9862391	0014372
58	4560622245	0774199	0926149	1078093	1230032	1381966	1533894
59	2141554	2293455	2445352	2597243	2749128	2901009	3052884
2860	3660331	3812180	3964023	4115861	4267694	4419521	4571343

OF NUMBERS. Logarithms 4471580313-4565026777.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2665914	2820978	2976036	155103	097	091	086	080	075	069	064	058	052
4216301	4371310	4526312	047	042	036	030	025	019	014	009	002	997
5766135	5921088	6076036	154992	986	981	975	970	964	958	953	948	942
7315416	7470314	7625206	936	931	925	920	914	909	903	898	892	887
8864145	9018987	9173824	881	876	870	864	859	854	848	842	837	832
0412322	0567109	0721891	826	820	815	810	803	799	793	787	782	776
1959946	2114679	2269405	771	765	760	754	749	743	737	733	726	721
3507020	3661697	3816369	716	710	705	699	693	688	683	677	672	666
5053543	5208165	5362781	660	655	650	644	638	633	628	622	616	611
6599515	6754082	6908643	605	600	595	589	583	578	573	567	561	556
8144937	8299449	8453955	154550	545	540	534	528	523	518	512	506	501
9689809	9844266	9998717	496	490	484	479	473	468	463	457	451	446
1234132	1388534	1542931	441	435	430	424	418	413	408	402	397	391
2777906	2932253	3086595	385	380	375	369	364	358	353	347	342	336
4321131	4475424	4629710	331	325	320	314	309	303	298	293	286	282
5863808	6018046	6172278	276	270	265	260	254	248	243	238	232	227
7405938	7560121	7714298	221	216	210	204	200	193	189	183	177	172
8947520	9101648	9255771	166	161	156	150	144	139	134	128	123	117
0488555	0642628	0796696	111	107	100	096	090	084	079	073	068	063
2029043	2183062	2337075	057	051	046	041	035	030	024	019	013	008
3568985	3722950	3876908	154003	997	991	986	981	975	969	965	958	954
5108382	5262291	5416195	153947	943	937	931	926	921	915	909	904	899
6647233	6801088	6954937	893	888	883	877	871	866	861	855	849	844
8185538	8339339	8493134	839	834	827	823	817	811	806	801	795	790
9723299	9877046	0030786	784	779	773	768	763	757	751	747	740	736
1260516	1414208	1567894	729	725	719	713	708	703	697	692	686	681
2797189	2950826	3104458	676	670	664	659	654	648	643	637	632	627
4333318	4486901	4640479	621	616	610	605	599	594	588	583	578	572
5868905	6022433	6175957	567	561	556	551	545	539	535	528	524	518
7403948	7557423	7710892	512	507	502	496	491	485	480	475	469	463
8938449	9091869	9245284	153458	453	448	442	436	431	426	420	415	410
0472408	0625774	0779135	404	398	393	388	383	377	371	366	361	355
2005826	2159138	2312444	350	344	340	333	328	323	318	312	306	301
3538702	3691960	3845212	296	290	285	280	274	268	264	258	252	247
5071037	5224241	5377439	242	236	231	225	220	215	209	204	198	193
6602832	6755982	6909126	188	182	177	171	166	161	155	150	144	139
8134087	8287183	8440273	134	128	123	117	112	107	101	096	090	085
9664802	9817844	9970880	080	074	069	063	058	053	047	042	036	031
1194978	1347966	1500948	026	020	015	010	004	998	994	988	982	977
2724614	2877549	3030477	152972	966	961	956	950	945	939	935	928	923
4253713	4406593	4559468	152918	913	907	902	896	891	886	880	875	869
5782273	5935099	6087920	864	859	853	848	843	837	832	826	821	816
7310295	7463068	7615835	810	805	800	794	789	783	778	773	767	762
8837780	8990499	9143212	756	752	745	741	735	730	724	719	713	709
0364728	0517393	0670053	702	698	692	687	681	676	671	665	660	654
1891139	2043750	2196357	649	644	639	633	627	623	617	611	607	600
3417014	3569572	3722124	596	590	585	579	574	569	564	558	552	547
4942352	5094857	5247356	542	537	531	526	521	515	509	505	499	494
6467156	6619607	6772052	488	483	478	472	467	461	457	451	445	440
7991424	8143821	8296213	435	430	424	419	413	408	403	397	392	387
9515157	9667501	9819840	152381	376	371	365	360	355	349	344	339	333
1038356	1190647	1342932	328	323	317	312	306	301	296	291	285	280
2561021	2713258	2865490	274	269	264	259	253	248	242	237	232	227
4083152	4235336	4387515	221	215	211	205	200	194	189	184	179	173
5604750	5756881	5909006	168	162	157	152	146	142	135	131	125	120
7125815	7277893	7429964	114	109	104	099	093	088	082	078	071	067
8646348	8798372	8950390	061	056	051	045	040	035	029	024	018	014
0166348	0318319	0470284	008	003	997	992	987	981	976	971	965	961
1685817	1837734	1989647	151954	950	944	939	934	928	923	917	913	907
3204754	3356618	3508477	901	897	891	885	881	875	870	864	859	854
4723160	4874971	5026777	849	843	838	833	827	822	817	811	806	801

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2860	4563660331	3812180	3964023	4115861	4267694	4419521	4571343
61	5178578	5330374	5482164	5633949	5785728	5937502	6089271
62	6696294	6848037	6999774	7151506	7303232	7454953	7606669
63	8213480	8365170	8516854	8668533	8820206	8971874	9123537
64	9730136	9881773	0033404	0185030	0336651	0488266	0639876
65	4571246263	1397847	1549425	1700998	1852566	2004128	2155685
66	2761861	2913391	3064917	3216437	3367952	3519461	3670965
67	4276929	4428407	4579880	4731347	4882809	5034266	5185717
68	5791469	5942895	6094315	6245729	6397138	6548542	6699941
69	7305482	7456855	7608222	7759583	7910940	8062291	8213637
2870	4578818967	8970287	9121601	9272910	9424214	9575512	9726805
71	4580331925	0483192	0634453	0785709	0936960	1088206	1239447
72	1844356	1995570	2146779	2297982	2449181	2600374	2751561
73	3356260	3507421	3658578	3809729	3960874	4112015	4263150
74	4867638	5018747	5169850	5320949	5472042	5623130	5774212
75	6378490	6529547	6680598	6831643	6982684	7133719	7284749
76	7888817	8039821	8190819	8341813	8492801	8643784	8794761
77	9398619	9549570	9700516	9851457	0002393	0153323	0304248
78	4590907896	1058795	1209688	1360577	1511460	1662338	1813211
79	2416649	2567495	2718336	2869172	3020003	3170829	3321649
2880	4593924878	4075672	4226461	4377244	4528022	4678796	4829564
81	5432583	5583325	5734061	5884792	6035518	6186239	6336955
82	6939765	7090454	7241138	7391817	7542491	7693160	7843823
83	8446424	8597061	8747693	8898320	9048941	9199557	9350169
84	9952560	0103145	0253725	0404300	0554869	0705433	0855992
85	4601458175	1608708	1759235	1909757	2060275	2210786	2361293
86	2963268	3113748	3264224	3414694	3565159	3715618	3866073
87	4467839	4618267	4768691	4919109	5069521	5219929	5370331
88	5971889	6122265	6272637	6423002	6573363	6723719	6874069
89	7475418	7625743	7776062	7926376	8076685	8226988	8377286
2890	4608978428	9128700	9278967	9429229	9579486	9729737	9879983
91	4610480917	0631137	0781352	0931562	1081767	1231966	1382161
92	1982886	2133055	2283218	2433376	2583529	2733676	2883819
93	3484336	3634453	3784564	3934670	4084771	4234867	4384958
94	4985268	5135332	5285392	5435446	5585495	5735539	5885578
95	6485681	6635693	6785701	6935703	7085701	7235693	7385680
96	7985575	8135536	8285492	8435443	8585388	8735328	8885263
97	9484952	9634861	9784765	9934664	0084558	0234446	0384330
98	4620983811	1133669	1283521	1433368	1583210	1733047	1882879
99	2482154	2631959	2781760	2931555	3081346	3231131	3380911
2900	4623979979	4129733	4279482	4429226	4578965	4728698	4878426
1	5477288	5626991	5776688	5926380	6076067	6225749	6375426
2	6974081	7123732	7273378	7423018	7572654	7722284	7871909
3	8470358	8619958	8769552	8919141	9068725	9218304	9367877
4	9966120	0115668	0265211	0414748	0564281	0713808	0863330
5	4631461367	1610864	1760355	1909841	2059322	2208798	2358268
6	2956100	3105545	3254984	3404419	3553849	3703273	3852692
7	4450318	4599711	4749100	4898483	5047861	5197234	5346602
8	5944022	6093364	6242701	6392033	6541360	6690681	6839998
9	7437212	7586503	7735789	7885070	8034345	8183615	8332880
2910	4638929890	9079129	9228364	9377593	9526817	9676036	9825250
11	4640422054	0571243	0720425	0869604	1018777	1167944	1317107
12	1913706	2062843	2211975	2361102	2510224	2659340	2808452
13	3404846	3553932	3703013	3852088	4001159	4150224	4299285
14	4895474	5044509	5193539	5342563	5491582	5640597	5789606
15	6385591	6534574	6683553	6832526	6981494	7130458	7279416
16	7875196	8024129	8173056	8321978	8470896	8619808	8768715
17	9364291	9513173	9662049	9810920	9959786	0108647	0257503
18	4650852876	1001706	1150531	1299351	1448166	1596976	1745781
19	2340950	2489729	2638504	2787273	2936037	3084796	3233550
2920	3828514	3977243	4125966	4274685	4423398	4572106	4720809

OF NUMBERS.

Logarithms 4563660331–4655166887.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4723160	4874971	5026777	151849	843	838	833	827	822	817	811	806	801
6241035	6392793	6544546	796	790	785	779	774	769	764	758	753	748
7758380	7910085	8061785	743	737	732	726	721	716	711	705	700	695
9275195	9426847	9578495	690	684	679	673	668	663	658	652	648	641
0791481	0943080	1094674	637	631	626	621	615	610	605	599	594	589
2307237	2458783	2610325	584	578	573	568	562	557	552	546	542	536
3822464	3973958	4125446	530	526	520	515	509	504	499	494	488	483
5337163	5488604	5640040	478	473	467	462	457	451	446	441	436	429
6851334	7002722	7154105	426	420	414	409	404	399	393	388	383	377
8364977	8516313	8667643	373	367	361	357	351	346	340	336	330	324
9878093	0029376	0180653	151320	314	309	304	298	293	288	283	277	272
1390682	1541912	1693136	267	261	256	251	246	241	235	230	224	220
2902744	3053921	3205093	214	209	203	199	193	187	183	177	172	167
4414280	4565404	4716524	161	157	151	145	141	135	130	124	120	114
5925290	6076362	6227429	109	103	099	093	088	082	078	072	067	061
7435774	7586794	7737808	057	051	045	041	035	030	025	020	014	009
8945733	9096701	9247662	004	998	994	988	983	977	972	968	961	957
0455168	0606083	0756992	150951	946	941	936	930	925	920	915	909	904
1964078	2114940	2265797	899	893	889	883	878	873	867	862	857	852
3472464	3623274	3774078	846	841	836	831	826	820	815	810	804	800
4980326	5131084	5281836	150794	789	783	778	774	768	762	758	752	747
6487665	6638370	6789070	742	736	731	726	721	716	710	705	700	695
7994481	8145134	8295781	689	684	679	674	669	663	658	653	647	643
9500774	9651375	9801970	637	632	627	621	616	612	605	601	595	590
1006545	1157094	1307637	585	580	575	569	564	559	553	549	543	538
2511795	2662291	2812782	533	527	522	518	511	507	502	496	491	486
4016522	4166966	4317405	480	476	470	465	459	455	449	444	439	434
5520729	5671121	5821507	428	424	418	412	408	402	398	392	386	382
7024414	7174754	7325089	376	372	365	361	356	350	345	340	335	329
8527579	8677867	8828150	325	319	314	309	303	298	293	288	283	278
0030225	0180460	0330691	150272	267	262	257	251	246	242	235	231	226
1532350	1682534	1832713	220	215	210	205	199	195	189	184	179	173
3033956	3184088	3334215	169	163	158	153	147	143	137	132	127	121
4535043	4685123	4835198	117	111	106	101	096	091	085	080	075	070
6035611	6185640	6335663	064	060	054	049	044	039	033	029	023	018
7535661	7685638	7835609	012	008	002	998	992	987	981	977	971	966
9035193	9185118	9335038	149961	956	951	945	940	935	930	925	920	914
0534208	0684081	0833949	909	904	899	894	888	884	878	873	868	862
2032705	2182526	2332343	858	852	847	842	837	832	826	821	817	811
3530686	3680455	3830220	805	801	795	791	785	780	775	769	765	759
5028150	5177868	5327580	149754	749	744	739	733	728	724	718	712	708
6525097	6674764	6824425	703	697	692	687	682	677	671	667	661	656
8021529	8171144	8320754	651	646	640	636	630	625	620	615	610	604
9517446	9667009	9816567	600	594	589	584	579	573	569	563	558	553
1012847	1162359	1311866	548	543	537	533	527	522	517	512	507	501
2507734	2657194	2806650	497	491	486	481	476	470	466	460	456	450
4002106	4151515	4300919	445	439	435	430	424	419	414	409	404	399
5495965	5645322	5794675	393	389	383	378	373	368	363	357	353	347
6989309	7138615	7287917	342	337	332	327	321	317	311	306	302	295
8482141	8631395	8780645	291	286	281	275	270	265	261	254	250	245
9974459	0123662	0272861	149239	235	229	224	219	214	209	203	199	193
1466265	1615417	1764564	189	182	179	173	167	163	158	152	147	142
2957558	3106659	3255755	137	132	127	122	116	112	106	101	096	091
4448340	4597390	4746435	086	081	075	071	065	061	055	050	045	039
5938610	6087609	6236602	035	030	024	019	015	009	004	999	993	989
7428638	7577316	7726259	148983	979	973	968	964	958	952	948	943	937
8917616	9066513	9215405	933	927	922	918	912	907	901	897	892	886
0406354	0555200	0704040	882	876	871	866	861	856	851	846	840	836
1894581	2043376	2192165	830	825	820	815	810	805	800	795	789	785
3382299	3531042	3679781	779	775	769	764	759	754	749	743	739	733
4869507	5018199	5166887	729	723	719	713	708	703	698	692	688	683

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2920	4653828514	3977243	4125966	4274685	4423398	4572106	4720809
21	5315570	5464247	5612920	5761587	5910249	6058906	6207559
22	6802116	6950743	7099364	7247981	7396592	7545198	7693799
23	8288154	8436729	8585300	8733866	8882426	9030982	9179532
24	9773683	9922208	0070728	0219243	0367752	0516257	0664757
25	4661258704	1407178	1555648	1704112	1852571	2001024	2149473
26	2743218	2891641	3040060	3188473	3336881	3485285	3633683
27	4227224	4375597	4523965	4672327	4820685	4969037	5117385
28	5710724	5859046	6007363	6155675	6303982	6452284	6600580
29	7193717	7341988	7490255	7638516	7786772	7935023	8083270
2930	4668676204	8824424	8972640	9120851	9269057	9417257	9565453
31	4670158184	0306355	0454520	0602680	0750835	0898985	1047130
32	1639660	1787779	1935894	2084004	2232108	2380208	2528302
33	3120630	3268699	3416763	3564822	3712876	3860926	4008970
34	4601095	4749114	4897128	5045136	5193140	5341138	5489132
35	6081056	6229024	6376987	6524946	6672899	6820847	6968790
36	7560512	7708430	7856343	8004251	8152154	8300052	8447945
37	9039465	9187333	9335195	9483053	9630905	9778753	9926595
38	4680517915	0665732	0813544	0961351	1109153	1256951	1404743
39	1995861	2143628	2291390	2439147	2586898	2734645	2882387
2940	4683473304	3621021	3768732	3916439	4064141	4211837	4359529
41	4950245	5097912	5245573	5393229	5540881	5688527	5836169
42	6426684	6574300	6721911	6869518	7017119	7164715	7312306
43	7902621	8050187	8197748	8345304	8492855	8640401	8787943
44	9378057	9525573	9673084	9820590	9968091	0115587	0263077
45	4690852991	1000457	1147918	1295374	1442825	1590271	1737712
46	2327425	2474841	2622252	2769658	2917058	3064454	3211845
47	3801358	3948724	4096085	4243441	4390792	4538138	4685479
48	5274792	5422108	5569419	5716724	5864025	6011321	6158612
49	6747726	6894991	7042252	7189508	7336759	7484005	7631246
2950	4698220160	8367376	8514587	8661793	8808994	8956190	9103381
51	9692095	9839261	9986422	0133578	0280729	0427876	0575017
52	4701163532	1310648	1457759	1604865	1751967	1899063	2046154
53	2634470	2781536	2928598	3075654	3222705	3369752	3516793
54	4104910	4251926	4398938	4545945	4692946	4839943	4986935
55	5574852	5721819	5868781	6015738	6162690	6309637	6456579
56	7044297	7191214	7338127	7485034	7631936	7778833	7925726
57	8513245	8660113	8806975	8953833	9100685	9247533	9394376
58	9981697	0128514	0275327	0422135	0568938	0715736	0862529
59	4711449652	1596420	1743183	1889941	2036695	2183443	2330186
2960	4712917111	3063829	3210543	3357252	3503955	3650654	3797348
61	4384074	4530743	4677407	4824066	4970720	5117370	5264014
62	5850542	5997161	6143776	6290386	6436990	6583590	6730185
63	7316515	7463085	7609650	7756210	7902765	8049316	8195861
64	8781993	8928514	9075029	9221540	9368046	9514547	9661043
65	4720246977	0393448	0539914	0686376	0832832	0979284	1125730
66	1711467	1857889	2004306	2150718	2297125	2443527	2589924
67	3175463	3321836	3468203	3614566	3760924	3907276	4053624
68	4638966	4785289	4931607	5077921	5224229	5370533	5516831
69	6101976	6248250	6394519	6540783	6687042	6833296	6979545
2970	4727564493	7710718	7856938	8003153	8149362	8295567	8441767
71	9026518	9172693	9318864	9465030	9611190	9757346	9903497
72	4730488051	0634177	0780298	0926415	1072526	1218633	1364735
73	1949092	2095169	2241241	2387309	2533371	2679428	2825481
74	3409642	3555670	3701693	3847711	3993724	4139733	4285736
75	4869701	5015680	5161654	5307623	5453587	5599546	5745500
76	6329269	6475199	6621124	6767044	6912959	7058869	7204774
77	7788346	7934227	8080103	8225974	8371840	8517702	8663558
78	9246934	9392766	9538593	9684415	9830232	9976044	0121852
79	4740705032	0850815	0996593	1142366	1288134	1433898	1579656
2980	2162641	2308375	2454104	2599828	2745547	2891262	3036971

OF NUMBERS.

Logarithms 4653828514-4743474070.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4869507	5018199	5166887	148729	723	719	713	708	703	698	692	688	683
6356206	6504847	6653484	677	673	667	662	657	653	647	641	637	632
7842396	7990987	8139573	627	621	617	611	606	601	597	591	586	581
9328077	9476618	9625153	575	571	566	560	556	550	545	541	535	530
0813251	0961741	1110225	525	520	515	509	505	500	494	490	484	479
2297917	2446356	2594789	474	470	464	459	453	449	444	439	433	429
3782076	3930464	4078847	423	419	413	408	404	398	393	388	383	377
5265727	5414064	5562397	373	368	362	358	352	348	342	337	333	327
6748872	6897159	7045440	322	317	312	307	302	296	292	287	281	277
8231511	8379747	8527978	271	267	261	256	251	247	241	236	231	226
9713643	9861829	0010009	148220	216	211	206	200	196	190	186	180	175
1195270	1343405	1491535	171	165	160	155	150	145	140	135	130	125
2676392	2824476	2972556	119	115	110	104	100	094	090	084	080	074
4157008	4305042	4453071	069	064	059	054	050	044	038	034	029	024
5637121	5785104	5933082	019	014	008	004	998	994	989	983	978	974
7116728	7264661	7412589	147968	963	959	953	948	943	938	933	928	923
8595832	8743715	8891593	918	913	908	903	898	893	887	883	878	872
0074433	0222265	0370092	868	862	858	852	848	842	838	832	827	823
1552530	1700312	1848089	817	812	807	802	798	792	787	782	777	772
3030124	3177856	3325582	767	762	757	751	747	742	737	732	726	722
4507216	4654897	4802574	147717	711	707	702	696	692	687	681	677	671
5983805	6131436	6279063	667	661	656	652	646	642	636	631	627	621
7459893	7607474	7755050	616	611	607	601	596	591	587	581	576	571
8935479	9083010	9230536	566	561	556	551	546	542	536	531	526	521
0410563	0558044	0705520	516	511	506	501	496	490	486	481	476	471
1885147	2032578	2180004	466	461	456	451	446	441	435	431	426	421
3359231	3506612	3653988	416	411	406	400	396	391	386	381	376	370
4832814	4980145	5127471	366	361	356	351	346	341	335	331	326	321
6305898	6453179	6600455	316	311	305	301	296	291	286	281	276	271
7778482	7925713	8072939	265	261	256	251	246	241	236	231	226	221
9250567	9397748	9544924	147216	211	206	201	196	191	186	181	176	171
0722153	0869284	1016410	166	161	156	151	147	141	136	131	126	122
2193241	2340322	2487398	116	111	106	102	096	091	087	081	076	072
3663830	3810862	3957888	066	062	056	051	047	041	037	032	026	022
5133922	5280903	5427880	016	012	007	001	997	992	987	981	977	972
6603516	6750448	6897375	146967	962	957	952	947	942	937	932	927	922
8072613	8219495	8366373	917	913	907	902	897	893	887	882	878	872
9541213	9688046	9834874	868	862	858	852	848	843	837	833	828	823
1009317	1156100	1302878	817	813	808	803	798	793	788	783	778	774
2476925	2623658	2770387	768	763	758	754	748	743	739	733	729	724
3944037	4090721	4237400	146718	714	709	703	699	694	689	684	679	674
5410653	5557288	5703917	669	664	659	654	650	644	639	635	629	625
6876775	7023360	7169940	619	615	610	604	600	595	590	585	580	575
8342402	8488937	8635468	570	565	560	555	551	545	541	535	531	525
9807534	9954020	0100501	521	515	511	506	501	496	491	486	481	476
1272172	1418608	1565040	471	466	462	456	452	446	442	436	432	427
2736316	2882703	3029086	422	417	412	407	402	397	392	387	383	377
4199967	4346305	4492638	373	367	363	358	352	348	343	338	333	328
5663125	5809413	5955697	323	318	314	308	304	298	294	288	284	279
7125790	7272029	7418264	274	269	264	259	254	249	245	239	235	229
8587962	8734152	8880338	146225	220	215	209	205	200	195	190	186	180
0049643	0195784	0341920	175	171	166	160	156	151	146	141	136	131
1510831	1656923	1803010	126	121	117	111	107	102	096	092	087	082
2971528	3117571	3263609	077	072	068	062	057	053	047	043	038	033
4431735	4577728	4723717	028	023	018	013	009	003	999	993	989	984
5891450	6037394	6183334	145979	974	969	964	959	954	950	944	940	935
7350675	7496570	7642461	930	925	920	915	910	905	901	895	891	885
8809409	8955256	9101097	881	876	871	866	862	856	851	847	841	837
0267654	0413452	0559244	832	827	822	817	812	808	802	798	792	788
1725410	1871158	2016902	783	778	773	768	764	758	754	748	744	739
3182676	3328376	3474070	734	729	724	719	715	709	705	700	694	690

Numbers 29800–30409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
2980	4742162641	2308375	2454104	2599828	2745547	2891262	3036971
81	3619760	3765445	3911126	4056801	4202471	4348137	4493797
82	5076391	5222027	5367659	5513285	5658907	5804523	5950135
83	6532534	6678121	6823704	6969281	7114854	7260422	7405985
84	7988188	8133727	8279260	8424789	8570313	8715832	8861347
85	9443355	9588845	9734329	9879810	0025285	0170755	0316221
86	4750898034	1043475	1188911	1334343	1479769	1625191	1770608
87	2352226	2497618	2643006	2788389	2933767	3079140	3224508
88	3805931	3951275	4096614	4241948	4387277	4532602	4677921
89	5259150	5404446	5549736	5695021	5840302	5985578	6130848
2990	4756711883	6857130	7002372	7147608	7292840	7438067	7583290
91	8164130	8309328	8454521	8599710	8744893	8890072	9035246
92	9615892	9761041	9906186	0051326	0196461	0341591	0486716
93	4761067168	1212269	1357366	1502457	1647543	1792625	1937702
94	2517960	2663013	2808060	2953103	3098141	3243174	3388202
95	3968267	4113271	4258271	4403265	4548255	4693239	4838219
96	5418090	5563046	5707997	5852943	5997884	6142820	6287752
97	6867429	7012337	7157239	7302137	7447030	7591918	7736801
98	8316285	8461144	8605998	8750848	8895692	9040532	9185367
99	9764658	9909468	0054274	0199075	0343871	0488663	0633449
3000	4771212547	1357310	1502067	1646820	1791568	1936311	2081049
1	2659954	2804668	2949378	3094082	3238782	3383477	3528167
2	4106879	4251545	4396206	4540863	4685514	4830161	4974803
3	5553322	5697940	5842553	5987161	6131764	6276363	6420957
4	6999283	7143853	7288418	7432978	7577533	7722083	7866629
5	8444763	8589285	8733802	8878314	9022821	9167323	9311821
6	9889763	0034236	0178705	0323169	0467628	0612082	0756531
7	4781334281	1478706	1623127	1767543	1911954	2056360	2200762
8	2778319	2922697	3067069	3211437	3355800	3500158	3644512
9	4221877	4366207	4510531	4654851	4799166	4943477	5087782
3010	4785664956	5809237	5953514	6097786	6242053	6386315	6530573
11	7107555	7251789	7396017	7540241	7684461	7828675	7972885
12	8549675	8693861	8838042	8982218	9126389	9270556	9414718
13	9991317	0135455	0279588	0423716	0567839	0711958	0856072
14	4791432480	1576570	1720655	1864735	2008811	2152882	2296948
15	2873165	3017207	3161244	3305277	3449305	3593328	3737346
16	4313372	4457366	4601356	4745341	4889321	5033297	5177267
17	5753102	5897048	6040990	6184928	6328860	6472788	6616711
18	7192354	7336253	7480148	7624037	7767922	7911802	8055677
19	8631130	8774982	8918828	9062670	9206507	9350339	9494167
3020	4800069430	0213233	0357032	0500827	0644616	0788401	0932181
21	1507253	1651009	1794760	1938507	2082249	2225986	2369718
22	2944600	3088309	3232012	3375711	3519406	3663095	3806780
23	4381472	4525133	4668789	4812441	4956087	5099729	5243367
24	5817868	5961482	6105091	6248695	6392294	6535888	6679478
25	7253790	7397356	7540917	7684474	7828026	7971573	8115115
26	8689237	8832755	8976269	9119778	9263283	9406782	9550277
27	4810124210	0267681	0411147	0554609	0698066	0841518	0984966
28	1558708	1702132	1845551	1988966	2132375	2275780	2419180
29	2992733	3136110	3279482	3422849	3566211	3709568	3852921
3030	4814426285	4569614	4712939	4856258	4999573	5142883	5286189
31	5859364	6002646	6145923	6289195	6432463	6575726	6718984
32	7291970	7435204	7578434	7721659	7864880	8008095	8151306
33	8724103	8867290	9010473	9153651	9296824	9439993	9583157
34	4820155765	0298905	0442040	0585171	0728297	0871418	1014535
35	1586954	1730047	1873135	2016219	2159298	2302372	2445442
36	3017672	3160718	3303759	3446796	3589828	3732855	3875877
37	4447919	4590918	4733912	4876901	5019886	5162866	5305841
38	5877695	6020647	6163594	6306536	6449474	6592407	6735335
39	7307001	7449905	7592805	7735701	7878591	8021477	8164358
3040	8735836	8878694	9021547	9164395	9307239	9450077	9592912

OF NUMBERS.

Logarithms 4742162641–4830021386.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3182676	3328376	3474070	145734	729	724	719	715	709	705	700	694	690
4639453	4785104	4930750	685	681	675	670	666	660	656	651	646	641
6095742	6241344	6386941	636	632	626	622	616	612	607	602	597	593
7551543	7697096	7842645	587	583	577	573	568	563	558	553	549	543
9006856	9152360	9297860	539	533	529	524	519	515	509	504	500	495
0461681	0607137	0752588	490	484	481	475	470	466	460	456	451	446
1916020	2061427	2206829	441	436	432	426	422	417	412	407	402	397
3369871	3515229	3660583	392	388	383	378	373	368	363	358	354	348
4823236	4968545	5113850	344	339	334	329	325	319	315	309	305	300
6276114	6421376	6566632	296	290	285	281	276	270	266	262	256	251
7728507	7873720	8018927	145247	242	236	232	227	223	217	213	207	203
9180414	9325578	9470738	198	193	189	183	179	174	168	164	160	154
0631836	0776952	0922063	149	145	140	135	130	125	120	116	111	105
2082773	2227841	2372903	101	097	091	086	082	077	071	068	062	057
3533226	3678245	3823258	053	047	043	038	033	028	024	019	013	009
4983194	5128164	5273130	004	000	994	990	984	980	975	970	966	960
6432678	6577600	6722517	144956	951	946	941	936	932	926	922	917	912
7881679	8026553	8171421	908	902	898	893	888	883	878	874	868	864
9330197	9475022	9619842	859	854	850	844	840	835	830	825	820	816
0778231	0923008	1067780	810	806	801	796	792	786	782	777	772	767
2225783	2370511	2515235	144763	757	753	748	743	738	734	728	724	719
3672852	3817533	3962208	714	710	704	700	695	690	685	681	675	671
5119440	5264072	5408699	666	661	657	651	647	642	637	632	627	623
6565545	6710130	6854709	618	613	608	603	599	594	588	585	579	574
8011170	8155706	8300237	570	565	560	555	550	546	541	536	531	526
9456313	9600801	9745284	522	517	512	507	502	498	492	488	483	479
0900976	1045416	1189851	473	469	464	459	454	449	445	440	435	430
2345158	2489550	2633937	425	421	416	411	406	402	396	392	387	382
3788860	3933204	4077543	378	372	368	363	358	354	348	344	339	334
5232083	5376379	5520670	330	324	320	315	311	305	301	296	291	286
6674826	6819074	6963317	144281	277	272	267	262	258	253	248	243	238
8117090	8261290	8405485	234	228	224	220	214	210	205	200	195	190
9558875	9703027	9847174	186	181	176	171	167	162	157	152	147	143
1000181	1144285	1288385	138	133	128	123	119	114	109	104	100	095
2441009	2585066	2729118	090	085	080	076	071	066	061	057	052	047
3881360	4025369	4169373	042	037	033	028	023	018	014	009	004	999
5321233	5465194	5609150	143994	990	985	980	976	970	966	961	956	952
6760629	6904542	7048451	946	942	938	932	928	923	918	913	909	903
8199548	8343413	8487274	899	895	889	885	880	875	871	865	861	856
9637990	9781808	9925621	852	846	842	837	832	828	823	818	813	809
1075956	1219726	1363492	143803	799	795	789	785	780	775	770	766	761
2513446	2657169	2800887	756	751	747	742	737	732	728	723	718	713
3950460	4094135	4237806	709	703	699	695	689	685	680	675	671	666
5386999	5530627	5674250	661	656	652	646	642	638	632	628	623	618
6823063	6966644	7110219	614	609	604	599	594	590	585	581	575	571
8258653	8402185	8545714	566	561	557	552	547	542	538	532	529	523
9693768	9837253	9980734	518	514	509	505	499	495	491	485	481	476
1128408	1271846	1415280	471	466	462	457	452	448	442	438	434	428
2562576	2705966	2849352	424	419	415	409	405	400	396	390	386	381
3996269	4139613	4282951	377	372	367	362	357	353	348	344	338	334
5429490	5572786	5716077	143329	325	319	315	310	306	301	296	291	287
6862237	7005486	7148730	282	277	272	268	263	258	253	249	244	240
8294513	8437714	8580911	234	230	225	221	215	211	207	201	197	192
9726316	9869470	0012620	187	183	178	173	169	164	159	154	150	145
1157647	1300754	1443856	140	135	131	126	121	117	112	107	102	098
2588506	2731566	2874622	093	088	084	079	074	070	064	060	056	050
4018895	4161907	4304916	046	041	037	032	027	022	018	012	009	003
5448812	5591778	5734739	142999	994	989	985	980	975	971	966	961	956
6878259	7021177	7164091	952	947	942	938	933	928	924	918	914	910
8307235	8450107	8592974	904	900	896	890	886	881	877	872	867	862
9735741	9878566	0021386	858	853	848	844	838	835	829	825	820	815

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3040	4828735836	8878694	9021547	9164395	9307239	9450077	9592912
41	4830164201	0307012	0449818	0592619	0735416	0878208	1020995
42	1592097	1734861	1877620	2020374	2163124	2305869	2448609
43	3019524	3162240	3304953	3447660	3590363	3733061	3875754
44	4446481	4589151	4731816	4874477	5017133	5159784	5302430
45	5872970	6015593	6158211	6300825	6443434	6586038	6728638
46	7298990	7441566	7584138	7726705	7869267	8011825	8154377
47	8724542	8867072	9009597	9152117	9294632	9437143	9579649
48	4840149627	0292109	0434587	0577061	0719530	0861994	1004453
49	1574244	1716680	1859111	2001538	2143960	2286377	2428790
3050	4842998393	3140783	3283168	3425547	3567923	3710293	3852659
51	4422076	4564419	4706757	4849090	4991419	5133743	5276062
52	5845293	5987589	6129880	6272167	6414449	6556726	6698999
53	7268043	7410292	7552537	7694777	7837013	7979243	8121469
54	8690327	8832530	8974728	9116922	9259110	9401295	9543474
55	4850112146	0254302	0396454	0538601	0680743	0822881	0965014
56	1533499	1675609	1817714	1959814	2101910	2244001	2386088
57	2954387	3096451	3238509	3380563	3522612	3664657	3806697
58	4374811	4516828	4658840	4800847	4942850	5084848	5226842
59	5794770	5936740	6078706	6220667	6362624	6504575	6646523
3060	4857214265	7356189	7498108	7640023	7781933	7923838	8065739
61	8633296	8775174	8917047	9058915	9200779	9342638	9484492
62	4860051864	0193695	0335522	0477344	0619161	0760974	0902782
63	1469968	1611753	1753533	1895309	2037080	2178847	2320609
64	2887610	3029348	3171082	3312812	3454537	3596257	3737972
65	4304789	4446481	4588169	4729852	4871531	5013205	5154874
66	5721505	5863151	6004793	6146430	6288062	6429690	6571313
67	7137760	7279360	7420955	7562546	7704132	7845714	7987291
68	8553553	8695107	8836656	8978201	9119741	9261276	9402807
69	9968884	0110392	0251895	0393394	0534888	0676377	0817862
3070	4871383755	1525216	1666674	1808126	1949574	2091017	2232456
71	2798164	2939580	3080991	3222398	3363799	3505197	3646589
72	4212114	4353483	4494848	4636209	4777564	4918916	5060262
73	5625603	5766926	5908245	6049560	6190869	6332175	6473475
74	7038632	7179909	7321182	7462451	7603715	7744974	7886228
75	8451201	8592433	8733660	8874882	9016100	9157314	9298522
76	9863311	0004497	0145678	0286855	0428027	0569194	0710357
77	4881274962	1416102	1557238	1698368	1839494	1980616	2121733
78	2686155	2827249	2968338	3109423	3250504	3391579	3532650
79	4096889	4237937	4378981	4520020	4661054	4802084	4943110
3080	4885507165	5648167	5789165	5930159	6071147	6212131	6353111
81	6916983	7057940	7198892	7339839	7480782	7621721	7762654
82	8326344	8467255	8608161	8749063	8889960	9030853	9171741
83	9735247	9876112	0016973	0157829	0298681	0439528	0580370
84	4891143694	1284513	1425328	1566139	1706945	1847746	1988543
85	2551684	2692458	2833227	2973992	3114752	3255508	3396259
86	3959217	4099946	4240669	4381388	4522103	4662813	4803519
87	5366295	5506978	5647656	5788329	5928998	6069663	6210323
88	6772917	6913554	7054186	7194814	7335438	7476057	7616671
89	8179083	8319675	8460262	8600844	8741422	8881996	9022564
3090	4899584794	9725340	9865882	0006419	0146951	0287479	0428003
91	4900990051	1130551	1271047	1411539	1552026	1692508	1832986
92	2394852	2535308	2675758	2816204	2956646	3097083	3237515
93	3799200	3939610	4080015	4220416	4360812	4501204	4641591
94	5203094	5343458	5483818	5624173	5764524	5904870	6045212
95	6606534	6746853	6887167	7027477	7167783	7308083	7448380
96	8009520	8149794	8290063	8430328	8570588	8710843	8851095
97	9412054	9552282	9692506	9832725	9972940	0113150	0253356
98	4910814134	0954317	1094496	1234670	1374840	1515005	1655165
99	2215762	2355900	2496034	2636163	2776287	2916407	3056522
3100	3616938	3757032	3897119	4037203	4177282	4317357	4457427

OF NUMBERS.

Logarithms 4828735836-4914877610.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9735741	9878566	0021386	142858	853	848	844	838	835	829	825	820	815
1163778	1306556	1449329	811	806	801	797	792	787	783	778	773	768
2591345	2734076	2876802	764	759	754	750	745	740	736	731	726	722
4018443	4161127	4303806	716	713	707	703	698	693	689	684	679	675
5445072	5587709	5730342	670	665	661	656	651	646	642	637	633	628
6871233	7013823	7156409	623	618	614	609	604	600	595	590	586	581
8296926	8439469	8582008	576	572	567	562	558	552	549	543	539	534
9722150	9864647	0007139	530	525	520	515	511	506	501	497	492	488
1146908	1289358	1431803	482	478	474	469	464	459	455	450	445	441
2571198	2713601	2856000	436	431	427	422	417	413	408	403	399	393
3995021	4137377	4279729	142390	385	379	376	370	366	362	356	352	347
5418377	5560687	5702992	343	338	333	329	324	319	315	310	305	301
6841267	6983530	7125789	296	291	287	282	277	273	268	263	259	254
8263691	8405908	8548120	249	245	240	236	230	226	222	217	212	207
9685649	9827819	9969985	203	198	194	188	185	179	175	170	166	161
1107142	1249266	1391385	156	152	147	142	138	133	128	124	119	114
2528170	2670247	2812319	110	105	100	096	091	087	082	077	072	068
3948732	4090763	4232789	064	058	054	049	045	040	035	031	026	022
5368831	5510815	5652795	017	012	007	003	998	994	989	984	980	975
6788465	6930403	7072336	141970	966	961	957	951	948	942	938	933	929
8207635	8349527	8491414	141924	919	915	910	905	901	896	892	887	882
9626342	9768187	9910028	878	873	868	864	859	854	850	845	841	836
1044585	1186384	1328178	831	827	822	817	813	808	803	799	794	790
2462366	2604118	2745866	785	780	776	771	767	762	757	752	748	744
3879683	4021390	4163091	738	734	730	725	720	715	711	707	701	698
5296539	5438199	5579854	692	688	683	679	674	669	665	660	655	651
6712932	6854546	6996155	646	642	637	632	628	623	619	614	609	605
8128863	8270431	8411994	600	595	591	586	582	577	572	568	563	559
9544333	9685855	9827372	554	549	545	540	535	531	526	522	517	512
0959342	1100818	1242288	508	503	499	494	489	485	480	476	470	467
2373890	2515319	2656744	141461	458	452	448	443	439	434	429	425	420
3787977	3929361	4070739	416	411	407	401	398	392	388	384	378	375
5201604	5342941	5484274	369	365	361	355	352	346	342	337	333	329
6614771	6756063	6897349	323	319	315	309	306	300	296	292	286	283
8027479	8168724	8309965	277	273	269	264	259	254	251	245	241	236
9439726	9580926	9722121	232	227	222	218	214	208	204	200	195	190
0851515	0992669	1133818	186	181	177	172	167	163	158	154	149	144
2262845	2403953	2545056	140	136	130	126	122	117	112	108	103	099
3673717	3814779	3955836	094	089	085	081	075	071	067	062	057	053
5084130	5225146	5366158	048	044	039	034	030	026	020	016	012	007
6494086	6635056	6776022	141002	998	994	988	984	980	975	970	966	961
7903584	8044508	8185428	140957	952	947	943	939	933	930	924	920	916
9312624	9453503	9594377	911	906	902	897	893	888	883	879	874	870
0721208	0862041	1002870	865	861	856	852	847	842	838	833	829	824
2129335	2270122	2410905	819	815	811	806	801	797	792	787	783	779
3537005	3677747	3818484	774	769	765	760	756	751	746	742	737	733
4944219	5084916	5225608	729	723	719	715	710	706	700	697	692	687
6350978	6491629	6632275	683	678	673	669	665	660	655	651	646	642
7757281	7897886	8038487	637	632	628	624	619	614	610	605	601	596
9163129	9303688	9444244	592	587	582	578	574	568	565	559	556	550
0568521	0709036	0849545	140546	542	537	532	528	524	518	515	509	506
1973460	2113928	2254393	500	496	492	487	482	478	474	468	465	459
3377943	3518367	3658786	456	450	446	442	437	432	428	424	419	414
4781973	4922351	5062725	410	405	401	396	392	387	382	378	374	369
6185549	6325882	6466210	364	360	355	351	346	342	337	333	328	324
7588672	7728959	7869242	319	314	310	306	300	297	292	287	283	278
8991341	9131583	9271821	274	269	265	260	255	252	246	242	238	233
0393558	0533754	0673947	228	224	219	215	210	206	202	196	193	187
1795321	1935473	2075620	183	179	174	170	165	160	156	152	147	142
3196633	3336739	3476841	138	134	129	124	120	115	111	106	102	097
4597493	4737554	4877610	094	087	084	079	075	070	066	061	056	052

Numbers 31000-31609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3100	4913616938	3757032	3897119	4037203	4177282	4317357	4457427
1	5017662	5157710	5297753	5437792	5577826	5717855	5857880
2	6417935	6557937	6697935	6837928	6977917	7117902	7257882
3	7817756	7957713	8097666	8237614	8377558	8517497	8657432
4	9217126	9357038	9496946	9636849	9776748	9916642	0056531
5	4920616045	0755912	0895775	1035633	1175487	1315336	1455180
6	2014514	2154336	2294154	2433967	2573775	2713579	2853379
7	3412533	3552310	3692082	3831850	3971614	4111373	4251128
8	4810101	4949833	5089561	5229284	5369003	5508717	5648427
9	6207220	6346908	6486590	6626269	6765942	6905611	7045276
3110	4927603890	7743533	7883170	8022804	8162432	8302057	8441677
11	9000111	9139708	9279301	9418890	9558474	9698053	9837628
12	4930395883	0535436	0674984	0814527	0954066	1093601	1233131
13	1791207	1930715	2070218	2209717	2349211	2488701	2628186
14	3186082	3325545	3465004	3604458	3743907	3883352	4022793
15	4580510	4719928	4859342	4998751	5138156	5277556	5416952
16	5974490	6113863	6253232	6392597	6531957	6671312	6810663
17	7368023	7507351	7646676	7785995	7925311	8064622	8203928
18	8761109	8900393	9039672	9178947	9318218	9457484	9596746
19	4940153748	0292987	0432222	0571452	0710678	0849900	0989117
3120	4941545940	1685135	1824325	1963511	2102692	2241869	2381042
21	2937687	3076837	3215982	3355124	3494260	3633393	3772521
22	4328987	4468093	4607194	4746291	4885383	5024470	5163554
23	5719842	5858903	5997960	6137012	6276060	6415103	6554142
24	7110252	7249269	7388281	7527288	7666291	7805290	7944284
25	8500217	8639189	8778156	8917119	9056078	9195032	9333982
26	9889737	0028664	0167587	0306506	0445420	0584330	0723236
27	4951278812	1417696	1556574	1695448	1834318	1973184	2112045
28	2667444	2806283	2945117	3083947	3222772	3361593	3500410
29	4055631	4194426	4333216	4472001	4610782	4749559	4888331
3130	4955443375	5582125	5720871	5859612	5998349	6137081	6275809
31	6830676	6969382	7108083	7246780	7385472	7524160	7662844
32	8217534	8356195	8494852	8633505	8772153	8910797	9049436
33	9603949	9742566	9881179	0019787	0158391	0296990	0435585
34	4960989921	1128494	1267063	1405627	1544187	1682742	1821293
35	2375452	2513980	2652505	2791025	2929540	3068051	3206558
36	3760540	3899025	4037505	4175981	4314452	4452919	4591381
37	5145187	5283627	5422063	5560495	5698922	5837345	5975763
38	6529393	6667789	6806181	6944568	7082951	7221330	7359704
39	7913157	8051509	8189857	8328200	8466539	8604874	8743204
3140	4969296481	9434789	9573093	9711392	9849687	9987977	0126264
41	4970679364	0817628	0955888	1094143	1232394	1370641	1508883
42	2061807	2200027	2338243	2476454	2614661	2752864	2891062
43	3443810	3581986	3720158	3858325	3996488	4134647	4272801
44	4825374	4963506	5101634	5239757	5377876	5515991	5654101
45	6206498	6344586	6482670	6620749	6758825	6896895	7034962
46	7587183	7725227	7863267	8001303	8139334	8277361	8415383
47	8967429	9105430	9243426	9381417	9519405	9657388	9795366
48	4980347237	0485194	0623146	0761094	0899037	1036976	1174911
49	1726606	1864519	2002428	2140332	2278232	2416127	2554018
3150	4983105538	3243407	3381272	3519132	3656988	3794840	3932687
51	4484032	4621857	4759678	4897495	5035307	5173115	5310918
52	5862088	5999870	6137647	6275420	6413188	6550952	6688712
53	7239707	7377445	7515179	7652908	7790633	7928353	8066069
54	8616890	8754584	8892274	9029960	9167641	9305317	9442990
55	9993636	0131286	0268933	0406574	0544212	0681845	0819474
56	4991369945	1507552	1645155	1782753	1920347	2057937	2195522
57	2745819	2883382	3020941	3158496	3296046	3433592	3571134
58	4121257	4258777	4396292	4533803	4671310	4808812	4946310
59	5496259	5633735	5771207	5908675	6046138	6183597	6321052
3160	6870826	7008259	7145687	7283112	7420531	7557947	7695358

OF NUMBERS. Logarithms 4913616938-4998107565.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4597493	4737554	4877610	140094	087	084	079	075	070	066	061	056	052
5997900	6137916	6277928	048	043	039	034	029	025	020	016	012	007
7397857	7537828	7677794	002	998	993	989	985	980	975	971	966	962
8797362	8937288	9077209	139957	953	948	944	939	935	930	926	921	917
0196417	0336297	0476173	912	908	903	899	894	889	886	880	876	872
1595021	1734856	1874687	867	863	858	854	849	844	841	835	831	827
2993174	3132965	3272751	822	818	813	808	804	800	795	791	786	782
4390878	4530624	4670365	777	772	768	764	759	755	750	746	741	736
5788132	5927833	6067529	732	728	723	719	714	710	705	701	696	691
7184936	7324592	7464243	688	682	679	673	669	665	660	656	651	647
8581292	8720903	8860509	139643	637	634	628	625	620	615	611	606	602
9977199	0116765	0256326	597	593	589	584	579	575	571	566	561	557
1372657	1512178	1651695	553	548	543	539	535	530	526	521	517	512
2767667	2907143	3046615	508	503	499	494	490	485	481	476	472	467
4162229	4301660	4441087	463	459	454	449	445	441	436	431	427	423
5556343	5695730	5835112	418	414	409	405	400	396	391	387	382	378
6950010	7089352	7228690	373	369	365	360	355	351	347	342	338	333
8343230	8482527	8621820	328	325	319	316	311	306	302	297	293	289
9736003	9875255	0014504	284	279	275	271	266	262	257	252	249	244
1128329	1267537	1406741	239	235	230	226	222	217	212	208	204	199
2520210	2659373	2798532	139195	190	186	181	177	173	168	163	159	155
3911644	4050763	4189877	150	145	142	136	133	128	123	119	114	110
5302633	5441707	5580777	106	101	097	092	087	084	079	074	070	065
6693176	6832206	6971231	061	057	052	048	043	039	034	030	025	021
8083274	8222259	8361240	017	012	007	003	999	994	990	985	981	977
9472928	9611868	9750805	138972	967	963	959	954	950	946	940	937	932
0862136	1001033	1139925	927	923	919	914	910	906	900	897	892	887
2250901	2389753	2528601	884	878	874	870	866	861	856	852	848	843
3639222	3778029	3916833	839	834	830	825	821	817	812	807	804	798
5027099	5165862	5304621	795	790	785	781	777	772	768	763	759	754
6414532	6553251	6691966	138750	746	741	737	732	728	723	719	715	710
7801523	7940198	8078868	706	701	697	692	688	684	679	675	670	666
9188071	9326701	9465327	661	657	653	648	644	639	635	630	626	622
0574176	0712762	0851344	617	613	608	604	599	595	591	586	582	577
1959839	2098381	2236919	573	569	564	560	555	551	546	542	538	533
3345060	3483558	3622051	528	525	520	515	511	507	502	498	493	489
4729839	4868293	5006742	485	480	476	471	467	462	458	454	449	445
6114177	6252587	6390992	440	436	432	427	423	418	414	410	405	401
7498074	7636439	7774800	396	392	387	383	379	374	370	365	361	357
8881530	9019851	9158168	352	348	343	339	335	330	326	321	317	313
0264545	0402823	0541095	138308	304	299	295	290	287	281	278	272	269
1647120	1785354	1923583	264	260	255	251	247	242	237	234	229	224
3029255	3167445	3305630	220	216	211	207	203	198	193	190	185	180
4410951	4549096	4687237	176	172	167	163	159	154	150	145	141	137
5792207	5930308	6068405	132	128	123	119	115	110	106	101	097	093
7173023	7311081	7449134	088	084	079	076	070	067	061	058	053	049
8553401	8691415	8829424	044	040	036	031	027	022	018	014	009	005
9933341	0071310	0209276	001	996	991	988	983	978	975	969	966	961
1312842	1450768	1588689	137957	952	948	943	939	935	931	926	921	917
2691904	2829787	2967664	913	909	904	900	895	891	886	883	877	874
4070530	4208368	4346202	137869	865	860	856	852	847	843	838	834	830
5448717	5586512	5724302	825	821	817	812	808	803	799	795	790	786
6826468	6964219	7101965	782	777	773	768	764	760	756	751	746	742
8203781	8341488	8479191	738	734	729	725	720	716	712	707	703	699
9580658	9718322	9855981	694	690	686	681	676	673	668	664	659	655
0957098	1094718	1232334	650	647	641	638	633	629	624	620	616	611
2333103	2470679	2608251	607	603	598	594	590	585	581	576	572	568
3708671	3846204	3983733	563	559	555	550	546	542	537	533	529	524
5083804	5221293	5358778	520	515	511	507	502	498	494	489	485	481
6458502	6595948	6733389	476	472	468	463	459	455	450	446	441	437
7832764	7970167	8107565	433	428	425	419	416	411	406	403	398	393

Numbers 31600-32209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3160	4996870826	7008259	7145687	7283112	7420531	7557947	7695358
61	8244958	8382348	8519733	8657113	8794490	8931861	9069229
62	9618656	9756002	9893343	0030681	0168013	0305342	0442666
63	5000991919	1129222	1266520	1403813	1541103	1678388	1815669
64	2364748	2502007	2639262	2776512	2913758	3051000	3188237
65	3737144	3874359	4011571	4148778	4285980	4423179	4560373
66	5109105	5246278	5383446	5520609	5657769	5794924	5932074
67	6480634	6617763	6754887	6892008	7029124	7166236	7303343
68	7851729	7988815	8125896	8262973	8400046	8537115	8674179
69	9222392	9359434	9496473	9633506	9770536	9907561	0044582
3170	5010592622	0729621	0866616	1003607	1140593	1277575	1414553
71	1962420	2099376	2236328	2373275	2510219	2647157	2784092
72	3331786	3468699	3605608	3742512	3879412	4016308	4153199
73	4700721	4837591	4974456	5111317	5248174	5385026	5521875
74	6069224	6206051	6342873	6479691	6616505	6753314	6890119
75	7437296	7574080	7710859	7847634	7984404	8121171	8257933
76	8804938	8941678	9078414	9215146	9351873	9488597	9625316
77	5020172148	0308846	0445539	0582228	0718912	0855592	0992268
78	1538929	1675583	1812233	1948879	2085520	2222158	2358791
79	2905279	3041891	3178498	3315100	3451699	3588293	3724883
3180	5024271200	4407768	4544332	4680892	4817448	4953999	5090546
81	5636691	5773217	5909738	6046255	6182767	6319276	6455780
82	7001753	7138236	7274714	7411188	7547658	7684123	7820584
83	8366386	8502826	8639261	8775693	8912119	9048542	9184960
84	9730591	9866988	0003380	0139768	0276152	0412532	0548908
85	5031094367	1230721	1367071	1503416	1639757	1776094	1912427
86	2457715	2594026	2730333	2866636	3002934	3139228	3275518
87	3820635	3956903	4093167	4229427	4365683	4501934	4638182
88	5183127	5319353	5455574	5591792	5728005	5864213	6000418
89	6545192	6681375	6817554	6953729	7089899	7226065	7362227
3190	5037906831	8042971	8179107	8315239	8451366	8587490	8723609
91	9268042	9404140	9540233	9676322	9812407	9948488	0084564
92	5040628827	0764882	0900933	1036979	1173021	1309059	1445093
93	1989185	2125198	2261206	2397210	2533210	2669205	2805196
94	3349118	3485088	3621053	3757015	3892972	4028925	4164873
95	4708625	4844552	4980475	5116394	5252309	5388219	5524125
96	6067706	6203591	6339472	6475348	6611220	6747088	6882951
97	7426363	7562205	7698043	7833877	7969706	8105532	8241353
98	8784594	8920394	9056189	9191981	9327768	9463551	9599329
99	5050142401	0278158	0413911	0549660	0685405	0821145	0956881
3200	5051499783	1635498	1771209	1906915	2042617	2178315	2314009
1	2856741	2992414	3128082	3263746	3399406	3535062	3670713
2	4213276	4348906	4484532	4620154	4755771	4891384	5026993
3	5569387	5704974	5840558	5976137	6111712	6247283	6382850
4	6925074	7060620	7196161	7331698	7467231	7602759	7738284
5	8280339	8415842	8551341	8686835	8822326	8957812	9093294
6	9635180	9770641	9906098	0041550	0176999	0312443	0447882
7	5060989599	1125018	1260432	1395843	1531249	1666650	1802048
8	2343596	2478973	2614345	2749713	2885077	3020436	3155792
9	3697171	3832505	3967835	4103161	4238483	4373800	4509113
3210	5065050324	5185616	5320904	5456188	5591467	5726743	5862014
11	6403056	6538305	6673551	6808793	6944030	7079264	7214492
12	7755366	7890574	8025778	8160977	8296172	8431363	8566550
13	9107256	9242421	9377583	9512740	9647893	9783042	9918187
14	5070458724	0593848	0728968	0864083	0999194	1134301	1269404
15	1809773	1944854	2079932	2215005	2350074	2485139	2620200
16	3160401	3295440	3430476	3565507	3700534	3835557	3970576
17	4510609	4645607	4780600	4915590	5050575	5185556	5320533
18	5860398	5995353	6130305	6265252	6400196	6535135	6670069
19	7209767	7344681	7479590	7614496	7749397	7884294	8019187
3220	8558717	8693589	8828457	8963320	9098180	9233035	9367886

OF NUMBERS. Logarithms 4996870826–5079772414.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7832764	7970167	8107565	137433	428	425	419	416	411	406	403	398	393
9206592	9343951	9481306	390	385	380	377	371	368	363	359	355	350
0579985	0717301	0854612	346	341	338	332	329	324	319	316	311	307
1952945	2090217	2227485	303	298	293	290	285	281	276	272	268	263
3325470	3462699	3599924	259	255	250	246	242	237	233	229	225	220
4697562	4834748	4971929	215	212	207	202	199	194	189	186	181	176
6069221	6206363	6343500	173	168	163	160	155	150	147	142	137	134
7440446	7577545	7714639	129	124	121	116	112	107	103	099	094	090
8811239	8948294	9085345	086	081	077	073	069	064	060	055	051	047
0181598	0318611	0455619	042	039	033	030	025	021	016	013	008	003
1551526	1688495	1825460	136999	995	991	986	982	978	973	969	965	960
2921022	3057948	3194869	956	952	947	944	938	935	930	926	921	917
4290086	4426969	4563847	913	909	904	900	896	891	887	883	878	874
5658719	5795558	5932393	870	865	861	857	852	849	844	839	835	831
7026920	7163716	7300508	827	822	818	814	809	805	801	796	792	788
8394690	8531444	8668193	784	779	775	770	767	762	757	754	749	745
9762030	9898741	0035447	740	736	732	727	724	719	714	711	706	701
1128940	1265607	1402270	698	693	689	684	680	676	672	667	663	659
2495419	2632043	2768663	654	650	646	641	638	633	628	624	620	616
3861469	3998050	4134627	612	607	602	599	594	590	586	581	577	573
5227089	5363627	5500161	136568	564	560	556	551	547	543	538	534	530
6592279	6728775	6865266	526	521	517	512	509	504	499	496	491	487
7957041	8093494	8229942	483	478	474	470	465	461	457	453	448	444
9321374	9457784	9594189	440	435	432	426	423	418	414	410	405	402
0685279	0821646	0958008	397	392	388	384	380	376	371	367	362	359
2048755	2185079	2321399	354	350	345	341	337	333	328	324	320	316
3411804	3548085	3684362	311	307	303	298	294	290	286	281	277	273
4774424	4910663	5046897	268	264	260	256	251	248	242	239	234	230
6136618	6272814	6409005	226	221	218	213	208	205	200	196	191	187
7498384	7634537	7770686	183	179	175	170	166	162	157	153	149	145
8859723	8995834	9131940	136140	136	132	127	124	119	114	111	106	102
0220636	0356704	0492768	098	093	089	085	081	076	072	068	064	059
1581123	1717148	1853169	055	051	046	042	038	034	030	025	021	016
2941183	3077166	3213144	013	008	004	000	995	991	987	983	978	974
4300818	4436758	4572693	135970	965	962	957	953	948	945	940	935	932
5660027	5795924	5931817	927	923	919	915	910	906	902	897	893	889
7018810	7154665	7290516	885	881	876	872	868	863	859	855	851	847
8377169	8512982	8648790	842	838	834	829	826	821	816	813	808	804
9735103	9870873	0006639	800	795	792	787	783	778	774	770	766	762
1092613	1228341	1364064	757	753	749	745	740	736	732	728	723	719
2449698	2585384	2721065	135715	711	706	702	698	694	689	686	681	676
3806360	3942003	4077641	673	668	664	660	656	651	647	643	638	635
5162598	5298198	5433795	630	626	622	617	613	609	605	600	597	592
6518412	6653970	6789524	587	584	579	575	571	567	562	558	554	550
7873804	8009319	8144831	546	541	537	533	528	525	520	515	512	508
9228772	9364246	9499715	503	499	494	491	486	482	478	474	469	465
0583318	0718749	0854176	461	457	452	449	444	439	436	431	427	423
1937441	2072831	2208215	419	414	411	406	401	398	393	390	384	381
3291143	3426490	3561832	377	372	368	364	359	356	351	347	342	339
4644422	4779727	4915028	334	330	326	322	317	313	309	305	301	296
5997280	6132543	6267801	135292	288	284	279	276	271	266	263	258	255
7349717	7484938	7620154	249	246	242	237	234	228	225	221	216	212
8701733	8836911	8972086	208	204	199	195	191	187	183	178	175	170
0053328	0188464	0323596	165	162	157	153	149	145	141	136	132	128
1404502	1539597	1674687	124	120	115	111	107	103	098	095	090	086
2755256	2890309	3025357	081	078	073	069	065	061	056	053	048	044
4105591	4240601	4375607	039	036	031	027	023	019	015	010	006	002
5455505	5590473	5725438	134998	993	990	985	981	977	972	968	965	960
6805000	6939927	7074849	955	952	947	944	939	934	931	927	922	918
8154076	8288960	8423841	914	909	906	901	897	893	889	884	881	876
9502733	9637575	9772414	872	868	863	860	855	851	847	842	839	834

Numbers 32200–32809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3220	5078558717	8693589	8828457	8963320	9098180	9233035	9367886
21	9907248	0042078	0176904	0311726	0446543	0581357	0716166
22	5081255361	1390149	1524933	1659713	1794489	1929260	2064028
23	2603055	2737802	2872544	3007282	3142016	3276745	3411471
24	3950331	4085036	4219736	4354433	4489125	4623813	4758496
25	5297190	5431853	5566511	5701166	5835816	5970462	6105104
26	6643631	6778252	6912869	7047481	7182090	7316694	7451295
27	7989654	8124233	8258809	8393380	8527947	8662509	8797068
28	9335261	9469798	9604332	9738861	9873386	0007907	0142424
29	5090680450	0814946	0949438	1083926	1218409	1352889	1487364
3230	5092025223	2159678	2294128	2428574	2563016	2697454	2831887
31	3369580	3503993	3638402	3772806	3907206	4041603	4175995
32	4713521	4847892	4982259	5116622	5250981	5385336	5519686
33	6057046	6191376	6325701	6460023	6594340	6728653	6862962
34	7400156	7534444	7668728	7803008	7937283	8071555	8205822
35	8742850	8877097	9011339	9145577	9279812	9414042	9548267
36	5100085129	0219335	0353535	0487732	0621925	0756114	0890298
37	1426994	1561158	1695317	1829473	1963624	2097771	2231914
38	2768444	2902566	3036684	3170798	3304908	3439014	3573115
39	4109480	4243561	4377638	4511710	4645779	4779843	4913903
3240	5105450102	5584142	5718177	5852208	5986235	6120258	6254277
41	6790310	6924308	7058302	7192292	7326278	7460259	7594237
42	8130105	8264062	8398014	8531963	8665907	8799848	8933784
43	9469487	9603402	9737313	9871221	0005124	0139023	0272917
44	5110808455	0942330	1076200	1210066	1343927	1477785	1611638
45	2147011	2280844	2414673	2548498	2682318	2816135	2949947
46	3485155	3618947	3752734	3886518	4020297	4154072	4287843
47	4822886	4956637	5090383	5224125	5357863	5491597	5625327
48	6160206	6293915	6427620	6561321	6695018	6828711	6962400
49	7497113	7630782	7764446	7898106	8031761	8165413	8299061
3250	5118833610	8967237	9100860	9234479	9368093	9501704	9635310
51	5120169695	0303281	0436863	0570440	0704014	0837583	0971149
52	1505369	1638914	1772455	1905991	2039524	2173052	2306577
53	2840633	2974137	3107636	3241132	3374623	3508111	3641594
54	4175486	4308949	4442407	4575862	4709312	4842759	4976201
55	5509929	5643351	5776768	5910182	6043591	6176997	6310398
56	6843962	6977343	7110720	7244092	7377461	7510825	7644185
57	8177586	8310925	8444261	8577593	8710920	8844244	8977563
58	9510800	9644099	9777393	9910684	0043971	0177253	0310532
59	5130843605	0976863	1110117	1243366	1376612	1509854	1643091
3260	5132176001	2309218	2442431	2575640	2708845	2842045	2975242
61	3507988	3641164	3774337	3907505	4040669	4173829	4306984
62	4839567	4972702	5105834	5238961	5372084	5505203	5638319
63	6170738	6303833	6436923	6570009	6703092	6836170	6969245
64	7501501	7634555	7767604	7900650	8033692	8166729	8299763
65	8831856	8964869	9097878	9230883	9363884	9496881	9629874
66	5140161804	0294776	0427745	0560709	0693669	0826625	0959577
67	1491345	1624276	1757205	1890128	2023047	2155963	2288874
68	2820479	2953370	3086257	3219139	3352018	3484893	3617764
69	4149206	4282056	4414902	4547745	4680583	4813417	4946247
3270	5145477527	5610336	5743142	5875944	6008741	6141535	6274324
71	6805441	6938210	7070975	7203736	7336493	7469246	7601995
72	8132950	8265679	8398403	8531124	8663840	8796552	8929261
73	9460053	9592741	9725425	9858105	9990781	0123453	0256120
74	5150786751	0919398	1052042	1184681	1317316	1449948	1582575
75	2113043	2245650	2378253	2510852	2643447	2776038	2908624
76	3438931	3571497	3704060	3836618	3969173	4101723	4234269
77	4764414	4896940	5029462	5161980	5294494	5427004	5559509
78	6089492	6221978	6354460	6486937	6619411	6751880	6884345
79	7414167	7546612	7679053	7811490	7943923	8076352	8208777
3280	8738437	8870842	9003243	9135640	9268032	9400421	9532806

OF NUMBERS. Logarithms 5078558717–5159929935.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9502733	9637575	9772414	134872	868	863	860	855	851	847	842	839	834
0850971	0985772	1120568	830	826	822	817	814	809	805	801	796	793
2198791	2333550	2468305	788	784	780	776	771	768	763	759	755	750
3546192	3680910	3815623	747	742	738	734	729	726	721	718	713	708
4893176	5027851	5162523	705	700	697	692	688	683	680	675	672	667
6239742	6374376	6509005	663	658	655	650	646	642	638	634	629	626
7585891	7720483	7855070	621	617	612	609	604	601	596	592	587	584
8931622	9066173	9200719	579	576	571	567	562	559	554	551	546	542
0276937	0411446	0545950	537	534	529	525	521	517	513	509	504	500
1621835	1756302	1890765	496	492	488	483	480	475	471	467	463	458
2966317	3100742	3235163	134455	450	446	442	438	433	430	425	421	417
4310382	4444766	4579146	413	409	404	400	397	392	387	384	380	375
5654032	5788374	5922712	371	367	363	359	355	350	346	342	338	334
6997266	7131567	7265863	330	325	322	317	313	309	304	301	296	293
8340085	8474344	8608599	288	284	280	275	272	267	263	259	255	251
9682489	9816707	9950920	247	242	238	235	230	225	222	218	213	209
1024478	1158654	1292826	206	200	197	193	189	184	180	176	172	168
2366053	2500187	2634318	164	159	156	151	147	143	139	134	131	126
3707213	3841306	3975395	122	118	114	110	106	101	098	093	089	085
5047959	5182011	5316058	081	077	072	069	064	060	056	052	047	044
6388291	6522302	6656308	134040	035	031	027	023	019	014	011	006	002
7728210	7862179	7996144	133998	994	990	986	981	978	973	969	965	961
9067716	9201643	9335567	957	952	949	944	941	936	932	927	924	920
0406808	0540695	0674577	915	911	908	903	899	894	891	887	882	878
1745488	1879333	2013174	875	870	866	861	858	853	850	845	841	837
3083755	3217559	3351359	833	829	825	820	817	812	808	804	800	796
4421610	4555373	4689132	792	787	784	779	775	771	767	763	759	754
5759053	5892775	6026492	751	746	742	738	734	730	726	722	717	714
7096084	7229765	7363441	709	705	701	697	693	689	684	681	676	672
8432704	8566343	8699979	669	664	660	655	652	648	643	639	636	631
9768913	9902511	0036105	133627	623	619	614	611	606	603	598	594	590
1104710	1238267	1371820	586	582	577	574	569	566	561	557	553	549
2440097	2573613	2707125	545	541	536	533	528	525	520	516	512	508
3775073	3908548	4042019	504	499	496	491	488	483	479	475	471	467
5109639	5243073	5376503	463	458	455	450	447	442	438	434	430	426
6443795	6577188	6710577	422	417	414	409	406	401	397	393	389	385
7777542	7910894	8044242	381	377	372	369	364	360	357	352	348	344
9110878	9244190	9377497	339	336	332	327	324	319	315	312	307	303
0443806	0577076	0710343	299	294	291	287	282	279	274	270	267	262
1776325	1909554	2042779	258	254	249	246	242	237	234	229	225	222
3108435	3241623	3374808	133217	213	209	205	200	197	193	188	185	180
4440136	4573284	4706428	176	173	168	164	160	155	152	148	144	139
5771429	5904536	6037639	135	132	127	123	119	116	110	107	103	099
7102315	7235381	7368443	095	090	086	083	078	075	070	066	062	058
8432792	8565818	8698839	054	049	046	042	037	034	029	026	021	017
9762862	9895847	0028828	013	009	005	001	997	993	988	985	981	976
1092525	1225469	1358409	132972	969	964	960	956	952	948	944	940	936
2421781	2554684	2687584	931	929	923	919	916	911	907	903	900	895
3750630	3883493	4016351	891	887	882	879	875	871	866	863	858	855
5079073	5211895	5344713	850	846	843	838	834	830	826	822	818	814
6407109	6539891	6672668	132809	806	802	797	794	789	785	782	777	773
7734740	7867481	8000217	769	765	761	757	753	749	745	741	736	733
9061965	9194665	9327361	729	724	721	716	712	709	704	700	696	692
0388784	0521444	0654099	688	684	680	676	672	667	664	660	655	652
1715198	1847817	1980432	647	644	639	635	632	627	623	619	615	611
3041207	3173786	3306360	607	603	599	595	591	586	583	579	574	571
4366811	4499350	4631884	566	563	558	555	550	546	542	539	534	530
5692011	5824509	5957003	526	522	518	514	510	505	502	498	494	489
7016807	7149264	7281717	486	482	477	474	469	465	462	457	453	450
8341198	8473615	8606028	445	441	437	433	429	425	421	417	413	409
9665186	9797563	9929935	405	401	397	392	389	385	380	377	372	369

Numbers 32800–33409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3280	5158738437	8870842	9003243	9135640	9268032	9400421	9532806
81	5160062304	0194668	0327029	0459385	0591738	0724086	0856430
82	1385767	1518091	1650411	1782728	1915040	2047348	2179652
83	2708827	2841111	2973391	3105667	3237939	3370206	3502470
84	4031484	4163728	4295968	4428203	4560435	4692662	4824885
85	5353739	5485942	5618142	5750337	5882528	6014715	6146898
86	6675591	6807754	6939913	7072068	7204219	7336366	7468509
87	7997041	8129164	8261283	8393397	8525508	8657615	8789718
88	9318089	9450171	9582250	9714325	9846395	9978462	0110525
89	5170638735	0770777	0902816	1034850	1166881	1298907	1430930
3290	5171958979	2090982	2222980	2354975	2486965	2618951	2750934
91	3278823	3410785	3542744	3674698	3806648	3938594	4070537
92	4598265	4730188	4862106	4994020	5125930	5257836	5389739
93	5917307	6049189	6181067	6312942	6444812	6576678	6708540
94	7235948	7367790	7499629	7631463	7763293	7895119	8026941
95	8554189	8685991	8817789	8949584	9081374	9213160	9344942
96	9872030	0003792	0135550	0267305	0399055	0530801	0662543
97	5181189471	1321194	1452912	1584626	1716336	1848042	1979744
98	2506513	2638195	2769873	2901548	3033218	3164884	3296546
99	3823155	3954798	4086436	4218070	4349701	4481327	4612949
3300	5185139399	5271001	5402600	5534194	5665784	5797371	5928953
1	6455243	6586806	6718364	6849919	6981470	7113016	7244559
2	7770689	7902212	8033731	8165245	8296756	8428263	8559766
3	9085737	9217220	9348699	9480174	9611644	9743111	9874574
4	5190400386	0531830	0663269	0794704	0926135	1057562	1188985
5	1714638	1846042	1977441	2108836	2240228	2371615	2502998
6	3028492	3159856	3291215	3422571	3553923	3685270	3816614
7	4341949	4473273	4604593	4735909	4867221	4998529	5129833
8	5655009	5786293	5917573	6048849	6180122	6311390	6442654
9	6967672	7098916	7230157	7361393	7492626	7623854	7755079
3310	5198279938	8411143	8542343	8673540	8804733	8935922	9067107
11	9591808	9722973	9854134	9985291	0116444	0247594	0378739
12	5200903281	1034407	1165528	1296646	1427760	1558869	1689975
13	2214359	2345445	2476527	2607605	2738679	2869749	3000815
14	3525041	3656087	3787130	3918168	4049203	4180234	4311260
15	4835327	4966334	5097337	5228336	5359331	5490322	5621310
16	6145219	6276186	6407150	6538109	6669065	6800016	6930964
17	7454715	7585643	7716567	7847487	7978403	8109315	8240224
18	8763817	8894705	9025590	9156470	9287347	9418220	9549089
19	5210072524	0203373	0334218	0465059	0595897	0726730	0857559
3320	5211380837	1511647	1642452	1773254	1904052	2034846	2165636
21	2688756	2819526	2950293	3081055	3211813	3342568	3473318
22	3996281	4127012	4257739	4388462	4519181	4649896	4780607
23	5303413	5434104	5564792	5695476	5826155	5956831	6087503
24	6610151	6740803	6871452	7002096	7132736	7263373	7394005
25	7916496	8047109	8177718	8308323	8438924	8569522	8700115
26	9222449	9353022	9483592	9614158	9744720	9875278	0005832
27	5220528009	0658543	0789074	0919600	1050123	1180641	1311156
28	1833176	1963671	2094163	2224650	2355133	2485613	2616088
29	3137952	3268408	3398860	3529308	3659752	3790192	3920629
3330	5224442335	4572752	4703165	4833574	4963979	5094380	5224777
31	5746327	5876705	6007078	6137448	6267814	6398176	6528534
32	7049927	7180266	7310600	7440931	7571258	7701581	7831900
33	8353137	8483436	8613732	8744023	8874311	9004595	9134874
34	9655955	9786215	9916472	0046724	0176973	0307218	0437458
35	5230958383	1088604	1218821	1349035	1479244	1609450	1739652
36	2260420	2390602	2520780	2650955	2781125	2911292	3041455
37	3562066	3692210	3822349	3952485	4082616	4212744	4342867
38	4863323	4993428	5123528	5253624	5383717	5513806	5643890
39	6164191	6294256	6424317	6554375	6684428	6814478	6944524
3340	7464668	7594694	7724717	7854735	7984750	8114761	8244768

OF NUMBERS. Logarithms 5158738437–5238634765.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9665186	9797563	9929935	132405	401	397	392	389	385	380	377	372	369
0988771	1121107	1253439	364	361	356	353	348	344	341	336	332	328
2311952	2444248	2576539	324	320	317	312	308	304	300	296	291	288
3634730	3766985	3899237	284	280	276	272	267	264	260	255	252	247
4957105	5089320	5221532	244	240	235	232	227	223	220	215	212	207
6279078	6411253	6543424	203	200	195	191	187	183	180	175	171	167
7600648	7732783	7864914	163	159	155	151	147	143	139	135	131	127
8921817	9053911	9186002	123	119	114	111	107	103	099	094	091	087
0242583	0374638	0506688	082	079	075	070	067	063	058	055	050	047
1562948	1694963	1826973	042	039	034	031	026	023	018	015	010	006
2882912	3014886	3146857	132003	998	995	990	986	983	978	974	971	966
4202475	4334409	4466339	131962	959	954	950	946	943	938	934	930	926
5521637	5653531	5785421	923	918	914	910	906	903	898	894	890	886
6840398	6972252	7104102	882	878	875	870	866	862	858	854	850	846
8158759	8290573	8422383	842	839	834	830	826	822	818	814	810	806
9476720	9608494	9740264	802	798	795	790	786	782	778	774	770	766
0794281	0926015	1057745	762	758	755	750	746	742	738	734	730	726
2111443	2243137	2374827	723	718	714	710	706	702	699	694	690	686
3428205	3559859	3691509	682	678	675	670	666	662	659	654	650	646
4744568	4876182	5007792	643	638	634	631	626	622	619	614	610	607
6060532	6192106	6323677	131602	599	594	590	587	582	579	574	571	566
7376097	7507632	7639163	563	558	555	551	546	543	538	535	531	526
8691264	8822759	8954250	523	519	514	511	507	503	498	495	491	487
0006033	0137488	0268939	483	479	475	470	467	463	459	455	451	447
1320404	1451820	1583231	444	439	435	431	427	423	419	416	411	407
2634378	2765753	2897125	404	399	395	392	387	383	380	375	372	367
3947954	4079290	4210621	364	359	356	352	347	344	340	336	331	328
5261133	5392429	5523721	324	320	316	312	308	304	300	296	292	288
6573914	6705171	6836423	284	280	276	273	268	264	260	257	252	249
7886300	8017516	8148729	244	241	236	233	228	225	221	216	213	209
9198288	9329465	9460638	131205	200	197	193	189	185	181	177	173	170
0509881	0641018	0772152	165	161	157	153	150	145	142	137	134	129
1821077	1952175	2083269	126	121	118	114	109	106	102	098	094	090
3131878	3262936	3393990	086	082	078	074	070	066	063	058	054	051
4442283	4573302	4704317	046	043	038	035	031	026	023	019	015	010
5752293	5883272	6014247	007	003	999	995	991	988	983	979	975	972
7061908	7192847	7323783	130967	964	959	956	951	948	944	939	936	932
8371128	8502028	8632924	928	924	920	916	912	909	904	900	896	893
9679953	9810814	9941671	888	885	880	877	873	869	864	861	857	853
0988385	1119206	1250023	849	845	841	838	833	829	826	821	817	814
2296422	2427204	2557982	130810	805	802	798	794	790	786	782	778	774
3604065	3734808	3865546	770	767	762	758	755	750	747	743	738	735
4911315	5042018	5172717	731	727	723	719	715	711	708	703	699	696
6218171	6348835	6479495	691	688	684	679	676	672	668	664	660	656
7524634	7655259	7785880	652	649	644	640	637	632	629	625	621	616
8830704	8961290	9091871	613	609	605	601	598	593	589	586	581	578
0136382	0266928	0397470	573	570	566	562	558	554	550	546	542	539
1441667	1572174	1702677	534	531	526	523	518	515	511	507	503	499
2746560	2877028	3007492	495	492	487	483	480	475	472	468	464	460
4051061	4181490	4311914	456	452	448	444	440	437	432	429	424	421
5355170	5485560	5615945	130417	413	409	405	401	397	393	390	385	382
6658888	6789239	6919585	378	373	370	366	362	358	354	351	346	342
7962215	8092526	8222833	339	334	331	327	323	319	315	311	307	304
9265150	9395423	9525691	299	296	291	288	284	279	276	273	268	264
0567695	0697928	0828157	260	257	252	249	245	240	237	233	229	226
1869850	2000043	2130234	221	217	214	209	206	202	198	193	191	186
3171613	3301768	3431919	182	178	175	170	167	163	158	155	151	147
4472987	4603103	4733215	144	139	136	131	128	123	120	116	112	108
5773971	5904048	6034121	105	100	096	093	089	084	081	077	073	070
7074566	7204604	7334638	065	061	058	053	050	046	042	038	034	030
8374771	8504770	8634765	026	023	018	015	011	007	003	999	995	991

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3340	5237464668	7594694	7724717	7854735	7984750	8114761	8244768
41	8764756	8994744	9024727	9154707	9284683	9414655	9544623
42	5240064456	0194404	0324349	0454289	0584226	0714159	0844088
43	1363766	1493676	1623581	1753483	1883381	2013275	2143166
44	2662688	2792558	2922425	3052288	3182148	3312003	3441854
45	3961221	4091053	4220881	4350705	4480526	4610342	4740155
46	5259366	5389159	5518949	5648734	5778516	5908293	6038067
47	6557124	6686878	6816629	6946375	7076118	7205857	7335592
48	7854493	7984209	8113921	8243629	8373333	8503033	8632729
49	9151475	9281152	9410825	9540495	9670160	9799821	9929479
3350	5250448070	0577709	0707343	0836973	0966600	1096223	1225842
51	1744278	1873878	2003474	2133065	2262653	2392237	2521817
52	3040100	3169660	3299217	3428771	3558320	3687865	3817407
53	4335534	4465057	4594575	4724089	4853600	4983107	5112610
54	5630583	5760066	5889546	6019022	6148494	6277962	6407426
55	6925245	7054690	7184131	7313569	7443002	7572432	7701857
56	8219522	8348928	8478331	8607729	8737124	8866515	8995902
57	9513412	9642780	9772144	9901505	0030861	0160213	0289562
58	5260806918	0936247	1065573	1194895	1324212	1453526	1582836
59	2100038	2229329	2358616	2487899	2617179	2746454	2875726
3360	5263392774	3522026	3651275	3780520	3909760	4038997	4168231
61	4685125	4814339	4943549	5072755	5201957	5331156	5460351
62	5977091	6106267	6235438	6364606	6493770	6622930	6752086
63	7268673	7397810	7526943	7656073	7785198	7914320	8043438
64	8559871	8688970	8818065	8947156	9076243	9205326	9334406
65	9850686	9979746	0108802	0237855	0366904	0495949	0624990
66	527114l116	1270138	1399157	1528171	1657181	1786188	1915191
67	2431164	2560148	2689127	2818103	2947076	3076044	3205008
68	3720828	3849774	3978715	4107653	4236587	4365517	4494443
69	5010110	5139017	5267920	5396820	5525715	5654607	5783495
3370	5276299009	6427878	6556743	6685604	6814461	6943315	7072164
71	7587525	7716356	7845183	7974006	8102825	8231640	8360452
72	8875660	9004452	9133241	9262025	9390806	9519583	9648357
73	528016341 2	0292166	0420917	0549663	0678406	0807145	0935880
74	1450783	1579499	1708211	1836919	1965624	2094325	2223022
75	2737772	2866450	2995124	3123794	3252461	3381123	3509782
76	4024380	4153019	4281655	4410288	4538916	4667541	4796161
77	5310606	5439208	5567806	5696400	5824990	5953577	6082160
78	6596452	6725016	6853576	6982132	7110684	7239233	7367777
79	7881918	8010443	8138965	8267483	8395997	8524508	8653014
3380	5289167003	9295490	9423974	9552454	9680930	9809403	9937871
81	529045l708	0580157	0708603	0837045	0965483	1093918	1222348
82	1736033	1864444	1992852	2121256	2249656	2378053	2506445
83	3019978	3148352	3276721	3405087	3533450	3661808	3790163
84	4303544	4431879	4560211	4688539	4816864	4945184	5073501
85	5586730	5715028	5843322	5971612	6099899	6228181	6356460
86	6869538	6997798	7126054	7254306	7382555	7510799	7639040
87	8151966	8280188	8408407	8536621	8664832	8793039	8921242
88	9434017	9562201	9690381	9818558	9946731	0074900	0203065
89	5300715688	0843835	0971977	1100116	1228251	1356382	1484510
3390	5301996982	2125091	2253195	2381296	2509394	2637487	2765577
91	3277898	3405969	3534036	3662099	3790158	3918214	4046266
92	4558436	4686469	4814498	4942524	5070545	5198563	5326577
93	5838596	5966592	6094583	6222571	6350555	6478535	6606512
94	7118380	7246337	7374291	7502241	7630188	7758130	7886069
95	8397786	8525706	8653622	8781535	8909443	9037348	9165249
96	9676816	9804698	9932576	0060451	0188322	0316189	0444053
97	5310955469	1083313	1211154	1338991	1466825	1594654	1722480
98	2233745	2361552	2489356	2617155	2744951	2872743	3000531
99	3511646	3639415	3767181	3894943	4022701	4150455	4278206
3400	4789170	4916902	5044630	5172355	5300075	5427792	5555505

OF NUMBERS.

Logarithms 5237464668–5315938621.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8374771	8504770	8634765	130026	023	018	015	011	007	003	999	995	991
9674587	9804547	9934503	129988	983	980	976	972	968	964	960	956	953
0974014	1103935	1233852	948	945	940	937	933	929	926	921	917	914
2273052	2402934	2532813	910	905	902	898	894	891	886	882	879	875
3571702	3701545	3831385	870	867	863	860	855	851	848	843	840	836
4869963	4999768	5129569	832	828	824	821	816	813	808	805	801	797
6167837	6297603	6427365	793	790	785	782	777	774	770	766	762	759
7465323	7595050	7724774	754	751	746	743	739	735	731	727	724	719
8762421	8892110	9021795	716	712	708	704	700	696	692	689	685	680
0059133	0188782	0318428	677	673	670	665	661	658	654	649	646	642
1355457	1485068	1614675	129639	634	630	627	623	619	615	611	607	603
2651394	2780966	2910535	600	596	591	588	584	580	577	572	569	565
3946944	4076478	4206008	560	557	554	549	545	542	537	534	530	526
5242109	5371604	5501095	523	518	514	511	507	503	499	495	491	488
6536887	6666343	6795796	483	480	476	472	468	464	461	456	453	449
7831279	7960697	8090111	445	441	438	433	430	425	422	418	414	411
9125286	9254665	9384041	406	403	398	395	391	387	384	379	376	371
0418907	0548248	0677585	368	364	361	356	352	349	345	341	337	333
1712143	1841445	1970744	329	326	322	317	314	310	307	302	299	294
3004994	3134258	3263518	291	287	283	280	275	272	268	264	260	256
4297460	4426685	4555907	129252	249	245	240	237	234	229	225	222	218
5589541	5718729	5847912	214	210	206	202	199	195	190	188	183	179
6881239	7010387	7139532	176	171	168	164	160	156	153	148	145	141
8172552	8301662	8430769	137	133	130	125	122	118	114	110	107	102
9463482	9592553	9721621	099	095	091	087	083	080	076	071	068	065
0754027	0883061	1012091	060	056	053	049	045	041	037	034	030	025
2044190	2173185	2302176	022	019	014	010	007	003	999	995	991	988
3333969	3462926	3591879	128984	979	976	973	968	964	961	957	953	949
4623366	4752284	4881199	946	941	938	934	930	926	923	918	915	911
5912379	6041260	6170136	907	903	900	895	892	888	884	881	876	873
7201010	7329852	7458691	128869	865	861	857	854	849	846	842	839	834
8489259	8618063	8746863	831	827	823	819	815	812	807	804	800	797
9777126	9905892	0034654	792	789	784	781	777	774	769	766	762	758
1064611	1193339	1322063	754	751	746	743	739	735	731	728	724	720
2351715	2480404	2609090	716	712	708	705	701	697	693	689	686	682
3638437	3767088	3895736	678	674	670	667	662	659	655	651	648	644
4924778	5053391	5182001	639	636	633	628	625	620	617	613	610	605
6210739	6339314	6467885	602	598	594	590	587	583	579	575	571	567
7496318	7624855	7753388	564	560	556	552	549	544	541	537	533	530
8781517	8910016	9038511	525	522	518	514	511	506	503	499	495	492
0066336	0194797	0323254	128487	484	480	476	473	468	465	461	457	454
1350775	1479198	1607617	449	446	442	438	435	430	427	423	419	416
2634834	2763219	2891600	411	408	404	400	397	392	389	385	381	378
3918514	4046861	4175204	374	369	366	363	358	355	351	347	343	340
5201814	5330123	5458429	335	332	328	325	320	317	313	309	306	301
6484735	6613007	6741274	298	294	290	287	282	279	275	272	267	264
7767278	7895511	8023741	260	256	252	249	244	241	238	233	230	225
9049441	9177637	9305829	222	219	214	211	207	203	199	196	192	188
0331227	0459384	0587538	184	180	177	173	169	165	162	157	154	150
1612634	1740754	1868870	147	142	139	135	131	128	124	120	116	112
2893663	3021745	3149823	128109	104	101	098	093	090	086	082	078	075
4174314	4302358	4430399	071	067	063	059	056	052	048	044	041	037
5454588	5582595	5710597	033	029	026	021	018	014	011	007	002	999
6734484	6862453	6990418	127996	991	988	984	980	977	972	969	965	962
8014004	8141935	8269862	957	954	950	947	942	939	935	931	927	924
9293146	9421040	9548930	920	916	913	908	905	901	897	894	890	886
0571912	0699768	0827620	882	878	875	871	867	864	859	856	852	849
1850302	1978120	2105935	844	841	837	834	829	826	822	818	815	810
3128315	3256096	3383873	807	804	799	796	792	788	784	781	777	773
4405953	4533696	4661435	769	766	762	758	754	751	747	743	739	735
5683214	5810920	5938621	732	728	725	720	717	713	709	706	701	698

Numbers 34000–34609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3400	5314789170	4916902	5044630	5172355	5300075	5427792	5555505
1	6066319	6194014	6321704	6449391	6577074	6704753	6832428
2	7343093	7470749	7598402	7726052	7853697	7981339	8108977
3	8619491	8747110	8874726	9002337	9129945	9257549	9385150
4	9895514	0023096	0150674	0278248	0405818	0533385	0660948
5	5321171162	1298707	1426247	1553784	1681317	1808846	1936372
6	2446436	2573943	2701446	2828945	2956441	3083933	3211421
7	3721336	3848805	3976271	4103733	4231191	4358645	4486096
8	4995861	5123293	5250721	5378146	5505566	5632983	5760397
9	6270012	6397407	6524798	6652185	6779568	6906948	7034324
3410	5327543790	7671147	7798501	7925850	8053196	8180539	8307877
11	8817194	8944514	9071830	9199143	9326451	9453756	9581057
12	5330090225	0217508	0344786	0472061	0599333	0726600	0853864
13	1362883	1490128	1617370	1744607	1871842	1999072	2126299
14	2635168	2762376	2889580	3016781	3143977	3271171	3398360
15	3907080	4034251	4161418	4288581	4415741	4542897	4670049
16	5178620	5305754	5432884	5560010	5687132	5814251	5941366
17	6449788	6576884	6703977	6831066	6958151	7085232	7212310
18	7720584	7847643	7974698	8101750	8228798	8355842	8482883
19	8991008	9118030	9245048	9372063	9499074	9626081	9753084
3420	5340261061	0388045	0515027	0642004	0768978	0895948	1022914
21	1530742	1657690	1784634	1911574	2038510	2165443	2292372
22	2800052	2926963	3053870	3180773	3307672	3434568	3561460
23	4068991	4195865	4322735	4449601	4576463	4703322	4830177
24	5337560	5464397	5591229	5718058	5844884	5971705	6098523
25	6605758	6732558	6859353	6986146	7112934	7239719	7366500
26	7873586	8000349	8127107	8253863	8380614	8507362	8634105
27	9141044	9267770	9394492	9521210	9647924	9774635	9901342
28	5350408133	0534821	0661506	0788187	0914864	1041538	1168208
29	1674851	1801503	1928151	2054795	2181435	2308072	2434705
3430	5352941200	3067815	3194426	3321033	3447637	3574237	3700833
31	4207181	4333758	4460332	4586903	4713469	4840032	4966592
32	5472792	5599333	5725870	5852403	5978933	6105459	6231981
33	6738034	6864538	6991039	7117535	7244028	7370517	7497003
34	8002908	8129375	8255839	8382299	8508755	8635207	8761656
35	9267414	9393844	9520271	9646694	9773113	9899529	0025941
36	5360531552	0657945	0784335	0910721	1037104	1163482	1289858
37	1795321	1921678	2048031	2174381	2300726	2427068	2553407
38	3058724	3185044	3311360	3437672	3563981	3690287	3816588
39	4321758	4448041	4574321	4700597	4826869	4953138	5079403
3440	5365584426	5710672	5836915	5963154	6089390	6215622	6341850
41	6846726	6972936	7099142	7225345	7351544	7477739	7603930
42	8108660	8234833	8361003	8487169	8613331	8739489	8865644
43	9370227	9496364	9622497	9748626	9874751	0000873	0126991
44	5370631428	0757528	0883624	1009717	1135806	1261891	1387973
45	1892262	2018326	2144385	2270441	2396494	2522543	2648588
46	3152731	3278758	3404781	3530800	3656816	3782828	3908837
47	4412834	4538824	4664811	4790794	4916773	5042748	5168720
48	5672572	5798525	5924475	6050422	6176364	6302303	6428239
49	6931944	7057861	7183774	7309684	7435590	7561493	7687392
3450	5378190951	8316831	8442708	8568582	8694451	8820317	8946180
51	9449593	9575437	9701278	9827114	9952948	0078777	0204603
52	5380707870	0833678	0959482	1085283	1211079	1336873	1462662
53	1965783	2091555	2217322	2343086	2468847	2594603	2720356
54	3223332	3349067	3474798	3600526	3726250	3851970	3977687
55	4480517	4606216	4731910	4857602	4983289	5108973	5234653
56	5737338	5863000	5988659	6114313	6239965	6365612	6491256
57	6993795	7119421	7245043	7370662	7496277	7621888	7747495
58	8249889	8375479	8501065	8626647	8752225	8877800	9003371
59	9505620	9631173	9756723	9882269	0007811	0133349	0258884
3460	5390760988	0886505	1012018	1137528	1263033	1388536	1514034

OF NUMBERS. Logarithms 5314789170-5391890509.

Mantissæ.			Differences.									
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5683214	5810920	5938621	127732	728	725	720	717	713	709	706	701	698
6960100	7087768	7215432	695	690	687	683	679	675	672	668	664	661
8236611	8364241	8491868	656	653	650	645	642	638	634	630	627	623
9512746	9640339	9767929	619	616	611	608	604	601	596	593	590	585
0788507	0916063	1043615	582	578	574	570	567	563	559	556	552	547
2063893	2191411	2318926	545	540	537	533	529	526	521	518	515	510
3338905	3466386	3593863	507	503	499	496	492	488	484	481	477	473
4613543	4740986	4868425	469	466	462	458	454	451	447	443	439	436
5887806	6015212	6142614	432	428	425	420	417	414	409	406	402	398
7161696	7289064	7416429	395	391	387	383	380	376	372	368	365	361
8435212	8562543	8689870	127357	354	349	346	343	338	335	331	327	324
9708355	9835649	9962939	320	316	313	308	305	301	298	294	290	286
0981125	1108381	1235634	283	278	275	272	267	264	261	256	253	249
2253521	2380741	2507956	245	242	237	235	230	227	222	220	215	212
3525546	3652727	3779906	208	204	201	196	194	189	186	181	179	174
4797197	4924342	5051483	171	167	163	160	156	152	148	145	141	137
6068477	6195584	6322688	134	130	126	122	119	115	111	107	104	100
7339384	7466454	7593521	096	093	089	085	081	078	074	070	067	063
8609920	8736953	8863982	059	055	052	048	044	041	037	033	029	026
9880084	0007080	0134072	022	018	015	011	007	003	000	996	992	989
1149876	1276835	1403790	126984	982	977	974	970	966	962	959	955	952
2419298	2546220	2673138	948	944	940	936	933	929	926	922	918	914
3688349	3815233	3942114	911	907	903	899	896	892	889	884	881	877
4957028	5083876	5210720	874	870	866	862	859	855	851	848	844	840
6225338	6352148	6478955	837	832	829	826	821	818	815	810	807	803
7493277	7620050	7746820	800	795	793	788	785	781	777	773	770	766
8760846	8887582	9014315	763	758	756	751	748	743	741	736	733	729
0028045	0154744	0281440	726	722	718	714	711	707	703	699	696	693
1294874	1421537	1548196	688	685	681	677	674	670	666	663	659	655
2561334	2687960	2814582	652	648	644	640	637	633	629	626	622	618
3827425	3954014	4080599	126615	611	607	604	600	596	592	589	585	582
5093147	5219699	5346247	577	574	571	566	563	560	555	552	548	545
6358500	6485015	6611527	541	537	533	530	526	522	519	515	512	507
7623485	7749963	7876437	504	501	496	493	489	486	482	478	474	471
8888101	9014542	9140980	467	464	460	456	452	449	445	441	438	434
0152349	0278754	0405154	430	427	423	419	416	412	408	405	400	398
1416229	1542597	1668961	393	390	386	383	378	376	371	368	364	360
2679741	2806072	2932400	357	353	350	345	342	339	334	331	328	324
3942886	4069181	4195471	320	316	312	309	306	301	298	295	290	287
5205664	5331922	5458175	283	280	276	272	269	265	261	258	253	251
6468075	6594295	6720513	126246	243	239	236	232	228	225	220	218	213
7730118	7856303	7982483	210	206	203	199	195	191	188	185	180	177
8991795	9117943	9244087	173	170	166	162	158	155	151	148	144	140
0253106	0379217	0505324	137	133	129	125	122	118	115	111	107	104
1514050	1640125	1766195	100	096	093	089	085	082	077	075	070	067
2774629	2900667	3026701	064	059	056	053	049	045	041	038	034	030
4034842	4160843	4286840	027	023	019	016	012	009	005	001	997	994
5294689	5420653	5546614	125990	987	983	979	975	972	969	964	961	958
6554170	6680098	6806023	953	950	947	942	939	936	931	928	925	921
7813287	7939179	8065066	917	913	910	906	903	899	895	892	887	885
9072039	9197894	9323745	125880	877	874	869	866	863	859	855	851	848
0330425	0456244	0582059	844	841	836	834	829	826	822	819	815	811
1588448	1714230	1840009	808	804	801	796	794	789	786	782	779	774
2846106	2971852	3097594	772	767	764	761	756	753	750	746	742	738
4103400	4229109	4354815	735	731	728	724	720	717	713	709	706	702
5360330	5486003	5611672	699	694	692	687	684	680	677	673	669	666
6616896	6742533	6868166	662	659	654	652	647	644	640	637	633	629
7873099	7998700	8124296	626	622	619	615	611	607	604	601	596	593
9128939	9254503	9380063	590	586	582	578	575	571	568	564	560	557
0384416	0509943	0635467	553	550	546	542	538	535	532	527	524	521
1639530	1765021	1890509	517	513	510	505	503	498	496	491	488	484

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3460	5390760988	0886505	1012018	1137528	1263033	1388536	1514034
61	2015993	2141473	2266950	2392424	2517893	2643359	2768822
62	3270635	3396080	3521520	3646957	3772391	3897821	4023247
63	4524915	4650324	4775728	4901129	5026526	5151920	5277310
64	5778833	5904205	6029574	6154938	6280299	6405657	6531010
65	7032389	7157725	7283057	7408386	7533711	7659032	7784349
66	8285584	8410883	8536179	8661472	8786761	8912045	9037327
67	9538417	9663680	9788940	9914196	0039449	0164697	0289943
68	5400790888	0916115	1041339	1166559	1291776	1416988	1542198
69	2042998	2168190	2293377	2418561	2543742	2668918	2794091
3470	5403294748	3419903	3545054	3670202	3795347	3920487	4045624
71	4546137	4671256	4796371	4921483	5046591	5171696	5296797
72	5797165	5922248	6047327	6172403	6297475	6422544	6547609
73	7047833	7172880	7297924	7422963	7547999	7673032	7798061
74	8298141	8423152	8548160	8673163	8798164	8923160	9048153
75	9548089	9673064	9798036	9923004	0047968	0172928	0297886
76	5410797678	0922617	1047552	1172484	1297413	1422337	1547258
77	2046907	2171810	2296710	2421605	2546498	2671387	2796272
78	3295777	3420644	3545508	3670368	3795224	3920077	4044926
79	4544287	4669119	4793947	4918771	5043591	5168408	5293222
3480	5415792439	5917235	6042027	6166815	6291600	6416381	6541159
81	7040233	7164992	7289749	7414501	7539250	7663995	7788737
82	8287668	8412392	8537112	8661828	8786541	8911251	9035957
83	9534745	9659433	9784117	9908798	0033475	0158149	0282819
84	5420781463	0906116	1030764	1155409	1280051	1404689	1529323
85	2027824	2152441	2277054	2401663	2526269	2650871	2775469
86	3273828	3398408	3522986	3647559	3772129	3896695	4021258
87	4519474	4644019	4768560	4893098	5017632	5142163	5266690
88	5764763	5889272	6013778	6138280	6262778	6387273	6511765
89	7009694	7134168	7258638	7383104	7507567	7632027	7756482
3490	5428254270	8378707	8503142	8627573	8752000	8876423	9000843
91	9498488	9622890	9747289	9871684	9996076	0120464	0244848
92	5430742350	0866717	0991080	1115440	1239795	1364148	1488497
93	1985856	2110187	2234515	2358839	2483159	2607476	2731789
94	3229006	3353302	3477594	3601882	3726167	3850448	3974726
95	4471801	4596061	4720317	4844570	4968819	5093065	5217307
96	5714240	5838464	5962685	6086902	6211116	6335326	6459532
97	6956323	7080512	7204697	7328879	7453057	7577232	7701403
98	8198051	8322205	8446354	8570501	8694643	8818782	8942918
99	9439425	9563543	9687657	9811768	9935875	0059978	0184079
3500	5440680444	0804526	0928605	1052680	1176752	1300820	1424885
1	1921108	2045155	2169198	2293238	2417274	2541307	2665336
2	3161417	3285429	3409437	3533441	3657442	3781440	3905433
3	4401373	4525349	4649322	4773291	4897256	5021218	5145177
4	5640975	5764916	5888853	6012787	6136717	6260643	6384566
5	6880223	7004128	7128030	7251928	7375823	7499714	7623602
6	8119118	8242988	8366854	8490717	8614576	8738432	8862285
7	9357659	9481494	9605325	9729152	9852976	9976797	0100614
8	5450595847	0719646	0843442	0967235	1091023	1214809	1338590
9	1833682	1957446	2081207	2204964	2328717	2452467	2576214
3510	5453071165	3194894	3318619	3442341	3566059	3689774	3813485
11	4308295	4431988	4555678	4679365	4803048	4926728	5050404
12	5545072	5668731	5792386	5916037	6039685	6163329	6286970
13	6781498	6905121	7028741	7152357	7275970	7399579	7523184
14	8017572	8141160	8264744	8388325	8511903	8635477	8759047
15	9253294	9376846	9500396	9623942	9747484	9871023	9994558
16	5460488664	0612182	0735696	0859207	0982714	1106217	1229718
17	1723683	1847166	1970645	2094120	2217593	2341061	2464526
18	2958351	3081799	3205243	3328683	3452120	3575554	3698984
19	4192668	4316081	4439490	4562895	4686297	4809695	4933090
3520	5426635	5550012	5673386	5796756	5920123	6043487	6166846

OF NUMBERS. Logarithms 5390760988–5466536905.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1639530	1765021	1890509	125517	513	510	505	503	498	496	491	488	484
2894281	3019736	3145187	480	477	474	469	466	463	459	455	451	448
4148669	4274088	4399504	445	440	437	434	430	426	422	419	416	411
5402696	5528079	5653458	409	404	401	397	394	390	386	383	379	375
6656361	6781707	6907050	372	369	364	361	358	353	351	346	343	339
7909663	8034974	8160281	336	332	329	325	321	317	314	311	307	303
9162605	9287879	9413150	299	296	293	289	284	282	278	274	271	267
0415185	0540423	0665657	263	260	256	253	248	246	242	238	234	231
1667403	1792605	1917804	227	224	220	217	212	210	205	202	199	194
2919261	3044427	3169589	192	187	184	181	176	173	170	166	162	159
4170758	4295888	4421014	125155	151	148	145	140	137	134	130	126	123
5421894	5546988	5672078	119	115	112	108	105	101	097	094	090	087
6672671	6797728	6922783	083	079	076	072	069	065	062	057	055	050
7923087	8048108	8173127	047	044	039	036	033	029	026	021	019	014
9173143	9298128	9423111	011	008	003	001	996	993	990	985	983	978
0422839	0547789	0672735	124975	972	968	964	960	958	953	950	946	943
1672176	1797090	1922000	939	935	932	929	924	921	918	914	910	907
2921153	3046031	3170906	903	900	895	893	889	885	881	878	875	871
4169772	4294614	4419453	867	864	860	856	853	849	846	842	839	834
5418032	5542838	5667640	832	828	824	820	817	814	810	806	802	799
6665932	6790703	6915470	124796	792	788	785	781	778	773	771	767	763
7913475	8038209	8162940	759	757	752	749	745	742	738	734	731	728
9160659	9285358	9410053	724	720	716	713	710	706	702	699	695	692
0407485	0532148	0656808	688	684	681	677	674	670	666	663	660	655
1653954	1778581	1903204	653	648	645	642	638	634	631	627	623	620
2900064	3024656	3149243	617	613	609	606	602	598	595	592	587	585
4145817	4270373	4394925	580	578	573	570	566	563	559	556	552	549
5391213	5515733	5640250	545	541	538	534	531	527	523	520	517	513
6636252	6760737	6885217	509	506	502	498	495	492	487	485	480	477
7880935	8005383	8129828	474	470	466	463	460	455	453	448	445	442
9125260	9249673	9374082	124437	435	431	427	423	420	417	413	409	406
0369229	0493606	0617980	402	399	395	392	388	384	381	377	374	370
1612842	1737184	1861522	367	363	360	355	353	349	345	342	338	334
2856099	2980405	3104707	331	328	324	320	317	313	310	306	302	299
4099000	4223270	4347537	296	292	288	285	281	278	274	270	267	264
5341545	5465780	5590012	260	256	253	249	246	242	238	235	232	228
6583735	6707935	6832131	224	221	217	214	210	206	203	200	196	192
7825570	7949734	8073895	189	185	182	178	175	171	167	164	161	156
9067050	9191179	9315303	154	149	147	142	139	136	132	129	124	122
0308175	0432268	0556358	118	114	111	107	103	101	096	093	090	086
1548946	1673003	1797057	124082	079	075	072	068	065	061	057	054	051
2789362	2913384	3037402	047	043	040	036	033	029	026	022	018	015
4029424	4153410	4277394	012	008	004	001	998	993	991	986	984	979
5269132	5393083	5517031	123976	973	969	965	962	959	955	951	948	944
6508486	6632402	6756314	941	937	934	930	926	923	920	916	912	909
7747486	7871367	7995244	905	902	898	895	891	888	884	881	877	874
8986134	9109979	9233821	870	866	863	859	856	853	849	845	842	838
0224428	0348238	0472044	835	831	827	824	821	817	814	810	806	803
1462369	1586143	1709915	799	796	793	788	786	781	779	774	772	767
2699957	2823696	2947432	764	761	757	753	750	747	743	739	736	733
3937193	4060897	4184598	123729	725	722	718	715	711	708	704	701	697
5174076	5297745	5421410	693	690	687	683	680	676	672	669	665	662
6410607	6534241	6657871	659	655	651	648	644	641	637	634	630	627
7646786	7770385	7893980	623	620	616	613	609	605	602	599	595	592
8882614	9006177	9129737	588	584	581	578	574	570	567	563	560	557
0118090	0241618	0365143	552	550	546	542	539	535	532	528	525	521
1353214	1476707	1600197	518	514	511	507	503	501	496	493	490	486
2587988	2711446	2834900	483	479	475	473	468	465	462	458	454	451
3822410	3945833	4069252	448	444	440	437	434	430	426	423	419	416
5056482	5179870	5303254	413	409	405	402	398	395	392	388	384	381
6290203	6413556	6536905	377	374	370	367	364	359	357	353	349	346

Numbers 35200–35809. **LOGARITHMS**

Numbers.	Mantissæ.						
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3520	5465426635	5550012	5673386	5796756	5920123	6043487	6166846
21	6660251	6783593	6906932	7030267	7153599	7276927	7400252
22	7893516	8016824	8140127	8263428	8386725	8510018	8633308
23	9126432	9249704	9372973	9496238	9619500	9742758	9866013
24	5470358997	0482235	0605469	0728699	0851926	0975149	1098369
25	1591213	1714416	1837615	1960810	2084002	2207190	2330375
26	2823080	2946247	3069411	3192571	3315728	3438882	3562032
27	4054597	4177729	4300858	4423984	4547106	4670224	4793339
28	5285765	5408862	5531956	5655047	5778134	5901218	6024298
29	6516584	6639646	6762706	6885761	7008814	7131862	7254908
3530	5477747054	7870082	7993106	8116127	8239144	8362158	8485169
31	8977176	9100169	9223158	9346144	9469127	9592106	9715081
32	5480206949	0329907	0452862	0575813	0698761	0821705	0944646
33	1436374	1559298	1682218	1805134	1928047	2050957	2173863
34	2665452	2788340	2911225	3034107	3156985	3279860	3402731
35	3894181	4017035	4139886	4262732	4385576	4508416	4631252
36	5122563	5245383	5368198	5491010	5613819	5736624	5859426
37	6350598	6473383	6596163	6718941	6841715	6964485	7087252
38	7578286	7701035	7823782	7946524	8069264	8191999	8314732
39	8805626	8928341	9051053	9173761	9296466	9419167	9541864
3540	5490032620	0155301	0277977	0400651	0523321	0645987	0768650
41	1259268	1381913	1504555	1627194	1749830	1872461	1995090
42	2485569	2608180	2730787	2853391	2975992	3098589	3221183
43	3711523	3834100	3956673	4079242	4201808	4324371	4446930
44	4937132	5059674	5182212	5304747	5427279	5549807	5672331
45	6162395	6284902	6407406	6529907	6652404	6774897	6897387
46	7387313	7509785	7632255	7754721	7877183	7999642	8122097
47	8611885	8734323	8856758	8979189	9101617	9224041	9346462
48	9836112	9958515	0080916	0203312	0325706	0448096	0570482
49	5501059993	1182363	1304728	1427091	1549450	1671805	1794157
3550	5502283531	2405865	2528197	2650524	2772849	2895170	3017487
51	3506723	3629023	3751320	3873614	3995904	4118190	4240473
52	4729571	4851837	4974099	5096358	5218614	5340866	5463115
53	5952075	6074306	6196534	6318759	6440980	6563198	6685412
54	7174235	7296432	7418625	7540816	7663002	7785186	7907366
55	8396051	8518213	8640373	8762528	8884681	9006830	9128975
56	9617523	9739651	9861776	9983898	0106016	0228130	0350242
57	5510838652	0960746	1082836	1204924	1327007	1449088	1571164
58	2059437	2181497	2303553	2425606	2547656	2669702	2791744
59	3279880	3401905	3523927	3645946	3767961	3889973	4011981
3560	5514499980	4621971	4743959	4865943	4987924	5109901	5231875
61	5719737	5841694	5963647	6085597	6207544	6329487	6451427
62	6939151	7061074	7182993	7304909	7426821	7548730	7670636
63	8158224	8280112	8401997	8523878	8645757	8767631	8889503
64	9376954	9498808	9620659	9742506	9864350	9986190	0108028
65	5520595342	0717162	0838979	0960792	1082601	1204408	1326211
66	1813388	1935174	2056957	2178736	2300511	2422284	2544052
67	3031093	3152845	3274593	3396338	3518080	3639818	3761553
68	4248457	4370175	4491889	4613600	4735307	4857011	4978711
69	5465480	5587163	5708843	5830520	5952193	6073863	6195529
3570	5526682161	6803811	6925457	7047099	7168738	7290374	7412006
71	7898502	8020117	8141729	8263338	8384943	8506545	8628143
72	9114502	9236083	9357661	9479236	9600807	9722375	9843939
73	5530330162	0451709	0573253	0694794	0816331	0937864	1059395
74	1545482	1666995	1788505	1910011	2031514	2153014	2274510
75	2760461	2881941	3003417	3124889	3246358	3367824	3489286
76	3975101	4096547	4217988	4339427	4460862	4582294	4703722
77	5189401	5310813	5432221	5553625	5675027	5796424	5917819
78	6403362	6524740	6646114	6767484	6888852	7010215	7131576
79	7616984	7738327	7859668	7981004	8102338	8223668	8344994
3580	8830266	8951576	9072882	9194185	9315485	9436781	9558073

OF NUMBERS. Logarithms 5465426635–5539921931.

Mantissæ.			Differences.									
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6290203	6413556	6536905	123377	374	370	367	364	359	357	353	349	346
7523573	7646891	7770206	342	339	335	332	328	325	321	318	315	310
8756594	8879877	9003156	308	303	301	297	293	290	286	283	279	276
9989264	0112512	0235757	272	269	265	262	258	255	251	248	245	240
1221585	1344798	1468007	238	234	230	227	223	220	216	213	209	206
2453556	2576734	2699909	203	199	195	192	188	185	181	178	175	171
3685178	3808321	3931461	167	164	160	157	154	150	146	143	140	136
4916451	5039559	5162664	132	129	126	122	118	115	112	108	105	101
6147375	6270448	6393517	097	094	091	087	084	080	077	073	069	067
7377949	7500987	7624023	062	060	055	053	048	046	041	038	036	031
8608176	8731179	8854179	123028	024	021	017	014	011	007	003	000	997
9838054	9961022	0083987	122993	989	986	983	979	975	973	968	965	962
1067583	1190517	1313447	958	955	951	948	944	941	937	934	930	927
2296765	2419664	2542560	924	920	916	913	910	906	902	899	896	892
3525599	3648463	3771324	888	885	882	878	875	871	868	864	861	857
4754085	4876915	4999741	854	851	846	844	840	836	833	830	826	822
5982224	6105019	6227810	820	815	812	809	805	802	798	795	791	788
7210016	7332776	7455533	785	780	778	774	770	767	764	760	757	753
8437461	8560186	8682908	749	747	742	740	735	733	729	725	722	718
9664558	9787249	9909936	715	712	708	705	701	697	694	691	687	684
0891310	1013966	1136618	122681	676	674	670	666	663	660	656	652	650
2117715	2240336	2362954	645	642	639	636	631	629	625	621	618	615
3343773	3466360	3588943	611	607	604	601	597	594	590	587	583	580
4569486	4692038	4814587	577	573	569	566	563	559	556	552	549	545
5794853	5917370	6039884	542	538	535	532	528	524	522	517	514	511
7019874	7142357	7264836	507	504	501	497	493	490	487	483	479	477
8244549	8366998	8489443	472	470	466	462	459	455	452	449	445	442
9468880	9591294	9713704	438	435	431	428	424	421	418	414	410	408
0692865	0815245	0937621	403	401	396	394	390	386	383	380	376	372
1916506	2038851	2161192	370	365	363	359	355	352	349	345	341	339
3139801	3262112	3384419	122334	332	327	325	321	317	314	311	307	304
4362753	4485029	4607302	300	297	294	290	286	283	280	276	273	269
5585360	5707602	5829840	266	262	259	256	252	249	245	242	238	235
6807623	6929830	7052034	231	228	225	221	218	214	211	207	204	201
8029542	8151715	8273885	197	193	191	186	184	180	176	173	170	166
9251117	9373256	9495391	162	160	155	153	149	145	142	139	135	132
0472349	0594454	0716554	128	125	122	118	114	112	107	105	100	098
1693238	1815308	1937374	094	090	088	083	081	076	074	070	066	063
2913783	3035819	3157851	060	056	053	050	046	042	039	036	032	029
4133986	4255987	4377985	025	022	019	015	012	008	005	001	998	995
5353846	5475813	5597776	121991	988	984	981	977	974	971	967	963	961
6573363	6695296	6817225	957	953	950	947	943	940	936	933	929	926
7792538	7914436	8036332	923	919	916	912	909	906	902	898	896	892
9011371	9133235	9255096	888	885	881	879	874	872	868	864	861	858
0229861	0351692	0473518	854	851	847	844	840	838	833	831	826	824
1448010	1569806	1691599	820	817	813	809	807	803	799	796	793	789
2665818	2787580	2909338	786	783	779	775	773	768	766	762	758	755
3883284	4005012	4126736	752	748	745	742	738	735	731	728	724	721
5100409	5222102	5343793	718	714	711	707	704	700	698	693	691	687
6317192	6438852	6560508	683	680	677	673	670	666	663	660	656	653
7533635	7655261	7776883	121650	646	642	639	636	632	629	626	622	619
8749738	8871329	8992917	615	612	609	605	602	598	595	591	588	585
9965500	0087057	0208611	581	578	575	571	568	564	561	557	554	551
1180922	1302445	1423965	547	544	541	537	533	531	527	523	520	517
2396003	2517493	2638979	513	510	506	503	500	496	493	490	486	482
3610745	3732200	3853653	480	476	472	469	466	462	459	455	453	448
4825147	4946569	5067987	446	441	439	435	432	428	425	422	418	414
6039210	6160597	6281982	412	408	404	402	397	395	391	387	385	380
7252933	7374287	7495637	378	374	370	368	363	361	357	354	350	347
8466317	8587637	8708953	343	341	336	334	330	326	323	320	316	313
9679363	9800648	9921931	310	306	303	300	296	292	290	285	283	279

Numbers.	Mantissæ.						
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3580	5538830266	8951576	9072882	9194185	9315485	9436781	9558073
81	5540043210	0164486	0285758	0407027	0528293	0649555	0770814
82	1255815	1377057	1498296	1619531	1740762	1861991	1983216
83	2468082	2589290	2710494	2831696	2952894	3074088	3195279
84	3680010	3801184	3922355	4043522	4164687	4285847	4407005
85	4891600	5012740	5133878	5255011	5376141	5497268	5618392
86	6102852	6223959	6345062	6466162	6587259	6708352	6829441
87	7313767	7434840	7555909	7676975	7798038	7919097	8040153
88	8524344	8645383	8766419	8887451	9008480	9129506	9250528
89	9734583	9855589	9976591	0097589	0218585	0339577	0460565
3590	5550944486	1065457	1186426	1307391	1428352	1549311	1670265
91	2154051	2274989	2395924	2516855	2637783	2758708	2879629
92	3363280	3484184	3605085	3725983	3846877	3967768	4088656
93	4572172	4693043	4813910	4934774	5055635	5176492	5297346
94	5780728	5901565	6022399	6143229	6264056	6384879	6505700
95	6988947	7109751	7230551	7351347	7472141	7592931	7713718
96	8196831	8317600	8438367	8559130	8679890	8800646	8921399
97	9404378	9525114	9645847	9766577	9887303	0008026	0128746
98	5560611590	0732293	0852992	0973688	1094381	1215070	1335756
99	1818467	1939136	2059802	2180464	2301123	2421779	2542431
3600	5563025008	3145643	3266276	3386905	3507530	3628153	3748771
1	4231214	4351816	4472415	4593010	4713602	4834191	4954777
2	5437085	5557654	5678219	5798781	5919340	6039895	6160447
3	6642621	6763156	6883688	7004217	7124742	7245264	7365782
4	7847823	7968325	8088823	8209318	8329810	8450299	8570784
5	9052691	9173159	9293624	9414086	9534544	9654999	9775451
6	5570257224	0377659	0498090	0618519	0738944	0859365	0979784
7	1461423	1581825	1702223	1822618	1943009	2063398	2183783
8	2665289	2785657	2906022	3026383	3146741	3267096	3387448
9	3868821	3989155	4109487	4229815	4350140	4470461	4590780
3610	5575072019	5192321	5312619	5432914	5553205	5673493	5793778
11	6274884	6395152	6515417	6635679	6755937	6876192	6996444
12	7477416	7597651	7717883	7838111	7958336	8078558	8198776
13	8679616	8799817	8920016	9040211	9160402	9280591	9400776
14	9881482	0001651	0121816	0241977	0362136	0482291	0602443
15	5581083016	1203151	1323283	1443412	1563537	1683659	1803777
16	2284218	2404320	2524419	2644514	2764606	2884694	3004780
17	3485088	3605156	3725222	3845284	3965342	4085398	4205450
18	4685625	4805661	4925693	5045722	5165747	5285770	5405789
19	5885831	6005833	6125832	6245828	6365821	6485810	6605795
3620	5587085705	7205675	7325640	7445603	7565562	7685518	7805471
21	8285248	8405184	8525117	8645046	8764973	8884895	9004815
22	9484460	9604363	9724262	9844159	9964052	0083941	0203828
23	5590683340	0803210	0923077	1042940	1162800	1282657	1402510
24	1881890	2001727	2121560	2241390	2361217	2481041	2600861
25	3080109	3199913	3319713	3439510	3559304	3679095	3798882
26	4277998	4397768	4517536	4637300	4757061	4876818	4996572
27	5475556	5595293	5715028	5834759	5954487	6074211	6193932
28	6672784	6792489	6912190	7031888	7151583	7271274	7390962
29	7869682	7989354	8109022	8228687	8348349	8468007	8587663
3630	5599066250	9185889	9305524	9425157	9544785	9664411	9784033
31	5600262489	0382095	0501697	0621297	0740892	0860485	0980074
32	1458398	1577971	1697541	1817107	1936670	2056230	2175786
33	2653979	2773519	2893055	3012588	3132119	3251645	3371169
34	3849230	3968737	4088240	4207741	4327238	4446732	4566223
35	5044152	5163626	5283097	5402565	5522029	5641490	5760948
36	6238745	6358187	6477625	6597059	6716491	6835919	6955344
37	7433011	7552419	7671824	7791226	7910625	8030020	8149412
38	8626947	8746323	8865695	8985064	9104430	9223793	9343152
39	9820556	9939899	0059238	0178574	0297907	0417237	0536564
3640	5611013836	1133147	1252453	1371757	1491057	1610354	1729648

OF NUMBERS. Logarithms 5538830266–5612087509.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9679363	9800648	9921931	121310	306	303	300	296	292	290	285	283	279
0892069	1013321	1134570	276	272	269	266	262	259	255	252	249	245
2104437	2225655	2346870	242	239	235	231	229	225	221	218	215	212
3316467	3437651	3558832	208	204	202	198	194	191	188	184	181	178
4528158	4649309	4770456	174	171	167	165	160	158	153	151	147	144
5739512	5860629	5981742	140	138	133	130	127	124	120	117	113	110
6950528	7071611	7192691	107	103	100	097	093	089	087	083	080	076
8161206	8282255	8403301	073	069	066	063	059	056	053	049	046	043
9371547	9492562	9613575	039	036	032	029	026	022	019	015	013	008
0581550	0702532	0823511	006	002	998	996	992	988	985	982	979	975
1791217	1912165	2033110	120971	969	965	961	959	954	952	948	945	941
3000547	3121461	3242372	938	935	931	928	925	921	918	914	911	908
4209540	4330421	4451298	904	901	898	894	891	888	884	881	877	874
5418196	5539043	5659887	871	867	864	861	857	854	850	847	844	841
6626517	6747330	6868140	837	834	830	827	823	821	817	813	810	807
7834501	7955281	8076057	804	800	796	794	790	787	783	780	776	774
9042149	9162896	9283639	769	767	763	760	756	753	750	747	743	739
0249462	0370175	0490884	736	733	730	726	723	720	716	713	709	706
1456439	1577118	1697794	703	699	696	693	689	686	683	679	676	673
2663081	2783726	2904369	669	666	662	659	656	652	650	645	643	639
3869387	3989999	4110608	120635	633	629	625	623	618	616	612	609	606
5075359	5195937	5316513	602	599	595	592	589	586	582	578	576	572
6280995	6401541	6522083	569	565	562	559	555	552	548	546	542	538
7486298	7606809	7727318	535	532	529	525	522	518	516	511	509	505
8691265	8811744	8932219	502	498	495	492	489	485	481	479	475	472
9895899	0016344	0136786	468	465	462	458	455	452	448	445	442	438
1100198	1220610	1341018	435	431	429	425	421	419	414	412	408	405
2304164	2424542	2544917	402	398	395	391	389	385	381	378	375	372
3507796	3628141	3748482	368	365	361	358	355	352	348	345	341	339
4711095	4831406	4951714	334	332	328	325	321	319	315	311	308	305
5914060	6034338	6154613	120302	298	295	291	288	285	282	278	275	271
7116692	7236937	7357178	268	265	262	258	255	252	248	245	241	238
8318991	8439202	8559411	235	232	228	225	222	218	215	211	209	205
9520957	9641136	9761311	201	199	195	191	189	185	181	179	175	171
0722591	0842736	0962878	169	165	161	159	155	152	148	145	142	138
1923892	2044004	2164113	135	132	129	125	122	118	115	112	109	105
3124862	3244940	3365016	102	099	095	092	088	086	082	078	076	072
4325499	4445544	4565586	068	066	062	058	056	052	049	045	042	039
5525804	5645816	5765825	036	032	029	025	023	019	015	012	009	006
6725778	6845757	6965733	002	999	996	993	989	985	983	979	976	972
7925420	8045366	8165309	119970	965	963	959	956	953	949	946	943	939
9124731	9244644	9364554	936	933	929	927	922	920	916	913	910	906
0323711	0443591	0563467	903	899	897	893	889	887	883	880	876	873
1522360	1642207	1762050	870	867	863	860	857	853	850	847	843	840
2720678	2840492	2960302	837	833	830	827	824	820	817	814	810	807
3918666	4038446	4158224	804	800	797	794	791	787	784	780	778	774
5116323	5236071	5355815	770	768	764	761	757	754	751	748	744	741
6313650	6433365	6553076	737	735	731	728	724	721	718	715	711	708
7510647	7630329	7750007	705	701	698	695	691	688	685	682	678	675
8707314	8826963	8946608	672	668	665	662	658	656	651	649	645	642
9903652	0023268	0142880	119639	635	633	628	626	622	619	616	612	609
1099660	1219243	1338822	606	602	600	595	593	589	586	583	579	576
2295339	2414889	2534435	573	570	566	563	560	556	553	550	546	544
3490689	3610206	3729719	540	536	533	531	526	524	520	517	513	511
4685710	4805194	4924675	507	503	501	497	494	491	487	484	481	477
5880402	5999853	6119301	474	471	468	464	461	458	454	451	448	444
7074766	7194184	7313599	442	438	434	432	428	425	422	418	415	412
8268801	8388186	8507568	408	405	402	399	395	392	389	385	382	379
9462508	9581860	9701210	376	372	369	366	363	359	356	352	350	346
0655887	0775207	0894523	343	339	336	333	330	327	323	320	316	313
1848938	1968225	2087509	311	306	304	300	297	294	290	287	284	280

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3640	5611013836	1133147	1252453	1371757	1491057	1610354	1729648
41	2206789	2326067	2445341	2564611	2683879	2803143	2922404
42	3399415	3518659	3637900	3757138	3876373	3995604	4114833
43	4591712	4710924	4830133	4949338	5068540	5187739	5306934
44	5783683	5902862	6022038	6141210	6260380	6379546	6498708
45	6975327	7094473	7213616	7332756	7451892	7571026	7690156
46	8166643	8285757	8404867	8523974	8643078	8762179	8881276
47	9357633	9476714	9595792	9714866	9833938	9953006	0072070
48	5620548297	0667345	0786390	0905432	1024471	1143506	1262538
49	1738634	1857649	1976662	2095671	2214677	2333680	2452679
3650	5622928645	3047628	3166608	3285584	3404558	3523528	3642495
51	4118329	4237280	4356227	4475171	4594112	4713050	4831984
52	5307689	5426607	5545521	5664433	5783341	5902246	6021148
53	6496722	6615608	6734490	6853369	6972244	7091117	7209986
54	7685430	7804283	7923133	8041979	8160822	8279662	8398499
55	8873813	8992633	9111450	9230264	9349075	9467882	9586687
56	5630061871	0180659	0299443	0418225	0537003	0655778	0774549
57	1249603	1368359	1487111	1605860	1724606	1843348	1962087
58	2437011	2555734	2674454	2793171	2911884	3030594	3149300
59	3624095	3742785	3861473	3980157	4098837	4217515	4336189
3660	5634810854	4929512	5048167	5166818	5285467	5404112	5522754
61	5997289	6115914	6234537	6353156	6471772	6590385	6708994
62	7183400	7301993	7420583	7539170	7657753	7776334	7894911
63	8369187	8487748	8606305	8724860	8843411	8961959	9080503
64	9554650	9673178	9791704	9910226	0028745	0147260	0265773
65	5640739790	0858286	0976779	1095269	1213755	1332238	1450718
66	1924606	2043070	2161531	2279988	2398442	2516893	2635341
67	3109100	3227531	3345960	3464385	3582807	3701225	3819641
68	4293270	4411669	4530065	4648458	4766848	4885234	5003617
69	5477118	5595485	5713848	5832209	5950566	6068920	6187271
3670	5646660643	6778977	6897309	7015637	7133962	7252284	7370603
71	7843845	7962148	8080447	8198743	8317036	8435325	8553612
72	9026725	9144996	9263263	9381527	9499787	9618045	9736299
73	5650209283	0327522	0445756	0563988	0682217	0800442	0918664
74	1391520	1509726	1627928	1746128	1864324	1982517	2100707
75	2573434	2691608	2809779	2927946	3046110	3164271	3282429
76	3755027	3873169	3991307	4109442	4227574	4345703	4463829
77	4936299	5054408	5172514	5290618	5408717	5526814	5644907
78	6117249	6235326	6353401	6471472	6589539	6707604	6825665
79	7297878	7415924	7533966	7652005	7770040	7888073	8006102
3680	5658478187	8596200	8714210	8832217	8950220	9068221	9186218
81	9658174	9776156	9894134	0012108	0130080	0248048	0366013
82	5660837842	0955791	1073737	1191679	1309619	1427555	1545488
83	2017189	2135106	2253019	2370930	2488838	2606742	2724643
84	3196215	3314100	3431982	3549861	3667736	3785609	3903478
85	4374922	4492775	4610625	4728472	4846315	4964155	5081992
86	5553309	5671130	5788948	5906763	6024574	6142382	6260188
87	6731376	6849165	6966951	7084734	7202513	7320290	7438063
88	7909124	8026881	8144635	8262386	8380134	8497878	8615619
89	9086552	9204278	9322000	9439719	9557434	9675147	9792856
3690	5670263662	0381355	0499045	0616732	0734416	0852097	0969774
91	1440452	1558113	1675772	1793427	1911079	2028728	2146373
92	2616924	2734553	2852180	2969803	3087423	3205040	3322654
93	3793077	3910674	4028269	4145860	4263449	4381034	4498615
94	4968911	5086477	5204040	5321599	5439156	5556709	5674259
95	6144427	6261961	6379492	6497020	6614545	6732066	6849584
96	7319625	7437128	7554627	7672123	7789616	7907105	8024592
97	8494506	8611976	8729444	8846908	8964369	9081827	9199281
98	9669068	9786507	9903943	0021375	0138804	0256230	0373653
99	5680843313	0960720	1078124	1195525	1312922	1430317	1547708
3700	2017241	2134616	2251988	2369357	2486723	2604085	2721445

OF NUMBERS. Logarithms 561101383б–568307350⁴.

Mantissæ.			Differences.									
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1848938	1968225	2087509	119311	306	304	300	297	294	290	287	284	280
3041661	3160916	3280167	278	274	270	268	264	261	257	255	251	248
4234057	4353279	4472497	244	241	238	235	231	229	224	222	218	215
5426126	5545315	5664501	212	209	205	202	199	195	192	189	186	182
6617868	6737024	6856177	179	176	172	170	166	162	160	156	153	150
7809283	7928406	8047526	146	143	140	136	134	130	127	123	120	117
9000370	9119461	9238549	114	110	107	104	101	097	094	091	088	084
0191132	0310190	0429245	081	078	074	072	068	064	062	058	055	052
1381567	1500592	1619615	048	045	042	039	035	032	029	025	023	019
2571676	2690668	2809658	015	013	009	006	003	999	997	992	990	987
3761458	3880419	3999376	118983	980	976	974	970	967	963	961	957	953
4950915	5069843	5188767	951	947	944	941	938	934	931	928	924	922
6140046	6258941	6377833	918	914	912	908	905	902	898	895	892	889
7328852	7447715	7566574	886	882	879	875	873	869	866	863	859	856
8517332	8636162	8754989	853	850	846	843	840	837	833	830	827	824
9705487	9824285	9943079	820	817	814	811	807	805	800	798	794	792
0893318	1012083	1130845	788	784	782	778	775	771	769	765	762	758
2080823	2199556	2318285	756	752	749	746	742	739	736	733	729	726
3268004	3386704	3505401	723	720	717	713	710	706	704	700	697	694
4454860	4573528	4692193	690	688	684	680	678	674	671	668	665	661
5641392	5760028	5878660	118658	655	651	649	645	642	638	636	632	629
6827600	6946203	7064803	625	623	619	616	613	609	606	603	600	597
8013485	8132055	8250623	593	590	587	583	581	577	574	570	568	564
9199045	9317583	9436118	561	557	555	551	548	544	542	538	535	532
0384282	0502788	0621290	528	526	522	519	515	513	509	506	502	500
1569195	1687669	1806139	496	493	490	486	483	480	477	474	470	467
2753786	2872227	2990665	464	461	457	454	451	448	445	441	438	435
3938053	4056462	4174867	431	429	425	422	418	416	412	409	405	403
5121997	5240374	5358747	399	396	393	390	386	383	380	377	373	371
6305619	6423963	6542305	367	363	361	357	354	351	348	344	342	338
7488918	7607230	7725539	118334	332	328	325	322	319	315	312	309	306
8671895	8790175	8908452	303	299	296	293	289	287	283	280	277	273
9854550	9972798	0091042	271	267	264	260	258	254	251	248	244	241
1036883	1155098	1273311	239	234	232	229	225	222	219	215	213	209
2218894	2337077	2455257	206	202	200	196	193	190	187	183	180	177
3400583	3518734	3636882	174	171	167	164	161	158	154	151	148	145
4581951	4700070	4818186	142	138	135	132	129	126	122	119	116	113
5762998	5881085	5999168	109	106	104	099	097	093	091	087	083	081
6943723	7061778	7179830	077	075	071	067	065	061	058	055	052	048
8124128	8242151	8360170	046	042	039	035	033	029	026	023	019	017
9304212	9422203	9540190	118013	010	007	003	001	997	994	991	987	984
0483975	0601934	0719889	117982	978	974	972	968	965	962	959	955	953
1663418	1781345	1899268	949	946	942	940	936	933	930	927	923	921
2842541	2960436	3078327	917	913	911	908	904	901	898	895	891	888
4021344	4139206	4257066	885	882	879	875	873	869	866	862	860	856
5199826	5317657	5435485	853	850	847	843	840	837	834	831	828	824
6377989	6495788	6613584	821	818	815	811	808	806	801	799	796	792
7555833	7673600	7791363	789	786	783	779	777	773	770	767	763	761
8733357	8851092	8968824	757	754	751	748	744	741	738	735	732	728
9910562	0028265	0145965	726	722	719	715	713	709	706	703	700	697
1087448	1205119	1322787	117693	690	687	684	681	677	674	671	668	665
2264016	2381655	2499291	661	659	655	652	649	645	643	639	636	633
3440264	3557871	3675476	629	627	623	620	617	614	610	607	605	601
4616194	4733770	4851342	597	595	591	589	585	581	579	576	572	569
5791806	5909350	6026890	566	563	559	557	553	550	547	544	540	537
6967099	7084611	7202120	534	531	528	525	521	518	515	512	509	505
8142075	8259555	8377032	503	499	496	493	489	487	483	480	477	474
9316733	9434181	9551626	470	468	464	461	458	454	452	448	445	442
0491073	0608490	0725903	439	436	432	429	426	423	420	417	413	410
1665096	1782481	1899862	407	404	401	397	395	391	388	385	381	379
2838801	2956154	3073504	375	372	369	366	362	360	356	353	350	347

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3700	5682017241	2134616	2251988	2369357	2486723	2604085	2721445
1	3190851	3308195	3425535	3542872	3660206	3777537	3894865
2	4364144	4481456	4598765	4716070	4833373	4950672	5067968
3	5537120	5654401	5771678	5888952	6006222	6123490	6240754
4	6709780	6827029	6944274	7061516	7178755	7295991	7413224
5	7882123	7999340	8116554	8233764	8350972	8468176	8585377
6	9054150	9171335	9288517	9405696	9522872	9640045	9757214
7	5690225860	0343014	0460164	0577312	0694456	0811597	0928735
8	1397255	1514377	1631496	1748611	1865724	1982833	2099940
9	2568333	2685424	2802511	2919595	3036676	3153754	3270829
3710	5693739096	3856155	3973211	4090263	4207313	4324359	4441402
11	4909543	5026571	5143595	5260616	5377634	5494649	5611661
12	6079675	6196671	6313664	6430654	6547640	6664623	6781603
13	7249492	7366457	7483418	7600376	7717331	7834283	7951231
14	8418994	8535927	8652857	8769783	8886707	9003627	9120544
15	9588181	9705082	9821981	9938876	0055768	0172656	0289542
16	5700757053	0873923	0990790	1107654	1224514	1341371	1458226
17	1925611	2042449	2159285	2276117	2392946	2509772	2626595
18	3093854	3210661	3327465	3444266	3561064	3677858	3794650
19	4261784	4378559	4495332	4612101	4728867	4845630	4962390
3720	5705429399	5546143	5662884	5779622	5896357	6013089	6129817
21	6596700	6713413	6830123	6946829	7063533	7180233	7296930
22	7763688	7880369	7997048	8113723	8230395	8347064	8463730
23	8930362	9047012	9163659	9280303	9396944	9513582	9630216
24	5710096723	0213342	0329958	0446570	0563180	0679786	0796389
25	1262771	1379358	1495943	1612524	1729102	1845677	1962249
26	2428506	2545062	2661615	2778165	2894712	3011256	3127796
27	3593928	3710453	3826974	3943493	4060009	4176521	4293031
28	4759037	4875531	4992021	5108509	5224993	5341474	5457952
29	5923834	6040296	6156755	6273212	6389665	6506115	6622562
3730	5717088318	7204749	7321178	7437603	7554024	7670443	7786859
31	8252490	8368890	8485287	8601681	8718072	8834460	8950844
32	9416351	9532720	9649085	9765448	9881808	9998164	0114517
33	5720579899	0696237	0812572	0928903	1045231	1161557	1277879
34	1743136	1859443	1975746	2092046	2208344	2324638	2440929
35	2906062	3022337	3138609	3254878	3371144	3487407	3603667
36	4068676	4184920	4301161	4417399	4533634	4649866	4766095
37	5230978	5347192	5463402	5579609	5695813	5812013	5928211
38	6392970	6509153	6625332	6741507	6857680	6973850	7090016
39	7554652	7670803	7786950	7903095	8019237	8135376	8251511
3740	5728716022	8832142	8948259	9064373	9180483	9296591	9412695
41	9877082	9993171	0109257	0225339	0341419	0457496	0573569
42	5731037832	1153890	1269944	1385996	1502045	1618090	1734133
43	2198271	2314298	2430322	2546343	2662360	2778375	2894386
44	3358401	3474397	3590389	3706379	3822366	3938349	4054330
45	4518220	4634185	4750147	4866106	4982062	5098014	5213964
46	5677730	5793664	5909595	6025523	6141448	6257369	6373288
47	6836931	6952834	7068734	7184631	7300525	7416415	7532303
48	7995822	8111694	8227563	8343429	8459292	8575152	8691008
49	9154404	9270245	9386084	9501919	9617751	9733579	9849405
3750	5740312677	0428488	0544295	0660099	0775900	0891698	1007493
51	1470642	1586421	1702197	1817971	1933741	2049508	2165272
52	2628297	2744046	2859791	2975534	3091273	3207009	3322742
53	3785644	3901362	4017077	4132788	4248497	4364202	4479904
54	4942683	5058370	5174054	5289734	5405412	5521087	5636758
55	6099413	6215070	6330723	6446372	6562019	6677663	6793304
56	7255836	7371461	7487084	7602703	7718319	7833932	7949542
57	8411951	8527545	8643137	8758725	8874310	8989893	9105472
58	9567758	9683321	9798882	9914440	0029994	0145546	0261094
59	5750723257	0838790	0954320	1069847	1185371	1300892	1416409
3760	1878449	1993952	2109451	2224947	2340440	2455930	2571417

OF NUMBERS. Logarithms 5682017241–5752917860.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2838801	2956154	3073504	117375	372	369	366	362	360	356	353	350	347
4012189	4129511	4246829	344	340	337	334	331	328	324	322	318	315
5185261	5302551	5419837	312	309	305	303	299	296	293	290	286	283
6358015	6475274	6592528	281	277	274	270	268	264	261	259	254	252
7530453	7647680	7764903	249	245	242	239	236	233	229	227	223	220
8702575	8819770	8936961	217	214	210	208	204	201	198	195	191	189
9874380	9991543	0108703	185	182	179	176	173	169	166	163	160	157
1045870	1163001	1280129	154	150	148	144	141	138	135	131	128	126
2217043	2334143	2451240	122	119	115	113	109	107	103	100	097	093
3387900	3504969	3622034	091	087	084	081	078	075	071	069	065	062
4558442	4675479	4792513	117059	056	052	050	046	043	040	037	034	030
5728669	5845674	5962676	028	024	021	018	015	012	008	005	002	999
6898580	7015554	7132525	116996	993	990	986	983	980	977	974	971	967
8068177	8185119	8302058	965	961	958	955	952	948	946	942	939	936
9237458	9354369	9471276	933	930	926	924	920	917	914	911	907	905
0406425	0523304	0640180	901	899	895	892	888	886	883	879	876	873
1575077	1691925	1808769	870	867	864	860	857	855	851	848	844	842
2743414	2860231	2977044	838	836	832	829	826	823	819	817	813	810
3911438	4028223	4145005	807	804	801	798	794	792	788	785	782	779
5079147	5195901	5312651	775	773	769	766	763	760	757	754	750	748
6246543	6363265	6479984	116744	741	738	735	732	728	726	722	719	716
7413625	7530315	7647003	713	710	706	704	700	697	695	690	688	685
8580393	8697052	8813709	681	679	675	672	669	666	663	659	657	653
9746848	9863476	9980101	650	647	644	641	638	634	632	628	625	622
0912989	1029586	1146180	619	616	612	610	606	603	600	597	594	591
2078818	2195384	2311946	587	585	581	578	575	572	569	566	562	560
3244334	3360868	3477399	556	553	550	547	544	540	538	534	531	529
4409537	4526040	4642540	525	521	519	516	512	510	506	503	500	497
5574427	5690899	5807368	494	490	488	484	481	478	475	472	469	466
6739006	6855446	6971884	462	459	457	453	450	447	444	440	438	434
7903271	8019681	8136087	116431	429	425	421	419	416	412	410	406	403
9067225	9183604	9299979	400	397	394	391	388	384	381	379	375	372
0230867	0347214	0463558	369	365	363	360	356	353	350	347	344	341
1394198	1510514	1626826	338	335	331	328	326	322	319	316	312	310
2557217	2673501	2789783	307	303	300	298	294	291	288	284	282	279
3719924	3836178	3952428	275	272	269	266	263	260	257	254	250	248
4882320	4998543	5114762	244	241	238	235	232	229	225	223	219	216
6044405	6160597	6276785	214	210	207	204	200	198	194	192	188	185
7206180	7322340	7438497	183	179	175	173	170	166	164	160	157	155
8367643	8483773	8599899	151	147	145	142	139	135	132	130	126	123
9528797	9644895	9760990	116120	117	114	110	108	104	102	098	095	092
0689639	0805707	0921771	089	086	082	080	077	073	070	068	064	061
1850172	1966208	2082241	058	054	052	049	045	043	039	036	033	030
3010394	3126400	3242402	027	024	021	017	015	011	008	006	002	999
4170307	4286281	4402252	115996	992	990	987	983	981	977	974	971	968
5329910	5445853	5561793	965	962	959	956	952	950	946	943	940	937
6489203	6605116	6721025	934	931	928	925	921	919	915	913	909	906
7648187	7764069	7879947	903	900	897	894	890	888	884	882	878	875
8806862	8922713	9038560	872	869	866	863	860	856	854	851	847	844
9965228	0081047	0196864	841	839	835	832	828	826	823	819	817	813
1123285	1239073	1354859	115811	807	804	801	798	795	792	788	786	783
2281033	2396791	2512545	779	776	774	770	767	764	761	758	754	752
3438472	3554199	3669923	749	745	743	739	736	733	730	727	724	721
4595604	4711300	4826993	718	715	711	709	705	702	700	696	693	690
5752427	5868092	5983754	687	684	680	678	675	671	669	665	662	659
6908942	7024576	7140208	657	653	649	647	644	641	638	634	632	628
8065149	8180752	8296353	625	623	619	616	613	610	607	603	601	598
9221048	9336621	9452191	594	592	588	585	583	579	576	573	570	567
0376640	0492182	0607721	563	561	558	554	552	548	546	542	539	536
1531924	1647435	1762944	533	530	527	524	521	517	515	511	509	505
2686901	2802382	2917860	503	499	496	493	490	487	484	481	478	474

Numbers 37600–38209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3760	5751878449	1993952	2109451	2224947	2340440	2455930	2571417
61	3033334	3148806	3264274	3379740	3495202	3610662	3726118
62	4187912	4303353	4418791	4534226	4649657	4765086	4880512
63	5342183	5457593	5573001	5688405	5803806	5919204	6034599
64	6496148	6611527	6726904	6842277	6957647	7073015	7188379
65	7649805	7765154	7880500	7995843	8111183	8226519	8341853
66	8803157	8918475	9033790	9149103	9264412	9379718	9495021
67	9956202	0071490	0186774	0302056	0417334	0532610	0647882
68	5761108941	1224198	1339452	1454703	1569951	1685196	1800438
69	2261374	2376601	2491824	2607045	2722262	2837476	2952688
3770	5763413502	3528698	3643891	3759081	3874268	3989451	4104632
71	4565324	4680489	4795652	4910811	5025967	5141121	5256271
72	5716841	5831976	5947107	6062236	6177362	6292484	6407604
73	6868052	6983156	7098258	7213356	7328451	7443543	7558632
74	8018958	8134032	8249103	8364171	8479235	8594297	8709356
75	9169560	9284603	9399643	9514681	9629715	9744746	9859774
76	5770319856	0434869	0549879	0664886	0779890	0894890	1009888
77	1469848	1584831	1699810	1814787	1929760	2044730	2159697
78	2619536	2734488	2849437	2964383	3079326	3194266	3309202
79	3768919	3883841	3998759	4113675	4228587	4343497	4458403
3780	5774917998	5032890	5147778	5262663	5377545	5492424	5607300
81	6066774	6181634	6296492	6411347	6526199	6641047	6755893
82	7215245	7330076	7444903	7559727	7674549	7789367	7904182
83	8363413	8478213	8593010	8707804	8822595	8937383	9052168
84	9511277	9626047	9740814	9855577	9970338	0085096	0199850
85	5780658838	0773578	0888314	1003048	1117778	1232505	1347229
86	1806096	1920805	2035511	2150215	2264915	2379612	2494306
87	2953051	3067730	3182406	3297079	3411748	3526415	3641079
88	4099703	4214352	4328997	4443640	4558279	4672916	4787549
89	5246053	5360671	5475286	5589899	5704508	5819114	5933717
3790	5786392100	6506688	6621273	6735855	6850434	6965010	7079583
91	7537844	7652402	7766957	7881509	7996057	8110603	8225146
92	8683287	8797814	8912339	9026860	9141379	9255895	9370407
93	9828427	9942924	0057419	0171910	0286399	0400884	0515366
94	5790973266	1087733	1202197	1316658	1431116	1545572	1660024
95	2117802	2232239	2346673	2461105	2575533	2689958	2804380
96	3262038	3376444	3490848	3605249	3719647	3834042	3948434
97	4405971	4520348	4634722	4749093	4863461	4977825	5092187
98	5549604	5663951	5778294	5892635	6006973	6121307	6235639
99	6692936	6807252	6921566	7035876	7150184	7264488	7378790
3800	5797835966	7950253	8064536	8178817	8293094	8407369	8521640
1	8978696	9092952	9207206	9321456	9435704	9549948	9664190
2	5800121125	0235352	0349575	0463795	0578013	0692227	0806439
3	1263254	1377450	1491644	1605834	1720022	1834206	1948387
4	2405083	2519249	2633412	2747573	2861730	2975884	3090036
5	3546611	3660747	3774881	3889011	4003138	4117263	4231384
6	4687840	4801946	4916049	5030150	5144247	5258341	5372433
7	5828768	5942845	6056918	6170988	6285056	6399120	6513181
8	6969397	7083444	7197487	7311527	7425565	7539599	7653631
9	8109727	8223743	8337757	8451767	8565775	8679779	8793781
3810	5809249757	9363743	9477727	9591707	9705685	9819660	9933631
11	5810389488	0503444	0617398	0731349	0845296	0959241	1073183
12	1528920	1642846	1756770	1870691	1984609	2098524	2212435
13	2668053	2781950	2895844	3009734	3123622	3237507	3351389
14	3806887	3920754	4034618	4148479	4262337	4376192	4490044
15	4945423	5059260	5173094	5286925	5400754	5514579	5628401
16	6083660	6197468	6311272	6425073	6538872	6652667	6766460
17	7221599	7335377	7449152	7562923	7676692	7790457	7904220
18	8359241	8472988	8586733	8700475	8814214	8927949	9041682
19	9496584	9610302	9724017	9837729	9951438	0065144	0178847
3820	5820633629	0747317	0861002	0974685	1088364	1202040	1315713

OF NUMBERS. Logarithms 5751878449–5821656715.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2686901	2802382	2917860	115503	499	496	493	490	487	484	481	478	474
3841571	3957021	4072468	472	468	466	462	460	456	453	450	447	444
4995934	5111354	5226770	441	438	435	431	429	426	422	420	416	413
6149990	6265379	6380765	410	408	404	401	398	395	391	389	386	383
7303740	7419098	7534453	379	377	373	370	368	364	361	358	355	352
8457184	8572511	8687835	349	346	343	340	336	334	331	327	324	322
9610321	9725617	9840911	318	315	313	309	306	303	300	296	294	291
0763152	0878418	0993681	288	284	282	278	276	272	270	266	263	260
1915677	2030912	2146145	257	254	251	248	245	242	239	235	233	229
3067896	3183101	3298303	227	223	221	217	214	212	208	205	202	199
4219810	4334984	4450156	115196	193	190	187	183	181	178	174	172	168
5371418	5486562	5601703	165	163	159	156	154	150	147	144	141	138
6522721	6637834	6752945	135	131	129	126	122	120	117	113	111	107
7673718	7788801	7903881	104	102	098	095	092	089	086	083	080	077
8824411	8939464	9054513	074	071	068	064	062	059	055	053	049	047
9974799	0089821	0204840	043	040	038	034	031	028	025	022	019	016
1124883	1239874	1354863	013	010	007	004	000	998	995	991	989	985
2274662	2389623	2504581	114983	979	977	973	970	967	965	961	958	955
3424136	3539067	3653995	952	949	946	943	940	936	934	931	928	924
4573307	4688207	4803104	922	918	916	912	910	906	904	900	897	894
5722173	5837043	5951910	114892	888	885	882	879	876	873	870	867	864
6870736	6985575	7100412	860	858	855	852	848	846	843	839	837	833
8018994	8133804	8248610	831	827	824	822	818	815	812	810	806	803
9166950	9281729	9396505	800	797	794	791	788	785	782	779	776	772
0314602	0429350	0544096	770	767	763	761	758	754	752	748	746	742
1461951	1576669	1691384	740	736	734	730	727	724	722	718	715	712
2608997	2723684	2838369	709	706	704	700	697	694	691	687	685	682
3755739	3870397	3985052	679	676	673	669	667	664	660	658	655	651
4902180	5016807	5131431	649	645	643	639	637	633	631	627	624	622
6048317	6162914	6277509	618	615	613	609	606	603	600	597	595	591
7194153	7308720	7423283	114588	585	582	579	576	573	570	567	563	561
8339686	8454222	8568756	558	555	552	548	546	543	540	536	534	531
9484917	9599423	9713927	527	525	521	519	516	512	510	506	504	500
0629846	0744322	0858795	497	495	491	489	485	482	480	476	473	471
1774473	1888919	2003362	467	464	461	458	456	452	449	446	443	440
2918799	3033215	3147628	437	434	432	428	425	422	419	416	413	410
4062823	4177209	4291592	406	404	401	398	395	392	389	386	383	379
5206546	5320902	5435254	377	374	371	368	364	362	359	356	352	350
6349968	6464293	6578616	347	343	341	338	334	332	329	325	323	320
7493089	7607384	7721677	316	314	310	308	304	302	299	295	293	289
8635909	8750174	8864437	114287	283	281	277	275	271	269	265	263	259
9778428	9892663	0006896	256	254	250	248	244	242	238	235	233	229
0920647	1034852	1149055	227	223	220	218	214	212	208	205	203	199
2062566	2176741	2290913	196	194	190	188	184	181	179	175	172	170
3204184	3318329	3432472	166	163	161	157	154	152	148	145	143	139
4345502	4459618	4573730	136	134	130	127	125	121	118	116	112	110
5486521	5600606	5714689	106	103	101	097	094	092	088	085	083	079
6627240	6741295	6855348	077	073	070	068	064	061	059	055	053	049
7767659	7881685	7995707	047	043	040	038	034	032	028	026	022	020
8907779	9021775	9135767	016	014	010	008	004	002	998	996	992	990
0047600	0161565	0275528	113986	984	980	978	975	971	969	965	963	960
1187121	1301057	1414990	956	954	951	947	945	942	938	936	933	930
2326344	2440250	2554153	926	924	921	918	915	911	909	906	903	900
3465268	3579144	3693017	897	894	890	888	885	882	879	876	873	870
4603894	4717740	4831583	867	864	861	858	855	852	850	846	843	840
5742220	5856037	5969850	837	834	831	829	825	822	819	817	813	810
6880249	6994036	7107819	808	804	801	799	795	793	789	787	783	780
8017980	8131736	8245490	778	775	771	769	765	763	760	756	754	751
9155412	9269139	9382863	747	745	742	739	735	733	730	727	724	721
0292547	0406244	0519938	718	715	712	709	706	703	700	697	694	691
1429384	1543051	1656715	688	685	683	679	676	673	671	667	664	662

Numbers 38200–38809. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3820	5820633629	0747317	0861002	0974685	1088364	1202040	1315713
21	1770377	1884035	1997691	2111343	2224993	2338639	2452283
22	2906827	3020456	3134082	3247704	3361324	3474941	3588555
23	4042980	4156579	4270175	4383768	4497358	4610945	4724529
24	5178836	5292405	5405972	5519535	5633095	5746653	5860207
25	6314395	6427934	6541471	6655005	6768535	6882063	6995588
26	7449657	7563167	7676674	7790178	7903679	8017177	8130672
27	8584622	8698102	8811580	8925054	9038525	9151994	9265459
28	9719291	9832742	9946189	0059634	0173076	0286514	0399950
29	5830853663	0967084	1080502	1193917	1307329	1420739	1534145
3830	5831987740	2101131	2214519	2327905	2441287	2554667	2668043
31	3121520	3234882	3348240	3461596	3574949	3688299	3801646
32	4255004	4368337	4481665	4594992	4708315	4821635	4934953
33	5388193	5501495	5614795	5728091	5841385	5954676	6067964
34	6521085	6634358	6747629	6860896	6974160	7087421	7200679
35	7653683	7766926	7880167	7993404	8106639	8219871	8333100
36	8785985	8899199	9012410	9125618	9238823	9352025	9465225
37	9917992	0031176	0144358	0257537	0370712	0483885	0597055
38	5841049704	1162859	1276011	1389160	1502306	1615449	1728590
39	2181121	2294247	2407369	2520489	2633606	2746719	2859830
3840	5843312244	3425340	3538433	3651523	3764610	3877694	3990776
41	4443072	4556138	4669202	4782263	4895320	5008375	5121427
42	5573605	5686642	5799677	5912708	6025736	6138762	6251784
43	6703845	6816852	6929857	7042859	7155858	7268854	7381847
44	7833790	7946768	8059744	8172716	8285686	8398652	8511616
45	8963441	9076390	9189336	9302280	9415220	9528157	9641091
46	5850092799	0205719	0318635	0431549	0544460	0657368	0770273
47	1221863	1334753	1447641	1560525	1673407	1786285	1899161
48	2350634	2463495	2576353	2689208	2802060	2914909	3027755
49	3479111	3591943	3704771	3817597	3930420	4043240	4156057
3850	5854607295	4720097	4832897	4945693	5058487	5171277	5284065
51	5735186	5847959	5960729	6073496	6186261	6299022	6411780
52	6862785	6975528	7088269	7201007	7313742	7426474	7539203
53	7990090	8102805	8215516	8328225	8440930	8553633	8666333
54	9117103	9229788	9342471	9455150	9567827	9680500	9793171
55	5860243824	0356480	0469133	0581783	0694430	0807075	0919716
56	1370252	1482879	1595503	1708124	1820742	1933357	2045969
57	2496389	2608986	2721581	2834173	2946761	3059347	3171930
58	3622233	3734801	3847367	3959929	4072489	4185046	4297600
59	4747786	4860325	4972861	5085395	5197925	5310453	5422977
3860	5865873047	5985557	6098064	6210568	6323069	6435568	6548063
61	6998016	7110497	7222975	7335450	7447922	7560392	7672858
62	8122694	8235146	8347595	8460041	8572484	8684924	8797362
63	9247081	9359504	9471924	9584341	9696755	9809166	9921574
64	5870371177	0483571	0595962	0708350	0820734	0933116	1045495
65	1494983	1607347	1719709	1832067	1944423	2056776	2169126
66	2618497	2730832	2843165	2955495	3067821	3180145	3292466
67	3741721	3854027	3966331	4078631	4190929	4303224	4415516
68	4864654	4976931	5089206	5201478	5313746	5426012	5538275
69	5987297	6099546	6211791	6324034	6436273	6548510	6660744
3870	5877109650	7221870	7334086	7446300	7558510	7670718	7782923
71	8231713	8343904	8456091	8568276	8680457	8792636	8904812
72	9353486	9465648	9577806	9689962	9802115	9914264	0026411
73	5880474970	0587102	0699232	0811358	0923482	1035603	1147721
74	1596164	1708267	1820368	1932466	2044560	2156652	2268741
75	2717068	2829143	2941215	3053283	3165349	3277412	3389472
76	3837684	3949729	4061772	4173812	4285849	4397883	4509914
77	4958010	5070027	5182041	5294052	5406060	5518065	5630067
78	6078047	6190035	6302020	6414003	6525982	6637958	6749931
79	7197796	7309755	7421711	7533664	7645615	7757562	7869507
3880	8317256	8429186	8541113	8653038	8764959	8876878	8988793

OF NUMBERS. Logarithms 5820633629-5889324523.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1429384	1543051	1656715	113688	685	683	679	676	673	671	667	664	662
2565923	2679561	2793196	658	656	652	650	646	644	640	638	635	631
3702165	3815773	3929378	629	626	622	620	617	614	610	608	605	602
4838110	4951689	5065264	599	596	593	590	587	584	581	579	575	572
5973758	6087307	6200852	569	567	563	560	558	554	551	549	545	543
7109109	7222628	7336144	539	537	534	530	528	525	521	519	516	513
8244164	8357653	8471139	510	507	504	501	498	495	492	489	486	483
9378921	9492381	9605838	480	478	474	471	469	465	462	460	457	453
0513383	0626813	0740240	451	447	445	442	438	436	433	430	427	423
1647548	1760948	1874345	421	418	415	412	410	406	403	400	397	395
2781417	2894787	3008155	113391	388	386	382	380	376	374	370	368	365
3914990	4028331	4141669	362	358	356	353	350	347	344	341	338	335
5048267	5161579	5274887	333	328	327	323	320	318	314	312	308	306
6181249	6294530	6407809	302	300	296	294	291	288	285	281	279	276
7313935	7427187	7540436	273	271	267	264	261	258	256	252	249	247
8446325	8559548	8672768	243	241	237	235	232	229	225	223	220	217
9578421	9691614	9804805	214	211	208	205	202	200	196	193	191	187
0710221	0823385	0936546	184	182	179	175	173	170	166	164	161	158
1841727	1954861	2067993	155	152	149	146	143	141	137	134	132	128
2972938	3086043	3199145	126	122	120	117	113	111	108	105	102	099
4103854	4216930	4330002	113096	093	090	087	084	082	078	076	072	070
5234476	5347522	5460565	066	064	061	057	055	052	049	046	043	040
6364804	6477820	6590834	037	035	031	028	026	022	020	016	014	011
7494837	7607824	7720809	007	005	002	999	996	993	990	987	985	981
8624577	8737535	8850489	112978	976	972	970	966	964	961	958	954	952
9754023	9867951	9979876	949	946	944	940	937	934	932	928	925	923
0883175	0996074	1108970	920	916	914	911	908	905	902	899	896	893
2012033	2124903	2237770	890	888	884	882	878	876	872	870	867	864
3140599	3253439	3366276	861	858	855	852	849	846	844	840	837	835
4268871	4381682	4494490	832	828	826	823	820	817	814	811	808	805
5396850	5509631	5622410	112802	800	796	794	790	788	785	781	779	776
6524536	6637288	6750038	773	770	767	765	761	758	756	752	750	747
7651929	7764652	7877373	743	741	738	735	732	729	726	723	721	717
8779030	8891724	9004415	715	711	709	705	703	700	697	694	691	688
9905838	0018503	0131165	685	683	679	677	673	671	667	665	662	659
1032354	1144990	1257623	656	653	650	647	645	641	638	636	633	629
2158578	2271185	2383788	627	624	621	618	615	612	609	607	603	601
3284510	3397088	3509662	597	595	592	588	586	583	580	578	574	571
4410151	4522699	4635244	568	566	562	560	557	554	551	548	545	542
5535499	5648018	5760534	539	536	534	530	528	524	522	519	516	513
6660556	6773046	6885532	112510	507	504	501	499	495	493	490	486	484
7785322	7897782	8010240	481	478	475	472	470	466	464	460	458	454
8909796	9022227	9134656	452	449	446	443	440	438	434	431	429	425
0033979	0146382	0258781	423	420	417	414	411	408	405	403	399	396
1157872	1270245	1382615	394	391	388	384	382	379	377	373	370	368
2281473	2393817	2506159	364	362	358	356	353	350	347	344	342	338
3404784	3517099	3629411	335	333	330	326	324	321	318	315	312	310
4527805	4640091	4752374	306	304	300	298	295	292	289	286	283	280
5650535	5762792	5875046	277	275	272	268	266	263	260	257	254	251
6772975	6885203	6997428	249	245	243	239	237	234	231	228	225	222
7895125	8007324	8119520	112220	216	214	210	208	205	202	199	196	193
9016985	9129155	9241322	191	187	185	181	179	176	173	170	167	164
0138555	0250696	0362835	162	158	156	153	149	147	144	141	139	135
1259836	1371948	1484057	132	130	126	124	121	118	115	112	109	107
2380827	2492911	2604991	103	101	098	094	092	089	086	084	080	077
3501530	3613584	3725635	075	072	068	066	063	060	058	054	051	049
4621943	4733968	4845990	045	043	040	037	034	031	029	025	022	020
5742067	5854063	5966057	017	014	011	008	005	002	000	996	994	990
6861902	6973869	7085834	111988	985	983	979	976	973	971	967	965	962
7981448	8093387	8205323	959	956	953	951	947	945	941	939	936	933
9100706	9212616	9324523	930	927	925	921	919	915	913	910	907	904

Numbers 38800–39409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3880	5888317256	8429186	8541113	8653038	8764959	8876878	8988793
81	9436427	9548329	9660227	9772123	9884015	9995905	0107792
82	5890555311	0667183	0779053	0890919	1002783	1114644	1226502
83	1673905	1785749	1897590	2009428	2121263	2233095	2344924
84	2792212	2904027	3015839	3127648	3239455	3351258	3463058
85	3910231	4022017	4133801	4245581	4357358	4469133	4580905
86	5027963	5139720	5251474	5363226	5474975	5586720	5698463
87	6145406	6257135	6368861	6480583	6592303	6704020	6815735
88	7262563	7374262	7485959	7597653	7709345	7821033	7932718
89	8379431	8491103	8602771	8714435	8826099	8937758	9049415
3890	5899496013	9607656	9719295	9830932	9942566	0054197	0165825
91	5900612308	0723922	0835533	0947141	1058746	1170348	1281947
92	1728316	1839901	1951483	2063062	2174639	2286212	2397783
93	2844037	2955594	3067147	3178698	3290245	3401790	3513332
94	3959472	4071000	4182524	4294046	4405565	4517082	4628595
95	5074620	5186119	5297615	5409109	5520599	5632087	5743572
96	6189482	6300953	6412420	6523885	6635347	6746806	6858262
97	7304058	7415500	7526939	7638375	7749808	7861239	7972666
98	8418348	8529761	8641171	8752579	8863984	8975386	9086785
99	9532352	9643737	9755118	9866497	9977874	0089247	0200617
3900	5910646070	0757426	0868780	0980130	1091478	1202822	1314164
1	1759503	1870831	1982155	2093477	2204796	2316113	2427426
2	2872651	2983950	3095246	3206539	3317830	3429117	3540402
3	3985513	4096783	4208051	4319316	4430578	4541837	4653093
4	5098090	5209332	5320571	5431808	5543041	5654272	5765499
5	6210382	6321596	6432806	6544014	6655219	6766421	6877621
6	7322390	7433575	7544757	7655936	7767113	7878286	7989457
7	8434112	8545269	8656423	8767574	8878722	8989867	9101009
8	9545550	9656679	9767804	9878926	9990046	0101163	0212277
9	5920656704	0767804	0878901	0989995	1101086	1212175	1323260
3910	5921767574	1878645	1989714	2100779	2211842	2322902	2433959
11	2878160	2989202	3100243	3211280	3322314	3433346	3544375
12	3988461	4099476	4210487	4321496	4432502	4543506	4654506
13	5098479	5209465	5320449	5431429	5542407	5653382	5764354
14	6208213	6319171	6430126	6541078	6652028	6762974	6873918
15	7317664	7428593	7539520	7650444	7761365	7872283	7983198
16	8426831	8537732	8648631	8759526	8870419	8981309	9092196
17	9535715	9646588	9757458	9868326	9979190	0090051	0200910
18	5930644317	0755161	0866003	0976842	1087678	1198511	1309341
19	1752635	1863451	1974264	2085075	2195883	2306688	2417490
3920	5932860670	2971458	3082243	3193026	3303805	3414582	3525356
21	3968423	4079183	4189940	4300694	4411445	4522193	4632939
22	5075893	5186625	5297353	5408079	5518802	5629523	5740240
23	6183081	6293785	6404485	6515183	6625877	6736569	6847259
24	7289987	7400662	7511334	7622004	7732670	7843334	7953995
25	8396611	8507258	8617902	8728543	8839181	8949817	9060450
26	9502953	9613571	9724187	9834800	9945410	0056018	0166622
27	5940609013	0719603	0830191	0940776	1051358	1161937	1272514
28	1714791	1825354	1935913	2046470	2157024	2267575	2378123
29	2820288	2930822	3041354	3151882	3262408	3372931	3483451
3930	5943925504	4036010	4146513	4257014	4367511	4478006	4588498
31	5030438	5140916	5251391	5361864	5472333	5582800	5693264
32	6135092	6245541	6355989	6466433	6576874	6687313	6797749
33	7239464	7349886	7460305	7570721	7681134	7791545	7901953
34	8343556	8453950	8564341	8674729	8785114	8895496	9005876
35	9447367	9557733	9668096	9778456	9888813	9999167	0109519
36	5950550898	0661235	0771570	0881902	0992231	1102558	1212881
37	1654148	1764458	1874764	1985068	2095370	2205668	2315964
38	2757118	2867400	2977678	3087954	3198228	3308498	3418766
39	3859808	3970062	4080313	4190561	4300806	4411048	4521288
3940	4962218	5072444	5182667	5292887	5403104	5513318	5623530

OF NUMBERS. Logarithms 5888317256–5955954148.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9100706	9212616	9324523	111930	927	925	921	919	915	913	910	907	904
0219676	0331557	0443435	902	898	896	892	890	887	884	881	878	876
1338357	1450210	1562059	872	870	866	864	861	858	855	853	849	846
2456751	2568574	2680395	844	841	838	835	832	829	827	823	821	817
3574856	3686651	3798442	815	812	809	807	803	800	798	795	791	789
4692673	4804439	4916202	786	784	780	777	775	772	768	766	763	761
5810203	5921941	6033675	757	754	752	749	745	743	740	738	734	731
6927446	7039154	7150860	729	726	722	720	717	715	711	708	706	703
8044401	8156081	8267758	699	697	694	692	688	685	683	680	677	673
9161069	9272720	9384368	672	668	665	663	659	657	654	651	648	645
0277450	0389072	0500691	111643	639	637	634	631	628	625	622	619	617
1393544	1505137	1616728	614	611	608	605	602	599	597	593	591	588
2509351	2620916	2732478	585	582	579	577	573	571	568	565	562	559
3624872	3736408	3847941	557	553	551	547	545	542	540	536	533	531
4740106	4851613	4963118	528	524	522	519	517	513	511	507	505	502
5855054	5966533	6078009	499	496	494	490	488	485	482	479	476	473
6969715	7081166	7192613	471	467	465	462	459	456	453	451	447	445
8084091	8195513	8306932	442	439	436	433	431	427	425	422	419	416
9198181	9309574	9420964	413	410	408	405	402	399	396	393	390	388
0311985	0423349	0534711	385	381	379	377	373	370	368	364	362	359
1425503	1536839	1648173	111356	354	350	348	344	342	339	336	334	330
2538736	2650044	2761349	328	324	322	319	317	313	310	308	305	302
3651684	3762963	3874239	299	296	293	291	287	285	282	279	276	274
4764347	4875597	4986845	270	268	265	262	259	256	254	250	248	245
5876724	5987946	6099166	242	239	237	233	231	227	225	222	220	216
6988817	7100011	7211202	214	210	208	205	202	200	196	194	191	188
8100625	8211790	8322953	185	182	179	177	173	171	168	165	163	159
9212149	9323286	9434419	157	154	151	148	145	142	140	137	133	131
0323388	0434496	0545602	129	125	122	120	117	114	111	108	106	102
1434343	1545423	1656500	100	097	094	091	089	085	083	080	077	074
2545014	2656065	2767114	111071	069	065	063	060	057	055	051	049	046
3655400	3766424	3877444	042	041	037	034	032	029	025	024	020	017
4765503	4876498	4987490	015	011	009	006	004	000	997	995	992	989
5875323	5986289	6097253	110986	984	980	978	975	972	969	966	964	960
6984858	7095796	7206732	958	955	952	950	946	944	940	938	936	932
8094111	8205020	8315927	929	927	924	921	918	915	913	909	907	904
9203080	9313961	9424840	901	899	895	893	890	887	884	881	879	875
0311766	0422619	0533469	873	870	868	864	861	859	856	853	850	848
1420169	1530994	1641816	844	842	839	836	833	830	828	825	822	819
2528289	2639086	2749879	816	813	811	808	805	802	799	797	793	791
3636127	3746895	3857660	110788	785	783	779	777	774	771	768	765	763
4743682	4854422	4965159	760	757	754	751	748	746	743	740	737	734
5850954	5961666	6072375	732	728	726	723	721	717	714	712	709	706
6957945	7068628	7179309	704	700	698	694	692	690	686	683	681	678
8064653	8175309	8285961	675	672	670	666	664	661	658	656	652	650
9171080	9281707	9392331	647	644	641	638	636	633	630	627	624	622
0277224	0387823	0498419	618	616	613	610	608	604	602	599	596	594
1383087	1493658	1604226	590	588	585	582	579	577	573	571	568	565
2488669	2599211	2709751	563	559	557	554	551	548	546	542	540	537
3593969	3704483	3814995	534	532	528	526	523	520	518	514	512	509
4698987	4809474	4919957	110506	503	501	497	495	492	489	487	483	481
5803725	5914183	6024639	478	475	473	469	467	464	461	458	456	453
6908182	7018612	7129039	449	448	444	441	439	436	433	430	427	425
8012358	8122760	8233159	422	419	416	413	411	408	405	402	399	397
9116253	9226627	9336998	394	391	388	385	382	380	377	374	371	369
0219868	0330214	0440557	366	363	360	357	354	352	349	346	343	341
1323202	1433520	1543835	337	335	332	329	327	323	321	318	315	313
2426256	2536546	2646834	310	306	304	302	298	296	292	290	288	284
3529030	3639292	3749552	282	278	276	274	270	268	264	262	260	256
4631525	4741759	4851990	254	251	248	245	242	240	237	234	231	228
5733739	5843945	5954148	226	223	220	217	214	212	209	206	203	201

Numbers 39400–40009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
3940	5954962218	5072444	5182667	5292887	5403104	5513318	5623530
41	6064349	6174546	6284741	6394933	6505123	6615309	6725493
42	7166199	7276369	7386536	7496700	7606861	7717020	7827176
43	8267771	8377912	8488051	8598188	8708321	8818452	8928579
44	9369063	9479177	9589288	9699396	9809501	9919604	0029704
45	5960470075	0580161	0690245	0800325	0910402	1020477	1130549
46	1570809	1680867	1790922	1900975	2011025	2121071	2231115
47	2671264	2781294	2891321	3001346	3111368	3221387	3331403
48	3771440	3881442	3991442	4101438	4211432	4321423	4431412
49	4871337	4981312	5091283	5201252	5311218	5421182	5531142
3950	5965970956	6080903	6190847	6300788	6410726	6520661	6630594
51	7070297	7180216	7290132	7400045	7509955	7619863	7729768
52	8169359	8279250	8389138	8499024	8608906	8718786	8828663
53	9268143	9378007	9487867	9597725	9707579	9817431	9927281
54	5970366650	0476485	0586318	0696148	0805975	0915799	1025620
55	1464878	1574686	1684491	1794293	1904092	2013888	2123682
56	2562829	2672609	2782386	2892160	3001932	3111701	3221467
57	3660503	3770255	3880004	3989751	4099494	4209235	4318974
58	4757899	4867623	4977345	5087063	5196779	5306493	5416203
59	5855018	5964714	6074408	6184099	6293787	6403473	6513156
3960	5976951859	7061528	7171194	7280858	7390518	7500176	7609831
61	8048424	8158065	8267704	8377339	8486972	8596603	8706230
62	9144712	9254326	9363936	9473544	9583150	9692752	9802352
63	5980240723	0350309	0459892	0569473	0679050	0788625	0898197
64	1336458	1446016	1555572	1665125	1774675	1884222	1993766
65	2431917	2541447	2650975	2760500	2870023	2979542	3089059
66	3527099	3636602	3746102	3855599	3965094	4074586	4184075
67	4622005	4731480	4840953	4950423	5059890	5169354	5278816
68	5716635	5826083	5935528	6044970	6154410	6263846	6373280
69	6810989	6920409	7029827	7139242	7248654	7358063	7467469
3970	5987905068	8014460	8123850	8233237	8342622	8452004	8561382
71	8998871	9108236	9217598	9326958	9436315	9545669	9655020
72	5990092398	0201736	0311071	0420403	0529732	0639059	0748383
73	1185651	1294961	1404268	1513573	1622874	1732174	1841470
74	2278628	2387910	2497190	2606467	2715742	2825013	2934282
75	3371330	3480585	3589837	3699087	3808334	3917578	4026819
76	4463757	4572985	4682210	4791432	4900651	5009868	5119082
77	5555910	5665110	5774307	5883502	5992694	6101883	6211070
78	6647788	6756961	6866131	6975298	7084462	7193624	7302783
79	7739391	7848537	7957679	8066819	8175956	8285090	8394222
3980	5998830721	8939839	9048955	9158066	9267176	9376283	9485387
81	9921776	0030866	0139954	0249039	0358121	0467201	0576277
82	6001012557	1121620	1230680	1339738	1448793	1557845	1666894
83	2103064	2212100	2321133	2430163	2539190	2648215	2757237
84	3193298	3302306	3411311	3520314	3629314	3738312	3847306
85	4283257	4392238	4501216	4610192	4719165	4828135	4937102
86	5372944	5481897	5590848	5699796	5808742	5917684	6026624
87	6462357	6571283	6680206	6789127	6898045	7006961	7115873
88	7551496	7660395	7769292	7878185	7987076	8095964	8204849
89	8640363	8749235	8858104	8966970	9075833	9184694	9293552
3990	6009728957	9837801	9946643	0055482	0164318	0273151	0381982
91	6010817278	0926095	1034909	1143721	1252530	1361336	1470140
92	1905326	2014116	2122903	2231687	2340469	2449248	2558024
93	2993102	3101865	3210624	3319382	3428136	3536888	3645637
94	4080605	4189341	4298073	4406803	4515530	4624255	4732977
95	5167837	5276545	5385250	5493953	5602653	5711350	5820045
96	6254796	6363476	6472155	6580830	6689503	6798173	6906840
97	7341483	7450136	7558787	7667436	7776081	7884724	7993364
98	8427898	8536524	8645148	8753769	8862388	8971004	9079617
99	9514041	9622641	9731237	9839831	9948423	0057011	0165597
4000	6020599913	0708486	0817055	0925622	1034186	1142747	1251306

OF NUMBERS. Logarithms 5954962218–6021576966.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5733739	5843945	5954148	110226	223	220	217	214	212	209	206	203	201
6835674	6945852	7056027	197	195	192	190	186	184	181	178	175	172
7937329	8047479	8157626	170	167	164	161	159	156	153	150	147	145
9038704	9148827	9258946	141	139	137	133	131	127	125	123	119	117
0139801	0249895	0359987	114	111	108	105	103	100	097	094	092	088
1240618	1350685	1460748	086	084	080	077	075	072	069	067	063	061
2341157	2451195	2561231	058	055	053	050	046	044	042	038	036	033
3441416	3551427	3661435	030	027	025	022	019	016	013	011	008	005
4541397	4651380	4761360	002	000	996	994	991	989	985	983	980	977
5641100	5751055	5861007	109975	971	969	966	964	960	958	955	952	949
6740524	6850451	6960375	109947	944	941	938	935	933	930	927	924	922
7839670	7949569	8059465	919	916	913	910	908	905	902	899	896	894
8938537	9048409	9158278	891	888	886	882	880	877	874	872	869	865
0037127	0146971	0256812	864	860	858	854	852	850	846	844	841	838
1135439	1245255	1355068	835	833	830	827	824	821	819	816	813	810
2233473	2343261	2453047	808	805	802	799	796	794	791	788	786	782
3331230	3440990	3550748	780	777	774	772	769	766	763	760	758	755
4428709	4538442	4648172	752	749	747	743	741	739	735	733	730	727
5525911	5635616	57453 18	724	722	718	716	714	710	708	705	702	700
6622836	6732513	6842188	696	694	691	688	686	683	680	677	675	671
7719484	7829133	7938780	109669	666	664	660	658	655	653	649	647	644
8815855	8925477	9035096	641	639	635	633	631	627	625	622	619	616
9911949	0021543	0131135	614	610	608	606	602	600	597	594	592	588
1007767	1117333	1226897	586	583	581	577	575	572	570	566	564	561
2103308	2212847	2322383	558	556	553	550	547	544	542	539	536	534
3198573	3308084	3417593	530	528	525	523	519	517	514	511	509	506
4293562	4403046	4512527	503	500	497	495	492	489	487	484	481	478
5388275	5497731	5607184	475	473	470	467	464	462	459	456	453	451
6482712	6592140	6701566	448	445	442	440	436	434	432	428	426	423
7576873	7686274	7795672	420	418	415	412	409	406	404	401	398	396
8670759	8780132	8889503	109392	390	387	385	382	378	377	373	371	368
9764369	9873715	9983058	365	362	360	357	354	351	349	346	343	340
0857704	0967022	1076338	338	335	332	329	327	324	321	318	316	313
1950763	2060054	2169342	310	307	305	301	300	296	293	291	288	286
3043548	3152811	3262072	282	280	277	275	271	269	266	263	261	258
4136058	4245294	4354527	255	252	250	247	244	241	239	236	233	230
5228293	5337501	5446707	228	225	222	219	217	214	211	208	206	203
6320253	6429434	6538612	200	197	195	192	189	187	183	181	178	176
7411939	7521093	7630243	173	170	167	164	162	159	156	154	150	148
8503351	8612477	8721600	146	142	140	137	134	132	129	126	123	121
9594488	9703587	9812683	109118	116	111	110	107	104	101	099	096	093
0685351	0794423	0903491	090	088	085	082	080	076	074	072	068	066
1775941	1884985	1994026	063	060	058	055	052	049	047	044	041	038
2866256	2975273	3084287	036	033	030	027	025	022	019	017	014	011
3956298	4065287	4174274	008	005	003	000	998	994	992	989	987	983
5046066	5155028	5263987	108981	978	976	973	970	967	964	962	959	957
6135561	6244496	6353428	953	951	948	946	942	940	937	935	932	929
7224783	7333690	7442595	926	923	921	918	916	912	910	907	905	901
8313732	8422612	8531489	899	897	893	891	888	885	883	880	877	874
9402407	9511260	9620110	872	869	866	863	861	858	855	853	850	847
0490810	0599635	0708458	108844	842	839	836	833	831	828	825	823	820
1578940	1687738	1796534	817	814	812	809	806	804	800	798	796	792
2666798	2775569	2884337	790	787	784	782	779	776	774	771	768	765
3754383	3863126	3971867	763	759	758	754	752	749	746	743	741	738
4841696	4950412	5059126	736	732	730	727	725	722	719	716	714	711
5928736	6037425	6146112	708	705	703	700	697	695	691	689	687	684
7015505	7124167	7232826	680	679	675	673	670	667	665	662	659	657
8102002	8210637	8319269	653	651	649	645	643	640	638	635	632	629
9188227	9296834	9405439	626	624	621	619	616	613	610	607	605	602
0274180	0382761	0491338	600	596	594	592	588	586	583	581	577	575
1359862	1468415	1576966	573	569	567	564	561	559	556	553	551	548

Numbers 40000-40609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4000	6020599913	0708486	0817055	0925622	1034186	1142747	1251306
1	1685514	1794059	1902601	2011141	2119678	2228212	2336744
2	2770843	2879361	2987876	3096389	3204899	3313406	3421910
3	3855901	3964392	4072880	4181366	4289848	4398328	4506806
4	4940688	5049152	5157613	5266071	5374527	5482980	5591430
5	6025204	6133641	6242075	6350506	6458935	6567361	6675784
6	7109450	7217859	7326266	7434670	7543072	7651471	7759867
7	8193424	8301807	8410187	8518564	8626938	8735310	8843679
8	9277129	9385484	9493837	9602187	9710535	9818879	9927221
9	6030360563	0468891	0577217	0685540	0793860	0902178	1010493
4010	6031443726	1552028	1660327	1768623	1876916	1985207	2093495
11	2526620	2634894	2743166	2851435	2959702	3067965	3176226
12	3609243	3717491	3825736	3933978	4042217	4150454	4258688
13	4691597	4799818	4908036	5016251	5124463	5232673	5340880
14	5773682	5881875	5990066	6098254	6206440	6314623	6422803
15	6855496	6963663	7071827	7179988	7288147	7396302	7504456
16	7937041	8045181	8153318	8261452	8369584	8477713	8585839
17	9018317	9126430	9234540	9342648	9450752	9558854	9666954
18	6040099324	0207410	0315493	0423574	0531652	0639727	0747799
19	1180062	1288121	1396177	1504231	1612282	1720330	1828376
4020	6042260531	2368563	2476592	2584619	2692643	2800665	2908683
21	3340731	3448736	3556739	3664739	3772736	3880730	3988722
22	4420663	4528641	4636617	4744590	4852560	4960528	5068493
23	5500326	5608277	5716226	5824172	5932116	6040057	6147995
24	6579720	6687645	6795567	6903487	7011403	7119317	7227229
25	7658847	7766745	7874640	7982533	8090423	8198310	8306194
26	8737706	8845577	8953445	9061311	9169174	9277034	9384892
27	9816296	9924140	0031982	0139821	0247657	0355491	0463322
28	6050894619	1002436	1110251	1218063	1325873	1433680	1541484
29	1972674	2080465	2188253	2296038	2403821	2511601	2619378
4030	6053050461	3158225	3265987	3373746	3481502	3589255	3697006
31	4127982	4235719	4343453	4451185	4558915	4666641	4774365
32	5205234	5312945	5420653	5528358	5636061	5743761	5851458
33	6282220	6389904	6497585	6605264	6712940	6820613	6928283
34	7358939	7466596	7574250	7681902	7789552	7897198	8004842
35	8435391	8543021	8650649	8758274	8865897	8973516	9081134
36	9511576	9619179	9726781	9834379	9941975	0049568	0157159
37	6060587494	0695071	0802646	0910218	1017787	1125353	1232917
38	1663146	1770697	1878245	1985790	2093332	2200872	2308409
39	2738532	2846056	2953577	3061095	3168611	3276125	3383635
4040	6063813651	3921148	4028643	4136135	4243624	4351111	4458595
41	4888504	4995975	5103443	5210909	5318371	5425831	5533289
42	5963092	6070536	6177977	6285416	6392852	6500286	6607717
43	7037413	7144831	7252246	7359658	7467068	7574474	7681879
44	8111469	8218860	8326248	8433634	8541017	8648398	8755775
45	9185259	9292624	9399986	9507345	9614701	9722055	9829406
46	6070258784	0366122	0473457	0580790	0688120	0795447	0902772
47	1332044	1439355	1546664	1653970	1761273	1868574	1975872
48	2405038	2512323	2619605	2726885	2834162	2941436	3048708
49	3477768	3585026	3692282	3799535	3906785	4014033	4121278
4050	6074550232	4657464	4764693	4871920	4979144	5086365	5193584
51	5622432	5729637	5836840	5944040	6051238	6158432	6265625
52	6694367	6801546	6908722	7015896	7123067	7230235	7337401
53	7766037	7873190	7980340	8087487	8194632	8301774	8408913
54	8837444	8944570	9051693	9158814	9265932	9373048	9480160
55	9908585	0015685	0122782	0229877	0336968	0444057	0551144
56	6080979463	1086537	1193607	1300675	1407740	1514803	1621863
57	2050077	2157124	2264168	2371210	2478249	2585285	2692319
58	3120427	3227447	3334465	3441481	3548493	3655503	3762510
59	4190513	4297507	4404499	4511488	4618474	4725457	4832438
4060	5260336	5367304	5474269	5581231	5688191	5795148	5902103

OF NUMBERS. Logarithms 6020599913-6086222951.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1359862	1468415	1576966	108573	569	567	564	561	559	556	553	551	548
2445273	2553799	2662322	545	542	540	537	534	532	529	526	523	521
3530412	3638911	3747407	518	515	513	510	507	504	502	499	496	494
4615280	4723752	4832222	491	488	486	482	480	478	474	472	470	466
5699878	5808323	5916765	464	461	458	456	453	450	448	445	442	439
6784204	6892622	7001037	437	434	431	429	426	423	420	418	415	413
7868260	7976651	8085039	409	407	404	402	399	396	393	391	388	385
8952046	9060409	9168770	383	380	377	374	372	369	367	363	361	359
0035561	0143897	0252231	355	353	350	348	344	342	340	336	334	332
1118805	1227115	1335422	328	326	323	320	318	315	312	310	307	304
2201780	2310062	2418343	108302	299	296	293	291	288	285	282	281	277
3284485	3392740	3500993	274	272	269	267	263	261	259	255	253	250
4366919	4475148	4583374	248	245	242	239	237	234	231	229	226	223
5449085	5557286	5665485	221	218	215	212	210	207	205	201	199	197
6530980	6639155	6747327	193	191	188	186	183	180	177	175	172	169
7612606	7720754	7828899	167	164	161	159	155	154	150	148	145	142
8693963	8802084	8910202	140	137	134	132	129	126	124	121	118	115
9775050	9883144	9991236	113	110	108	104	102	100	096	094	092	088
0855869	0963936	1072000	086	083	081	078	075	072	070	067	064	062
1936418	2044459	2152496	059	056	054	051	048	046	042	041	037	035
3016699	3124712	3232723	108032	029	027	024	022	018	016	013	011	008
4096711	4204698	4312682	005	003	000	997	994	992	989	987	984	981
5176455	5284415	5392371	107978	976	973	970	968	965	962	960	956	955
6255930	6363863	6471793	951	949	946	944	941	938	935	933	930	927
7335137	7443043	7550946	925	922	920	916	914	912	908	906	903	901
8414076	8521955	8629832	898	895	893	890	887	884	882	879	877	874
9492747	9600599	9708449	871	868	866	863	960	858	855	852	850	847
0571150	0678976	0786799	844	842	839	836	834	831	828	826	823	820
1649285	1757084	1864880	817	815	812	810	807	804	801	799	796	794
2727153	2834925	2942695	791	788	785	783	780	777	775	772	770	766
3804754	3912499	4020242	107764	762	759	756	753	751	748	745	743	740
4882087	4989805	5097521	737	734	732	730	726	724	722	718	716	713
5959152	6066844	6174534	711	708	705	703	700	697	694	692	690	686
7035951	7143616	7251279	684	681	679	676	673	670	668	665	663	660
8112483	8220122	8327757	657	654	652	650	646	644	641	639	635	634
9188748	9296360	9403969	630	628	625	623	619	618	614	612	609	607
0264747	0372332	0479914	603	602	598	596	593	591	588	585	582	580
1340478	1448037	1555593	577	575	572	569	566	564	561	559	556	553
2415944	2523476	2631005	551	548	545	542	540	537	535	532	529	527
3491143	3598649	3706151	524	521	518	516	514	510	508	506	502	500
4566076	4673555	4781031	107497	495	492	489	487	484	481	479	476	473
5640744	5748196	5855645	471	468	466	462	460	458	455	452	449	447
6715145	6822570	6929993	444	441	439	436	434	431	428	425	423	420
7789280	7896679	8004076	418	415	412	410	406	405	401	399	397	393
8863150	8970523	9077892	391	388	386	383	381	377	375	373	369	367
9936755	0044101	0151444	365	362	359	356	354	351	349	346	343	340
1010094	1117413	1224730	338	335	333	330	327	325	322	319	317	314
2083168	2190461	2297751	311	309	306	303	301	298	296	293	290	287
3155977	3263243	3370507	285	282	280	277	274	272	269	266	264	261
4228521	4335760	4442998	258	256	253	250	248	245	243	239	238	234
5300800	5408013	5515224	107232	229	227	224	221	219	216	213	211	208
6372814	6480001	6587185	205	203	200	198	194	193	189	187	184	182
7444564	7551724	7658882	179	176	174	171	168	166	163	160	158	155
8516049	8623183	8730315	153	150	147	145	142	139	136	134	132	129
9587271	9694378	9801483	126	123	121	118	116	112	111	107	105	102
0658228	0765309	0872387	100	097	095	091	089	087	084	081	078	076
1728921	1835975	1943028	074	070	068	065	063	060	058	054	053	049
2799350	2906378	3013404	047	044	042	039	036	034	031	028	026	023
3869515	3976517	4083516	020	018	016	012	010	007	005	002	999	997
4939417	5046392	5153365	106994	992	989	986	983	981	979	975	973	971
6009055	6116004	6222951	968	965	962	960	957	955	952	949	947	944

Numbers 40600–41209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4060	6085260336	5367304	5474269	5581231	5688191	5795148	5902103
61	6329895	6436836	6543775	6650711	6757645	6864576	6971504
62	7399191	7506106	7613018	7719928	7826835	7933740	8040642
63	8468223	8575112	8681998	8788882	8895763	9002641	9109517
64	9536993	9643855	9750715	9857572	9964427	0071279	0178128
65	6090605499	0712335	0819169	0926000	1032828	1139654	1246477
66	1673743	1780553	1887360	1994165	2100967	2207766	2314563
67	2741724	2848508	2955289	3062067	3168843	3275616	3382387
68	3809443	3916200	4022955	4129707	4236456	4343203	4449948
69	4876899	4983630	5090358	5197084	5303807	5410528	5517246
4070	6095944092	6050797	6157500	6264199	6370896	6477591	6584283
71	7011024	7117703	7224379	7331052	7437723	7544391	7651057
72	8077693	8184346	8290996	8397643	8504288	8610930	8717569
73	9144101	9250727	9357351	9463972	9570591	9677206	9783820
74	6100210247	0316847	0423444	0530039	0636632	0743221	0849809
75	1276131	1382705	1489276	1595845	1702411	1808975	1915536
76	2341753	2448301	2554846	2661389	2767929	2874467	2981001
77	3407115	3513636	3620155	3726672	3833186	3939697	4046206
78	4472214	4578710	4685203	4791693	4898181	5004666	5111149
79	5537053	5643523	5749990	5856454	5962916	6069375	6175831
4080	6106601631	6708074	6814515	6920953	7027389	7133822	7240252
81	7665948	7772365	7878780	7985192	8091601	8198008	8304413
82	8730004	8836395	8942784	9049170	9155553	9261934	9368312
83	9793799	9900164	0006527	0112887	0219244	0325599	0431951
84	6110857334	0963673	1070010	1176344	1282675	1389004	1495330
85	1920609	2026922	2133232	2239540	2345846	2452148	2558448
86	2983623	3089910	3196195	3302477	3408756	3515033	3621307
87	4046377	4152638	4258897	4365153	4471406	4577657	4683905
88	5108871	5215106	5321339	5427569	5533796	5640021	5746243
89	6171106	6277315	6383521	6489725	6595927	6702125	6808321
4090	6117233080	7339263	7445444	7551622	7657797	7763970	7870140
91	8294795	8400952	8507107	8613259	8719408	8825555	8931699
92	9356250	9462382	9568510	9674636	9780760	9886881	9992999
93	6120417446	0523552	0629655	0735755	0841852	0947947	1054040
94	1478383	1584463	1690540	1796614	1902685	2008754	2114821
95	2539061	2645114	2751165	2857214	2963260	3069303	3175343
96	3599480	3705507	3811532	3917555	4023575	4129592	4235606
97	4659640	4765641	4871640	4977637	5083631	5189622	5295611
98	5719541	5825517	5931490	6037461	6143429	6249394	6355357
99	6779183	6885133	6991081	7097026	7202968	7308907	7414845
4100	6127838567	7944491	8050413	8156332	8262248	8368162	8474074
1	8897693	9003591	9109487	9215380	9321271	9427159	9533044
2	9956560	0062433	0168303	0274170	0380035	0485897	0591757
3	6131015170	1121016	1226861	1332702	1438541	1544378	1650211
4	2073521	2179342	2285160	2390976	2496789	2602600	2708408
5	3131615	3237410	3343202	3448992	3554780	3660565	3766347
6	4189450	4295220	4400987	4506751	4612513	4718272	4824028
7	5247029	5352772	5458513	5564252	5669988	5775721	5881452
8	6304349	6410067	6515783	6621495	6727205	6832913	6938618
9	7361413	7467105	7572794	7678481	7784166	7889848	7995527
4110	6138418219	8523885	8629549	8735210	8840869	8946525	9052179
11	9474768	9580409	9686047	9791682	9897315	0002946	0108574
12	6140531060	0636675	0742287	0847897	0953505	1059110	1164712
13	1587095	1692684	1798271	1903856	2009437	2115016	2220593
14	2642874	2748437	2853998	2959557	3065113	3170667	3276218
15	3698395	3803934	3909469	4015002	4120532	4226060	4331585
16	4753661	4859173	4964683	5070191	5175695	5281197	5386697
17	5808670	5914157	6019641	6125123	6230602	6336078	6441552
18	6863423	6968884	7074343	7179799	7285252	7390703	7496152
19	7917920	8023355	8128788	8234219	8339647	8445072	8550495
4120	8972160	9077570	9182978	9288383	9393785	9499185	9604582

OF NUMBERS. Logarithms 6085260336–6149920758.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6009055	6116004	6222951	106968	965	962	960	957	955	952	949	947	944
7078430	7185353	7292273	941	939	936	934	931	928	926	923	920	918
8147541	8254438	8361332	915	912	910	907	905	902	899	897	894	891
9216390	9323260	9430128	889	886	884	881	878	876	873	870	868	865
0284975	0391819	0498660	862	860	857	855	852	849	847	844	841	839
1353297	1460115	1566930	836	834	831	828	826	823	820	818	815	813
2421357	2528149	2634938	810	807	805	802	799	797	794	792	789	786
3489155	3595920	3702682	784	781	778	776	773	771	768	765	762	761
4556689	4663428	4770165	757	755	752	749	747	745	741	739	737	734
5623962	5730674	5837385	731	728	726	723	721	718	716	712	711	707
6690972	6797658	6904342	106705	703	699	697	695	692	689	686	684	682
7757720	7864380	7971038	679	676	673	671	668	666	663	660	658	655
8824206	8930840	9037472	653	650	647	645	642	639	637	634	632	629
9890430	9997038	0103644	626	624	621	619	615	614	610	608	606	603
0956393	1062975	1169554	600	597	595	593	589	588	584	582	579	577
2022094	2128650	2235203	574	571	569	566	564	561	558	556	553	550
3087534	3194063	3300590	548	545	543	540	538	534	533	529	527	525
4152712	4259215	4365716	521	519	517	514	511	509	506	503	501	498
5217629	5324106	5430581	496	493	490	488	485	483	480	477	475	472
6282285	6388736	6495185	470	467	464	462	459	456	454	451	449	446
7346680	7453105	7559528	106443	441	438	436	433	430	428	425	423	420
8410814	8517213	8623610	417	415	412	409	407	405	401	399	397	394
9474688	9581061	9687431	391	389	386	383	381	378	376	373	370	368
0538301	0644648	0750992	365	363	360	357	355	352	350	347	344	342
1601654	1707975	1814293	339	337	334	331	329	326	324	321	318	316
2664746	2771041	2877333	313	310	308	306	302	300	298	295	292	290
3727578	3833847	3940113	287	285	282	279	277	274	271	269	266	264
4790150	4896393	5002634	261	259	256	253	251	248	245	243	241	237
5852463	5958679	6064894	235	233	230	227	225	222	220	216	215	212
6914515	7020706	7126894	209	206	204	202	198	196	194	191	188	186
7976308	8082473	8188635	106183	181	178	175	173	170	168	165	162	160
9037841	9143980	9250117	157	155	152	149	147	144	142	139	137	133
0099115	0205228	0311339	132	128	126	124	121	118	116	113	111	107
1160129	1266217	1372301	106	103	100	097	095	093	089	088	084	082
2220885	2326946	2433005	080	077	074	071	069	067	064	061	059	056
3281381	3387417	3493449	053	051	049	046	043	040	038	036	032	031
4341619	4447628	4553635	027	025	023	020	017	014	013	009	007	005
5401597	5507581	5613562	001	999	997	994	991	989	986	984	981	979
6461318	6567275	6673231	105976	973	971	968	965	963	961	957	956	952
7520779	7626711	7732640	950	948	945	942	939	938	934	932	929	927
8579982	8685888	8791792	105924	922	919	916	914	912	908	906	904	901
9638927	9744807	9850685	898	896	893	891	888	885	883	880	878	875
0697614	0803468	0909320	873	870	867	865	862	860	857	854	852	850
1756043	1861871	1967698	846	845	841	839	837	833	832	828	827	823
2814214	2920016	3025817	821	818	816	813	811	808	806	802	801	798
3872127	3977904	4083678	795	792	790	788	785	782	780	777	774	772
4929782	5035534	5141282	770	767	764	762	759	756	754	752	748	747
5987180	6092906	6198629	743	741	739	736	733	731	728	726	723	720
7044321	7150021	7255718	718	716	712	710	708	705	703	700	697	695
8101204	8206878	8312550	692	689	687	685	682	679	677	674	672	669
9157830	9263479	9369124	105666	664	661	659	656	654	651	649	645	644
0214199	0319822	0425442	641	638	635	633	631	628	625	623	620	618
1270311	1375909	1481503	615	612	610	608	605	602	599	598	594	592
2326167	2431738	2537307	589	587	585	581	579	577	574	571	569	567
3381766	3487312	3592855	563	561	559	556	554	551	548	546	543	540
4437108	4542628	4648146	539	535	533	530	528	525	523	520	518	515
5492194	5597689	5703181	512	510	508	504	502	500	497	495	492	489
6547024	6652493	6757959	487	484	482	479	476	474	472	469	466	464
7601597	7707041	7812481	461	459	456	453	451	449	445	444	440	439
8655915	8761333	8866748	435	433	431	428	425	423	420	418	415	412
9709977	9815369	9920758	410	408	405	402	400	397	395	392	389	387

Numbers 41200-41809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4120	6148972160	9077570	9182978	9288383	9393785	9499185	9604582
21	6150026145	0131530	0236912	0342291	0447668	0553042	0658413
22	1079874	1185233	1290590	1395943	1501295	1606643	1711989
23	2133348	2238681	2344012	2449340	2554666	2659989	2765310
24	3186566	3291874	3397179	3502482	3607782	3713079	3818374
25	4239529	4344811	4450091	4555368	4660642	4765915	4871184
26	5292236	5397493	5502747	5607999	5713248	5818494	5923738
27	6344689	6449920	6555149	6660375	6765598	6870819	6976038
28	7396886	7502092	7607295	7712496	7817694	7922889	8028082
29	8448829	8554009	8659187	8764362	8869534	8974704	9079872
4130	6159500517	9605671	9710824	9815973	9921120	0026265	0131407
31	6160551950	0657079	0762206	0867330	0972452	1077571	1182688
32	1603128	1708232	1813334	1918432	2023529	2128622	2233714
33	2654053	2759131	2864207	2969281	3074351	3179420	3284485
34	3704723	3809776	3914826	4019874	4124920	4229963	4335003
35	4755139	4860167	4965192	5070214	5175234	5280252	5385267
36	5805301	5910303	6015303	6120300	6225295	6330287	6435276
37	6855209	6960186	7065160	7170132	7275101	7380068	7485032
38	7904863	8009815	8114764	8219710	8324654	8429596	8534534
39	8954264	9059190	9164114	9269035	9373953	9478869	9583783
414c	6170003411	0108312	0213210	0318106	0422999	0527890	0632778
41	1052305	1157180	1262053	1366924	1471792	1576657	1681520
42	2100946	2205796	2310643	2415488	2520331	2625171	2730008
43	3149333	3254158	3358980	3463800	3568617	3673432	3778244
44	4197467	4302267	4407064	4511858	4616650	4721440	4826227
45	5245349	5350123	5454895	5559664	5664431	5769195	5873956
46	6292978	6397727	6502473	6607217	6711958	6816697	6921434
47	7340354	7445077	7549799	7654517	7759233	7863947	7968658
48	8387477	8492176	8596872	8701565	8806256	8910944	9015630
49	9434348	9539022	9643692	9748360	9853026	9957689	0062350
4150	6180480967	0585615	0690261	0794904	0899544	1004182	1108817
51	1527334	1631957	1736577	1841195	1945810	2050423	2155033
52	2573448	2678046	2782641	2887234	2991824	3096411	3200996
53	3619311	3723884	3828453	3933021	4037586	4142148	4246708
54	4664922	4769469	4874014	4978556	5083096	5187633	5292168
55	5710281	5814803	5919323	6023840	6128354	6232866	6337376
56	6755389	6859886	6964380	7068872	7173362	7277848	7382333
57	7800245	7904717	8009186	8113653	8218117	8322579	8427038
58	8844850	8949297	9053741	9158182	9262622	9367058	9471492
59	9889204	9993625	0098044	0202461	0306875	0411286	0515695
4160	6190933306	1037703	1142097	1246488	1350877	1455263	1559647
61	1977158	2081529	2185898	2290265	2394628	2498990	2603349
62	3020759	3125105	3229449	3333790	3438129	3542465	3646799
63	4064109	4168430	4272749	4377065	4481379	4585690	4689999
64	5107208	5211505	5315798	5420089	5524378	5628664	5732948
65	6150057	6254329	6358597	6462863	6567127	6671388	6775647
66	7192656	7296902	7401146	7505387	7609626	7713862	7818095
67	8235005	8339226	8443444	8547660	8651874	8756085	8860294
68	9277103	9381299	9485493	9589684	9693872	9798058	9902242
69	6200318951	0423122	0527291	0631457	0735621	0839782	0943940
4170	6201360550	1464696	1568839	1672981	1777119	1881255	1985389
71	2401898	2506020	2610138	2714254	2818368	2922479	3026588
72	3442998	3547094	3651187	3755279	3859367	3963454	4067537
73	4483847	4587918	4691987	4796053	4900117	5004178	5108237
74	5524447	5628494	5732537	5836579	5940618	6044654	6148688
75	6564798	6668820	6772838	6876855	6980869	7084880	7188889
76	7604900	7708896	7812890	7916882	8920871	8124857	8228841
77	8644753	8748724	8852693	8956660	9060624	9164586	9268545
78	9684356	9788303	9892247	9996189	0100128	0204065	0307999
79	6210723711	0827633	0931553	1035469	1139384	1243296	1347205
4180	1762818	1866715	1970609	2074501	2178391	2282278	2386162

OF NUMBERS. Logarithms 6148972160-6212697801.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9709977	9815369	9920758	105410	408	405	402	400	397	395	392	389	387
0763783	0869149	0974513	385	382	379	377	374	371	370	366	364	361
1817332	1922674	2028012	359	357	353	352	348	346	343	342	338	336
2870628	2975943	3081256	333	331	328	326	323	321	318	315	313	310
3923667	4028957	4134244	308	305	303	300	297	295	293	290	287	285
4976451	5081715	5186977	282	280	277	274	273	269	267	264	262	259
6028980	6134219	6239455	257	254	252	249	246	244	242	239	236	234
7081254	7186467	7291678	231	229	226	223	221	219	216	213	211	208
8133273	8238461	8343646	206	203	201	198	195	193	191	188	185	183
9185037	9290199	9395359	180	178	175	172	170	168	165	162	160	158
0236547	0341683	0446818	105154	153	149	147	145	142	140	136	135	132
1287802	1392913	1498022	129	127	124	122	119	117	114	111	109	106
2338802	2443888	2548972	104	102	098	097	093	092	088	086	084	081
3389549	3494609	3599667	078	076	074	070	069	065	064	060	058	056
4440041	4545076	4650109	053	050	048	046	043	040	038	035	033	030
5490279	5595289	5700296	028	025	022	020	018	015	012	010	007	005
6540263	6645248	6750230	002	000	997	995	992	989	987	985	982	979
7589994	7694953	7799909	104977	974	972	969	967	964	962	959	956	954
8639470	8744404	8849335	952	949	946	944	942	938	936	934	931	929
9688694	9793602	9898508	926	924	921	918	916	914	911	908	906	903
0737663	0842547	0947427	104901	898	896	893	891	888	885	884	880	878
1786380	1891238	1996093	875	873	871	868	865	863	860	858	855	853
2834843	2939676	3044506	850	847	845	843	840	837	835	833	830	827
3883054	3987861	4092665	825	822	820	817	815	812	810	807	804	802
4931011	5035793	5140572	800	797	794	792	790	787	784	782	779	777
5978715	6083472	6188226	774	772	769	767	764	761	759	757	754	752
7026167	7130899	7235627	749	746	744	741	739	737	733	732	728	727
8073367	8178073	8282776	723	722	718	716	714	711	709	706	703	701
9120313	9224994	9329673	699	696	693	691	688	686	683	681	679	675
0167008	0271664	0376317	674	670	668	666	663	661	658	656	653	650
1213450	1318081	1422708	104648	646	643	640	638	635	633	631	627	626
2259640	2364246	2468848	623	620	618	615	613	610	607	606	602	600
3305579	3410159	3514736	598	595	593	590	587	585	583	580	577	575
4351265	4455820	4560372	573	569	568	565	562	560	557	555	552	550
5396700	5501229	5605757	547	545	542	540	537	535	532	529	528	524
6441883	6546387	6650889	522	520	517	514	512	510	507	504	502	500
7486815	7591294	7695771	497	494	492	490	486	485	482	479	477	474
8531495	8635949	8740401	472	469	467	464	462	459	457	454	452	449
9575924	9680353	9784780	447	444	441	440	436	434	432	429	427	424
0620102	0724506	0828907	421	419	417	414	411	409	407	404	401	399
1664029	1768408	1872784	104397	394	391	389	386	384	382	379	376	374
2707705	2812059	2916410	371	369	367	363	362	359	356	354	351	349
3751130	3855459	3959785	346	344	341	339	336	334	331	329	326	324
4794305	4898609	5002910	321	319	316	314	311	309	306	304	301	298
5837229	5941508	6045784	297	293	291	289	286	284	281	279	276	273
6879903	6984156	7088408	272	268	266	264	261	259	256	253	252	248
7922326	8026555	8130781	246	244	241	239	236	233	231	229	226	224
8964500	9068703	9172904	221	218	216	214	211	209	206	203	201	199
0006423	0110602	0214778	196	194	191	188	186	184	181	179	176	173
1048096	1152250	1256401	171	169	166	164	161	158	156	154	151	149
2089520	2193649	2297775	104146	143	142	138	136	134	131	129	126	123
3130694	3234798	3338899	122	118	116	114	111	109	106	104	101	099
4171618	4275697	4379773	096	093	092	088	087	083	081	079	076	074
5212293	5316347	5420398	071	069	066	064	061	059	056	054	051	049
6252719	6356748	6460774	047	043	042	039	036	034	031	029	026	024
7292896	7396900	7500901	022	018	017	014	011	009	007	004	001	999
8332823	8436802	8540779	103996	994	992	989	986	984	982	979	977	974
9372501	9476456	9580407	971	969	967	964	962	959	956	955	951	949
0411931	0515860	0619787	947	944	942	939	937	934	932	929	927	924
1451112	1555016	1658918	922	920	916	915	912	909	907	904	902	900
2490044	2593924	2697801	897	894	892	890	887	884	882	880	877	875

Numbers 41800–42409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4180	6211762818	1866715	1970609	2074501	2178391	2282278	2386162
81	2801676	2905548	3009417	3113284	3217149	3321011	3424871
82	3840285	3944132	4047977	4151819	4255659	4359496	4463331
83	4878646	4982468	5086288	5190106	5293921	5397733	5501543
84	5916759	6020556	6124351	6228144	6331934	6435722	6539507
85	6954623	7058396	7162166	7265934	7369700	7473463	7577223
86	7992240	8095988	8199734	8303477	8407217	8510955	8614691
87	9029609	9133332	9237053	9340771	9444487	9548200	9651911
88	6220066730	0170429	0274125	0377818	0481509	0585198	0688884
89	1103604	1207277	1310949	1414617	1518284	1621948	1725609
4190	6222140230	2243879	2347525	2451169	2554811	2658450	2762087
91	3176608	3280233	3383854	3487474	3591091	3694705	3798317
92	4212740	4316339	4419936	4523531	4627123	4730713	4834300
93	5248624	5352199	5455771	5559341	5662909	5766474	5870036
94	6284261	6387811	6491359	6594904	6698447	6801987	6905525
95	7319652	7423177	7526700	7630221	7733739	7837254	7940767
96	8354795	8458296	8561794	8665290	8768784	8872274	8975763
97	9389692	9493168	9596642	9700113	9803582	9907048	0010512
98	6230424342	0527794	0631243	0734690	0838134	0941575	1045014
99	1458746	1562173	1665598	1769020	1872439	1975856	2079270
4200	6232492904	2596306	2699706	2803103	2906498	3009890	3113280
1	3526815	3630193	3733568	3836941	3940311	4043679	4147044
2	4560481	4663834	4767184	4870532	4973878	5077221	5180562
3	5593900	5697228	5800554	5903878	6007199	6110518	6213834
4	6627074	6730377	6833679	6936978	7040274	7143568	7246860
5	7660001	7763281	7866557	7969832	8073104	8176373	8279640
6	8692684	8795938	8899190	9002440	9105688	9208933	9312175
7	9725120	9828350	9931578	0034803	0138026	0241246	0344464
8	624075731	0860517	0963720	1066921	1170119	1273315	1376508
9	1789257	1892439	1995617	2098793	2201967	2305139	2408307
4210	6242820958	2924115	3027269	3130421	3233570	3336717	3439861
11	3852414	3955546	4058676	4161803	4264928	4368050	4471170
12	4883625	4986733	5089838	5192941	5296041	5399139	5502234
13	5914591	6017674	6120755	6223833	6326909	6429983	6533053
14	6945313	7048371	7151428	7254481	7357533	7460582	7563628
15	7975790	8078824	8181856	8284885	8387912	8490936	8593958
16	9006022	9109032	9212039	9315044	9418047	9521047	9624044
17	6250036010	0138996	0241978	0344959	0447937	0550913	0653886
18	1065754	1168715	1271674	1374630	1477583	1580534	1683483
19	2095254	2198191	2301124	2404056	2506985	2609912	2712837
4220	6253124510	3227422	3330332	3433239	3536144	3639046	3741946
21	4153522	4256409	4359295	4462178	4565058	4667936	4770812
22	5182290	5285153	5388014	5490873	5593729	5696582	5799434
23	6210814	6313653	6416490	6519324	6622156	6724985	6827812
24	7239095	7341910	7444722	7547532	7650339	7753144	7855947
25	8267133	8369923	8472711	8575497	8678280	8781060	8883839
26	9294927	9397693	9500457	9603218	9705977	9808733	9911487
27	6260322478	0425220	0527959	0630696	0733431	0836163	0938892
28	1349786	1452504	1555219	1657931	1760642	1863349	1966055
29	2376851	2479545	2582235	2684924	2787610	2890293	2992974
4230	6263403674	3506343	3609009	3711673	3814335	3916994	4019651
31	4430253	4532898	4635540	4738180	4840817	4943452	5046085
32	5456590	5559211	5661829	5764444	5867057	5969668	6072276
33	6482685	6585281	6687875	6790466	6893055	6995641	7098225
34	7508537	7611109	7713678	7816245	7918810	8021372	8123932
35	8534147	8636694	8739240	8841782	8944323	9046861	9149396
36	9559514	9662038	9764559	9867077	9969594	0072107	0174619
37	6270584640	0687139	0789636	0892131	0994623	1097112	1199599
38	1609524	1711999	1814471	1916942	2019410	2121875	2224338
39	2634166	2736617	2839065	2941511	3043955	3146396	3248835
4240	3658566	3760993	3863417	3965839	4068258	4170675	4273090

OF NUMBERS. Logarithms 6211762818–6274580320.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2490044	2593924	2697801	103897	894	892	890	887	884	882	880	877	875
3528728	3632583	3736435	872	869	867	865	862	860	857	855	852	850
4567164	4670993	4774821	847	845	842	840	837	835	833	829	828	825
5605351	5709156	5812958	822	820	818	815	812	810	808	805	802	801
6643290	6747070	6850848	797	795	793	790	788	785	783	780	778	775
7680981	7784737	7888490	773	770	768	766	763	760	758	756	753	750
8718424	8822155	8925883	748	746	743	740	738	736	733	731	728	726
9755620	9859326	9963029	723	721	718	716	713	711	709	706	703	701
0792568	0896249	0999927	699	696	693	691	689	686	684	681	678	677
1829268	1932924	2036578	673	672	668	667	664	661	659	656	654	652
2865721	2969352	3072982	103649	646	644	642	639	637	634	631	630	626
3901926	4005533	4109138	625	621	620	617	614	612	609	607	605	602
4937885	5041467	5145047	599	597	595	592	590	587	585	582	580	577
5973596	6077154	6180709	575	572	570	568	565	562	560	558	555	552
7009061	7112593	7216124	550	548	545	543	540	538	536	532	531	528
8044278	8147786	8251292	525	523	521	518	515	513	511	508	506	503
9079249	9182732	9286214	501	498	496	494	490	489	486	483	482	478
0113973	0217432	0320889	476	474	471	469	466	464	461	459	457	453
1148451	1251885	1355317	452	449	447	444	441	439	437	434	432	429
2182683	2286092	2389499	427	425	422	419	417	414	413	409	407	405
3216668	3320053	3423435	103402	400	397	395	392	390	388	385	382	380
4250407	4353767	4457125	378	375	373	370	368	365	363	360	358	356
5283900	5387236	5490569	353	350	348	346	343	341	338	336	333	331
6317147	6420459	6523767	328	326	324	321	319	316	313	312	308	307
7350149	7453435	7556720	303	302	299	296	294	292	289	286	285	281
8382905	8486167	8589426	280	276	275	272	269	267	265	262	259	258
9415415	9518652	9621888	254	252	250	248	245	242	240	237	236	232
0447680	0550893	0654103	230	228	225	223	220	218	216	213	210	208
1479699	1582888	1686074	206	203	201	198	196	193	191	189	186	183
2511474	2614638	2717799	182	178	176	174	172	168	167	164	161	159
3543003	3646143	3749280	103157	154	152	149	147	144	142	140	137	134
4574288	4677403	4780515	132	130	127	125	122	120	118	115	112	110
5605327	5708418	5811506	108	105	103	100	098	095	093	091	088	085
6636122	6739188	6842252	083	081	078	076	074	070	069	066	064	061
7666672	7769714	7872753	058	057	053	052	049	046	044	042	039	037
8696978	8799995	8903010	034	032	029	027	024	022	020	017	015	012
9727039	9830032	9933022	010	007	005	003	000	997	995	993	990	988
0756857	0859825	0962791	102986	982	981	978	976	973	971	968	966	963
1786430	1889373	1992315	961	959	956	953	951	949	947	943	942	939
2815758	2918678	3021595	937	933	932	929	927	925	921	920	917	915
3844844	3947739	4050631	102912	910	907	905	902	900	898	895	892	891
4873685	4976556	5079424	887	886	883	880	878	876	873	871	868	866
5902282	6005129	6107973	863	861	859	856	853	852	848	847	844	841
6930637	7033459	7136278	839	837	834	832	829	827	825	822	819	817
7958747	8061545	8164340	815	812	810	807	805	803	800	798	795	793
8986614	9089388	9192159	790	788	786	783	780	779	775	774	771	768
0014238	0116988	0219734	766	764	761	759	756	754	751	750	746	744
1041619	1144344	1247066	742	739	737	735	732	729	727	725	722	720
2068757	2171458	2274156	718	715	712	711	707	706	702	701	698	695
3095653	3198329	3301002	694	690	689	686	683	681	679	676	673	672
4122305	4224957	4327606	102669	666	664	662	659	657	654	652	649	647
5148715	5251342	5353967	645	642	640	637	635	633	630	627	625	623
6174882	6277485	6380086	621	618	615	613	611	608	606	603	601	599
7200807	7303386	7405963	596	594	591	589	586	584	582	579	577	574
8226489	8329044	8431597	572	569	567	565	562	560	557	555	553	550
9251929	9354460	9456988	547	546	542	541	538	535	533	531	528	526
0277128	0379634	0482138	524	521	518	517	513	512	509	506	504	502
1302084	1404566	1507046	499	497	495	492	489	487	485	482	480	478
2326798	2429257	2531712	475	472	471	468	465	463	460	459	455	454
3351271	3453705	3556137	451	448	446	444	441	439	436	434	432	429
4375502	4477912	4580320	427	424	422	419	417	415	412	410	408	405

Numbers 42400–43009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4240	6273658566	3760993	3863417	3965839	4068258	4170675	4273090
41	4682725	4785127	4887527	4989925	5092320	5194713	5297104
42	5706642	5809020	5911396	6013770	6116141	6218510	6320876
43	6730318	6832672	6935024	7037373	7139720	7242065	7344407
44	7753752	7856082	7958410	8060736	8163059	8265379	8367697
45	8776946	8879252	8981556	9083857	9186156	9288452	9390746
46	9799898	9902180	0004460	0106737	0209012	0311284	0413554
47	6280822610	0924868	1027123	1129376	1231627	1333875	1436121
48	1845081	1947315	2049546	2151775	2254002	2356226	2458448
49	2867311	2969521	3071728	3173933	3276136	3378336	3480534
4250	6283889301	3991486	4093670	4195850	4298029	4400205	4502379
51	4911050	5013211	5115371	5217528	5319682	5421834	5523984
52	5932559	6034696	6136831	6238964	6341095	6443223	6545349
53	6953827	7055941	7158052	7260161	7362267	7464371	7566473
54	7974856	8076945	8179033	8281117	8383200	8485280	8587358
55	8995644	9097710	9199773	9301834	9403892	9505949	9608002
56	6290016193	0118235	0220274	0322311	0424345	0526377	0628407
57	1036502	1138519	1240535	1342548	1444558	1546566	1648572
58	2056571	2158565	2260556	2362545	2464531	2566516	2668498
59	3076401	3178371	3280338	3382303	3484266	3586226	3688184
4260	6294095991	4197937	4299880	4401821	4503760	4605696	4707630
61	5115342	5217264	5319183	5421101	5523015	5624928	5726838
62	6134454	6236352	6338247	6440141	6542032	6643920	6745806
63	7153326	7255201	7357072	7458942	7560809	7662673	7764535
64	8171960	8273810	8375658	8477504	8579347	8681187	8783026
65	9190355	9292181	9394005	9495827	9597646	9699463	9801277
66	6300208511	0310314	0412114	0513911	0615707	0717500	0819290
67	1226429	1328207	1429983	1531757	1633529	1735298	1837065
68	2224108	2345862	2447615	2549365	2651112	2752858	2854600
69	3261548	3363279	3465008	3566734	3668458	3770179	3871898
4270	6304278750	4380457	4482162	4583864	4685564	4787262	4888957
71	5295714	5397398	5499078	5600757	5702433	5804107	5905778
72	6312440	6414100	6515757	6617412	6719064	6820714	6922362
73	7328928	7430564	7532197	7633828	7735457	7837083	7938707
74	8345178	8446790	8548400	8650007	8751612	8853214	8954814
75	9361191	9462779	9564365	9665948	9767529	9869108	9970684
76	6310376965	0478530	0580092	0681651	0783209	0884764	0986316
77	1392503	1494043	1595582	1697117	1798651	1900182	2001711
78	2407802	2509319	2610834	2712346	2813856	2915363	3016868
79	3422865	3524358	3625849	3727337	3828823	3930307	4031788
4280	6314437690	4539160	4640627	4742091	4843554	4945014	5046472
81	5452278	5553724	5655168	5756609	5858047	5959484	6060918
82	6466630	6568052	6669471	6770889	6872304	6973716	7075127
83	7480744	7582142	7683538	7784932	7886323	7987712	8089099
84	8494622	8595996	8697369	8798739	8900106	9001472	9102835
85	9508263	9609614	9710962	9812309	9913653	0014994	0116334
86	6320521667	0622994	0724320	0825642	0926963	1028281	1129596
87	1534835	1636139	1737440	1838739	1940036	2041331	2142623
88	2547767	2649047	2750325	2851600	2952873	3054144	3155413
89	3560462	3661719	3762973	3864225	3965474	4066722	4167966
4290	6324572922	4674155	4775385	4876614	4977840	5079063	5180284
91	5585145	5686355	5787562	5888766	5989969	6091169	6192366
92	6597133	6698319	6799502	6900683	7001862	7103038	7204212
93	7608885	7710047	7811207	7912364	8013520	8114672	8215823
94	8620401	8721540	8822676	8923810	9024942	9126071	9227198
95	9631682	9732797	9833910	9935020	0036128	0137234	0238337
96	6330642727	0743818	0844908	0945995	1047079	1148161	1249241
97	1653537	1754605	1855671	1956734	2057795	2158854	2259910
98	2664112	2765156	2866198	2967238	3068276	3169311	3270344
99	3674451	3775472	3876491	3977507	4078521	4179533	4280542
4300	4684556	4785553	4886549	4987541	5088532	5189520	5290506

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4375502	4477912	4580320	102427	424	422	419	417	415	412	410	408	405
5399492	5501878	5604261	402	400	398	395	393	391	388	386	383	381
6423240	6525602	6627961	378	376	374	371	369	366	364	362	359	357
7446747	7549085	7651420	354	352	349	347	345	342	340	338	335	332
8470013	8572326	8674637	330	328	326	323	320	318	316	313	311	309
9493038	9595327	9697614	306	304	301	299	296	294	292	289	287	284
0515822	0618087	0720350	282	280	277	275	272	270	268	265	263	260
1538365	1640606	1742844	258	255	253	251	248	246	244	241	238	237
2560667	2662884	2765099	234	231	229	227	224	222	219	217	215	212
3582729	3684922	3787112	210	207	205	203	200	198	195	193	190	189
4604550	4706719	4808886	102185	184	180	179	176	174	171	169	167	164
5626131	5728276	5830418	161	160	157	154	152	150	147	145	142	141
6647472	6749593	6851711	137	135	133	131	128	126	123	121	118	116
7668572	7770669	7872764	114	111	109	106	104	102	099	097	095	092
8689433	8791506	8893576	089	088	084	083	080	078	075	073	070	068
9710053	9812102	9914149	066	063	061	058	057	053	051	049	047	044
0730434	0832459	0934482	042	039	037	034	032	030	027	025	023	020
1750575	1852576	1954575	017	016	013	010	008	006	003	001	999	996
2770477	2872454	2974429	101994	991	989	986	985	982	979	977	975	972
3790139	3892092	3994043	970	967	965	963	960	958	955	953	951	948
4809562	4911491	5013418	101946	943	941	939	936	934	932	929	927	924
5828745	5930651	6032553	922	919	918	914	913	910	907	906	902	901
6847690	6949571	7051450	898	895	894	891	888	886	884	881	879	876
7866395	7968253	8070108	875	871	870	867	864	862	860	858	855	852
8884862	8986695	9088526	850	848	846	843	840	839	836	833	831	829
9903089	0004899	0106706	826	824	822	819	817	814	812	810	807	805
0921078	1022864	1124648	803	800	797	796	793	790	788	786	784	781
1938829	2040591	2142350	778	776	774	772	769	767	764	762	759	758
2956341	3058079	3159815	754	753	750	747	746	742	741	738	736	733
3973615	4075329	4177041	731	729	726	724	721	719	717	714	712	709
4990650	5092341	5194029	101707	705	702	700	698	695	693	691	688	685
6007447	6109114	6210778	684	680	679	676	674	671	669	667	664	662
7024007	7125650	7227290	660	657	655	652	650	648	645	643	640	638
8040328	8141947	8243564	636	633	631	629	626	624	621	619	617	614
9056412	9158007	9259600	612	610	607	605	602	600	598	595	593	591
0072258	0173829	0275399	588	586	583	581	579	576	574	571	570	566
1087866	1189414	1290960	565	562	559	558	555	552	550	548	546	543
2103237	2204761	2306283	540	539	535	534	531	529	526	524	522	519
3118371	3219871	3321369	517	515	512	510	507	505	503	500	498	496
4133267	4234744	4336218	493	491	488	486	484	481	479	477	474	472
5147927	5249380	5350830	101470	467	464	463	460	458	455	453	450	448
6162349	6263778	6365205	446	444	441	438	437	434	431	429	427	425
7176535	7277940	7379343	422	419	418	415	412	411	408	405	403	401
8190483	8291865	8393244	398	396	394	391	389	387	384	382	379	378
9204195	9305553	9406909	374	373	370	367	366	363	360	358	356	354
0217671	0319005	0420337	351	348	347	344	341	340	337	334	332	330
1230910	1332221	1433529	327	326	322	321	318	315	314	311	308	306
2243912	2345199	2446484	304	301	299	297	295	292	289	287	285	283
3256679	3357942	3459203	280	278	275	273	271	269	266	263	261	259
4269209	4370449	4471687	257	254	252	249	248	244	243	240	238	235
5281503	5382720	5483934	101233	230	229	226	223	221	219	217	214	211
6293561	6394754	6495945	210	207	204	203	200	197	195	193	191	188
7305384	7406553	7507720	186	183	181	179	176	174	172	169	167	165
8316971	8418117	8519260	162	160	157	156	152	151	148	146	143	141
9328322	9429444	9530564	139	136	134	132	129	127	124	122	120	118
0339438	0440537	0541633	115	113	110	108	106	103	101	099	096	094
1350319	1451394	1552466	091	090	087	084	082	080	078	075	072	071
2360964	2462015	2563065	068	066	063	061	059	056	054	051	050	047
3371374	3472402	3573428	044	042	040	038	035	033	030	028	026	023
4381549	4482554	4583556	021	019	016	014	012	009	007	005	002	000
5391489	5492470	5593449	100997	996	992	991	988	986	983	981	979	977

Numbers 43000–43609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4300	6334684556	4785553	4886549	4987541	5088532	5189520	5290506
1	5694426	5795400	5896371	5997341	6098308	6199272	6300235
2	6704061	6805011	6905959	7006905	7107849	7208790	7309729
3	7713461	7814388	7915313	8016235	8117155	8218073	8318988
4	8722627	8823530	8924432	9025331	9126227	9227122	9328013
5	9731558	9832438	9933316	0034192	0135065	0235936	0336804
6	6340740255	0841112	0941966	1042818	1143668	1244516	1345361
7	1748718	1849551	1950382	2051211	2152037	2252861	2353683
8	2756946	2857756	2958564	3059369	3160172	3260973	3361771
9	3764941	3865727	3966512	4067294	4168073	4268850	4369625
4310	6344772702	4873465	4974226	5074984	5175740	5276494	5377246
11	5780229	5880968	5981706	6082441	6183174	6283904	6384633
12	6787522	6888238	6988952	7089664	7190374	7291081	7391786
13	7794581	7895275	7995965	8096654	8197340	8298024	8398705
14	8801408	8902077	9002745	9103410	9204073	9304733	9405391
15	9808001	9908647	0009291	0109933	0210572	0311209	0411844
16	6350814360	0914983	1015604	1116223	1216839	1317452	1418064
17	1820487	1921086	2021684	2122279	2222872	2323462	2424051
18	2826380	2926957	3027531	3128103	3228672	3329239	3429804
19	3832040	3932594	4033145	4133693	4234239	4334783	4435325
4320	6354837468	4937998	5038526	5139051	5239574	5340095	5440613
21	5842663	5943170	6043674	6144176	6244676	6345173	6445668
22	6847625	6948109	7048590	7149069	7249545	7350019	7450491
23	7852355	7952816	8053273	8153729	8254182	8354633	8455082
24	8856853	8957290	9057724	9158157	9258587	9359014	9459440
25	9861118	9961532	0061943	0162352	0262759	0363164	0463566
26	6360865151	0965542	1065930	1166316	1266699	1367081	1467459
27	1868952	1969319	2069684	2170047	2270407	2370765	2471121
28	2872521	2972865	3073207	3173546	3273884	3374219	3474551
29	3875858	3976179	4076498	4176814	4277128	4377440	4477749
4330	6364878964	4979261	5079557	5179850	5280141	5380429	5480716
31	5881837	5982112	6082384	6182654	6282922	6383187	6483450
32	6884480	6984731	7084980	7185227	7285472	7385714	7485954
33	7886890	7987119	8087345	8187568	8287790	8388009	8488226
34	8889070	8989275	9089478	9189679	9289877	9390073	9490267
35	9891018	9991200	0091380	0191558	0291733	0391906	0492076
36	6370892735	0992894	1093051	1193205	1293357	1393507	1493655
37	1894221	1994357	2094491	2194622	2294751	2394878	2495002
38	2895477	2995590	3095700	3195808	3295914	3396018	3496119
39	3896501	3996591	4096679	4196764	4296847	4396927	4497005
4340	6374897295	4997362	5097426	5197488	5297548	5397606	5497661
41	5897858	5997902	6097943	6197982	6298019	6398054	6498086
42	6898191	6998212	7098230	7198246	7298260	7398271	7498280
43	7898294	7998291	8098286	8198279	8298270	8398258	8498245
44	8898166	8998140	9098113	9198083	9298050	9398016	9497979
45	9897808	9997759	0097709	0197656	0297600	0397543	0497483
46	6380897220	0997148	1097075	1196999	1296920	1396840	1496757
47	1896402	1996307	2096211	2196112	2296010	2395907	2495801
48	2895354	2995237	3095117	3194995	3294871	3394744	3494615
49	3894077	3993936	4093794	4193649	4293501	4393352	4493200
4350	6384892570	4992406	5092241	5192073	5291902	5391730	5491555
51	5890833	5990647	6090458	6190267	6290074	6389879	6489681
52	6888867	6988658	7088446	7188232	7288016	7387798	7487577
53	7886672	7986439	8086205	8185968	8285729	8385488	8485244
54	8884247	8983992	9083735	9183475	9283213	9382949	9482682
55	9881593	9981315	0081035	0180753	0280468	0380181	0479891
56	6390878711	0978410	1078107	1177801	1277494	1377184	1476871
57	1875599	1975276	2074950	2174621	2274291	2373958	2473623
58	2872259	2971912	3071564	3171212	3270859	3370503	3470145
59	3868690	3968321	4067949	4167575	4267199	4366820	4466439
4360	4864893	4964500	5064106	5163709	5263310	5362908	5462505

OF NUMBERS. Logarithms 6334684556–6395761280.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5391489	5492470	5593449	100997	996	992	991	988	986	983	981	979	977
6401195	6502152	6603108	974	971	970	967	964	963	960	957	956	953
7410665	7511600	7612531	950	948	946	944	941	939	936	935	931	930
8419901	8520812	8621721	927	925	922	920	918	915	913	911	909	906
9428903	9529790	9630675	903	902	899	896	895	891	890	887	885	883
0437670	0538534	0639396	880	878	876	873	871	868	866	864	862	859
1446203	1547044	1647882	857	854	852	850	848	845	842	841	838	836
2454502	2555319	2656134	833	831	829	826	824	822	819	817	815	812
3462567	3563361	3664152	810	808	805	803	801	798	796	794	791	789
4470398	4571168	4671936	786	785	782	779	777	775	773	770	768	766
5477995	5578742	5679486	100763	761	758	756	754	752	749	747	744	743
6485358	6586082	6686803	739	738	735	733	730	729	725	724	721	719
7492488	7593188	7693886	716	714	712	710	707	705	702	700	698	695
8499384	8600061	8700736	694	690	689	686	684	681	679	677	675	672
9506047	9606701	9707352	669	668	665	663	660	658	656	654	651	649
0512477	0613107	0713735	646	644	642	639	637	635	633	630	628	625
1518673	1619280	1719884	623	621	619	616	613	612	609	607	604	603
2524636	2625220	2725801	599	598	595	593	590	589	585	584	581	579
3530367	3630927	3731485	577	574	572	569	567	565	563	560	558	555
4535864	4636401	4736936	554	551	548	546	544	542	539	537	535	532
5541129	5641643	5742154	100530	528	525	523	521	518	516	514	511	509
6546161	6646652	6747140	507	504	502	500	497	495	493	491	488	485
7550961	7651428	7751893	484	481	479	476	474	472	470	467	465	462
8555528	8655972	8756414	461	457	456	453	451	449	446	444	442	439
9559863	9660284	9760702	437	434	433	430	427	426	423	421	418	416
0563965	0664363	0764758	414	411	409	407	405	402	399	398	395	393
1567836	1668210	1768582	391	388	386	383	382	378	377	374	372	370
2571475	2671826	2772175	367	365	363	360	358	356	354	351	349	346
3574881	3675209	3775535	344	342	339	338	335	332	330	328	326	323
4578056	4678361	4778663	321	319	316	314	312	309	307	305	302	301
5580999	5681281	5781560	100297	296	293	291	288	287	283	282	279	277
6583711	6683970	6784226	275	272	270	268	265	263	261	259	256	254
7586191	7686427	7786660	251	249	247	245	242	240	237	236	233	230
8588440	8688652	8788862	229	226	223	222	219	217	214	212	210	208
9590458	9690647	9790834	205	203	201	198	196	194	191	189	187	184
0592244	0692410	0792574	182	180	178	175	173	170	168	166	164	161
1593800	1693943	1794083	159	157	154	152	150	148	145	143	140	138
2595124	2695244	2795362	136	134	131	129	127	124	122	120	118	115
3596218	3696315	3796409	113	110	108	106	104	101	099	097	094	092
4597081	4697155	4797226	090	088	085	083	080	078	076	074	071	069
5597714	5697764	5797812	100067	064	062	060	058	055	053	050	048	046
6598116	6698143	6798168	044	041	039	037	035	032	030	027	025	023
7598287	7698292	7798294	021	018	016	014	011	009	007	005	002	000
8598228	8698210	8798189	99997	995	993	991	988	987	983	982	979	977
9597939	9697898	9797854	974	973	970	967	966	963	960	959	956	954
0597420	0697356	0797289	951	950	947	944	943	940	937	936	933	931
1596671	1696584	1796494	928	927	924	921	920	917	914	913	910	908
2595693	2695582	2795469	905	904	901	898	897	894	892	889	887	885
3594484	3694351	3794215	883	880	878	876	873	871	869	867	864	862
4593046	4692889	4792731	859	858	855	852	851	848	846	843	842	839
5591378	5691199	5791017	99836	835	832	829	828	825	823	821	818	816
6589481	6689278	6789074	814	811	809	807	805	802	800	797	796	793
7587354	7687129	7786901	791	788	786	784	782	779	777	775	772	771
8584998	8684750	8784500	767	766	763	761	759	756	754	752	750	747
9582414	9682142	9781869	745	743	740	738	736	733	732	728	727	724
0579600	0679306	0779009	722	720	718	715	713	710	709	706	703	702
1576557	1676240	1775921	699	697	694	693	690	687	686	683	681	678
2573285	2672945	2772603	677	674	671	670	667	665	662	660	658	656
3569785	3669422	3769057	653	652	648	647	644	642	640	637	635	633
4566056	4665670	4765283	631	628	626	624	621	619	617	614	613	610
5562099	5661690	5761280	607	606	603	601	598	597	594	591	590	587

Numbers 43600–44209 **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4360	6394864893	4964500	5064106	5163709	5263310	5362908	5462505
61	5860867	5960452	6060034	6159614	6259192	6358768	6458342
62	6856612	6956174	7055734	7155292	7254847	7354400	7453950
63	7852130	7951669	8051206	8150741	8250273	8349803	8449331
64	8847419	8946936	9046450	9145961	9245471	9344978	9444483
65	9842480	9941974	0041465	0140954	0240441	0339926	0439408
66	6400837314	0936785	1036253	1135719	1235183	1334645	1434104
67	1831919	1931367	2030813	2130256	2229698	2329137	2428573
68	2826297	2925722	3025145	3124566	3223984	3323400	3422814
69	3820447	3919850	4019250	4118648	4218043	4317437	4416828
4370	6404814370	4913749	5013127	5112502	5211875	5311246	5410614
71	5808065	5907422	6006777	6106129	6205479	6304827	6404173
72	6801533	6900867	7000199	7099529	7198856	7298182	7397504
73	7794773	7894085	7993394	8092701	8192006	8291309	8390609
74	8787787	8887076	8986362	9085647	9184929	9284209	9383486
75	9780574	9879840	9979104	0078365	0177625	0276882	0376137
76	6410773133	0872377	0971618	1070857	1170094	1269328	1368560
77	1765466	1864687	1963906	2063122	2162336	2261548	2360757
78	2757572	2856770	2955966	3055160	3154351	3253540	3352727
79	3749452	3848627	3947801	4046972	4146140	4245307	4344471
4380	6414741105	4840258	4939408	5038557	5137703	5236847	5335988
81	5732532	5831662	5930790	6029916	6129039	6228160	6327279
82	6723732	6822840	6921945	7021048	7120149	7219248	7318344
83	7714707	7813792	7912874	8011955	8111033	8210109	8309183
84	8705455	8804517	8903577	9002635	9101691	9200744	9299795
85	9695977	9795017	9894054	9993090	0092123	0191153	0290182
86	6420686273	0785291	0884306	0983318	1082329	1181337	1280343
87	1676344	1775339	1874331	1973321	2072309	2171295	2270278
88	2666189	2765161	2864131	2963099	3062064	3161027	3259988
89	3655808	3754758	3853705	3952650	4051593	4150534	4249472
4390	6424645202	4744129	4843054	4941977	5040897	5139815	5238731
91	5634371	5733276	5832178	5931078	6029975	6128871	6227764
92	6623314	6722196	6821076	6919954	7018829	7117702	7216572
93	7612033	7710892	7809749	7908604	8007457	8106307	8205156
94	8600526	8699363	8798197	8897030	8995860	9094688	9193514
95	9588794	9687609	9786421	9885231	9984038	0082844	0181647
96	6430576838	0675629	0774419	0873207	0971992	1070775	1169556
97	1564656	1663426	1762193	1860958	1959721	2058481	2157240
98	2552250	2650997	2749742	2848485	2947225	3045963	3144699
99	3539620	3638344	3737067	3835787	3934505	4033220	4131934
4400	6434526765	4625467	4724167	4822865	4921560	5020253	5118944
1	5513686	5612365	5711043	5809718	5908391	6007062	6105730
2	6500382	6599040	6697695	6796347	6894998	6993646	7092293
3	7486855	7585490	7684122	7782753	7881381	7980007	8078631
4	8473103	8571716	8670326	8768934	8867540	8966143	9064745
5	9459127	9557718	9656306	9754891	9853475	9952056	0050635
6	6440444928	0543496	0642061	0740625	0839186	0937745	1036301
7	1430505	1529050	1627594	1726135	1824673	1923210	2021744
8	2415858	2514381	2612902	2711421	2809937	2908451	3006963
9	3400988	3499489	3597987	3696484	3794978	3893469	3991959
4410	6444385895	4484373	4582849	4681323	4779795	4878264	4976731
11	5370578	5469034	5567488	5665939	5764389	5862836	5961281
12	6355038	6453471	6551903	6650332	6748759	6847184	6945607
13	7339274	7437686	7536095	7634502	7732907	7831309	7929709
14	8323288	8421677	8520064	8618449	8716831	8815212	8913590
15	9307079	9405446	9503811	9602173	9700533	9798891	9897247
16	6450290647	0388992	0487334	0585674	0684012	0782348	0880681
17	1273993	1372315	1470635	1568953	1667268	1765582	1863893
18	2257115	2355415	2453713	2552009	2650302	2748593	2846882
19	3240016	3338293	3436569	3534842	3633113	3731382	3829649
4420	4222693	4320949	4419202	4517453	4615702	4713949	4812194

OF NUMBERS. Logarithms 6394864893-6455106914.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5562099	5661690	5761280	99607	606	603	601	598	597	594	591	590	587
6557913	6657482	6757048	585	582	580	578	576	574	571	569	566	564
7553499	7653045	7752588	562	560	558	555	553	550	549	546	543	542
8548856	8648380	8747900	539	537	535	532	530	528	525	524	520	519
9543986	9643486	9742985	517	514	511	510	507	505	503	500	499	495
0538888	0638365	0737841	494	491	489	487	485	482	480	477	476	473
1533561	1633016	1732469	471	468	466	464	462	459	457	455	453	450
2528008	2627440	2726869	448	446	443	442	439	436	435	432	429	428
3522226	3621635	3721042	425	423	421	418	416	414	412	409	407	405
4516217	4615603	4714988	403	400	398	395	394	391	389	386	385	382
5509980	5609344	5708706	99379	378	375	373	371	368	366	364	362	359
6503516	6602857	6702196	357	355	352	350	348	346	343	341	339	337
7496825	7596143	7695460	334	332	330	327	326	322	321	318	317	313
8489907	8589202	8688496	312	309	307	305	303	300	298	295	294	291
9482761	9582034	9681305	289	286	285	282	280	277	275	273	271	269
0475389	0574639	0673887	266	264	261	260	257	255	252	250	248	246
1467790	1567018	1666243	244	241	239	237	234	232	230	228	225	223
2459964	2559169	2658372	221	219	216	214	212	209	207	205	203	200
3451912	3551094	3650274	198	196	194	191	189	187	185	182	180	178
4443633	4542793	4641950	175	174	171	168	167	164	162	160	157	155
5435128	5534265	5633399	99153	150	149	146	144	141	140	137	134	133
6426396	6525510	6624622	130	128	126	123	121	119	117	114	112	110
7417438	7516530	7615619	108	105	103	101	099	096	094	092	089	088
8408254	8507323	8606390	085	082	081	078	076	074	071	069	067	065
9398844	9497891	9596935	062	060	058	056	053	051	049	047	044	042
0389208	0488232	0587254	040	037	036	033	030	029	026	024	022	019
1379347	1478348	1577347	018	015	012	011	008	006	004	001	999	997
2369259	2468238	2567215	98995	992	990	988	986	983	981	979	977	974
3358946	3457903	3556857	972	970	968	965	963	961	958	957	954	951
4348408	4447342	4546273	950	947	945	943	941	938	936	934	931	929
5337644	5436555	5535464	98927	925	923	920	918	916	913	911	909	907
6326655	6425544	6524430	905	902	900	897	896	893	891	889	886	884
7315441	7414307	7513171	882	880	878	875	873	870	869	866	864	862
8304002	8402845	8501687	859	857	855	853	850	849	846	843	842	839
9292337	9391158	9489977	837	834	833	830	828	826	823	821	819	817
0280448	0379247	0478043	815	812	810	807	806	803	801	799	796	795
1268334	1367110	1465884	791	790	788	785	783	781	778	776	774	772
2255996	2354749	2453501	770	767	765	763	760	759	756	753	752	749
3243432	3342164	3440893	747	745	743	740	738	736	733	732	729	727
4230645	4329354	4428060	724	723	720	718	715	714	711	709	706	705
5217633	5316319	5415004	98702	700	698	695	693	691	689	686	685	682
6204397	6303061	6401723	679	678	675	673	671	668	667	664	662	659
7190936	7289578	7388217	658	655	652	651	648	647	643	642	639	638
8177252	8275871	8374488	635	632	631	628	626	624	621	619	617	615
9163344	9261940	9360535	613	610	608	606	603	602	599	596	595	592
0149211	0247786	0346358	591	588	585	584	581	579	576	575	572	570
1134855	1233408	1331957	568	565	564	561	559	556	554	553	549	548
2120276	2218806	2317333	545	544	541	538	537	534	532	530	527	525
3105473	3203980	3302485	523	521	519	516	514	512	510	507	505	503
4090446	4188931	4287414	501	498	497	494	491	490	487	485	483	481
5075196	5173659	5272120	98478	476	474	472	469	467	465	463	461	458
6059723	6158164	6256602	456	454	451	450	447	445	442	441	438	436
7044027	7142445	7240861	433	432	429	427	425	423	420	418	416	413
8028108	8126503	8224897	412	409	407	405	402	400	399	395	394	391
9011965	9110339	9208710	389	387	385	382	381	378	375	374	371	369
9995600	0093951	0192300	367	365	362	360	358	356	353	351	349	347
0979012	1077341	1175668	345	342	340	338	336	333	331	329	327	325
1962202	2060509	2158813	322	320	318	315	314	311	309	307	304	302
2945169	3043453	3141736	300	298	296	293	291	289	287	284	283	280
3927913	4026176	4124436	277	276	273	271	269	267	264	263	260	257
4910436	5008676	5106914	256	253	251	249	247	245	242	240	238	235

Numbers 44200–44809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4420	6454222693	4320949	4419202	4517453	4615702	4713949	4812194
21	5205149	5303382	5401614	5499842	5598069	5696294	5794516
22	6187382	6285594	6383802	6482009	6580214	6678416	6776616
23	7169394	7267583	7365769	7463954	7562136	7660316	7758494
24	8151183	8249350	8347514	8445676	8543837	8641994	8740150
25	9132750	9230895	9329037	9427177	9525315	9623451	9721584
26	6460114096	0212218	0310338	0408456	0506572	0604686	0702797
27	1095220	1193320	1291418	1389514	1487607	1585699	1683788
28	2076122	2174200	2272276	2370350	2468421	2566490	2664557
29	3056803	3154859	3252912	3350964	3449013	3547060	3645105
4430	6464037262	4135296	4233328	4331357	4429384	4527409	4625432
31	5017500	5115512	5213521	5311529	5409534	5507536	5605537
32	5997517	6095507	6193494	6291479	6389462	6487443	6585421
33	6977313	7075280	7173246	7271209	7369169	7467128	7565084
34	7956888	8054833	8152776	8250717	8348656	8446592	8544527
35	8936242	9034165	9132086	9230005	9327921	9425836	9523748
36	9915375	0013276	0111175	0209072	0306966	0404859	0502749
37	6470894287	0992166	1090043	1187918	1285790	1383661	1481529
38	1872979	1970836	2068691	2166543	2264394	2362242	2460088
39	2851450	2949285	3047118	3144949	3242777	3340603	3438427
4440	6473829701	3927514	4025325	4123133	4220940	4318744	4416546
41	4807732	4905523	5003311	5101098	5198882	5296664	5394444
42	5785542	5883311	5981078	6078842	6176605	6274365	6372123
43	6763132	6860879	6958624	7056367	7154107	7251845	7349581
44	7740503	7838228	7935950	8033671	8131389	8229105	8326819
45	8717653	8815356	8913057	9010755	9108452	9206146	9303838
46	9694584	9792265	9889943	9987620	0085294	0182967	0280637
47	6480671294	0768953	0866610	0964265	1061917	1159568	1257216
48	1647786	1745423	1843058	1940690	2038321	2135949	2233575
49	2624057	2721673	2819285	2916896	3014505	3112111	3209715
4450	6483600110	3697703	3795294	3892883	3990469	4088054	4185636
51	4575943	4673514	4771083	4868650	4966215	5063777	5161337
52	5551557	5649106	5746653	5844198	5941741	6039281	6136820
53	6526951	6624479	6722004	6819527	6917048	7014567	7112083
54	7502127	7599633	7697136	7794637	7892136	7989633	8087127
55	8477084	8574567	8672049	8769528	8867005	8964480	9061953
56	9451822	9549283	9646743	9744200	9841656	9939109	0036559
57	6490426341	0523781	0621218	0718654	0816087	0913518	1010947
58	1400641	1498059	1595475	1692889	1790300	1887710	1985117
59	2374723	2472120	2569514	2666906	2764295	2861683	2959068
4460	6493348587	3445961	3543334	3640704	3738071	3835437	3932800
61	4322232	4419585	4516935	4614283	4711629	4808973	4906315
62	5295659	5392990	5490319	5587645	5684969	5782291	5879611
63	6268868	6366177	6463484	6560789	6658091	6755391	6852689
64	7241859	7339146	7436431	7533714	7630995	7728273	7825549
65	8214632	8311898	8409161	8506422	8603680	8700937	8798191
66	9187187	9284431	9381672	9478911	9576148	9673383	9770616
67	6500159525	0256746	0353966	0451183	0548399	0645612	0742823
68	1131644	1228844	1326042	1423238	1520431	1617623	1714812
69	2103547	2200725	2297901	2395075	2492247	2589416	2686584
4470	6503075231	3172388	3269542	3366694	3463844	3560992	3658138
71	4046699	4143833	4240966	4338097	4435225	4532351	4629475
72	5017949	5115062	5212173	5309281	5406388	5503492	5600595
73	5988982	6086073	6183162	6280249	6377334	6474417	6571497
74	6959798	7056867	7153935	7251000	7348063	7445124	7542183
75	7930397	8027444	8124490	8221534	8318575	8415615	8512652
76	8900779	8997805	9094829	9191851	9288871	9385888	9482904
77	9870944	9967948	0064951	0161951	0258949	0355945	0452939
78	6510840892	0937875	1034856	1131835	1228811	1325786	1422758
79	1810624	1907586	2004545	2101502	2198457	2295409	2392360
4480	2780140	2877080	2974017	3070952	3167886	3264817	3361745

OF NUMBERS. Logarithms 6454222693-6513652519.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4910436	5008676	5106914	98256	253	251	249	247	245	242	240	238	235
5892736	5990954	6089169	233	232	228	227	225	222	220	218	215	213
6874814	6973009	7071203	212	208	207	205	202	200	198	195	194	191
7856669	7954843	8053014	189	186	185	182	180	178	175	174	171	169
8838303	8936455	9034604	167	164	162	161	157	156	153	152	149	146
9819716	9917845	0015971	145	142	140	138	136	133	132	129	126	125
0800906	0899013	0997117	122	120	118	116	114	111	109	107	104	103
1781875	1879959	1978042	100	098	096	093	092	089	087	084	083	080
2762622	2860684	2958745	078	076	074	071	069	067	065	062	061	058
3743148	3841188	3939226	056	053	052	049	047	045	043	040	038	036
4723452	4821470	4919486	98034	032	029	027	025	023	020	018	016	014
5703535	5801532	5899525	012	009	008	005	002	001	998	997	993	992
6683397	6781372	6879343	97990	987	985	983	981	978	976	975	971	970
7663039	7760991	7858940	967	966	963	960	959	956	955	952	949	948
8642459	8740389	8838316	945	943	941	939	936	935	932	930	927	926
9621658	9719566	9817471	923	921	919	916	915	912	910	908	905	904
0600637	0698522	0796406	901	899	897	894	893	890	888	885	884	881
1579395	1677258	1775120	879	877	875	872	871	868	866	863	862	859
2557932	2655774	2753613	857	855	852	851	848	846	844	842	839	837
3536249	3634069	3731886	835	833	831	828	826	824	822	820	817	815
4514346	4612143	4709939	97813	811	808	807	804	802	800	797	796	793
5492222	5589998	5687771	791	788	787	784	782	780	778	776	773	771
6469878	6567632	6665383	769	767	764	763	760	758	755	754	751	749
7447315	7545046	7642776	747	745	743	740	738	736	734	731	730	727
8424531	8522241	8619948	725	722	721	718	716	714	712	710	707	705
9401528	9499215	9596900	703	701	698	697	694	692	690	687	685	684
0378304	0475970	0573633	681	678	677	674	673	670	667	666	663	661
1354861	1452505	1550146	659	657	655	652	651	648	645	644	641	640
2331199	2428821	2526440	637	635	632	631	628	626	624	622	619	617
3307317	3404917	3502514	616	612	611	609	606	604	602	600	597	596
4283216	4380794	4478369	97593	591	589	586	585	582	580	578	575	574
5258895	5356451	5454005	571	569	567	565	562	560	558	556	554	552
6234356	6331890	6429422	549	547	545	543	540	539	536	534	532	529
7209597	7307109	7404619	528	525	523	521	519	516	514	512	510	508
8184620	8282110	8379598	506	503	501	499	497	494	493	490	488	486
9159423	9256892	9354358	483	482	479	477	475	473	470	469	466	464
0134008	0231455	0328899	461	460	457	456	453	450	449	447	444	442
1108374	1205799	1303221	440	437	436	433	431	429	427	425	422	420
2082522	2179925	2277325	418	416	414	411	410	407	405	403	400	398
3056451	3153832	3251211	397	394	392	389	388	385	383	381	379	376
4030162	4127521	4224878	97374	373	370	367	366	363	362	359	357	354
5003654	5100992	5198327	353	350	348	346	344	342	339	338	335	332
5976929	6074244	6171557	331	329	326	324	322	320	318	315	313	311
6949985	7047279	7144570	309	307	305	302	300	298	296	294	291	289
7922823	8020095	8117365	287	285	283	281	278	276	274	272	270	267
8895444	8992694	9089942	266	263	261	258	257	254	253	250	248	245
9867846	9965075	0062301	244	241	239	237	235	233	230	229	226	224
0840031	0937238	1034442	221	220	217	216	213	211	208	207	204	202
1811999	1909184	2006366	200	198	196	193	192	189	187	185	182	181
2783749	2880912	2978073	178	176	174	172	169	168	165	163	161	158
3755281	3852423	3949562	97157	154	152	150	148	146	143	142	139	137
4726597	4823716	4920834	134	133	131	128	126	124	122	119	118	115
5697695	5794793	5891888	113	111	108	107	104	103	100	098	095	094
6668576	6765652	6862726	091	089	087	085	083	080	079	076	074	072
7639240	7736294	7833346	069	068	065	063	061	059	057	054	052	051
8609687	8706719	8803750	047	046	044	041	040	037	035	032	031	029
9579917	9676928	9773937	026	024	022	020	017	016	013	011	009	007
0549931	0646920	0743907	004	003	000	998	996	994	992	989	987	985
1519728	1616695	1713661	96983	981	979	976	975	972	970	967	966	963
2489308	2586254	2683198	962	959	957	955	952	951	948	946	944	942
3458672	3555597	3652519	940	937	935	934	931	928	927	925	922	920

Numbers 44800–45409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4480	6512780140	2877080	2974017	3070952	3167886	3264817	3361745
81	3749439	3846357	3943273	4040187	4137098	4234008	4330915
82	4718522	4815418	4912312	5009205	5106095	5202982	5299868
83	5687389	5784263	5881136	5978007	6074875	6171741	6268605
84	6656039	6752892	6849743	6946592	7043439	7140284	7237126
85	7624474	7721305	7818135	7914962	8011787	8108610	8205431
86	8592692	8689502	8786310	8883116	8979920	9076721	9173520
87	9560695	9657484	9754270	9851054	9947836	0044616	0141394
88	6520528482	0625249	0722014	0818777	0915537	1012295	1109051
89	1496054	1592799	1689542	1786283	1883022	1979759	2076493
4490	6522463410	2560134	2656855	2753575	2850292	2947007	3043720
91	3430551	3527253	3623953	3720651	3817347	3914040	4010732
92	4397476	4494157	4590835	4687511	4784186	4880858	4977528
93	5364186	5460845	5557502	5654157	5750810	5847460	5944109
94	6330681	6427318	6523954	6620587	6717219	6813848	6910475
95	7296961	7393577	7490191	7586803	7683412	7780020	7876625
96	8263026	8359620	8456213	8552803	8649391	8745977	8842561
97	9228876	9325449	9422020	9518589	9615156	9711720	9808283
98	6530194511	0291063	0387612	0484160	0580705	0677248	0773789
99	1159932	1256462	1352990	1449516	1546040	1642562	1739081
4500	6532125138	2221647	2318153	2414658	2511160	2607660	2704158
1	3090129	3186617	3283102	3379585	3476066	3572545	3669021
2	4054907	4151373	4247836	4344298	4440758	4537215	4633670
3	5019470	5115914	5212357	5308797	5405235	5501671	5598105
4	5983818	6080242	6176663	6273081	6369498	6465913	6562325
5	6947953	7044355	7140754	7237152	7333547	7429940	7526331
6	7911873	8008254	8104632	8201008	8297382	8393754	8490124
7	8875581	8971940	9068296	9164651	9261004	9357354	9453702
8	9839074	9935411	0031747	0128080	0224411	0320740	0417067
9	6540802353	0898669	0994983	1091295	1187605	1283913	1380218
4510	6541765419	1861714	1958006	2054297	2150585	2246872	2343156
11	2728271	2824544	2920816	3017085	3113352	3209617	3305880
12	3690910	3787162	3883412	3979660	4075906	4172149	4268391
13	4653335	4749566	4845795	4942021	5038246	5134468	5230688
14	5615547	5711757	5807964	5904170	6000373	6096574	6192772
15	6577546	6673735	6769921	6866105	6962286	7058466	7154644
16	7539333	7635499	7731664	7827827	7923987	8020146	8116302
17	8500906	8597051	8693195	8789336	8885475	8981612	9077747
18	9462266	9558390	9654512	9750632	9846750	9942866	0038980
19	6550423413	0519516	0615617	0711716	0807813	0903907	1000000
4520	6551384348	1480430	1576510	1672587	1768663	1864736	1960807
21	2345070	2441131	2537189	2633246	2729300	2825352	2921402
22	3305580	3401619	3497657	3593692	3689725	3785755	3881784
23	4265877	4361895	4457911	4553925	4649937	4745947	4841954
24	5225963	5321959	5417954	5513947	5609937	5705925	5801912
25	6185835	6281811	6377785	6473756	6569725	6665692	6761657
26	7145496	7241451	7337403	7433353	7529301	7625247	7721191
27	8104945	8200878	8296809	8392738	8488665	8584590	8680512
28	9064182	9160094	9256004	9351912	9447817	9543721	9639622
29	6560023207	0119098	0214986	0310873	0406758	0502640	0598520
4530	6560982020	1077890	1173757	1269623	1365486	1461347	1557207
31	1940622	2036470	2132317	2228161	2324003	2419843	2515681
32	2899012	2994839	3090665	3186488	3282309	3378128	3473944
33	3857191	3952997	4048801	4144603	4240403	4336201	4431996
34	4815158	4910943	5006726	5102507	5198286	5294062	5389837
35	5772914	5868678	5964440	6060200	6155957	6251713	6347466
36	6730459	6826202	6921942	7017681	7113418	7209152	7304884
37	7687793	7783514	7879234	7974952	8070667	8166380	8262092
38	8644915	8740616	8836315	8932011	9027706	9123398	9219088
39	9601827	9697507	9793185	9888860	9984533	0080204	0175873
4540	6570558529	0654187	0749844	0845498	0941150	1036800	1132448

OF NUMBERS. Logarithms 6512780140–6571419379.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3458672	3555597	3652519	96940	937	935	934	931	928	927	925	922	920
4427820	4524723	4621623	918	916	914	911	910	907	905	903	900	899
5396751	5493633	5590512	896	894	893	890	887	886	883	882	879	877
6365467	6462326	6559184	874	873	871	868	866	864	862	859	858	855
7333966	7430804	7527640	853	851	849	847	845	842	840	838	836	834
8302250	8399066	8495880	831	830	827	825	823	821	819	816	814	812
9270317	9367112	9463905	810	808	806	804	801	799	797	795	793	790
0238169	0334942	0431713	789	786	784	782	780	778	775	773	771	769
1205805	1302557	1399307	767	765	763	760	758	756	754	752	750	747
2173226	2269956	2366684	745	743	741	739	737	734	733	730	728	726
3140431	3237140	3333846	96724	721	720	717	715	713	711	709	706	705
4107421	4204108	4300793	702	700	698	696	693	692	689	687	685	683
5074196	5170861	5267525	681	678	676	675	672	670	668	665	664	661
6040755	6137399	6234041	659	657	655	653	650	649	646	644	642	640
7007099	7103722	7200342	637	636	633	632	629	627	624	623	620	619
7973229	8069830	8166429	616	614	612	609	608	605	604	601	599	597
8939143	9035723	9132300	594	593	590	588	586	584	582	580	577	576
9904843	0001401	0097957	573	571	569	567	564	563	560	558	556	554
0870328	0966865	1063399	552	549	548	545	543	541	539	537	534	533
1835598	1932114	2028627	530	528	526	524	522	519	517	516	513	511
2800654	2897148	2993640	96509	506	505	502	500	498	496	494	492	489
3765496	3861968	3958439	488	485	483	481	479	476	475	472	471	468
4730123	4826574	4923023	466	463	462	460	457	455	453	451	449	447
5694536	5790966	5887393	444	443	440	438	436	434	431	430	427	425
6658735	6755143	6851549	424	421	418	417	415	412	410	408	406	404
7622720	7719107	7815491	402	399	398	395	393	391	389	387	384	382
8586491	8682856	8779220	381	378	376	374	372	370	367	365	364	361
9550048	9646392	9742734	359	356	355	353	350	348	346	344	342	340
0513392	0609714	0706035	337	336	333	331	329	327	325	322	321	318
1476521	1572823	1669122	316	314	312	310	308	305	303	302	299	297
2439438	2535718	2631995	96295	292	291	288	287	284	282	280	277	276
3402141	3498399	3594655	273	272	269	267	265	263	261	258	256	255
4364630	4460867	4557102	252	250	248	246	243	242	239	237	235	233
5326906	5423122	5519336	231	229	226	225	222	220	218	216	214	211
6288969	6385164	6481356	210	207	206	203	201	198	197	195	192	190
7250819	7346992	7443164	189	186	184	181	180	178	175	173	172	169
8212456	8308608	8404758	166	165	163	160	159	156	154	152	150	148
9173880	9270011	9366139	145	144	141	139	137	135	133	131	128	127
0135091	0231201	0327308	124	122	120	118	116	114	111	110	107	105
1096090	1192178	1288264	103	101	099	097	094	093	090	088	086	084
2056876	2152943	2249008	96082	080	077	076	073	071	069	067	065	062
3017449	3113495	3209539	061	058	057	054	052	050	047	046	044	041
3977811	4073835	4169857	039	038	035	033	030	029	027	024	022	020
4937959	5033963	5129964	018	016	014	012	010	007	005	004	001	999
5897896	5993878	6089858	95996	995	993	990	988	987	984	982	980	977
6857620	6953581	7049540	976	974	971	969	967	965	963	961	959	956
7817133	7913072	8009010	955	952	950	948	946	944	942	939	938	935
8776433	8872351	8968268	933	931	929	927	925	922	921	918	917	914
9735522	9831419	9927314	912	910	908	905	904	901	900	897	895	893
0694398	0790274	0886148	891	888	887	885	882	880	878	876	874	872
1653064	1748918	1844771	95870	867	866	863	861	860	857	854	853	851
2611517	2707351	2803182	848	847	844	842	840	838	836	834	831	830
3569759	3665572	3761382	827	826	823	821	819	816	815	813	810	809
4527790	4623581	4719371	806	804	802	800	798	795	794	791	790	787
5485609	5581380	5677148	785	783	781	779	776	775	772	771	768	766
6443218	6538967	6634714	764	762	760	757	756	753	752	749	747	745
7400615	7496343	7592069	743	740	739	737	734	732	731	728	726	724
8357801	8453508	8549213	721	720	718	715	713	712	709	707	705	702
9314776	9410462	9506146	701	699	696	695	692	690	688	686	684	681
0271540	0367205	0462868	680	678	675	673	671	669	667	665	663	661
1228094	1323738	1419379	658	657	654	652	650	648	646	644	641	640

Numbers 45400–46009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4540	6570558529	0654187	0749844	0845498	0941150	1036800	1132448
41	1515019	1610656	1706292	1801925	1897556	1993185	2088812
42	2471299	2566915	2662530	2758142	2853752	2949360	3044966
43	3427368	3522964	3618557	3714148	3809737	3905324	4000909
44	4383227	4478801	4574374	4669944	4765512	4861078	4956641
45	5338876	5434429	5529980	5625529	5721076	5816621	5912164
46	6294314	6389846	6485376	6580904	6676430	6771954	6867476
47	7249542	7345053	7440562	7536070	7631575	7727077	7822578
48	8204560	8300050	8395539	8491025	8586509	8681990	8777470
49	9159368	9254838	9350305	9445770	9541233	9636694	9732152
4550	6580113967	0209415	0304861	0400305	0495747	0591187	0686625
51	1068355	1163782	1259208	1354631	1450052	1545471	1640888
52	2022534	2117940	2213344	2308747	2404147	2499545	2594941
53	2976503	3071888	3167272	3262653	3358032	3453409	3548784
54	3930263	4025627	4120990	4216350	4311708	4407064	4502418
55	4883813	4979157	5074498	5169837	5265175	5360510	5455843
56	5837154	5932477	6027797	6123116	6218432	6313746	6409058
57	6790286	6885588	6980887	7076185	7171480	7266773	7362064
58	7743208	7838489	7933768	8029044	8124319	8219591	8314862
59	8695922	8791182	8886440	8981695	9076949	9172200	9267450
4560	6589648427	9743666	9838903	9934137	0029370	0124601	0219829
61	6590600722	0695941	0791157	0886370	0981582	1076792	1172000
62	1552809	1648007	1743202	1838395	1933586	2028775	2123961
63	2504688	2599864	2695038	2790211	2885381	2980549	3075715
64	3456357	3551513	3646666	3741818	3836967	3932114	4027259
65	4407819	4502953	4598086	4693216	4788345	4883471	4978595
66	5359072	5454185	5549297	5644407	5739514	5834620	5929723
67	6310116	6405209	6500300	6595389	6690476	6785560	6880643
68	7260952	7356025	7451095	7546163	7641229	7736292	7831354
69	8211581	8306632	8401681	8496728	8591774	8686817	8781858
4570	6599162001	9257031	9352060	9447086	9542111	9637133	9732153
71	6600112213	0207223	0302230	0397236	0492240	0587241	0682240
72	1062217	1157206	1252193	1347178	1442161	1537142	1632120
73	2012014	2106982	2201948	2296912	2391874	2486834	2581792
74	2961603	3056550	3151496	3246439	3341380	3436319	3531256
75	3910984	4005911	4100835	4195758	4290678	4385596	4480513
76	4860158	4955064	5049968	5144870	5239769	5334667	5429563
77	5809124	5904010	5998893	6093774	6188653	6283530	6378405
78	6757883	6852748	6947610	7042471	7137329	7232185	7327039
79	7706435	7801279	7896121	7990960	8085798	8180634	8275467
4580	6608654780	8749603	8844424	8939243	9034060	9128875	9223688
81	9602918	9697720	9792520	9887319	9982115	0076909	0171701
82	6610550849	0645630	0740410	0835187	0929963	1024736	1119508
83	1498572	1593333	1688092	1782849	1877604	1972357	2067108
84	2446090	2540830	2635568	2730304	2825039	2919771	3014501
85	3393400	3488120	3582837	3677553	3772266	3866978	3961687
86	4340504	4435203	4529900	4624595	4719288	4813978	4908667
87	5287401	5382080	5476756	5571430	5666102	5760773	5855441
88	6234092	6328750	6423406	6518059	6612711	6707360	6802008
89	7180577	7275214	7369849	7464482	7559113	7653742	7748369
4590	6618126855	8221472	8316086	8410699	8505309	8599917	8694523
91	9072928	9167524	9262117	9356709	9451299	9545887	9640472
92	6620018794	0113369	0207942	0302514	0397083	0491650	0586215
93	0964454	1059009	1153562	1248112	1342661	1437207	1531752
94	1909909	2004443	2098975	2193505	2288033	2382559	2477082
95	2855157	2949671	3044182	3138692	3233199	3327704	3422208
96	3800200	3894693	3989184	4083673	4178160	4272645	4367127
97	4745038	4839510	4933980	5028449	5122915	5217379	5311841
98	5689669	5784121	5878571	5973019	6067465	6161908	6256350
99	6634096	6728527	6822956	6917384	7011809	7106232	7200653
4600	7578317	7672728	7767136	7861543	7955948	8050350	8144751

OF NUMBERS. Logarithms 6570558529-6628427940.

Mantissæ			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1228094	1323738	1419379	95658	657	654	652	650	648	646	644	641	640
2184437	2280060	2375680	637	636	633	631	629	627	625	623	620	619
3140569	3236171	3331771	616	615	612	610	608	606	603	602	600	597
4096491	4192072	4287651	596	593	591	589	587	585	582	581	579	576
5052203	5147763	5243320	574	573	570	568	566	563	562	560	557	556
6007704	6103243	6198780	553	551	549	547	545	543	540	539	537	534
6962996	7058513	7154029	532	530	528	526	524	522	520	517	516	513
7918077	8013573	8109068	511	509	508	505	502	501	499	496	495	492
8872948	8968423	9063897	490	489	486	484	481	480	478	475	474	471
9827609	9923064	0018516	470	467	465	463	461	458	457	455	452	451
0782061	0877494	0972926	95448	446	444	442	440	438	436	433	432	429
1736302	1831715	1927125	427	426	423	421	419	417	414	413	410	409
2690334	2785726	2881116	406	404	403	400	398	396	393	392	390	387
3644157	3739528	3834896	385	384	381	379	377	375	373	371	368	367
4597770	4693120	4788468	364	363	360	358	356	354	352	350	348	345
5551174	5646503	5741829	344	341	339	338	335	333	331	329	326	325
6504368	6599676	6694982	323	320	319	316	314	312	310	308	306	304
7457354	7552641	7647926	302	299	298	295	293	291	290	287	285	282
8410130	8505396	8600660	281	279	276	275	272	271	268	266	264	262
9362697	9457942	9553186	260	258	255	254	251	250	247	245	244	241
0315056	0410280	0505502	95239	237	234	233	231	228	227	224	222	220
1267205	1362409	1457610	219	216	213	212	210	208	205	204	201	199
2219146	2314329	2409509	198	195	193	191	189	186	185	183	180	179
3170878	3266040	3361200	176	174	173	170	168	166	163	162	160	157
4122402	4217543	4312682	156	153	152	149	147	145	143	141	139	137
5073718	5168838	5263956	134	133	130	129	126	124	123	120	118	116
6024825	6119924	6215021	113	112	110	107	106	103	102	099	097	095
6975723	7070802	7165878	093	091	089	087	084	083	080	079	076	074
7926414	8021472	8116527	073	070	068	066	063	062	060	058	055	054
8876897	8971933	9066968	051	049	047	046	043	041	039	036	035	033
9827171	9922187	0017201	95030	029	026	025	022	020	018	016	014	012
0777238	0872233	0967226	010	007	006	004	001	999	998	995	993	991
1727097	1822071	1917043	94989	987	985	983	981	978	977	974	972	971
2676748	2771702	2866653	968	966	964	962	960	958	956	954	951	950
3626191	3721124	3816055	947	946	943	941	939	937	935	933	931	929
4575427	4670340	4765250	927	924	923	920	918	917	914	913	910	908
5524456	5619348	5714237	906	904	902	899	898	896	893	892	889	887
6473277	6568148	6663017	886	883	881	879	877	875	872	871	869	866
7421891	7516741	7611589	865	862	861	858	856	854	852	850	848	846
8370298	8465128	8559955	844	842	839	838	836	833	831	830	827	825
9318498	9413307	9508113	94823	821	819	817	815	813	810	809	806	805
0266491	0361279	0456065	802	800	799	796	794	792	790	788	786	784
1214277	1309044	1403809	781	780	777	776	773	772	769	767	765	763
2161856	2256603	2351347	761	759	757	755	753	751	748	747	744	743
3109229	3203954	3298678	740	738	736	735	732	730	728	725	724	722
4056394	4151100	4245803	720	717	716	713	712	709	707	706	703	701
5003354	5098038	5192721	699	697	695	693	690	689	687	684	683	680
5950107	6044771	6139432	679	676	674	672	671	668	666	664	661	660
6896653	6991297	7085938	658	656	653	652	649	648	645	644	641	639
7842993	7937616	8032237	637	635	633	631	629	627	624	623	621	618
8789128	8883730	8978330	94617	614	613	610	608	606	605	602	600	598
9735056	9829637	9924217	596	593	592	590	588	585	584	581	580	577
0680778	0775339	0869897	575	573	572	569	567	565	563	561	558	557
1626294	1720834	1815372	555	553	550	549	546	545	542	540	538	537
2571604	2666124	2760642	534	532	530	528	526	523	522	520	518	515
3516709	3611208	3705705	514	511	510	507	505	504	501	499	497	495
4461608	4556086	4650563	493	491	489	487	485	482	481	478	477	475
5406301	5500759	5595215	472	470	469	466	464	462	460	458	456	454
6350789	6445227	6539662	452	450	448	446	443	442	439	438	435	434
7295072	7389489	7483904	431	429	428	425	423	421	419	417	415	413
8239149	8333546	8427940	411	408	407	405	402	401	398	397	394	393

Numbers 46000–46609. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4600	6627578317	7672728	7767136	7861543	7955948	8050350	8144751
1	8522333	8616723	8711111	8805497	8899882	8994264	9088644
2	9466143	9560513	9654881	9749247	9843610	9937972	0032331
3	6630409749	0504098	0598445	0692791	0787134	0881475	0975814
4	1353150	1447478	1541805	1636130	1730452	1824773	1919092
5	2296345	2390654	2484960	2579264	2673566	2767866	2862164
6	3239336	3333624	3427910	3522194	3616475	3710755	3805033
7	4182123	4276390	4370655	4464919	4559180	4653439	4747696
8	5124704	5218951	5313196	5407439	5501680	5595918	5690155
9	6067081	6161308	6255532	6349755	6443975	6538193	6632409
4610	6637009254	7103460	7197664	7291866	7386066	7480264	7574459
11	7951222	8045408	8139591	8233773	8327952	8422130	8516305
12	8892986	8987151	9081315	9175476	9269635	9363792	9457947
13	9834546	9928691	0022834	0116974	0211113	0305249	0399384
14	6640775902	0870026	0964149	1058269	1152387	1246503	1340617
15	1717054	1811158	1905260	1999359	2093457	2187553	2281647
16	2658001	2752085	2846167	2940246	3034324	3128399	3222472
17	3598746	3692809	3786870	3880929	3974986	4069041	4163094
18	4539286	4633329	4727369	4821408	4915445	5009480	5103512
19	5479622	5573645	5667665	5761684	5855700	5949714	6043727
4620	6646419756	6513758	6607758	6701756	6795752	6889746	6983738
21	7359685	7453667	7547647	7641624	7735600	7829574	7923545
22	8299411	8393373	8487332	8581290	8675245	8769198	8863150
23	9238934	9332875	9426815	9520752	9614687	9708620	9802551
24	6650178254	0272175	0366094	0460010	0553925	0647838	0741748
25	1117371	1211271	1305170	1399066	1492961	1586853	1680743
26	2056284	2150165	2244043	2337919	2431793	2525665	2619535
27	2994995	3088855	3182713	3276569	3370422	3464274	3558124
28	3933503	4027342	4121180	4215016	4308849	4402681	4496510
29	4871808	4965627	5059445	5153260	5247073	5340884	5434694
4630	6655809910	5903709	5997506	6091301	6185094	6278885	6372674
31	6747810	6841589	6935366	7029140	7122913	7216684	7310453
32	7685507	7779266	7873022	7966777	8060529	8154280	8248028
33	8623002	8716740	8810477	8904211	8997943	9091674	9185402
34	9560295	9654013	9747729	9841443	9935155	0028865	0122573
35	6660497385	0591083	0684779	0778472	0872164	0965854	1059542
36	1434273	1527951	1621626	1715300	1808972	1902641	1996309
37	2370959	2464616	2558272	2651925	2745577	2839226	2932874
38	3307443	3401080	3494716	3588349	3681980	3775609	3869237
39	4243725	4337342	4430957	4524570	4618182	4711791	4805398
4640	6665179806	5273402	5366997	5460590	5554181	5647770	5741357
41	6115684	6209261	6302836	6396408	6489979	6583548	6677115
42	7051361	7144918	7238472	7332025	7425576	7519124	7612671
43	7986837	8080373	8173908	8267440	8360970	8454499	8548025
44	8922111	9015627	9109141	9202654	9296164	9389672	9483178
45	9857183	9950679	0044174	0137666	0231156	0324644	0418130
46	6670792055	0885531	0979005	1072477	1165947	1259415	1352881
47	1726725	1820181	1913635	2007087	2100537	2193984	2287430
48	2661194	2754630	2848064	2941495	3034925	3128353	3221779
49	3595462	3688878	3782291	3875703	3969113	4062520	4155926
4650	6674529529	4622925	4716318	4809710	4903099	4996487	5089873
51	5463395	5556771	5650144	5743516	5836885	5930253	6023618
52	6397061	6490416	6583770	6677121	6770471	6863818	6957164
53	7330525	7423861	7517194	7610526	7703855	7797182	7890508
54	8263790	8357105	8450418	8543730	8637039	8730346	8823652
55	9196853	9290149	9383442	9476733	9570023	9663310	9756595
56	6680129716	0222992	0316265	0409536	0502806	0596073	0689338
57	1062379	1155635	1248888	1342139	1435388	1528636	1621881
58	1994842	2088077	2181310	2274542	2367771	2460998	2554223
59	2927104	3020320	3113533	3206744	3299953	3393161	3486366
4660	3859167	3952362	4045555	4138747	4231936	4325123	4418308

OF NUMBERS.

Logarithms 6627578317–6684697852.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8239149	8333546	8427940	94411	408	407	405	402	401	398	397	394	393
9183022	9277398	9371771	390	388	386	385	382	380	378	376	373	372
0126689	0221044	0315398	370	368	366	363	362	359	358	355	354	351
1070151	1164486	1258819	349	347	346	343	341	339	337	335	333	331
2013408	2107723	2202035	328	327	325	322	321	319	316	315	312	310
2956460	3050754	3145046	309	306	304	302	300	298	296	294	292	290
3899308	3993582	4087853	288	286	284	281	280	278	275	274	271	270
4841951	4936204	5030455	267	265	264	261	259	257	255	253	251	249
5784390	5878622	5972853	247	245	243	241	238	237	235	232	231	228
6726624	6820836	6915046	227	224	223	220	218	216	215	212	210	208
7668653	7762845	7857035	94206	204	202	200	198	195	194	192	190	187
8610478	8704650	8798819	186	183	182	179	178	175	173	172	169	167
9552100	9646250	9740399	165	164	161	159	157	155	153	150	149	147
0493517	0587647	0681775	145	143	140	139	136	135	133	130	128	127
1434730	1528840	1622948	124	123	120	118	116	114	113	110	108	106
2375739	2469828	2563916	104	102	099	098	096	094	092	089	088	085
3316544	3410613	3504680	084	082	079	078	075	073	072	069	067	066
4257145	4351194	4445241	063	061	059	057	055	053	051	049	047	045
5197543	5291571	5385598	043	040	039	037	035	032	031	028	027	024
6137737	6231745	6325751	023	020	019	016	014	013	010	008	006	005
7077728	7171716	7265701	94002	000	998	996	994	992	990	988	985	984
8017515	8111482	8205448	93982	980	977	976	974	971	970	967	966	963
8957099	9051046	9144991	962	959	958	955	953	952	949	947	945	943
9896480	9990406	0084331	941	940	937	935	933	931	929	926	925	923
0835657	0929564	1023468	921	919	916	915	913	910	909	907	904	903
1774632	1868518	1962402	900	899	896	895	892	890	889	886	884	882
2713403	2807269	2901133	881	878	876	874	872	870	868	866	864	862
3651972	3745817	3839661	860	858	856	853	852	850	848	845	844	842
4590338	4684163	4777986	839	838	836	833	832	829	828	825	823	822
5528501	5622306	5716109	819	818	815	813	811	810	807	805	803	801
6466461	6560246	6654029	93799	797	795	793	791	789	787	785	783	781
7404219	7497984	7591747	779	777	774	773	771	769	766	765	763	760
8341775	8435519	8529262	759	756	755	752	751	748	747	744	743	740
9279128	9372852	9466574	738	737	734	732	731	728	726	724	722	721
0216279	0309983	0403685	718	716	714	712	710	708	706	704	702	700
1153228	1246911	1340593	698	696	693	692	690	688	686	683	682	680
2089974	2183638	2277299	678	675	674	672	669	668	665	664	661	660
3026519	3120162	3213804	657	656	653	652	649	648	645	643	642	639
3962862	4056485	4150106	637	636	633	631	629	628	625	623	621	619
4899003	4992606	5086207	617	615	613	612	609	607	605	603	601	599
5834942	5928525	6022105	93596	595	593	591	589	587	585	583	580	579
6770679	6864242	6957803	577	575	572	571	569	567	564	563	561	558
7706215	7799758	7893298	557	554	553	551	548	547	544	543	540	539
8641550	8735072	8828592	536	535	532	530	529	526	525	522	520	519
9576683	9670185	9763685	516	514	513	510	508	506	505	502	500	498
0511614	0605096	0698577	496	495	492	490	488	486	484	482	481	478
1446345	1539807	1633267	476	474	472	470	468	466	464	462	460	458
2380874	2474316	2567756	456	454	452	450	447	446	444	442	440	438
3315203	3408624	3502044	436	434	431	430	428	426	424	421	420	418
4249330	4342732	4436131	416	413	412	410	407	406	404	402	399	398
5183256	5276638	5370018	93396	393	392	389	388	386	383	382	380	377
6116982	6210344	6303703	376	373	372	369	368	365	364	362	359	358
7050507	7143848	7237188	355	354	351	350	347	346	343	341	340	337
7983831	8077153	8170472	336	333	332	329	327	326	323	322	319	318
8916955	9010256	9103556	315	313	312	309	307	306	303	301	300	297
9849878	9943160	0036439	296	293	291	290	287	285	283	282	279	277
0782601	0875863	0969122	276	273	271	270	267	265	263	262	259	257
1715124	1808365	1901605	256	253	251	249	248	245	243	241	240	237
2647447	2740668	2833887	235	233	232	229	227	225	224	221	219	217
3579569	3672770	3765970	216	213	211	209	208	205	203	201	200	197
4511492	4604673	4697852	195	193	192	189	187	185	184	181	179	177

Numbers 46600-47209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4660	6683859167	3952362	4045555	4138747	4231936	4325123	4418308
61	4791029	4884205	4977378	5070549	5163718	5256886	5350051
62	5722692	5815847	5909000	6002152	6095301	6188448	6281593
63	6654155	6747290	6840423	6933554	7026684	7119811	7212936
64	7585418	7678533	7771646	7864757	7957867	8050974	8144079
65	8516481	8609576	8702670	8795761	8888850	8981938	9075023
66	9447345	9540420	9633493	9726565	9819634	9912702	0005767
67	6690378009	0471064	0564118	0657169	0750219	0843266	0936312
68	1308474	1401509	1494543	1587574	1680604	1773631	1866657
69	2238739	2331755	2424769	2517780	2610790	2703797	2796803
4670	6693168806	3261801	3354795	3447787	3540776	3633764	3726750
71	4098673	4191649	4284622	4377594	4470564	4563532	4656498
72	5028341	5121297	5214251	5307203	5400153	5493101	5586046
73	5957810	6050746	6143680	6236612	6329542	6422470	6515396
74	6887081	6979997	7072911	7165823	7258733	7351641	7444547
75	7816152	7909048	8001943	8094835	8187725	8280613	8373500
76	8745025	8837901	8930776	9023648	9116518	9209387	9302253
77	9673699	9766556	9859410	9952263	0045113	0137962	0230808
78	6700602175	0695011	0787846	0880679	0973509	1066338	1159165
79	1530452	1623269	1716084	1808896	1901707	1994516	2087323
4680	6702458531	2551328	2644123	2736916	2829707	2922496	3015283
81	3386411	3479188	3571964	3664737	3757508	3850277	3943044
82	4314094	4406851	4499606	4592360	4685111	4777860	4870608
83	5241578	5334315	5427051	5519784	5612516	5705246	5797973
84	6168864	6261582	6354297	6447011	6539723	6632433	6725141
85	7095952	7188650	7281346	7374040	7466732	7559422	7652110
86	8022843	8115521	8208197	8300871	8393543	8486214	8578882
87	8949535	9042194	9134850	9227504	9320157	9412807	9505456
88	9876030	9968669	0061305	0153940	0246573	0339203	0431832
89	6710802327	0894946	0987563	1080178	1172791	1265402	1358011
4690	6711728427	1821026	1913623	2006219	2098812	2191403	2283992
91	2654329	2746909	2839486	2932062	3024635	3117207	3209776
92	3580034	3672594	3765152	3857707	3950261	4042813	4135363
93	4505542	4598082	4690620	4783156	4875690	4968222	5060752
94	5430853	5523373	5615891	5708407	5800922	5893434	5985944
95	6355966	6448467	6540965	6633462	6725956	6818449	6910939
96	7280882	7373363	7465842	7558319	7650794	7743267	7835738
97	8205602	8298063	8390522	8482979	8575434	8667888	8760339
98	9130124	9222566	9315005	9407443	9499878	9592312	9684744
99	6720054450	0146872	0239292	0331710	0424125	0516539	0608951
4700	6720978579	1070981	1163382	1255780	1348176	1440570	1532962
1	1902512	1994894	2087275	2179653	2272030	2364404	2456777
2	2826248	2918611	3010972	3103330	3195687	3288042	3380395
3	3749787	3842131	3934472	4026811	4119148	4211484	4303817
4	4673131	4765454	4857776	4950095	5042413	5134729	5227042
5	5596278	5688582	5780883	5873183	5965481	6057778	6150072
6	6519228	6611513	6703795	6796075	6888354	6980630	7072905
7	7441983	7534248	7626510	7718771	7811030	7903287	7995542
8	8364542	8456787	8549030	8641271	8733510	8825748	8917983
9	9286904	9379130	9471353	9563575	9655795	9748012	9840228
4710	6730209071	0301277	0393481	0485683	0577883	0670081	0762277
11	1131042	1223229	1315413	1407596	1499776	1591955	1684131
12	2052818	2144985	2237149	2329312	2421473	2513632	2605789
13	2974398	3066545	3158690	3250833	3342975	3435114	3527252
14	3895782	3987910	4080035	4172159	4264281	4356401	4448519
15	4816971	4909079	5001185	5093289	5185392	5277492	5369590
16	5737964	5830053	5922140	6014224	6106307	6198388	6290467
17	6658762	6750832	6842899	6934964	7027027	7119088	7211148
18	7579365	7671415	7763463	7855508	7947552	8039594	8131634
19	8499773	8591803	8683832	8775858	8867882	8959904	9051925
4720	9419986	9511997	9604006	9696012	9788017	9880020	9972021

OF NUMBERS. Logarithms 6683859167-6740248011.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4511492	4604673	4697852	93195	193	192	189	187	185	184	181	179	177
5443214	5536375	5629535	176	173	171	169	168	165	163	161	160	157
6374737	6467878	6561017	155	153	152	149	147	145	144	141	139	138
7306060	7399181	7492300	135	133	131	130	127	125	124	121	119	118
8237183	8330284	8423383	115	113	111	110	107	105	104	101	099	098
9168106	9261188	9354267	095	094	091	089	088	085	083	082	079	078
0098831	0191892	0284951	075	073	072	069	068	065	064	061	059	058
1029355	1122397	1215436	055	054	051	050	047	046	043	042	039	038
1959681	2052702	2145722	035	034	031	030	027	026	024	021	020	017
2889807	2982808	3075808	016	014	011	010	007	006	004	001	000	998
3819734	3912715	4005695	92995	994	992	989	988	986	984	981	980	978
4749461	4842423	4935383	976	973	972	970	968	966	963	962	960	958
5678990	5771932	5864872	956	954	952	950	948	945	944	942	940	938
6608320	6701242	6794162	936	934	932	930	928	926	924	922	920	919
7537451	7630354	7723254	916	914	912	910	908	906	904	903	900	898
8466384	8559266	8652147	896	895	892	890	888	887	884	882	881	878
9395118	9487980	9580841	876	875	872	870	869	866	865	862	861	858
0323653	0416495	0509336	857	854	853	850	849	846	845	842	841	839
1251990	1344812	1437633	836	835	833	830	829	827	825	822	821	819
2180128	2272931	2365732	817	815	812	811	809	807	805	803	801	799
3108068	3200851	3293632	92797	795	793	791	789	787	785	783	781	779
4035810	4128573	4221334	777	776	773	771	769	767	766	763	761	760
4963353	5056097	5148838	757	755	754	751	749	748	745	744	741	740
5890699	5983423	6076144	737	736	733	732	730	727	726	724	721	720
6817847	6910550	7003252	718	715	714	712	710	708	706	703	702	700
7744796	7837480	7930162	698	696	694	692	690	688	686	684	682	681
8671548	8764213	8856875	678	676	674	672	671	668	666	665	662	660
9598102	9690747	9783390	659	656	654	653	650	649	646	645	643	640
0524459	0617084	0709707	639	636	635	633	630	629	627	625	623	620
1450618	1543223	1635826	619	617	615	613	611	609	607	605	603	601
2376580	2469165	2561748	92599	597	596	593	591	589	588	585	583	581
3302344	3394909	3487473	580	577	576	573	572	569	568	565	564	561
4227911	4320456	4413000	560	558	555	554	552	550	548	545	544	542
5153280	5245806	5338330	540	538	536	534	532	530	528	526	524	523
6078453	6170959	6263464	520	518	516	515	512	510	509	506	505	502
7003428	7095915	7188400	501	498	497	494	493	490	489	487	485	482
7928207	8020674	8113139	481	479	477	475	473	471	469	467	465	463
8852788	8945236	9037681	461	459	457	455	454	451	449	448	445	443
9777173	9869601	9962027	442	439	438	435	434	432	429	428	426	423
0701361	0793769	0886175	422	420	418	415	414	412	410	408	406	404
1625353	1717741	1810127	92402	401	398	396	394	392	391	388	386	385
2549148	2641516	2733883	382	381	378	377	374	373	371	368	367	365
3472746	3565095	3657442	363	361	358	357	355	353	351	349	347	345
4396148	4488478	4580805	344	341	339	337	336	333	331	330	327	326
5319354	5411664	5503972	323	322	319	318	316	313	312	310	308	306
6242364	6334654	6426942	304	301	300	298	297	294	292	290	288	286
7165177	7257448	7349716	285	282	280	279	276	275	272	271	268	267
8087795	8180046	8272295	265	262	261	259	257	255	253	251	249	247
9010216	9102448	9194677	245	243	241	239	238	235	233	232	229	227
9932442	0024654	0116863	226	223	222	220	217	216	214	212	209	208
0854472	0946664	1038854	92206	204	202	200	198	196	195	192	190	188
1776306	1868478	1960649	187	184	183	180	179	176	175	172	171	169
2697944	2790097	2882248	167	164	163	161	159	157	155	153	151	150
3619387	3711521	3803652	147	145	143	142	139	138	135	134	131	130
4540635	4632749	4724861	128	125	124	122	120	118	116	114	112	110
5461687	5553781	5645874	108	106	104	103	100	098	097	094	093	090
6382543	6474618	6566691	089	087	084	083	081	079	076	075	073	071
7303205	7395260	7487314	070	067	065	063	061	060	057	055	054	051
8223672	8315707	8407741	050	048	045	044	042	040	038	035	034	032
9143943	9235959	9327974	030	029	026	024	022	021	018	016	015	012
0064019	0156016	0248011	011	009	006	005	003	001	998	997	995	993

Numbers 47200-47809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4720	6739419986	9511997	9604006	9696012	9788017	9880020	9972021
21	6740340004	0431995	0523985	0615972	0707957	0799940	0891922
22	1259827	1351799	1443769	1535736	1627702	1719666	1811628
23	2179456	2271408	2363358	2455306	2547253	2639197	2731139
24	3098889	3190822	3282753	3374682	3466608	3558533	3650456
25	4018128	4110042	4201953	4293862	4385770	4477675	4569578
26	4937173	5029067	5120959	5212848	5304736	5396622	5488506
27	5856023	5947897	6039770	6131640	6223509	6315375	6407240
28	6774679	6866534	6958387	7050238	7142087	7233934	7325779
29	7693140	7784976	7876809	7968641	8060470	8152298	8244124
4730	6748611407	8703223	8795038	8886850	8978660	9070468	9162275
31	9529480	9621277	9713072	9804865	9896655	9988444	0080231
32	6750447360	0539137	0630912	0722685	0814457	0906226	0997994
33	1365045	1456803	1548558	1640312	1732064	1823815	1915563
34	2282536	2374274	2466011	2557746	2649478	2741209	2832938
35	3199833	3291552	3383270	3474985	3566698	3658409	3750119
36	4116937	4208637	4300335	4392031	4483724	4575416	4667106
37	5033847	5125528	5217206	5308883	5400557	5492230	5583900
38	5950564	6042225	6133884	6225541	6317196	6408850	6500501
39	6867087	6958729	7050368	7142006	7233642	7325276	7416908
4740	6757783417	7875039	7966659	8058278	8149895	8241509	8333122
41	8699553	8791156	8882757	8974356	9065954	9157549	9249142
42	9615496	9707080	9798662	9890242	9981820	0073396	0164970
43	6760531247	0622811	0714373	0805934	0897492	0989049	1080604
44	1446804	1538349	1629892	1721433	1812972	1904510	1996045
45	2362168	2453693	2545217	2636739	2728259	2819777	2911293
46	3277339	3368845	3460350	3551853	3643353	3734852	3826349
47	4192317	4283804	4375290	4466773	4558255	4649734	4741211
48	5107103	5198571	5290037	5381501	5472963	5564423	5655882
49	6021696	6113145	6204591	6296036	6387479	6478920	6570359
4750	6766936096	7027526	7118953	7210379	7301803	7393224	7484644
51	7850304	7941714	8033123	8124529	8215933	8307336	8398737
52	8764320	8855711	8947100	9038487	9129872	9221255	9312637
53	9678143	9769515	9860885	9952252	0043618	0134982	0226345
54	6770591774	0683126	0774477	0865826	0957173	1048517	1139860
55	1505213	1596546	1687877	1779207	1870534	1961860	2053184
56	2418459	2509774	2601086	2692396	2783704	2875011	2966315
57	3331514	3422809	3514102	3605393	3696682	3787970	3879255
58	4244377	4335653	4426927	4518198	4609468	4700736	4792003
59	5157048	5248305	5339559	5430812	5522063	5613312	5704559
4760	6776069527	6160765	6252000	6343234	6434465	6525695	6616923
61	6981815	7073033	7164249	7255464	7346676	7437887	7529095
62	7893911	7985110	8076307	8167502	8258695	8349887	8441076
63	8805815	8896995	8988173	9079349	9170523	9261696	9352866
64	9717528	9808689	9899848	9991005	0082160	0173313	0264464
65	6780629050	0720191	0811331	0902469	0993605	1084739	1175871
66	1540380	1631503	1722623	1813742	1904859	1995974	2087087
67	2451519	2542623	2633724	2724824	2815921	2907017	2998111
68	3362467	3453552	3544634	3635714	3726793	3817870	3908944
69	4273224	4364290	4455353	4546414	4637474	4728531	4819587
4770	6785183790	5274837	5365881	5456923	5547963	5639002	5730038
71	6094166	6185193	6276218	6367241	6458262	6549282	6640299
72	7004350	7095358	7186364	7277368	7368370	7459371	7550369
73	7914344	8005333	8096320	8187305	8278288	8369269	8460248
74	8824147	8915117	9006084	9097050	9188015	9278977	9369937
75	9733759	9824710	9915659	0006606	0097551	0188494	0279435
76	6790643181	0734113	0825043	0915971	1006897	1097821	1188743
77	1552413	1643326	1734236	1825145	1916052	2006957	2097860
78	2461454	2552348	2643240	2734129	2825017	2915903	3006788
79	3370305	3461180	3552053	3642923	3733792	3824659	3915525
4780	4278966	4369822	4460675	4551527	4642377	4733225	4824071

OF NUMBERS. Logarithms 6739419986–6795096598.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0064019	0156016	0248011	92011	009	006	005	003	001	998	997	995	993
0983901	1075878	1167854	91991	990	987	985	983	982	979	977	976	973
1903588	1995546	2087502	972	970	967	966	964	962	960	958	956	954
2823080	2915018	3006955	952	950	948	947	944	942	941	938	937	934
3742377	3834296	3926213	933	931	929	926	925	923	921	919	917	915
4661480	4753380	4845277	914	911	909	908	905	903	902	900	897	896
5580388	5672269	5764147	894	892	889	888	886	884	882	881	878	876
6499102	6590963	6682822	874	873	870	869	866	865	862	861	859	857
7417622	7509463	7601303	855	853	851	849	847	845	843	841	840	837
8335948	8427769	8519589	836	833	832	829	828	826	824	821	820	818
9254079	9345881	9437682	91816	815	812	810	808	807	804	802	801	798
0172016	0263799	0355580	797	795	793	790	789	787	785	783	781	780
1089760	1181523	1273285	777	775	773	772	769	768	766	763	762	760
2007309	2099053	2190796	758	755	754	752	751	748	746	744	743	740
2924664	3016389	3108112	738	737	735	732	731	729	726	725	723	721
3841826	3933532	4025235	719	718	715	713	711	710	707	706	703	702
4758795	4850481	4942165	700	698	696	693	692	690	689	686	684	682
5675569	5767236	5858901	681	678	677	674	673	670	669	667	665	663
6592150	6683798	6775443	661	659	657	655	654	651	649	648	645	644
7508538	7600166	7691792	642	639	638	636	634	632	630	628	626	625
8424733	8516341	8607948	91622	620	619	617	614	613	611	608	607	605
9340734	9432323	9523911	603	601	599	598	595	593	592	589	588	585
0256542	0348112	0439680	584	582	580	578	576	574	572	570	568	567
1172157	1263708	1355257	564	562	561	558	557	555	553	551	549	547
2087579	2179110	2270640	545	543	541	539	538	535	534	531	530	528
3002808	3094320	3185830	525	524	522	520	518	516	515	512	510	509
3917844	4009337	4100828	506	505	503	500	499	497	495	493	491	489
4832687	4924161	5015633	487	486	483	482	479	477	476	474	472	470
5747338	5838793	5930245	468	466	464	462	460	459	456	455	452	451
6661796	6753232	6844665	449	446	445	443	441	439	437	436	433	431
7576062	7667478	7758892	91430	427	426	424	421	420	418	416	414	412
8490135	8581532	8672927	410	409	406	404	403	401	398	397	395	393
9404016	9495394	9586769	391	389	387	385	383	382	379	378	375	374
0317705	0409063	0500419	372	370	367	366	364	363	360	358	356	355
1231201	1322540	1413877	352	351	349	347	344	343	341	339	337	336
2144506	2235825	2327143	333	331	330	327	326	324	322	319	318	316
3057618	3148919	3240217	315	312	310	308	307	304	303	301	298	297
3970538	4061820	4153099	295	293	291	289	288	285	283	282	279	278
4883267	4974529	5065790	276	274	271	270	268	267	264	262	261	258
5795804	5887047	5978288	257	254	253	251	249	247	245	243	241	239
6708149	6799373	6890595	91238	235	234	231	230	228	226	224	222	220
7620302	7711507	7802710	218	216	215	212	211	208	207	205	203	201
8532264	8623450	8714633	199	197	195	193	192	189	188	186	183	182
9444034	9535201	9626365	180	178	176	174	173	170	168	167	164	163
0355613	0446761	0537906	161	159	157	155	153	151	149	148	145	144
1267001	1358129	1449256	141	140	138	136	134	132	130	128	127	124
2178198	2269307	2360414	123	120	119	117	115	113	111	109	107	105
3089203	3180293	3271381	104	101	100	097	096	094	092	090	088	086
4000017	4091088	4182157	085	082	080	079	077	074	073	071	069	067
4910641	5001692	5092742	066	063	061	060	057	056	054	051	050	048
5821073	5912106	6003137	91047	044	042	040	039	036	035	033	031	029
6731315	6822328	6913340	027	025	023	021	020	017	016	013	012	010
7641366	7732360	7823353	008	006	004	002	001	998	997	994	993	991
8551226	8642201	8733175	90989	987	985	983	981	979	978	975	974	972
9460895	9551852	9642807	970	967	966	965	962	960	958	957	955	952
0370375	0461312	0552248	951	949	947	945	943	941	940	937	936	933
1279663	1370582	1461498	932	930	928	926	924	922	920	919	916	915
2188762	2279661	2370559	913	910	909	907	905	903	902	899	898	895
3097670	3188550	3279429	894	892	889	888	886	885	882	880	879	876
4006388	4097249	4188109	875	873	870	869	867	866	863	861	860	857
4914916	5005758	5096598	856	853	852	850	848	846	845	842	840	839

Numbers 47800–48409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4780	6794278966	4369822	4460675	4551527	4642377	4733225	4824071
81	5187437	5278274	5369108	5459941	5550772	5641601	5732428
82	6095718	6186535	6277351	6368165	6458977	6549787	6640595
83	7003809	7094607	7185404	7276199	7366992	7457783	7548572
84	7911710	8002489	8093267	8184043	8274817	8365589	8456359
85	8819421	8910182	9000941	9091698	9182453	9273206	9363957
86	9726943	9817685	9908424	9999162	0089898	0180632	0271365
87	6800634275	0724998	0815718	0906437	0997155	1087870	1178583
88	1541417	1632121	1722823	1813523	1904221	1994918	2085612
89	2448370	2539055	2629738	2720419	2811099	2901776	2992451
4790	6803355134	3445800	3536464	3627126	3717787	3808445	3899102
91	4261709	4352356	4443001	4533644	4624285	4714925	4805562
92	5168094	5258722	5349348	5439972	5530595	5621216	5711834
93	6074290	6164899	6255506	6346112	6436715	6527317	6617917
94	6980297	7070887	7161476	7252062	7342647	7433230	7523811
95	7886115	7976686	8067256	8157824	8248389	8338953	8429515
96	8791744	8882297	8972847	9063396	9153943	9244488	9335031
97	9697185	9787718	9878250	9968780	0059308	0149834	0240358
98	6810602436	0692951	0783464	0873975	0964484	1054991	1145497
99	1507499	1597995	1688489	1778981	1869472	1959960	2050447
4800	6812412374	2502851	2593326	2683799	2774271	2864740	2955208
1	3317060	3407518	3497974	3588429	3678881	3769332	3859781
2	4221557	4311997	4402434	4492870	4583303	4673735	4764165
3	5125866	5216287	5306706	5397122	5487537	5577950	5668362
4	6029987	6120389	6210789	6301187	6391583	6481977	6572370
5	6933920	7024303	7114684	7205063	7295440	7385816	7476189
6	7837665	7928029	8018391	8108751	8199110	8289466	8379821
7	8741221	8831567	8921910	9012252	9102591	9192929	9283265
8	9644590	9734916	9825241	9915564	0005885	0096204	0186521
9	6820547771	0638078	0728384	0818688	0908990	0999291	1089589
4810	6821450764	1541053	1631340	1721625	1811908	1902190	1992469
11	2353569	2443839	2534108	2624374	2714639	2804901	2895162
12	3256187	3346438	3436688	3526935	3617181	3707425	3797667
13	4158617	4248849	4339080	4429309	4519536	4609762	4699985
14	5060859	5151073	5241285	5331496	5421704	5511910	5602115
15	5962915	6053110	6143303	6233495	6323684	6413872	6504058
16	6864782	6954959	7045134	7135306	7225477	7315646	7405813
17	7766463	7856621	7946777	8036931	8127083	8217233	8307382
18	8667957	8758096	8848233	8938368	9028502	9118633	9208763
19	9569263	9659383	9749502	9839618	9929733	0019846	0109957
4820	6830470382	0560484	0650584	0740682	0830778	0920872	1010964
21	1371315	1461398	1551479	1641558	1731635	1821711	1911785
22	2272060	2362125	2452187	2542248	2632306	2722363	2812418
23	3172619	3262665	3352709	3442750	3532790	3622829	3712865
24	4072991	4163018	4253043	4343067	4433088	4523107	4613125
25	4973177	5063185	5153192	5243196	5333199	5423200	5513199
26	5873176	5963165	6053153	6143139	6233123	6323105	6413086
27	6772988	6862959	6952928	7042896	7132861	7222825	7312786
28	7672614	7762567	7852517	7942466	8032413	8122357	8212300
29	8572054	8661988	8751920	8841850	8931778	9021704	9111628
4830	6839471308	9561223	9651136	9741047	9830957	9920865	0010770
31	6840370375	0460271	0550166	0640059	0729950	0819839	0909726
32	1269256	1359134	1449010	1538884	1628757	1718627	1808496
33	2167951	2257811	2347668	2437524	2527377	2617229	2707079
34	3066461	3156301	3246140	3335977	3425812	3515646	3605477
35	3964784	4054606	4144427	4234245	4324062	4413876	4503689
36	4862922	4952725	5042527	5132327	5222125	5311921	5401715
37	5760874	5850659	5940442	6030223	6120003	6209780	6299556
38	6658640	6748407	6838171	6927934	7017695	7107454	7197211
39	7556221	7645969	7735715	7825459	7915201	8004942	8094681
4840	8453616	8543346	8633073	8722799	8812523	8902245	8991965

OF NUMBERS. Logarithms 6794278966–6849261114.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4914916	5005758	5096598	90856	853	852	850	848	846	845	842	840	839
5823253	5914077	6004898	837	834	833	831	829	827	825	824	821	820
6731401	6822206	6913008	817	816	814	812	810	808	806	805	802	801
7639359	7730145	7820928	798	797	795	793	791	789	787	786	783	782
8547128	8637894	8728659	779	778	776	774	772	770	769	766	765	762
9454706	9545454	9636199	761	759	757	755	753	751	749	748	745	744
0362095	0452824	0543550	742	739	738	736	734	733	730	729	726	725
1269294	1360004	1450712	723	720	719	718	715	713	711	710	708	705
2176304	2266995	2357684	704	702	700	698	697	694	692	691	689	686
3083125	3173797	3264466	685	683	681	680	677	675	674	672	669	668
3989756	4080409	4171060	90666	664	662	661	658	657	654	653	651	649
4896198	4986832	5077464	647	645	643	641	640	637	636	634	632	630
5802451	5893066	5983679	628	626	624	623	621	618	617	615	613	611
6708515	6799111	6889705	609	607	606	603	602	600	598	596	594	592
7614389	7704967	7795542	590	589	586	585	583	581	578	578	575	573
8520075	8610634	8701190	571	570	568	565	564	562	560	559	556	554
9425572	9516112	9606649	553	550	549	547	545	543	541	540	537	536
0330881	0421401	0511920	533	532	530	528	526	524	523	520	519	516
1236000	1326502	1417002	515	513	511	509	507	506	503	502	500	497
2140931	2231414	2321895	496	494	492	491	488	487	484	483	481	479
3045674	3136138	3226600	90477	475	473	472	469	468	466	464	462	460
3950228	4040673	4131116	458	456	455	452	451	449	447	445	443	441
4854593	4945020	5035444	440	437	436	433	432	430	428	427	424	422
5758771	5849178	5939584	421	419	416	415	413	412	409	407	406	403
6662760	6753149	6843535	402	400	398	396	394	393	390	389	386	385
7566561	7656931	7747299	383	381	379	377	376	373	372	370	368	366
8470174	8560525	8650874	364	362	360	359	356	355	353	351	349	347
9373599	9463931	9554262	346	343	342	339	338	336	334	332	331	328
0276836	0367150	0457461	326	325	323	321	319	317	315	314	311	310
1179886	1270180	1360473	307	306	304	302	301	298	297	294	293	291
2082747	2173023	2263297	90289	287	285	283	282	279	278	276	274	272
2985421	3075678	3165933	270	269	266	265	262	261	259	257	255	254
3887907	3978146	4068382	251	250	247	246	244	242	240	239	236	235
4790206	4880426	4970644	232	231	229	227	226	223	221	220	218	215
5692318	5782519	5872718	214	212	211	208	206	205	203	201	199	197
6594242	6684424	6774604	195	193	192	189	188	186	184	182	180	178
7495979	7586142	7676304	177	175	172	171	169	167	166	163	162	159
8397528	8487673	8577816	158	156	154	152	150	149	146	145	143	141
9298891	9389017	9479141	139	137	135	134	131	130	128	126	124	122
0200066	0290173	0380279	120	119	116	115	113	111	109	107	106	103
1101055	1191143	1281230	90102	100	098	096	094	092	091	088	087	085
2001856	2091926	2181994	083	081	079	077	076	074	071	070	068	066
2902471	2992522	3082572	065	062	061	058	057	055	053	051	050	047
3802899	3892932	3982963	046	044	041	040	039	036	034	033	031	028
4703141	4793155	4883167	027	025	024	021	019	018	016	014	012	010
5603196	5693191	5783184	008	007	004	003	001	999	997	995	993	992
6503064	6593041	6683015	89989	988	986	984	982	981	978	977	974	973
7402746	7492704	7582660	971	969	968	965	964	961	960	958	956	954
8302242	8392181	8482118	953	950	949	947	944	943	942	939	937	936
9201551	9291472	9381391	934	932	930	928	926	924	923	921	919	917
0100674	0190576	0280477	89915	913	911	910	908	905	904	902	901	898
0999611	1089495	1179376	896	895	893	891	889	887	885	884	881	880
1898362	1988227	2078090	878	876	874	873	870	869	866	865	863	861
2796927	2886774	2976618	860	857	856	853	852	850	848	847	844	843
3695307	3785134	3874960	840	839	837	835	834	831	830	827	826	824
4593500	4683309	4773116	822	821	818	817	814	813	811	809	807	806
5491508	5581298	5671087	803	802	800	798	796	794	793	790	789	787
6389330	6479102	6568872	785	783	781	780	777	776	774	772	770	768
7286966	7376720	7466471	767	764	763	761	759	757	755	754	751	750
8184417	8274152	8363885	748	746	744	742	741	739	736	735	733	731
9081683	9171399	9261114	730	727	726	724	722	720	718	716	715	712

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4840	6848453616	8543346	8633073	8722799	8812523	8902245	8991965
41	9350826	9440537	9530246	9619953	9709659	9799362	9889063
42	6850247851	0337543	0427234	0516922	0606609	0696294	0785977
43	1144690	1234364	1324036	1413706	1503374	1593041	1682705
44	2041345	2131000	2220653	2310305	2399955	2489602	2579248
45	2937814	3027451	3117085	3206719	3296350	3385979	3475607
46	3834098	3923716	4013333	4102947	4192560	4282171	4371780
47	4730197	4819797	4909395	4998991	5088585	5178178	5267768
48	5626112	5715693	5805272	5894850	5984426	6073999	6163571
49	6521841	6611404	6700965	6790524	6880081	6969637	7059190
4850	6857417386	7506930	7596473	7686013	7775552	7865089	7954624
51	8312746	8402272	8491796	8581318	8670839	8760357	8849874
52	9207922	9297429	9386935	9476439	9565941	9655441	9744939
53	6860102913	0192402	0281889	0371375	0460858	0550340	0639819
54	0997720	1087191	1176659	1266126	1355591	1445054	1534516
55	1892342	1981795	2071245	2160693	2250140	2339585	2429027
56	2786781	2876214	2965646	3055076	3144504	3233931	3323355
57	3681035	3770450	3859863	3949275	4038685	4128093	4217499
58	4575105	4664502	4753897	4843290	4932681	5022071	5111458
59	5468991	5558369	5647746	5737121	5826493	5915865	6005234
4860	6866362693	6452053	6541411	6630767	6720122	6809475	6898826
61	7256211	7345552	7434892	7524230	7613566	7702901	7792233
62	8149545	8238868	8328190	8417510	8506827	8596143	8685458
63	9042696	9132001	9221304	9310605	9399905	9489202	9578498
64	9935663	0024949	0114234	0203517	0292798	0382077	0471355
65	6870828446	0917714	1006981	1096245	1185508	1274769	1364028
66	1721046	1810296	1899544	1988790	2078035	2167277	2256518
67	2613462	2702694	2791924	2881152	2970378	3059602	3148824
68	3505696	3594909	3684120	3773330	3862538	3951743	4040947
69	4397745	4486940	4576133	4665325	4754514	4843702	4932887
4870	6875289612	5378789	5467964	5557136	5646308	5735477	5824644
71	6181296	6270454	6359610	6448765	6537918	6627069	6716218
72	7072796	7161936	7251074	7340211	7429345	7518478	7607609
73	7964114	8053236	8142355	8231473	8320590	8409704	8498817
74	8855248	8944352	9033453	9122553	9211651	9300747	9389842
75	9746200	9835285	9924369	0013450	0102530	0191608	0280684
76	6880636969	0726036	0815101	0904165	0993226	1082286	1171343
77	1527556	1616605	1705651	1794696	1883739	1972781	2061820
78	2417960	2506990	2596019	2685045	2774070	2863093	2952114
79	3308181	3397193	3486203	3575212	3664219	3753223	3842226
4880	6884198220	4287214	4376206	4465196	4554185	4643171	4732156
81	5088077	5177052	5266026	5354998	5443968	5532936	5621903
82	5977751	6066708	6155664	6244618	6333569	6422520	6511468
83	6867243	6956182	7045119	7134055	7222989	7311921	7400851
84	7756553	7845474	7934393	8023310	8112226	8201140	8290051
85	8645681	8734583	8823484	8912383	9001281	9090176	9179070
86	9534626	9623511	9712394	9801275	9890154	9979031	0067907
87	6890423390	0512257	0601121	0689984	0778845	0867704	0956561
88	1311972	1400821	1489667	1578512	1667354	1756195	1845034
89	2200373	2289203	2378031	2466857	2555682	2644505	2733326
4890	6893088591	3177403	3266213	3355021	3443828	3532632	3621435
91	3976628	4065422	4154214	4243004	4331792	4420579	4509363
92	4864484	4953259	5042033	5130805	5219575	5308343	5397110
93	5752158	5840915	5929671	6018424	6107176	6195927	6284675
94	6639650	6728389	6817127	6905863	6994596	7083328	7172059
95	7526961	7615683	7704402	7793119	7881835	7970549	8059261
96	8414091	8502794	8591496	8680195	8768893	8857588	8946282
97	9301040	9389725	9478408	9567090	9655769	9744447	9833123
98	6900187809	0276475	0365140	0453803	0542464	0631124	0719782
99	1074395	1163043	1251690	1340335	1428979	1517620	1606260
4900	1960800	2049431	2138060	2226687	2315312	2403935	2492557

OF NUMBERS. Logarithms 684845361 6–690275841 1.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9081683	9171399	9261114	89730	727	726	724	722	720	718	716	715	712
9978763	0068461	0158157	711	709	707	706	703	701	700	698	696	694
0875658	0965337	1055015	692	691	688	687	685	683	681	679	678	675
1772368	1862029	1951688	674	672	670	668	667	664	663	661	659	657
2668893	2758535	2848175	655	653	652	650	647	646	645	642	640	639
3565232	3654856	3744478	637	634	634	631	629	628	625	624	622	620
4461387	4550992	4640596	618	617	614	613	611	609	607	605	604	601
5357357	5446943	5536528	600	598	596	594	593	590	589	586	585	584
6253142	6342710	6432277	581	579	578	576	573	572	571	568	567	564
7148742	7238292	7327840	563	561	559	557	556	553	552	550	548	546
8044158	8133689	8223219	89544	543	540	539	537	535	534	531	530	527
8939389	9028902	9118413	526	524	522	521	518	517	515	513	511	509
9834435	9923930	0013422	507	506	504	502	500	498	496	495	492	491
0729297	0818773	0908248	489	487	486	483	482	479	478	476	475	472
1623975	1713433	1802888	471	468	467	465	463	462	459	458	455	454
2518469	2607908	2697345	453	450	448	447	445	442	442	439	437	436
3412778	3502199	3591618	433	432	430	428	427	424	423	421	419	417
4306903	4396305	4485706	415	413	412	410	408	406	404	402	401	399
5200844	5290228	5379610	397	395	393	391	390	387	386	384	382	381
6094601	6183967	6273331	378	377	375	372	372	369	367	366	364	362
6988175	7077522	7166867	89360	358	356	355	353	351	349	347	345	344
7881564	7970893	8060220	341	340	338	336	335	332	331	329	327	325
8774770	8864080	8953389	323	322	320	317	316	315	312	310	309	307
9667792	9757084	9846374	305	303	301	300	297	296	294	292	290	289
0560630	0649904	0739176	286	285	283	281	279	278	275	274	272	270
1453285	1542541	1631794	268	267	264	263	261	259	257	256	253	252
2345757	2434994	2524229	250	248	246	245	242	241	239	237	235	233
3238045	3327264	3416481	232	230	228	226	224	222	221	219	217	215
4130150	4219350	4308549	213	211	210	208	205	204	203	200	199	196
5022071	5111253	5200434	195	193	192	189	188	185	184	182	181	178
5913810	6002974	6092136	89177	175	172	172	169	167	166	164	162	160
6805365	6894511	6983654	158	156	155	153	151	149	147	146	143	142
7696738	7785865	7874990	140	138	137	134	133	131	129	127	125	124
8587927	8677036	8766143	122	119	118	117	114	113	110	109	107	105
9478934	9568025	9657113	104	101	100	098	096	095	092	091	088	087
0369758	0458830	0547901	085	084	081	080	078	076	074	072	071	068
1260399	1349453	1438505	067	065	064	061	060	057	056	054	052	051
2150858	2239894	2328928	049	046	045	043	042	039	038	036	034	032
3041134	3130151	3219167	030	029	026	025	023	021	020	017	016	014
3931228	4020227	4109224	012	010	009	007	004	003	002	999	997	996
4821139	4910120	4999099	88994	992	990	989	986	985	983	981	979	978
5710868	5799831	5888792	975	974	972	970	968	967	965	963	961	959
6600414	6689359	6778302	957	956	954	951	951	948	946	945	943	941
7489779	7578705	7667630	939	937	936	934	932	930	928	926	925	923
8378961	8467870	8556776	921	919	917	916	914	911	910	909	906	905
9267962	9356852	9445740	902	901	899	898	895	894	892	890	888	886
0156780	0245652	0334522	885	883	881	879	877	876	873	872	870	868
1045417	1134270	1223122	867	864	863	861	859	857	856	853	852	850
1933872	2022707	2111541	849	846	845	842	841	839	838	835	834	832
2822145	2910962	2999778	830	828	826	825	823	821	819	817	816	813
3710236	3799035	3887833	88812	810	808	807	804	803	801	799	798	795
4598146	4686927	4775706	794	792	790	788	787	784	783	781	779	778
5485874	5574637	5663398	775	774	772	770	768	767	764	763	761	760
6373421	6462166	6550909	757	756	753	752	751	748	746	745	743	741
7260787	7349514	7438238	739	738	736	733	732	731	728	727	724	723
8147971	8236680	8325387	722	719	717	716	714	712	710	709	707	704
9034975	9123665	9212353	703	702	699	698	695	694	693	690	688	687
9921797	0010469	0099139	685	683	682	679	678	676	674	672	670	670
0808438	0897092	0985744	666	665	663	661	660	658	656	654	652	651
1694898	1783534	1872168	648	647	645	644	641	640	638	636	634	632
2581177	2669795	2758411	631	629	627	625	623	622	620	618	616	614

Numbers 49000–49609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4900	6901960800	2049431	2138060	2226687	2315312	2403935	2492557
1	2847025	2935638	3024248	3112857	3201464	3290070	3378673
2	3733069	3821664	3910256	3998847	4087436	4176023	4264609
3	4618932	4707509	4796083	4884656	4973227	5061796	5150364
4	5504615	5593173	5681730	5770285	5858838	5947389	6035938
5	6390117	6478657	6567196	6655733	6744267	6832800	6921332
6	7275439	7363961	7452481	7541000	7629517	7718032	7806545
7	8160580	8249084	8337586	8426087	8514586	8603083	8691578
8	9045541	9134027	9222511	9310994	9399474	9487953	9576430
9	9930321	0018789	0107255	0195720	0284183	0372644	0461103
4910	6910814921	0903371	0991820	1080266	1168711	1257154	1345595
11	1699341	1787773	1876204	1964632	2053059	2141484	2229907
12	2583581	2671995	2760408	2848818	2937227	3025634	3114039
13	3467641	3556037	3644432	3732824	3821215	3909604	3997991
14	4351521	4439900	4528276	4616650	4705023	4793394	4881763
15	5235222	5323582	5411940	5500297	5588651	5677004	5765356
16	6118742	6207084	6295425	6383763	6472100	6560435	6648768
17	7002083	7090407	7178729	7267050	7355369	7443686	7532001
18	7885244	7973550	8061855	8150157	8238458	8326757	8415055
19	8768226	8856514	8944800	9033085	9121368	9209649	9297928
4920	6919651028	9739298	9827567	9915833	0004098	0092361	0180623
21	6920533650	0621903	0710153	0798402	0886649	0974894	1063138
22	1416094	1504328	1592561	1680792	1769021	1857248	1945474
23	2298358	2386574	2474789	2563002	2651213	2739423	2827630
24	3180443	3268641	3356838	3445033	3533226	3621418	3709608
25	4062348	4150529	4238708	4326885	4415060	4503234	4591406
26	4944075	5032238	5120399	5208558	5296716	5384871	5473025
27	5825623	5913768	6001911	6090052	6178192	6266330	6354466
28	6706992	6795119	6883244	6971367	7059489	7147609	7235727
29	7588182	7676291	7764398	7852504	7940607	8028709	8116810
4930	6928469193	8557284	8645374	8733461	8821547	8909631	8997714
31	9350025	9438099	9526170	9614240	9702308	9790375	9878439
32	6930230679	0318735	0406789	0494841	0582891	0670939	0758986
33	1111155	1199192	1287228	1375262	1463295	1551325	1639354
34	1991452	2079471	2167490	2255506	2343520	2431533	2519544
35	2871570	2959572	3047572	3135571	3223568	3311562	3399556
36	3751510	3839494	3927477	4015458	4103436	4191414	4279389
37	4631272	4719239	4807203	4895166	4983127	5071086	5159044
38	5510856	5598805	5686751	5774696	5862640	5950581	6038521
39	6390262	6478192	6566121	6654049	6741974	6829898	6917820
4940	6937269489	7357402	7445313	7533223	7621130	7709036	7796940
41	8148539	8236434	8324327	8412219	8500109	8587997	8675883
42	9027411	9115288	9203164	9291038	9378910	9466780	9554648
43	9906105	9993964	0081822	0169678	0257532	0345385	0433236
44	6940784621	0872463	0960303	1048141	1135978	1223812	1311645
45	1662959	1750783	1838606	1926426	2014245	2102062	2189877
46	2541120	2628927	2716731	2804534	2892335	2980134	3067932
47	3419104	3506892	3594679	3682464	3770247	3858029	3945808
48	4296910	4384680	4472449	4560217	4647982	4735746	4823508
49	5174538	5262291	5350043	5437792	5525540	5613286	5701030
4950	6946051989	6139725	6227458	6315190	6402920	6490648	6578375
51	6929263	7016981	7104697	7192411	7280123	7367834	7455543
52	7806360	7894060	7981758	8069455	8157149	8244842	8332533
53	8683280	8770962	8858643	8946321	9033998	9121673	9209347
54	9560022	9647687	9735350	9823011	9910670	9998327	0085983
55	6950436588	0524235	0611880	0699523	0787165	0874805	0962443
56	1312977	1400606	1488234	1575859	1663483	1751105	1838725
57	2189189	2276801	2364410	2452018	2539624	2627229	2714831
58	3065224	3152818	3240410	3328000	3415589	3503176	3590761
59	3941083	4028659	4116233	4203806	4291377	4378946	4466513
4960	4816765	4904323	4991880	5079435	5166988	5254540	5342089

OF NUMBERS. Logarithms 6901960800–6955604728.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2581177	2669795	2758411	88631	629	627	625	623	622	620	618	616	614
3467275	3555875	3644473	613	610	609	607	606	603	602	600	598	596
4353192	4441774	4530354	595	592	591	589	587	586	583	582	580	578
5238929	5327493	5416055	577	574	573	571	569	568	565	564	562	560
6124486	6213031	6301575	558	557	555	553	551	549	548	545	544	542
7009861	7098389	7186915	540	539	537	534	533	532	529	528	526	524
7895056	7983566	8072074	522	520	519	517	515	513	511	510	508	506
8780071	8868563	8957053	504	502	501	499	497	495	493	492	490	488
9664906	9753379	9841851	486	484	483	480	479	477	476	473	472	470
0549560	0638016	0726469	468	466	465	463	461	459	457	456	453	452
1434034	1522472	1610907	88450	449	446	445	443	441	439	438	435	434
2318328	2406748	2495165	432	431	428	427	425	423	421	420	417	416
3202442	3290844	3379243	414	413	410	409	407	405	403	402	399	398
4086376	4174760	4263142	396	395	392	391	389	387	385	384	382	379
4970130	5058496	5146860	379	376	374	373	371	369	367	366	364	362
5853705	5942052	6030398	360	358	357	354	353	352	349	347	346	344
6737100	6825429	6913757	342	341	338	337	335	333	332	329	328	326
7620315	7708626	7796936	324	322	321	319	317	315	314	311	310	308
8503350	8591644	8679936	306	305	302	301	299	298	295	294	292	290
9386206	9474482	9562756	288	286	285	283	281	279	278	276	274	272
0268882	0357140	0445396	88270	269	266	265	263	262	259	258	256	254
1151379	1239619	1327857	253	250	249	247	245	244	241	240	238	237
2033697	2121919	2210139	234	233	231	229	227	226	223	222	220	219
2915836	3004040	3092242	216	215	213	211	210	207	206	204	202	201
3797795	3885982	3974166	198	197	195	193	192	190	187	187	184	182
4679576	4767744	4855910	181	179	177	175	174	172	170	168	166	165
5561177	5649328	5737476	163	161	159	158	155	154	152	151	148	147
6442600	6530732	6618863	145	143	141	140	138	136	134	132	131	129
7323843	7411958	7500071	127	125	123	122	120	118	116	115	113	111
8204908	8293005	8381100	109	107	106	103	102	101	098	097	095	093
9085794	9173873	9261950	88091	090	087	086	084	083	080	079	077	075
9966502	0054563	0142622	074	071	070	068	067	064	063	061	059	057
0847031	0935074	1023115	056	054	052	050	048	047	045	043	041	040
1727381	1815406	1903430	037	036	034	033	030	029	027	025	024	022
2607553	2695561	2783566	019	019	016	014	013	011	009	008	005	004
3487547	3575536	3663524	002	000	999	997	994	994	991	989	988	986
4367362	4455334	4543304	87984	983	981	978	978	975	973	972	970	968
5247000	5334953	5422906	967	964	963	961	959	958	956	953	953	950
6126459	6214395	6302329	949	946	945	944	941	940	938	936	934	933
7005740	7093658	7181574	930	929	928	925	924	922	920	918	916	915
7884843	7972743	8060641	87913	911	910	907	906	904	903	900	898	898
8763768	8851651	8939531	895	893	892	890	888	886	885	883	880	880
9642515	9730380	9818243	877	876	874	872	870	868	867	865	863	862
0521085	0608932	0696777	859	858	856	854	853	851	849	847	845	844
1399476	1487306	1575133	842	840	838	837	834	833	831	830	827	826
2277691	2365502	2453312	824	823	820	819	817	815	814	811	810	808
3155727	3243521	3331313	807	804	803	801	799	798	795	794	792	791
4033586	4121363	4209137	788	787	785	783	782	779	778	777	774	773
4911268	4999027	5086783	770	769	768	765	764	762	760	759	756	755
5788773	5876513	5964252	753	752	749	748	746	744	743	740	739	737
6666100	6753823	6841544	87736	733	732	730	728	727	725	723	721	719
7543250	7630955	7718658	718	716	714	712	711	709	707	705	703	702
8420223	8507910	8595596	700	698	697	694	693	691	690	687	686	684
9297018	9384688	9472356	682	681	678	677	675	674	671	670	668	666
0173637	0261289	0348940	665	663	661	659	657	656	654	652	651	648
1050079	1137713	1225346	647	645	643	642	640	638	636	634	633	631
1926344	2013961	2101576	629	628	625	624	622	620	619	617	615	613
2802432	2890031	2977629	612	609	608	606	605	602	601	599	598	595
3678344	3765925	3853505	594	592	590	589	587	585	583	581	580	578
4554079	4641643	4729205	576	574	573	571	569	567	566	564	562	560
5429637	5517183	5604728	558	557	555	553	552	549	548	546	545	542

Numbers 49600–50209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
4960	6954816765	4904323	4991880	5079435	5166988	5254540	5342089
61	5692270	5779811	5867350	5954888	6042423	6129957	6217489
62	6567599	6655123	6742644	6830164	6917682	7005198	7092712
63	7442752	7530258	7617761	7705263	7792764	7880262	7967759
64	8317728	8405216	8492702	8580187	8667669	8755150	8842629
65	9192528	9279999	9367467	9454934	9542399	9629862	9717324
66	6960067152	0154605	0242056	0329505	0416952	0504398	0591842
67	0941600	1029035	1116468	1203900	1291330	1378758	1466184
68	1815872	1903289	1990705	2078119	2165531	2252942	2340350
69	2689967	2777367	2864766	2952162	3039557	3126949	3214340
4970	6963563887	3651270	3738650	3826029	3913406	4000781	4088155
71	4437631	4524996	4612359	4699720	4787080	4874438	4961793
72	5311200	5398547	5485892	5573236	5660578	5747918	5835256
73	6184592	6271922	6359250	6446576	6533900	6621223	6708544
74	7057809	7145121	7232432	7319740	7407047	7494352	7581655
75	7930851	8018145	8105438	8192729	8280018	8367306	8454591
76	8803717	8890994	8978269	9065542	9152814	9240084	9327352
77	9676407	9763667	9850925	9938180	0025435	0112687	0199938
78	6970548923	0636165	0723405	0810643	0897880	0985115	1072348
79	1421263	1508487	1595710	1682931	1770150	1857367	1944583
4980	6972293428	2380634	2467840	2555043	2642244	2729444	2816642
81	3165417	3252607	3339794	3426980	3514164	3601347	3688527
82	4037232	4124404	4211574	4298742	4385909	4473074	4560237
83	4908872	4996026	5083179	5170330	5257479	5344626	5431772
84	5780337	5867473	5954608	6041742	6128873	6216003	6303131
85	6651626	6738746	6825863	6912979	7000094	7087206	7174317
86	7522742	7609844	7696944	7784042	7871139	7958234	8045327
87	8393682	8480767	8567849	8654930	8742009	8829087	8916163
88	9264448	9351515	9438580	9525644	9612706	9699766	9786824
89	6980135039	0222089	0309137	0396183	0483227	0570270	0657310
4990	6981005456	1092488	1179519	1266547	1353574	1440599	1527623
91	1875699	1962713	2049726	2136737	2223747	2310754	2397760
92	2745767	2832764	2919759	3006753	3093745	3180735	3267724
93	3615661	3702640	3789618	3876595	3963569	4050542	4137513
94	4485380	4572343	4659303	4746262	4833219	4920175	5007128
95	5354926	5441871	5528814	5615755	5702695	5789633	5876569
96	6224297	6311225	6398150	6485075	6571997	6658917	6745836
97	7093494	7180405	7267313	7354220	7441125	7528028	7614929
98	7962518	8049411	8136302	8223191	8310079	8396964	8483849
99	8831368	8918243	9005117	9091989	9178859	9265727	9352594
5000	6989700043	9786901	9873758	9960612	0047465	0134316	0221165
1	6990568545	0655386	0742225	0829062	0915898	1002731	1089563
2	1436874	1523697	1610519	1697339	1784157	1870973	1957788
3	2305029	2391835	2478639	2565441	2652242	2739041	2825838
4	3173010	3259799	3346586	3433371	3520154	3606936	3693716
5	4040818	4127589	4214359	4301127	4387893	4474657	4561420
6	4908453	4995207	5081959	5168709	5255458	5342205	5428950
7	5775914	5862651	5949385	6036119	6122850	6209580	6296308
8	6643202	6729921	6816639	6903355	6990069	7076781	7163492
9	7510317	7597019	7683719	7770418	7857114	7943809	8030503
5010	6998377258	8463943	8550626	8637307	8723987	8810665	8897341
11	9244027	9330695	9417360	9504024	9590686	9677347	9764006
12	7000110623	0197273	0283922	0370568	0457213	0543856	0630498
13	0977046	1063679	1150310	1236939	1323567	1410193	1496817
14	1843296	1929912	2016526	2103138	2189748	2276356	2362963
15	2709374	2795972	2882568	2969163	3055756	3142347	3228937
16	3575278	3661859	3748438	3835016	3921592	4008166	4094738
17	4441010	4527574	4614136	4700696	4787255	4873812	4960367
18	5306570	5393116	5479661	5566204	5652745	5739285	5825823
19	6171957	6258486	6345014	6431539	6518063	6604586	6691106
5020	7037171	7123683	7210194	7296702	7383209	7469714	7556218

OF NUMBERS. Logarithms 6954816765-7007815717.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5429637	5517183	5604728	87558	557	555	553	552	549	548	546	545	542
6305019	6392548	6480074	541	539	538	535	534	532	530	529	526	525
7180225	7267736	7355245	524	521	520	518	516	514	513	511	509	507
8055254	8142747	8230239	506	503	502	501	498	497	495	493	492	489
8930107	9017582	9105056	488	486	485	482	481	479	478	475	474	472
9804784	9892242	9979698	471	468	467	465	463	462	460	458	456	454
0679284	0766724	0854163	453	451	449	447	446	444	442	440	439	437
1553609	1641031	1728452	435	433	432	430	428	426	425	422	421	420
2427757	2515162	2602566	417	416	414	412	411	408	407	405	404	401
3301730	3389117	3476503	400	399	396	395	392	391	390	387	386	384
4175527	4262897	4350265	87383	380	379	377	375	374	372	370	368	366
5049148	5136500	5223851	365	363	361	360	358	355	355	352	351	349
5922593	6009928	6097261	347	345	344	342	340	338	337	335	333	331
6795863	6883180	6970496	330	328	326	324	323	321	319	317	316	313
7668957	7756257	7843555	312	311	308	307	305	303	302	300	298	296
8541875	8629158	8716438	294	293	291	289	288	285	284	283	280	279
9414619	9501883	9589146	277	275	273	272	270	268	267	264	263	261
0287187	0374434	0461679	260	258	255	255	252	251	249	247	245	244
1159579	1246809	1334037	242	240	238	237	235	233	231	230	228	226
2031797	2119009	2206219	224	223	221	219	217	216	214	212	210	209
2903839	2991033	3078226	87206	206	203	201	200	198	197	194	193	191
3775706	3862883	3950058	190	187	186	184	183	180	179	177	175	174
4647398	4734558	4821716	172	170	168	167	165	163	161	160	158	156
5518915	5606058	5693198	154	153	151	149	147	146	143	143	140	139
6390258	6477382	6564505	136	135	134	131	130	128	127	124	123	121
7261425	7348533	7435638	120	117	116	115	112	111	108	108	105	104
8132418	8219508	8306596	102	100	098	097	095	093	091	090	088	086
9003237	9090309	9177379	085	082	081	079	078	076	074	072	070	069
9873880	9960935	0047988	067	065	064	062	060	058	056	055	053	051
0744349	0831387	0918422	050	048	046	044	043	040	039	038	035	034
1614644	1701664	1788682	87032	031	028	027	025	024	021	020	018	017
2484765	2571767	2658768	014	013	011	010	007	006	005	002	001	999
3354711	3441696	3528679	86997	995	994	992	990	989	987	985	983	982
4224483	4311450	4398416	979	978	977	974	973	971	970	967	966	964
5094080	5181030	5267979	963	960	959	957	956	953	952	950	949	947
5963504	6050437	6137368	945	943	941	940	938	936	935	933	931	929
6832753	6919669	7006583	928	925	925	922	920	919	917	916	914	911
7701829	7788727	7875623	911	908	907	905	903	901	900	898	896	895
8570731	8657612	8744490	893	891	889	888	885	885	882	881	878	878
9439459	9526322	9613184	875	874	872	870	868	867	865	863	862	859
0308013	0394859	0481703	86858	857	854	853	851	849	848	846	844	842
1176394	1263222	1350049	841	839	837	836	833	832	831	828	827	825
2044601	2131412	2218221	823	822	820	818	816	815	813	811	809	808
2912634	2999428	3086220	806	804	802	801	799	797	796	794	792	790
3780494	3867270	3954045	789	787	785	783	782	780	778	776	775	773
4648181	4734940	4821697	771	770	768	766	764	763	761	759	757	756
5515694	5602436	5689176	754	752	750	749	747	745	744	742	740	738
6383034	6469758	6556481	737	734	734	731	730	728	726	724	723	721
7250201	7336908	7423613	719	718	716	714	712	711	709	707	705	704
8117194	8203884	8290572	702	700	699	696	695	694	691	690	688	686
8984015	9070688	9157358	86685	683	681	680	678	676	674	673	670	669
9850663	9937318	0023971	668	665	664	662	661	659	657	655	653	652
0717137	0803775	0890412	650	649	646	645	643	642	639	638	637	634
1583439	1670060	1756679	633	631	629	628	626	624	622	621	619	617
2449568	2536172	2622774	616	614	612	610	608	607	605	604	602	600
3315525	3402111	3488696	598	596	595	593	591	590	588	586	585	582
4181309	4267878	4354445	581	579	578	576	574	572	571	569	567	565
5046920	5133472	5220022	564	562	560	559	557	555	553	552	550	548
5912359	5998893	6085426	546	545	543	541	540	538	536	534	533	531
6777625	6864142	6950658	529	528	525	524	523	520	519	517	516	513
7642719	7729219	7815717	512	511	508	507	505	504	501	500	498	497

Numbers 50200–50809. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5020	7007037171	7123683	7210194	7296702	7383209	7469714	7556218
21	7902214	7988709	8075202	8161693	8248182	8334670	8421156
22	8767084	8853561	8940037	9026511	9112984	9199454	9285923
23	9631782	9718242	9804701	9891157	9977613	0064066	0150518
24	7010496307	0582750	0669192	0755631	0842069	0928506	1014940
25	1360661	1447087	1533511	1619933	1706354	1792773	1879191
26	2224843	2311251	2397658	2484064	2570467	2656869	2743269
27	3088852	3175244	3261634	3348022	3434408	3520793	3607176
28	3952690	4039064	4125437	4211808	4298177	4384545	4470910
29	4816356	4902713	4989069	5075423	5161775	5248125	5334473
5030	7015679851	5766191	5852529	5938865	6025200	6111533	6197865
31	6543173	6629496	6715817	6802137	6888454	6974770	7061085
32	7406324	7492630	7578934	7665236	7751537	7837836	7924133
33	8269304	8355593	8441879	8528164	8614448	8700729	8787009
34	9132112	9218384	9304653	9390921	9477187	9563452	9649715
35	9994749	0081003	0167256	0253507	0339756	0426003	0512249
36	7020857214	0943451	1029687	1115921	1202153	1288383	1374611
37	1719509	1805729	1891947	1978163	2064378	2150591	2236803
38	2581632	2667835	2754036	2840235	2926433	3012629	3098823
39	3443584	3529769	3615953	3702136	3788316	3874495	3960673
5040	7024305364	4391533	4477700	4563865	4650029	4736191	4822351
41	5166974	5253126	5339276	5425424	5511571	5597715	5683858
42	6028413	6114548	6200681	6286812	6372941	6459069	6545195
43	6889682	6975799	7061915	7148029	7234141	7320252	7406361
44	7750779	7836879	7922978	8009075	8095170	8181264	8267356
45	8611706	8697789	8783871	8869950	8956029	9042105	9128180
46	9472462	9558528	9644593	9730655	9816716	9902776	9988834
47	7030333047	0419097	0505144	0591190	0677234	0763276	0849317
48	1193462	1279494	1365525	1451554	1537581	1623606	1709630
49	2053707	2139722	2225735	2311747	2397757	2483765	2569772
5050	7032913781	2999779	3085776	3171770	3257763	3343754	3429744
51	3773685	3859666	3945645	4031623	4117599	4203573	4289546
52	4633419	4719383	4805345	4891306	4977265	5063222	5149177
53	5492982	5578929	5664875	5750818	5836760	5922700	6008639
54	6352376	6438306	6524234	6610161	6696086	6782009	6867930
55	7211599	7297512	7383424	7469333	7555241	7641147	7727052
56	8070653	8156549	8242443	8328336	8414227	8500116	8586003
57	8929536	9015415	9101293	9187168	9273042	9358914	9444785
58	9788250	9874112	9959972	0045831	0131688	0217543	0303397
59	7040646794	0732639	0818483	0904324	0990164	1076002	1161839
5060	7041505168	1590997	1676823	1762648	1848471	1934292	2020112
61	2363373	2449184	2534994	2620801	2706607	2792412	2878215
62	3221408	3307202	3392995	3478786	3564575	3650362	3736148
63	4079274	4165051	4250827	4336601	4422373	4508143	4593912
64	4936970	5022730	5108489	5194246	5280001	5365755	5451507
65	5794497	5880240	5965982	6051722	6137460	6223197	6308932
66	6651855	6737581	6823306	6909029	6994750	7080470	7166188
67	7509043	7594752	7680460	7766166	7851871	7937574	8023275
68	8366062	8451755	8537446	8623135	8708822	8794508	8880192
69	9222912	9308588	9394262	9479934	9565605	9651274	9736941
5070	7050079593	0165252	0250909	0336565	0422218	0507871	0593521
71	0936105	1021747	1107388	1193026	1278663	1364298	1449932
72	1792449	1878074	1963697	2049319	2134939	2220557	2306174
73	2648623	2734231	2819838	2905443	2991046	3076647	3162247
74	3504629	3590220	3675810	3761398	3846984	3932568	4018151
75	4360466	4446040	4531613	4617184	4702753	4788321	4873887
76	5216134	5301692	5387248	5472802	5558354	5643905	5729454
77	6071634	6157175	6242714	6328251	6413787	6499321	6584853
78	6926965	7012489	7098011	7183532	7269051	7354568	7440083
79	7782128	7867635	7953141	8038644	8124146	8209647	8295145
5080	8637123	8722613	8808102	8893588	8979074	9064557	9150039

OF NUMBERS. Logarithms 7007037171–7059406474.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7642719	7729219	7815717	86512	511	508	507	505	504	501	500	498	497
8507641	8594124	8680605	495	493	491	489	488	486	485	483	481	479
9372390	9458856	9545320	477	476	474	473	470	469	467	466	464	462
0236968	0323416	0409862	460	459	456	456	453	452	450	448	446	445
1101373	1187804	1274233	443	442	439	438	437	434	433	431	429	428
1965606	2052020	2138432	426	424	422	421	419	418	415	414	412	411
2829667	2916064	3002459	408	407	406	403	402	400	398	397	395	393
3693557	3779936	3866314	392	390	388	386	385	383	381	379	378	376
4557274	4643637	4729997	374	373	371	369	368	365	364	363	360	359
5420820	5507165	5593509	357	356	354	352	350	348	347	345	344	342
6284194	6370522	6456849	86340	338	336	335	333	332	329	328	327	324
7147397	7233708	7320017	323	321	320	317	316	315	312	311	309	307
8010428	8096722	8183014	306	304	302	301	299	297	295	294	292	290
8873288	8959564	9045839	289	286	285	284	281	280	279	276	275	273
9735976	9822235	9908493	272	269	268	266	265	263	261	259	258	256
0598493	0684735	0770976	254	253	251	249	247	246	244	242	241	238
1460838	1547063	1633287	237	236	234	232	230	228	227	225	224	222
2323013	2409221	2495427	220	218	216	215	213	212	210	208	206	205
3185016	3271207	3357396	203	201	199	198	196	194	193	191	189	188
4046848	4133022	4219194	185	184	183	180	179	178	175	174	172	170
4908509	4994666	5080821	86169	167	165	164	162	160	158	157	155	153
5770000	5856139	5942277	152	150	148	147	144	143	142	139	138	136
6631319	6717442	6803562	135	133	131	129	128	126	124	123	120	120
7492468	7578573	7664677	117	116	114	112	111	109	107	105	104	102
8353446	8439534	8525621	100	099	097	095	094	092	090	088	087	085
9214253	9300324	9386394	083	082	079	079	076	075	073	071	070	068
0074890	0160944	0246996	066	065	062	061	060	058	056	054	052	051
0935356	1021393	1107429	050	047	046	044	042	041	039	037	036	033
1795651	1881672	1967690	032	031	029	027	025	024	021	021	018	017
2655777	2741780	2827781	015	013	012	010	008	007	005	003	001	000
3515732	3601718	3687702	85998	997	994	993	991	990	988	986	984	983
4375517	4461486	4547453	981	979	978	976	974	973	971	969	967	966
5235131	5321083	5407034	964	962	961	959	957	955	954	952	951	948
6094576	6180511	6266444	947	946	943	942	940	939	937	935	933	932
6953850	7039768	7125685	930	928	927	925	923	921	920	918	917	914
7812955	7898856	7984755	913	912	909	908	906	905	903	901	899	898
8671889	8757773	8843656	896	894	893	891	889	887	886	884	883	880
9530654	9616521	9702386	879	878	875	874	872	871	869	867	865	864
0389249	0475099	0560947	862	860	859	857	855	854	852	850	848	847
1247674	1333507	1419339	845	844	841	840	838	837	835	833	832	829
2105929	2191746	2277560	85829	826	825	823	821	820	817	817	814	813
2964015	3049815	3135612	811	810	807	806	805	803	800	800	797	796
3821932	3907714	3993495	794	793	791	789	787	786	784	782	781	779
4679679	4765444	4851208	777	776	774	772	770	769	767	765	764	762
5537257	5623005	5708752	760	759	757	755	754	752	750	748	747	745
6394665	6480397	6566126	743	742	740	738	737	735	733	732	729	729
7251904	7337619	7423332	726	725	723	721	720	718	716	715	713	711
8108974	8194672	8280368	709	708	706	705	703	701	699	698	696	694
8965875	9051556	9137235	693	691	689	687	686	684	683	681	679	677
9822607	9908271	9993933	676	674	672	671	669	667	666	664	662	660
0679170	0764817	0850462	85659	657	656	653	653	650	649	647	645	643
1535563	1621194	1706822	642	641	638	637	635	634	631	631	628	627
2391789	2477402	2563013	625	623	622	620	618	617	615	613	611	610
3247845	3333441	3419036	608	607	605	603	601	600	598	596	595	593
4103732	4189312	4274890	591	590	588	586	584	583	581	580	578	576
4959451	5045014	5130575	574	573	571	569	568	566	564	563	561	559
5815002	5900548	5986092	558	556	554	552	551	549	548	546	544	542
6670384	6755913	6841440	541	539	537	536	534	532	531	529	527	525
7525597	7611109	7696620	524	522	521	519	517	515	514	512	511	508
8380642	8466137	8551631	507	506	503	502	501	498	497	495	494	492
9235519	9320997	9406474	490	489	486	486	483	482	480	478	477	475

Numbers 50800–51409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5080	7058637123	8722613	8808102	8893588	8979074	9064557	9150039
81	9491949	9577422	9662894	9748364	9833833	9919299	0004764
82	7060346607	0432064	0517519	0602972	0688423	0773873	0859321
83	1201097	1286537	1371975	1457411	1542846	1628279	1713710
84	2055419	2140842	2226263	2311683	2397100	2482517	2567931
85	2909573	2994979	3080383	3165786	3251187	3336586	3421984
86	3763558	3848948	3934335	4019721	4105106	4190488	4275869
87	4617376	4702749	4788120	4873489	4958856	5044222	5129587
88	5471026	5556382	5641736	5727089	5812439	5897789	5983136
89	6324509	6409848	6495185	6580521	6665855	6751187	6836518
5090	7067177823	7263146	7348466	7433785	7519102	7604418	7689732
91	8030970	8116276	8201580	8286882	8372182	8457481	8542778
92	8883950	8969239	9054526	9139811	9225095	9310377	9395657
93	9736762	9822034	9907304	9992573	0077840	0163105	0248369
94	7070589406	0674662	0759915	0845167	0930417	1015666	1100913
95	1441883	1527122	1612359	1697594	1782827	1868059	1953289
96	2294193	2379415	2464635	2549854	2635070	2720285	2805499
97	3146336	3231541	3316744	3401946	3487146	3572345	3657541
98	3998311	4083500	4168686	4253871	4339055	4424236	4509416
99	4850120	4935291	5020461	5105630	5190796	5275961	5361125
5100	7075701761	5786916	5872069	5957221	6042371	6127519	6212666
1	6553235	6638374	6723510	6808645	6893778	6978910	7064040
2	7404543	7489664	7574784	7659902	7745019	7830134	7915247
3	8255683	8340788	8425891	8510993	8596093	8681191	8766288
4	9106657	9191745	9276832	9361917	9447000	9532082	9617161
5	9957464	0042536	0127606	0212674	0297740	0382805	0467868
6	7080808105	0893160	0978213	1063264	1148314	1233362	1318409
7	1658579	1743617	1828653	1913688	1998721	2083753	2168783
8	2508886	2593907	2678927	2763946	2848962	2933977	3018990
9	3359027	3444032	3529035	3614037	3699037	3784035	3869032
5110	7084209001	4293990	4378976	4463961	4548945	4633926	4718906
11	5058810	5143781	5228751	5313720	5398686	5483651	5568615
12	5908452	5993407	6078360	6163312	6248262	6333210	6418157
13	6757927	6842866	6927802	7012738	7097671	7182603	7267533
14	7607237	7692158	7777079	7861997	7946914	8031829	8116743
15	8456380	8541286	8626189	8711091	8795991	8880890	8965787
16	9305358	9390247	9475134	9560019	9644903	9729785	9814665
17	7090154170	0239042	0323912	0408781	0493648	0578514	0663377
18	1002816	1087671	1172525	1257377	1342227	1427076	1511923
19	1851296	1936134	2020972	2105807	2190641	2275473	2360304
5120	7092699610	2784432	2869253	2954072	3038889	3123705	3208519
21	3547758	3632564	3717368	3802171	3886971	3971771	4056568
22	4395741	4480531	4565318	4650104	4734888	4819671	4904452
23	5243559	5328331	5413102	5497872	5582639	5667405	5752170
24	6091211	6175967	6260721	6345474	6430225	6514975	6599723
25	6938697	7023437	7108175	7192911	7277646	7362379	7447110
26	7786018	7870742	7955463	8040183	8124901	8209617	8294332
27	8633174	8717881	8802586	8887289	8971991	9056690	9141389
28	9480165	9564855	9649543	9734230	9818915	9903599	9988280
29	7100326991	0411664	0496336	0581006	0665675	0750342	0835007
5130	7101173651	1258308	1342963	1427617	1512269	1596919	1681568
31	2020147	2104787	2189426	2274063	2358699	2443332	2527965
32	2866477	2951101	3035723	3120344	3204963	3289580	3374196
33	3712643	3797250	3881856	3966460	4051063	4135664	4220263
34	4558643	4643234	4727824	4812411	4896998	4981582	5066165
35	5404479	5489054	5573627	5658198	5742768	5827336	5911902
36	6250151	6334709	6419265	6503820	6588373	6672925	6757474
37	7095657	7180199	7264739	7349277	7433814	7518349	7602882
38	7940999	8025524	8110048	8194570	8279090	8363609	8448126
39	8786177	8870686	8955193	9039698	9124202	9208704	9293204
5140	9631190	9715682	9800173	9884662	9969149	0053635	0138119

OF NUMBERS. Logarithms 7058637123-7110391561.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9235519	9320997	9406474	85490	489	486	486	483	482	480	478	477	475
0090227	0175689	0261149	473	472	470	469	466	465	463	462	460	458
0944768	1030213	1115656	457	455	453	451	450	448	447	445	443	441
1799140	1884568	1969994	440	438	436	435	433	431	430	428	426	425
2653344	2738755	2824165	423	421	420	417	417	414	413	411	410	408
3507380	3592775	3678167	406	404	403	401	399	398	396	395	392	391
4361249	4446626	4532002	390	387	386	385	382	381	380	377	376	374
5214949	5300310	5385669	373	371	369	367	366	365	362	361	359	357
6068482	6153826	6239168	356	354	353	350	350	347	346	344	342	341
6921847	7007174	7092499	339	337	336	334	332	331	329	327	325	324
7775044	7860354	7945663	85323	320	319	317	316	314	312	310	309	307
8628074	8713367	8798659	306	304	302	300	299	297	296	293	292	291
9480936	9566213	9651488	289	287	285	284	282	280	279	277	275	274
0333631	0418891	0504149	272	270	269	267	265	264	262	260	258	257
1186158	1271401	1356643	256	253	252	250	249	247	245	243	242	240
2038518	2123745	2208970	239	237	235	233	232	230	229	227	225	223
2890711	2975921	3061129	222	220	219	216	215	214	212	210	208	207
3742736	3827930	3913121	205	203	202	200	199	196	195	194	191	190
4594595	4679771	4764946	189	186	185	184	181	180	179	176	175	174
5446286	5531446	5616604	171	170	169	166	165	164	161	160	158	157
6297811	6382954	6468095	85155	153	152	150	148	147	145	143	141	140
7149168	7234295	7319420	139	136	135	133	132	130	128	127	125	123
8000359	8085469	8170577	121	120	118	117	115	113	112	110	108	106
8851383	8936476	9021567	105	103	102	100	098	097	095	093	091	090
9702240	9787316	9872391	088	087	085	083	082	079	079	076	075	073
0552930	0637990	0723048	072	070	068	066	065	063	062	060	058	057
1403454	1488497	1573539	055	053	051	050	048	047	045	043	042	040
2253811	2338838	2423863	038	036	035	033	032	030	028	027	025	023
3104002	3189012	3274020	021	020	019	016	015	013	012	010	008	007
3954026	4039020	4124011	005	003	002	000	998	997	994	994	991	990
4803885	4888861	4973836	84989	986	985	984	981	980	979	976	975	974
5653576	5738536	5823495	971	970	969	966	965	964	961	960	959	957
6503102	6588045	6672987	955	953	952	950	948	947	945	943	942	940
7352461	7437388	7522313	939	936	936	933	932	930	928	927	925	924
8201655	8286565	8371474	921	921	918	917	915	914	912	910	909	906
9050682	9135576	9220468	906	903	902	900	899	897	895	894	892	890
9899544	9984421	0069296	889	887	885	884	882	880	879	877	875	874
0748239	0833100	0917958	872	870	869	867	866	863	862	861	858	858
1596769	1681613	1766455	855	854	852	850	849	847	846	844	842	841
2445133	2529960	2614786	838	838	835	834	832	831	829	827	826	824
3293331	3378142	3462951	84822	821	819	817	816	814	812	811	809	807
4141364	4226158	4310950	806	804	803	800	800	797	796	794	792	791
4989231	5074009	5158784	790	787	786	784	783	781	779	778	775	775
5836933	5921694	6006453	772	771	770	767	766	765	763	761	759	758
6684469	6769213	6853956	756	754	753	751	750	748	746	744	743	741
7531839	7616567	7701294	740	738	736	735	733	731	729	728	727	724
8379045	8463756	8548466	724	721	720	718	716	715	713	711	710	708
9226085	9310780	9395473	707	705	703	702	699	699	696	695	693	692
0072960	0157639	0242316	690	688	687	685	684	681	680	679	677	675
0919670	1004332	1088993	673	672	670	669	667	665	663	662	661	658
1766215	1850861	1935504	84657	655	654	652	650	649	647	646	643	643
2612595	2697224	2781851	640	639	637	636	633	633	630	629	627	626
3458810	3543423	3628033	624	622	621	619	617	616	614	613	610	610
4304860	4389456	4474051	607	606	604	603	601	599	597	596	595	592
5150746	5235325	5319903	591	590	587	587	584	583	581	579	578	576
5996467	6081030	6165591	575	573	571	570	568	566	565	563	561	560
6842023	6926569	7011114	558	556	555	553	552	549	549	546	545	543
7687414	7771944	7856473	542	540	538	537	535	533	532	530	529	526
8532641	8617155	8701667	525	524	522	520	519	517	515	514	512	510
9177703	9462200	9546696	509	507	505	504	502	500	499	497	496	494
0222601	0307082	0391561	492	491	489	487	486	484	482	481	479	478

Numbers 51400–52009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5140	7109631190	9715682	9800173	9884662	9969149	0053635	0138119
41	7110476039	0560515	0644989	0729461	0813932	0898401	0982869
42	1320723	1405182	1489640	1574096	1658551	1743004	1827455
43	2165243	2249686	2334128	2418567	2503005	2587442	2671876
44	3009599	3094026	3178451	3262874	3347296	3431716	3516134
45	3853791	3938201	4022610	4107017	4191422	4275825	4360227
46	4697819	4782212	4866605	4950995	5035384	5119771	5204157
47	5541683	5626060	5710436	5794810	5879182	5963553	6047922
48	6385382	6469743	6554103	6638460	6722816	6807171	6891524
49	7228918	7313263	7397606	7481947	7566287	7650625	7734961
5150	7118072290	8156619	8240945	8325270	8409593	8493915	8578235
51	8915499	8999811	9084121	9168429	9252736	9337042	9421345
52	9758544	9842839	9927133	0011425	0095716	0180005	0264292
53	7120601425	0685704	0769981	0854257	0938531	1022804	1107075
54	1444142	1528405	1612666	1696926	1781183	1865440	1949694
55	2286696	2370943	2455187	2539431	2623672	2707912	2792150
56	3129087	3213317	3297545	3381772	3465997	3550221	3634443
57	3971314	4055528	4139740	4223950	4308159	4392366	4476572
58	4813378	4897575	4981771	5065965	5150158	5234349	5318538
59	5655279	5739460	5823639	5907817	5991993	6076168	6160341
5160	7126497016	6581181	6665344	6749506	6833666	6917824	7001981
61	7338591	7422739	7506886	7591031	7675175	7759317	7843457
62	8180002	8264134	8348265	8432394	8516521	8600647	8684771
63	9021250	9105366	9189481	9273593	9357704	9441814	9525921
64	9862336	9946436	0030533	0114630	0198725	0282818	0366909
65	7130703259	0787342	0871424	0955504	1039582	1123659	1207734
66	1544018	1628085	1712151	1796215	1880277	1964337	2048396
67	2384615	2468666	2552715	2636763	2720809	2804853	2888896
68	3225050	3309084	3393117	3477148	3561178	3645206	3729232
69	4065322	4149340	4233357	4317372	4401385	4485397	4569407
5170	7134905431	4989433	5073433	5157432	5241429	5325425	5409419
71	5745378	5829363	5913348	5997330	6081311	6165290	6249268
72	6585162	6669132	6753099	6837066	6921030	7004993	7088955
73	7424784	7508737	7592689	7676639	7760587	7844534	7928479
74	8264244	8348181	8432116	8516050	8599982	8683913	8767842
75	9103541	9187462	9271381	9355299	9439215	9523129	9607042
76	9942677	0026581	0110484	0194386	0278285	0362183	0446080
77	7140781650	0865538	0949425	1033310	1117194	1201076	1284956
78	1620461	1704333	1788204	1872073	1955940	2039806	2123670
79	2459110	2542966	2626821	2710673	2794525	2878374	2962222
5180	7143297597	3381437	3465275	3549112	3632947	3716780	3800612
81	4135923	4219747	4303569	4387389	4471208	4555025	4638840
82	4974087	5057894	5141700	5225504	5309307	5393108	5476907
83	5812088	5895880	5979669	6063457	6147244	6231029	6314812
84	6649929	6733704	6817477	6901249	6985019	7068788	7152555
85	7487607	7571366	7655124	7738879	7822633	7906386	7990137
86	8325124	8408867	8492608	8576348	8660086	8743822	8827557
87	9162480	9246207	9329932	9413655	9497377	9581097	9664816
88	9999674	0083385	0167094	0250801	0334507	0418211	0501913
89	7150836707	0920401	1004094	1087785	1171475	1255163	1338849
5190	7151673578	1757257	1840933	1924609	2008282	2091954	2175624
91	2510289	2593951	2677612	2761270	2844928	2928584	3012238
92	3346838	3430484	3514128	3597771	3681412	3765052	3848690
93	4183226	4266856	4350484	4434111	4517736	4601360	4684981
94	5019453	5103067	5186679	5270290	5353899	5437506	5521112
95	5855519	5939117	6022713	6106307	6189900	6273492	6357081
96	6691424	6775006	6858586	6942164	7025741	7109316	7192890
97	7527168	7610734	7694298	7777860	7861421	7944980	8028538
98	8362752	8446301	8529849	8613395	8696940	8780483	8864025
99	9198174	9281708	9365240	9448770	9532298	9615825	9699351
5200	7160033436	0116954	0200469	0283984	0367496	0451007	0534516

OF NUMBERS. Logarithms 7109631190–7160785035.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0222601	0307082	0391561	84492	491	489	487	486	484	482	481	479	478
1067335	1151799	1236262	476	474	472	471	469	468	466	464	463	461
1911904	1996352	2080799	459	458	456	455	453	451	449	448	447	444
2756310	2840741	2925171	443	442	439	438	437	434	434	431	430	428
3600551	3684966	3769379	427	425	423	422	420	418	417	415	413	412
4444628	4529026	4613423	410	409	407	405	403	402	401	398	397	396
5288541	5372923	5457304	393	393	390	389	387	386	384	382	381	379
6132290	6216655	6301020	377	376	374	372	371	369	368	365	365	362
6975875	7060224	7144572	361	360	357	356	355	353	351	349	348	346
7819296	7903629	7987961	345	343	341	340	338	336	335	333	332	329
8662553	8746870	8831185	84329	326	325	323	322	320	318	317	315	314
9505647	9589948	9674246	312	310	308	307	306	303	302	301	298	298
0348577	0432861	0517144	295	294	292	291	289	287	285	284	283	281
1191344	1275612	1359878	279	277	276	274	273	271	269	268	266	264
2033947	2118198	2202448	263	261	260	257	257	254	253	251	250	248
2876387	2960622	3044855	247	244	244	241	240	238	237	235	233	232
3718663	3802882	3887099	230	228	227	225	224	222	220	219	217	215
4560776	4644978	4729179	214	212	210	209	207	206	204	202	201	199
5402726	5486912	5571096	197	196	194	193	191	189	188	186	184	183
6244512	6328682	6412850	181	179	178	176	175	173	171	170	168	166
7086136	7170289	7254441	84165	163	162	160	158	157	155	153	152	150
7927596	8011733	8095868	148	147	145	144	142	140	139	137	135	134
8768893	8853014	8937133	132	131	129	127	126	124	122	121	119	117
9610027	9694132	9778235	116	115	112	111	110	107	106	105	103	101
0450999	0535087	0619174	100	097	097	095	093	091	090	088	087	085
1291808	1375879	1459950	083	082	080	078	077	075	074	071	071	068
2132453	2216509	2300563	067	066	064	062	060	059	057	056	054	052
2972937	3056976	3141014	051	049	048	046	044	043	041	039	038	036
3813257	3897280	3981302	034	033	031	030	028	026	025	023	022	020
4653415	4737422	4821427	018	017	015	013	012	010	008	007	005	004
5493411	5577401	5661390	84002	000	999	997	996	994	992	990	989	988
6333244	6417218	6501191	83985	985	982	981	979	978	976	974	973	971
7172915	7256873	7340829	970	967	967	964	963	962	960	958	956	955
8012423	8096365	8180305	953	952	950	948	947	945	944	942	940	939
8851769	8935695	9019619	937	935	934	932	931	929	927	926	924	922
9690953	9774863	9858770	921	919	918	916	914	913	911	910	907	907
0529975	0613868	0697760	904	903	902	899	898	897	895	893	892	890
1368835	1452712	1536587	888	887	885	884	882	880	879	877	875	874
2207532	2291393	2375253	872	871	869	867	866	864	862	861	860	857
3046068	3129913	3213756	856	855	852	852	849	848	846	845	843	841
3884442	3968271	4052098	83840	838	837	835	833	832	830	829	827	825
4722654	4806467	4890277	824	822	820	819	817	815	814	813	810	810
5560705	5644501	5728295	807	806	804	803	801	799	798	796	794	793
6398594	6482374	6566152	792	789	788	787	785	783	782	780	778	777
7236321	7320084	7403847	775	773	772	770	769	767	766	763	763	760
8073886	8157634	8241380	759	758	755	754	753	751	749	748	746	744
8911290	8995022	9078752	743	741	740	738	736	735	733	732	730	728
9748533	9832248	9915962	727	725	723	722	720	719	717	715	714	712
0585614	0669313	0753011	711	709	707	706	704	702	701	699	698	696
1422534	1506217	1589899	694	693	691	690	688	686	685	683	682	679
2259293	2342960	2426625	83679	676	676	673	672	670	669	667	665	664
3095890	3179541	3263190	662	661	658	658	656	654	652	651	649	648
3932326	4015961	4099594	646	644	643	641	640	638	636	635	633	632
4768602	4852220	4935837	630	628	627	625	624	621	621	618	617	616
5604716	5688319	5771920	614	612	611	609	607	606	604	603	601	599
6440669	6524256	6607841	598	596	594	593	592	589	588	587	585	583
7276462	7360032	7443601	582	580	578	577	575	574	572	570	569	567
8112094	8195648	8279201	566	564	562	561	559	558	556	554	553	551
8947564	9031103	9114639	549	548	546	545	543	542	539	539	536	535
9782875	9866397	9949917	534	532	530	528	527	526	524	522	520	519
0618024	0701530	0785035	518	515	515	512	511	509	508	506	505	503

Numbers 52000–52609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5200	7160033436	0116954	0200469	0283984	0367496	0451007	0534516
1	0868538	0952039	1035539	1119037	1202533	1286028	1369522
2	1703479	1786964	1870448	1953930	2037410	2120889	2204366
3	2538259	2621728	2705196	2788662	2872126	2955589	3039050
4	3372879	3456332	3539784	3623234	3706682	3790129	3873574
5	4207338	4290776	4374211	4457645	4541077	4624508	4707937
6	5041638	5125059	5208478	5291896	5375312	5458727	5542140
7	5875777	5959182	6042585	6125987	6209388	6292786	6376183
8	6709756	6793145	6876532	6959918	7043302	7126685	7210066
9	7543574	7626947	7710319	7793689	7877057	7960424	8043789
5210	7168377233	8460590	8543946	8627299	8710652	8794002	8877351
11	9210732	9294073	9377412	9460750	9544086	9627421	9710754
12	7170044070	0127395	0210719	0294041	0377361	0460680	0543997
13	0877249	0960558	1043866	1127172	1210476	1293779	1377080
14	1710268	1793561	1876853	1960143	2043431	2126718	2210003
15	2543128	2626405	2709680	2792954	2876227	2959497	3042767
16	3375827	3459088	3542348	3625606	3708862	3792117	3875370
17	4208367	4291612	4374856	4458098	4541339	4624577	4707815
18	5040748	5123977	5207205	5290431	5373655	5456878	5540099
19	5872969	5956182	6039394	6122604	6205812	6289019	6372225
5220	7176705030	6788227	6871423	6954617	7037810	7121001	7204190
21	7536932	7620114	7703293	7786472	7869648	7952823	8035997
22	8368675	8451840	8535004	8618167	8701327	8784487	8867644
23	9200258	9283408	9366556	9449702	9532847	9615990	9699132
24	7180031683	0114816	0197948	0281079	0364208	0447335	0530461
25	0862948	0946066	1029182	1112296	1195409	1278521	1361631
26	1694054	1777156	1860256	1943355	2026452	2109547	2192641
27	2525001	2608087	2691171	2774254	2857335	2940415	3023493
28	3355789	3438859	3521928	3604995	3688060	3771124	3854186
29	4186418	4269472	4352525	4435576	4518626	4601673	4684720
5230	7185016889	5099927	5182964	5265999	5349032	5432064	5515095
31	5847200	5930223	6013244	6096263	6179280	6262297	6345311
32	6677353	6760360	6843365	6926368	7009370	7092370	7175369
33	7507347	7590338	7673327	7756315	7839301	7922285	8005268
34	8337183	8420158	8503131	8586103	8669073	8752041	8835008
35	9166860	9249819	9332777	9415732	9498687	9581639	9664590
36	9996379	0079322	0162264	0245203	0328142	0411079	0494014
37	7190825739	0908666	0991592	1074516	1157439	1240360	1323279
38	1654941	1737852	1820762	1903671	1986577	2069482	2152386
39	2483984	2566880	2649774	2732667	2815558	2898447	2981335
5240	7193312870	3395750	3478628	3561505	3644380	3727253	3810125
41	4141597	4224461	4307323	4390184	4473044	4555901	4638757
42	4970166	5053014	5135861	5218706	5301549	5384391	5467232
43	5798577	5881410	5964240	6047070	6129897	6212723	6295548
44	6626830	6709647	6792462	6875275	6958087	7040897	7123706
45	7454925	7537726	7620525	7703323	7786119	7868914	7951707
46	8282863	8365648	8448431	8531213	8613993	8696772	8779549
47	9110642	9193411	9276179	9358945	9441710	9524473	9607234
48	9938264	0021017	0103769	0186519	0269268	0352015	0434761
49	7200765728	0848465	0931202	1013936	1096669	1179401	1262130
5250	7201593034	1675756	1758476	1841195	1923912	2006628	2089342
51	2420183	2502889	2585594	2668297	2750998	2833698	2916397
52	3247174	3329865	3412554	3495241	3577927	3660611	3743293
53	4074008	4156683	4239356	4322028	4404698	4487366	4570033
54	4900685	4983343	5066001	5148657	5231311	5313964	5396615
55	5727204	5809847	5892489	5975129	6057767	6140404	6223040
56	6553566	6636193	6718819	6801443	6884066	6966688	7049307
57	7379770	7462382	7544992	7627601	7710208	7792814	7875418
58	8205818	8288414	8371008	8453601	8536193	8618783	8701371
59	9031708	9114289	9196867	9279445	9362020	9444594	9527167
5260	9857442	9940006	0022569	0105131	0187691	0270249	0352806

OF NUMBERS.

Logarithms 7160033436–7210600467.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0618024	0701530	0785035	83518	515	515	512	511	509	508	506	505	503
1453013	1536503	1619992	501	500	498	496	495	494	491	490	489	487
2287842	2371316	2454788	485	484	482	480	479	477	476	474	472	471
3122510	3205968	3289424	469	468	466	464	463	461	460	458	456	455
3957017	4040459	4123900	453	452	450	448	447	445	443	442	441	438
4791365	4874791	4958215	438	435	434	432	431	429	428	426	424	423
5625552	5708962	5792370	421	419	418	416	415	413	412	410	408	407
6459579	6542973	6626365	405	403	402	401	398	397	396	394	392	391
7293446	7376823	7460200	389	387	386	384	383	381	380	377	377	374
8127152	8210514	8293874	373	372	370	368	367	365	363	362	360	359
8960699	9044045	9127389	83357	356	353	353	350	349	348	346	344	343
9794086	9877415	9960744	341	339	338	336	335	333	332	329	329	326
0627312	0710626	0793939	325	324	322	320	319	317	315	314	313	310
1460379	1543677	1626974	309	308	306	304	303	301	299	298	297	294
2293287	2376569	2459849	293	292	290	288	287	285	284	282	280	279
3126034	3209300	3292564	277	275	274	273	270	270	267	266	264	263
3958622	4041872	4125120	261	260	258	256	255	253	252	250	248	247
4791050	4874284	4957517	245	244	242	241	238	238	235	234	233	231
5623319	5706537	5789754	229	228	226	224	223	221	220	218	217	215
6455428	6538630	6621831	213	212	210	208	207	206	203	202	201	199
7287378	7370564	7453749	83197	196	194	193	191	189	188	186	185	183
8119169	8202339	8285508	182	179	179	176	175	174	172	170	169	167
8950800	9033954	9117107	165	164	163	160	160	157	156	154	153	151
9782272	9865411	9948547	150	148	146	145	143	142	140	139	136	136
0613585	0696708	0779828	133	132	131	129	127	126	124	123	120	120
1444739	1527845	1610950	118	116	114	113	112	110	108	106	105	104
2275734	2358824	2441913	102	100	099	097	095	094	093	090	089	088
3106569	3189644	3272717	086	084	083	081	080	078	076	075	073	072
3937246	4020305	4103363	070	069	067	065	064	062	060	059	058	055
4767764	4850807	4933849	054	053	051	050	047	047	044	043	042	040
5598123	5681151	5764176	83038	037	035	033	032	031	028	028	025	024
6428324	6511335	6594345	023	021	019	017	017	014	013	011	010	008
7258366	7341361	7424355	007	005	003	002	000	999	997	995	994	992
8088249	8171229	8254207	82991	989	988	986	984	983	981	980	978	976
8917974	9000937	9083900	975	973	972	970	968	967	966	963	963	960
9747540	9830488	9913434	959	958	955	955	952	951	950	948	946	945
0576948	0659880	0742810	943	942	939	939	937	935	934	932	930	929
1406197	1489113	1572028	927	926	924	923	921	919	918	916	915	913
2235288	2318188	2401087	911	910	909	906	905	904	902	900	899	897
3064221	3147105	3229988	896	894	893	891	889	888	886	884	883	882
3892995	3975864	4058731	82880	878	877	875	873	872	870	869	867	866
4721612	4804465	4887316	864	862	861	860	857	856	855	853	851	850
5550070	5632908	5715743	848	847	845	843	842	841	838	838	835	834
6378371	6461192	6544012	833	830	830	827	826	825	823	821	820	818
7206513	7289319	7372123	817	815	813	812	810	809	807	806	804	802
8034498	8117288	8200076	801	799	798	796	795	793	791	790	788	787
8862325	8945099	9027871	785	783	782	780	779	777	776	774	772	771
9689994	9772752	9855509	769	768	766	765	763	761	760	758	757	755
0517505	0600247	0682988	753	752	750	749	747	746	744	742	741	740
1344859	1427585	1510311	737	737	734	733	732	729	729	726	726	723
2172055	2254766	2337475	82722	720	719	717	716	714	713	711	709	708
2999093	3081789	3164482	706	705	703	701	700	699	696	696	693	692
3825974	3908654	3991332	691	689	687	686	684	682	681	680	678	676
4652698	4735362	4818024	675	673	672	670	668	667	665	664	662	661
5479264	5561912	5644559	658	658	656	654	653	651	649	648	647	645
6305673	6388306	6470936	643	642	640	638	637	636	633	633	630	630
7131925	7214542	7297157	627	626	624	623	622	619	618	617	615	613
7958020	8040621	8123220	612	610	609	607	606	604	602	601	599	598
8783958	8866543	8949126	596	594	593	592	590	588	587	585	583	582
9609738	9692307	9774875	581	578	578	575	574	573	571	569	568	567
0435362	0517915	0600467	564	563	562	560	558	557	556	553	552	551

Numbers 52600–53209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5260	7209857442	9940006	0022569	0105131	0187691	0270249	0352806
61	7210683018	0765567	0848114	0930660	1013205	1095747	1178289
62	1508438	1590971	1673503	1756033	1838561	1921088	2003614
63	2333700	2416218	2498734	2581248	2663761	2746273	2828783
64	3158806	3241308	3323808	3406307	3488805	3571300	3653794
65	3983755	4066242	4148726	4231209	4313691	4396171	4478650
66	4808548	4891018	4973487	5055955	5138421	5220885	5303348
67	5633184	5715639	5798092	5880544	5962994	6045443	6127890
68	6457663	6540102	6622540	6704976	6787411	6869844	6952275
69	7281986	7364409	7446832	7529252	7611671	7694088	7776504
5270	7218106152	8188560	8270967	8353372	8435775	8518177	8600577
71	8930162	9012555	9094945	9177335	9259722	9342109	9424493
72	9754016	9836393	9918768	0001142	0083514	0165884	0248253
73	7220577713	0660074	0742434	0824792	0907149	0989503	1071857
74	1401255	1483600	1565944	1648287	1730627	1812967	1895304
75	2224640	2306970	2389298	2471625	2553950	2636274	2718596
76	3047869	3130183	3212496	3294807	3377117	3459425	3541731
77	3870942	3953240	4035538	4117833	4200127	4282420	4364711
78	4693859	4776142	4858424	4940704	5022982	5105259	5187534
79	5516620	5598888	5681153	5763418	5845681	5927942	6010202
5280	7226339225	6421477	6503728	6585977	6668224	6750470	6832714
81	7161675	7243911	7326146	7408379	7490611	7572841	7655070
82	7983969	8066190	8148409	8230627	8312843	8395057	8477270
83	8806107	8888312	8970516	9052718	9134919	9217118	9299315
84	9628089	9710279	9792467	9874654	9956839	0039022	0121204
85	7230449916	0532091	0614263	0696434	0778604	0860772	0942938
86	1271588	1353747	1435904	1518059	1600213	1682365	1764516
87	2093104	2175247	2257389	2339529	2421667	2503804	2585939
88	2914465	2996592	3078718	3160843	3242966	3325087	3407207
89	3735670	3817782	3899893	3982002	4064109	4146215	4228319
5290	7234556720	4638817	4720912	4803005	4885097	4967187	5049276
91	5377615	5459696	5541776	5623854	5705930	5788005	5870078
92	6198355	6280421	6362485	6444547	6526608	6608667	6690725
93	7018940	7100990	7183038	7265085	7347130	7429174	7511216
94	7839370	7921404	8003437	8085468	8167498	8249526	8331553
95	8659644	8741663	8823681	8905697	8987711	9069724	9151735
96	9479764	9561768	9643770	9725770	9807769	9889766	9971762
97	7240299729	0381717	0463704	0545689	0627672	0709654	0791634
98	1119540	1201512	1283483	1365453	1447420	1529387	1611352
99	1939195	2021152	2103108	2185062	2267014	2348965	2430914
5300	7242758696	2840638	2922578	3004516	3086453	3168388	3250322
1	3578042	3659968	3741893	3823816	3905737	3987657	4069576
2	4397234	4479145	4561054	4642961	4724867	4806772	4888675
3	5216271	5298166	5380060	5461952	5543843	5625732	5707619
4	6035154	6117034	6198912	6280789	6362664	6444537	6526410
5	6853882	6935747	7017610	7099471	7181331	7263189	7345045
6	7672456	7754305	7836153	7917999	7999843	8081686	8163527
7	8490876	8572710	8654542	8736372	8818201	8900028	8981854
8	9309142	9390960	9472777	9554592	9636405	9718217	9800027
9	7250127253	0209056	0290857	0372657	0454455	0536251	0618046
5310	7250945211	1026998	1108784	1190568	1272351	1354132	1435911
11	1763014	1844786	1926556	2008325	2090092	2171858	2253622
12	2580664	2662420	2744175	2825928	2907680	2989431	3071179
13	3398159	3479900	3561640	3643378	3725114	3806849	3888583
14	4215501	4297226	4378951	4460673	4542394	4624114	4705832
15	5032689	5114399	5196108	5277815	5359521	5441225	5522928
16	5849723	5931418	6013111	6094803	6176493	6258182	6339869
17	6666603	6748283	6829961	6911637	6993312	7074986	7156658
18	7483330	7564994	7646657	7728318	7809978	7891636	7973292
19	8299903	8381552	8463199	8544845	8626490	8708132	8789773
5320	9116323	9197956	9279588	9361219	9442848	9524475	9606101

OF NUMBERS. Logarithms 7209857442–7259850970.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0435362	0517915	0600467	82564	563	562	560	558	557	556	553	552	551
1260828	1343366	1425903	549	547	546	545	542	542	539	538	537	535
2086138	2168660	2251181	533	532	530	528	527	526	524	522	521	519
2911291	2993797	3076303	518	516	514	513	512	510	508	506	506	503
3736287	3818778	3901267	502	500	499	498	495	494	493	491	489	488
4561126	4643602	4726076	487	484	483	482	480	479	476	476	474	472
5385809	5468269	5550727	470	469	468	466	464	463	461	460	458	457
6210336	6292780	6375222	455	453	452	450	449	447	446	444	442	441
7034705	7117134	7199560	439	438	436	435	433	431	430	429	426	426
7858919	7941331	8023743	423	423	420	419	417	416	415	412	412	409
8682976	8765373	8847768	82408	407	405	403	402	400	399	397	395	394
9506876	9589258	9671638	393	390	390	387	387	384	383	382	380	378
0330620	0412986	0495351	377	375	374	372	370	369	367	366	365	362
1154209	1236559	1318907	361	360	358	357	354	354	352	350	348	348
1977641	2059975	2142308	345	344	343	340	340	337	337	334	333	332
2800916	2883235	2965553	330	328	327	325	324	322	320	319	318	316
3624036	3706340	3788641	314	313	311	310	308	306	305	304	301	301
4447000	4529288	4611574	298	298	295	294	293	291	289	288	286	285
5269808	5352080	5434351	283	282	280	278	277	275	274	272	271	269
6092460	6174717	6256972	268	265	265	263	261	260	258	257	255	253
6914956	6997197	7079437	82252	251	249	247	246	244	242	241	240	238
7737297	7819522	7901746	236	235	233	232	230	229	227	225	224	223
8559482	8641692	8723900	221	219	218	216	214	213	212	210	208	207
9381511	9463705	9545898	205	204	202	201	199	197	196	194	193	191
0203385	0285563	0367741	190	188	187	185	183	182	181	178	178	175
1025103	1107266	1189428	175	172	171	170	168	166	165	163	162	160
1846666	1928813	2010959	159	157	155	154	152	151	150	147	146	145
2668073	2750205	2832336	143	142	140	138	137	135	134	132	131	129
3489325	3571442	3653557	127	126	125	123	121	120	118	117	115	113
4310422	4392523	4474622	112	111	109	107	106	104	103	101	099	098
5131363	5213449	5295533	82097	095	093	092	090	089	087	086	084	082
5952149	6034220	6116288	081	080	078	076	075	073	071	071	068	067
6772781	6854835	6936888	066	064	062	061	059	058	056	054	053	052
7593257	7675296	7757334	050	048	047	045	044	042	041	039	038	036
8413578	8495602	8577624	034	033	031	030	028	027	025	024	022	020
9233745	9315753	9397759	019	018	016	014	013	011	010	008	006	005
0053756	0135749	0217740	004	002	000	999	997	996	994	993	991	989
0873613	0955590	1037566	81988	987	985	983	982	980	979	977	976	974
1693315	1775276	1857237	972	971	970	967	967	965	963	961	961	958
2512862	2594808	2676753	957	956	954	952	951	949	948	946	945	943
3332255	3414185	3496115	81942	940	938	937	935	934	933	930	930	927
4151493	4233408	4315322	926	925	923	921	920	919	917	915	914	912
4970576	5052476	5134374	911	909	907	906	905	903	901	900	898	897
5789505	5871390	5953273	895	894	892	891	889	887	886	885	883	881
6608280	6690149	6772016	880	878	877	875	873	873	870	869	867	866
7426900	7508754	7590606	865	863	861	860	858	856	855	854	852	850
8245367	8327205	8409041	849	848	846	844	843	841	840	838	836	835
9063678	9145501	9227322	834	832	830	829	827	826	824	823	821	820
9881836	9963643	0045449	818	817	815	813	812	810	809	807	806	804
0699840	0781632	0863422	803	801	800	798	796	795	794	792	790	789
1517689	1599466	1681241	81787	786	784	783	781	779	778	777	775	773
2335385	2417146	2498906	772	770	769	767	766	764	763	761	760	758
3152927	3234672	3316416	756	755	753	752	751	748	748	745	744	743
3970314	4052045	4133774	741	740	738	736	735	734	731	731	729	727
4787548	4869263	4950977	725	725	722	721	720	718	716	715	714	712
5604629	5686328	5768026	710	709	707	706	704	703	701	699	698	697
6421555	6503239	6584922	695	693	692	690	689	687	686	684	683	681
7238328	7319997	7401664	680	678	676	675	674	672	670	669	667	666
8054947	8136601	8218253	664	663	661	660	658	656	655	654	652	650
8871413	8953051	9034688	649	647	646	645	642	641	640	638	637	635
9687725	9769348	9850970	633	632	631	629	627	626	624	623	622	619

Numbers 53200–53809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5320	7259116323	9197956	9279588	9361219	9442848	9524475	9606101
21	9932589	0014207	0095824	0177439	0259053	0340665	0422275
22	7260748702	0830305	0911906	0993506	1075104	1156701	1238296
23	1564662	1646249	1727835	1809420	1891003	1972584	2054164
24	2380468	2462040	2543611	2625180	2706748	2788314	2869878
25	3196121	3277678	3359233	3440787	3522339	3603890	3685439
26	4011621	4093163	4174703	4256241	4337778	4419314	4500847
27	4826968	4908494	4990019	5071542	5153064	5234584	5316102
28	5642162	5723673	5805182	5886690	5968196	6049701	6131204
29	6457202	6538698	6620192	6701685	6783176	6864665	6946153
5330	7267272090	7353571	7435049	7516527	7598003	7679477	7760950
31	8086825	8168290	8249754	8331216	8412676	8494135	8575593
32	8901407	8982857	9064306	9145752	9227198	9308641	9390083
33	9715837	9797271	9878704	9960136	0041566	0122994	0204421
34	7270530114	0611533	0692951	0774367	0855781	0937195	1018606
35	1344238	1425642	1507044	1588445	1669845	1751242	1832639
36	2158209	2239598	2320985	2402371	2483755	2565138	2646519
37	2972028	3053402	3134774	3216144	3297513	3378880	3460246
38	3785695	3867053	3948410	4029765	4111118	4192471	4273821
39	4599209	4680552	4761893	4843233	4924572	5005908	5087244
5340	7275412570	5493898	5575224	5656549	5737872	5819194	5900514
41	6225780	6307092	6388403	6469713	6551021	6632327	6713632
42	7038837	7120134	7201430	7282724	7364017	7445308	7526598
43	7851742	7933024	8014305	8095584	8176861	8258137	8339412
44	8664495	8745762	8827027	8908291	8989553	9070814	9152073
45	9477095	9558347	9639597	9720846	9802093	9883339	9964583
46	7280289544	0370781	0452016	0533249	0614481	0695712	0776941
47	1101841	1183062	1264282	1345500	1426717	1507932	1589146
48	1913986	1995192	2076397	2157600	2238801	2320001	2401200
49	2725979	2807170	2888359	2969547	3050734	3131919	3213102
5350	7283537820	3618996	3700170	3781343	3862514	3943684	4024852
51	4349510	4430670	4511829	4592987	4674143	4755298	4836451
52	5161048	5242193	5323337	5404479	5485620	5566760	5647898
53	5972434	6053564	6134693	6215820	6296946	6378070	6459193
54	6783669	6864784	6945897	7027009	7108120	7189229	7270337
55	7594752	7675852	7756950	7838047	7919143	8000236	8081329
56	8405683	8486768	8567852	8648933	8730014	8811092	8892170
57	9216464	9297533	9378602	9459668	9540733	9621797	9702859
58	7290027093	0108147	0189200	0270252	0351302	0432350	0513398
59	0837570	0918610	0999648	1080684	1161719	1242753	1323784
5360	7291647897	1728921	1809944	1890965	1971985	2053003	2134020
61	2458072	2539081	2620089	2701095	2782100	2863103	2944105
62	3268096	3349091	3430083	3511074	3592064	3673052	3754038
63	4077970	4158949	4239926	4320902	4401877	4482850	4563821
64	4887692	4968656	5049618	5130579	5211538	5292496	5373453
65	5697263	5778212	5859159	5940105	6021049	6101992	6182933
66	6506683	6587617	6668549	6749480	6830409	6911337	6992263
67	7315953	7396872	7477789	7558704	7639618	7720531	7801442
68	8125072	8205975	8286877	8367778	8448677	8529574	8610471
69	8934040	9014928	9095815	9176701	9257585	9338467	9419348
5370	7299742857	9823730	9904602	9985473	0066342	0147209	0228075
71	7300551524	0632382	0713239	0794094	0874948	0955801	1036652
72	1360040	1440883	1521725	1602565	1683404	1764242	1845077
73	2168406	2249234	2330061	2410886	2491710	2572532	2653353
74	2976621	3057434	3138246	3219056	3299865	3380672	3461478
75	3784686	3865484	3946281	4027076	4107870	4188662	4269453
76	4592600	4673384	4754165	4834946	4915724	4996501	5077277
77	5400365	5481133	5561900	5642665	5723428	5804191	5884951
78	6207979	6288732	6369484	6450234	6530982	6611730	6692475
79	7015443	7096181	7176918	7257653	7338386	7419119	7499849
5380	7822757	7903480	7984201	8064922	8145640	8226357	8307073

OF NUMBERS. Logarithms 7259116323-7308549211.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9687725	9769348	9850970	81633	632	631	629	627	626	624	623	622	619
0503884	0585492	0667098	618	617	615	614	612	610	609	608	606	604
1319890	1401482	1483073	603	601	600	598	597	595	594	592	591	589
2135742	2217319	2298894	587	586	585	583	581	580	578	577	575	574
2951441	3033003	3114563	572	571	569	568	566	564	563	562	560	558
3766987	3848533	3930078	557	555	554	552	551	549	548	546	545	543
4582380	4663911	4745440	542	540	538	537	536	533	533	531	529	528
5397620	5479135	5560649	526	525	523	522	520	518	518	515	514	513
6212706	6294206	6375705	511	509	508	506	505	503	502	500	499	497
7027640	7109125	7190608	496	494	493	491	489	488	487	485	483	482
7842421	7923890	8005359	81481	478	478	476	474	473	471	469	469	466
8657049	8738503	8819956	465	464	462	460	459	458	456	454	453	451
9471524	9552963	9634401	450	449	446	446	443	442	441	439	438	436
0285847	0367270	0448693	434	433	432	430	428	427	426	423	423	421
1100016	1181425	1262832	419	418	416	414	414	411	410	409	407	406
1914034	1995427	2076819	404	402	401	400	397	397	395	393	392	390
2727898	2809276	2890653	389	387	386	384	383	381	379	378	377	375
3541611	3622973	3704335	374	372	370	369	367	366	365	362	362	360
4355170	4436518	4517864	358	357	355	353	353	350	549	348	346	345
5168578	5249910	5331241	343	341	340	339	336	336	334	332	331	329
5981833	6063150	6144466	81328	326	325	323	322	320	319	317	316	314
6794936	6876238	6957538	312	311	310	308	306	305	304	302	300	299
7607886	7689173	7770458	297	296	294	293	291	290	288	287	285	284
8420685	8501956	8583226	282	281	279	277	276	275	273	271	270	269
9233331	9314587	9395842	267	265	264	262	261	259	258	256	255	253
0045826	0127067	0208306	252	250	249	247	246	244	243	241	239	238
0858168	0939394	1020618	237	235	233	232	231	229	227	226	224	223
1670358	1751569	1832778	221	220	218	217	215	214	212	211	209	208
2482397	2563592	2644786	206	205	203	201	200	199	197	195	194	193
3294284	3375464	3456643	191	189	188	187	185	183	182	180	179	177
4106019	4187184	4268348	81176	174	173	171	170	168	167	165	164	162
4917602	4998752	5079901	160	159	158	156	155	153	151	150	149	147
5729034	5810169	5891302	145	144	142	141	140	138	136	135	133	132
6540314	6621434	6702552	130	129	127	126	124	123	121	120	118	117
7351443	7432547	7513650	115	113	112	111	109	108	106	104	103	102
8162420	8243509	8324597	100	098	097	096	093	093	091	089	088	086
8973246	9054320	9135393	085	084	081	081	078	078	076	074	073	071
9783920	9864979	9946037	069	069	066	065	064	062	061	059	058	056
0594443	0675487	0756529	054	053	052	050	048	048	045	044	042	041
1404815	1485844	1566871	040	038	036	035	034	031	031	029	027	026
2215036	2296049	2377062	81024	023	021	020	018	017	016	013	013	010
3025105	3106104	3187101	009	008	006	005	003	002	000	999	997	995
3835024	3916007	3996989	80995	992	991	990	988	986	986	983	982	981
4644791	4725759	4806726	979	977	976	975	973	971	970	968	967	966
5454408	5535361	5616313	964	962	961	959	958	957	955	953	952	950
6263873	6344811	6425748	949	947	946	944	943	941	940	938	937	935
7073188	7154111	7235033	934	932	931	929	928	926	925	923	922	920
7882352	7963260	8044167	919	917	915	914	913	911	910	908	907	905
8691365	8772258	8853150	903	902	901	899	897	897	894	893	892	890
9500228	9581106	9661982	888	887	886	884	882	881	880	878	876	875
0308940	0389802	0470664	80873	872	871	869	867	866	865	862	862	860
1117501	1198349	1279195	858	857	855	854	853	851	849	848	846	845
1925912	2006745	2087576	843	842	840	839	838	835	835	833	831	830
2734172	2814990	2895806	828	827	825	824	822	821	819	818	816	815
3542282	3623085	3703886	813	812	810	809	807	806	804	803	801	800
4350242	4431030	4511816	798	797	795	794	792	791	789	788	786	784
5158051	5238824	5319595	784	781	781	778	777	776	774	773	771	770
5965710	6046468	6127224	768	767	765	763	763	760	759	758	756	755
6773219	6853962	6934703	753	752	750	748	748	745	744	743	741	740
7580578	7661306	7742032	738	737	735	733	733	730	729	728	726	725
8387787	8468500	8549211	723	721	721	718	717	716	714	713	711	709

Numbers 53800–54409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5380	7307822757	7903480	7984201	8064922	8145640	8226357	8307073
81	8629920	8710629	8791335	8872040	8952744	9033446	9114147
82	9436934	9517627	9598319	9679009	9759698	9840385	9921071
83	7310243798	0324476	0405153	0485828	0566502	0647174	0727845
84	1050512	1131175	1211837	1292497	1373156	1453813	1534469
85	1857076	1937725	2018371	2099016	2179660	2260302	2340943
86	2663491	2744124	2824756	2905386	2986015	3066642	3147268
87	3469755	3550374	3630990	3711606	3792219	3872832	3953442
88	4275871	4356474	4437076	4517676	4598275	4678872	4759468
89	5081836	5162424	5243011	5323596	5404180	5484763	5565343
5390	7315887652	5968225	6048797	6129367	6209936	6290504	6371070
91	6693318	6773877	6854434	6934989	7015543	7095095	7176646
92	7498835	7579379	7659921	7740461	7821000	7901538	7982074
93	8304203	8384731	8465258	8545784	8626308	8706831	8787352
94	9109421	9189935	9270447	9350958	9431467	9511974	9592480
95	9914490	9994989	0075486	0155982	0236476	0316969	0397460
96	7320719410	0799894	0880376	0960857	1041336	1121814	1202290
97	1524181	1604650	1685117	1765583	1846047	1926510	2006971
98	2328802	2409256	2489709	2570160	2650609	2731057	2811504
99	3133275	3213714	3294151	3374587	3455022	3535455	3615887
5400	7323937598	4018022	4098445	4178866	4259286	4339704	4420121
1	4741773	4822182	4902590	4982996	5063401	5143804	5224206
2	5545799	5626193	5706586	5786977	5867367	5947756	6028143
3	6349675	6430055	6510433	6590809	6671184	6751558	6831930
4	7153404	7233768	7314131	7394493	7474853	7555212	7635569
5	7956983	8037333	8117681	8198028	8278373	8358717	8439059
6	8760414	8840749	8921082	9001414	9081744	9162073	9242401
7	9563696	9644016	9724334	9804651	9884967	9965281	0045594
8	7330366829	0447135	0527438	0607740	0688041	0768340	0848638
9	1169814	1250105	1330394	1410681	1490967	1571251	1651534
5410	7331972651	2052927	2133201	2213473	2293744	2374014	2454282
11	2775339	2855600	2935859	3016117	3096373	3176628	3256881
12	3577879	3658125	3738369	3818612	3898854	3979094	4059332
13	4380271	4460502	4540731	4620960	4701186	4781411	4861635
14	5182514	5262731	5342945	5423158	5503370	5583581	5663789
15	5984610	6064811	6145011	6225209	6305406	6385602	6465796
16	6786557	6866743	6946928	7027112	7107294	7187475	7267654
17	7588356	7668528	7748698	7828867	7909034	7989200	8069364
18	8390007	8470164	8550319	8630473	8710626	8790777	8870927
19	9191510	9271652	9351793	9431932	9512070	9592206	9672341
5420	7339992865	0072993	0153119	0233243	0313366	0393488	0473608
21	7340794073	0874185	0954297	1034406	1114514	1194621	1274726
22	1595132	1675230	1755327	1835422	1915515	1995607	2075697
23	2396044	2476127	2556209	2636289	2716368	2796445	2876521
24	3196809	3276877	3356944	3437009	3517073	3597135	3677196
25	3997425	4077479	4157531	4237581	4317631	4397678	4477724
26	4797894	4877933	4957970	5038006	5118041	5198073	5278105
27	5598216	5678240	5758262	5838284	5918303	5998321	6078338
28	6398390	6478399	6558407	6638413	6718418	6798422	6878424
29	7198417	7278411	7358404	7438396	7518386	7598375	7678362
5430	7347998296	8078276	8158254	8238231	8318206	8398180	8478153
31	8798028	8877993	8957957	9037919	9117880	9197839	9277796
32	9597613	9677563	9757512	9837459	9917405	9997350	0077293
33	7350397050	0476986	0556920	0636853	0716784	0796714	0876642
34	1196341	1276262	1356181	1436099	1516016	1595931	1675845
35	1995484	2075390	2155295	2235199	2315100	2395001	2474900
36	2794481	2874372	2954262	3034151	3114038	3193924	3273808
37	3593330	3673207	3753082	3832956	3912829	3992700	4072569
38	4392033	4471895	4551755	4631615	4711472	4791329	4871184
39	5190588	5270436	5350282	5430126	5509969	5589811	5669651
5440	5988997	6068830	6148661	6228491	6308319	6388146	6467972

OF NUMBERS. Logarithms 7307822757-7356707439.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8387787	8468500	8549211	80723	721	721	718	717	716	714	713	711	709
9194846	9275544	9356240	709	706	705	704	702	701	699	698	696	694
0001755	0082437	0163119	693	692	690	689	687	686	684	682	682	679
0808514	0889181	0969848	678	677	675	674	672	671	669	667	667	664
1615123	1695775	1776427	663	662	660	659	657	656	654	652	652	649
2421582	2502220	2582856	649	646	645	644	642	641	639	638	636	635
3227892	3308515	3389136	633	632	630	629	627	626	624	623	621	619
4034052	4114659	4195266	619	616	616	613	613	610	610	607	607	605
4840062	4920655	5001246	603	602	600	599	597	596	594	593	591	590
5645923	5726501	5807077	588	587	585	584	583	580	580	578	576	575
6451634	6532197	6612758	80573	572	570	569	568	566	564	563	561	560
7257196	7337744	7418290	559	557	555	554	552	551	550	548	546	545
8062608	8143141	8223673	544	542	540	539	538	536	534	533	532	530
8867871	8948389	9028906	528	527	526	524	523	521	519	518	517	515
9672985	9753488	9833990	514	512	511	509	507	506	505	503	502	500
0477950	0558438	0638925	499	497	496	494	493	491	490	488	487	485
1282765	1363238	1443710	484	482	481	479	478	476	475	473	472	471
2087431	2167890	2248347	469	467	466	464	463	461	460	459	457	455
2891949	2972392	3052834	454	453	451	449	448	447	445	443	442	441
3696317	3776745	3857173	439	437	436	435	433	432	430	428	428	425
4500536	4580950	4661362	80423	423	421	420	418	417	415	414	412	411
5304606	5385005	5465403	409	408	406	405	403	402	400	399	398	396
6108528	6188912	6269294	394	393	391	390	389	387	385	384	382	381
6912301	6992670	7073037	380	378	376	375	374	372	371	369	367	367
7715925	7796279	7876632	364	363	362	360	359	357	356	354	353	351
8519400	8599739	8680077	350	348	347	345	344	342	341	339	338	337
9322727	9403051	9483374	335	333	332	330	329	328	326	324	323	322
0125905	0206215	0286523	320	318	317	316	314	313	311	310	308	306
0928934	1009229	1089523	306	303	302	301	299	298	296	295	294	291
1731816	1812096	1892374	291	289	287	286	284	283	282	280	278	277
2534548	2614814	2695077	80276	274	272	271	270	268	266	266	263	262
3337133	3417383	3497632	261	259	258	256	255	253	252	250	249	247
4139569	4219804	4300038	246	244	243	242	240	238	237	235	234	233
4941857	5022078	5102297	231	229	229	226	225	224	222	221	219	217
5743997	5824202	5904407	217	214	213	212	211	208	208	205	205	203
6545988	6626179	6706369	201	200	198	197	196	194	192	191	190	188
7347832	7428008	7508183	186	185	184	182	181	179	178	176	175	173
8149527	8229689	8309849	172	170	169	167	166	164	163	162	160	158
8951075	9031221	9111366	157	155	154	153	151	150	148	146	145	144
9752474	9832606	9912737	142	141	139	138	136	135	133	132	131	128
0553726	0633843	0713959	80128	126	124	123	122	120	118	117	116	114
1354830	1434932	1515033	112	112	109	108	107	105	104	102	101	099
2155786	2235874	2315960	098	097	095	093	092	090	089	088	086	084
2956595	3036668	3116739	083	082	080	079	077	076	074	073	071	070
3757256	3837314	3917370	068	067	065	064	062	061	060	058	056	055
4557769	4637812	4717854	054	052	050	050	047	046	045	043	042	040
5358135	5438163	5518190	039	037	036	035	032	032	030	028	027	026
6158353	6238367	6318379	024	022	022	019	018	017	015	014	012	011
6958424	7038423	7118421	009	008	006	005	004	002	000	999	998	996
7758348	7838332	7918315	79994	993	992	990	989	987	986	984	983	981
8558124	8638093	8718061	79980	978	977	975	974	973	971	969	968	967
9357753	9437708	9517661	965	964	962	961	959	957	957	955	953	952
0157235	0237175	0317113	950	949	947	946	945	943	942	940	938	937
0956569	1036494	1116418	936	934	933	931	930	928	927	925	924	923
1755757	1835667	1915577	921	919	918	917	915	914	912	910	910	907
2554797	2634693	2714588	906	905	904	901	901	899	897	896	895	893
3353691	3433572	3513452	891	890	889	887	886	884	883	881	880	878
4152437	4232304	4312169	877	875	874	873	871	869	868	867	865	864
4951037	5030889	5110739	862	860	860	857	857	855	853	852	850	849
5749490	5829327	5909163	848	846	844	843	842	840	839	837	836	834
6547796	6627618	6707439	833	831	830	828	827	826	824	822	821	820

Numbers 54400–55009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5440	7355988997	6068830	6148661	6228491	6308319	6388146	6467972
41	6787259	6867077	6946894	7026709	7106523	7186335	7266146
42	7585374	7665178	7744980	7824780	7904580	7984377	8064173
43	8383343	8463132	8542919	8622705	8702490	8782273	8862054
44	9181165	9260939	9340712	9420483	9500253	9580021	9659788
45	9978841	0058600	0138358	0218115	0297870	0377624	0457376
46	7360776370	0856115	0935858	1015600	1095341	1175080	1254817
47	1573753	1653483	1733212	1812939	1892665	1972389	2052112
48	2370989	2450705	2530419	2610131	2689843	2769552	2849261
49	3168079	3247780	3327479	3407178	3486874	3566569	3646263
5450	7363965023	4044709	4124394	4204077	4283759	4363440	4443119
51	4761820	4841492	4921162	5000831	5080498	5160164	5239829
52	5558472	5638129	5717784	5797439	5877091	5956743	6036392
53	6354977	6434619	6514260	6593900	6673538	6753175	6832810
54	7151336	7230964	7310590	7390215	7469839	7549461	7629081
55	7947549	8027163	8106774	8186385	8265994	8345601	8425207
56	8743616	8823215	8902812	8982408	9062003	9141595	9221187
57	9539538	9619122	9698705	9778286	9857866	9937444	0017021
58	7370335313	0414883	0494451	0574018	0653583	0733146	0812709
59	1130943	1210498	1290052	1369604	1449154	1528703	1608251
5460	7371926427	2005967	2085506	2165044	2244580	2324114	2403648
61	2721765	2801291	2880816	2960338	3039860	3119380	3198898
62	3516958	3596469	3675979	3755487	3834994	3914500	3994004
63	4312005	4391502	4470997	4550491	4629983	4709474	4788964
64	5106907	5186389	5265870	5345349	5424827	5504303	5583778
65	5901663	5981130	6060597	6140061	6219525	6298986	6378447
66	6696274	6775727	6855178	6934628	7014077	7093524	7172970
67	7490739	7570177	7649615	7729050	7808484	7887917	7967348
68	8285059	8364483	8443906	8523327	8602746	8682165	8761581
69	9079234	9158643	9238051	9317458	9396863	9476267	9555669
5470	7379873263	9952658	0032052	0111444	0190835	0270224	0349611
71	7380667148	0746528	0825907	0905285	0984661	1064036	1143409
72	1460887	1540253	1619618	1698981	1778342	1857702	1937061
73	2254481	2333833	2413183	2492531	2571879	2651224	2730568
74	3047931	3127268	3206603	3285937	3365270	3444601	3523931
75	3841235	3920558	3999879	4079198	4158516	4237833	4317148
76	4634395	4713703	4793009	4872314	4951618	5030920	5110221
77	5427409	5506703	5585995	5665285	5744575	5823862	5903149
78	6220279	6299558	6378836	6458112	6537387	6616660	6695932
79	7013004	7092269	7171532	7250794	7330054	7409313	7488570
5480	7387805585	7884835	7964084	8043331	8122577	8201821	8281064
81	8598021	8677256	8756491	8835723	8914955	8994184	9073413
82	9390312	9469533	9548753	9627971	9707188	9786404	9865617
83	7390182459	0261666	0340871	0420075	0499277	0578478	0657678
84	0974461	1053653	1132844	1212034	1291222	1370408	1449593
85	1766319	1845497	1924673	2003848	2083022	2162194	2241365
86	2558033	2637196	2716358	2795519	2874678	2953835	3032992
87	3349602	3428751	3507899	3587045	3666189	3745333	3824474
88	4141027	4220162	4299295	4378426	4457557	4536685	4615813
89	4932308	5011428	5090547	5169664	5248780	5327894	5407007
5490	7395723445	5802550	5881655	5960757	6039859	6118959	6198057
91	6514437	6593528	6672618	6751707	6830794	6909879	6988964
92	7305286	7384363	7463438	7542512	7621585	7700656	7779726
93	8095990	8175053	8254114	8333174	8412232	8491289	8570344
94	8886551	8965599	9044646	9123691	9202735	9281777	9360818
95	9676968	9756001	9835034	9914065	9993094	0072122	0151149
96	7400467241	0546260	0625278	0704294	0783309	0862323	0941335
97	1257370	1336375	1415378	1494380	1573381	1652380	1731378
98	2047355	2126346	2205335	2284323	2363309	2442294	2521277
99	2837197	2916173	2995148	3074121	3153093	3232064	3311033
5500	3626895	3705857	3784817	3863776	3942734	4021690	4100645

OF NUMBERS. Logarithms 7355988997-7404337501.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6547796	6627618	6707439	79833	831	830	828	827	826	824	822	821	820
7345955	7425763	7505570	818	817	815	814	812	811	809	808	807	804
8143968	8223761	8303553	804	802	800	800	797	796	795	793	792	790
8941834	9021613	9101390	789	787	786	785	783	781	780	779	777	775
9739554	9819318	9899080	774	773	771	770	768	767	766	764	762	761
0537127	0616876	0696624	759	758	757	755	754	752	751	749	748	746
1334553	1414288	1494021	745	743	742	741	739	737	736	735	733	732
2131834	2211553	2291272	730	729	727	726	724	723	722	719	719	717
2928967	3008673	3088377	716	714	712	712	709	709	706	706	704	702
3725955	3805646	3885335	701	699	699	696	695	694	692	691	689	688
4522796	4602472	4682147	79686	685	683	682	681	679	677	676	675	673
5319492	5399153	5478813	672	670	669	667	666	665	663	661	660	659
6116041	6195688	6275333	657	655	655	652	652	649	649	647	645	644
6912444	6992076	7071707	642	641	640	638	637	635	634	632	631	629
7708701	7788318	7867934	628	626	625	624	622	620	620	617	616	615
8504812	8584415	8664016	614	611	611	609	607	606	605	603	601	600
9300777	9380365	9459952	599	597	596	595	592	592	590	588	587	586
0096596	0176170	0255742	584	583	581	580	578	577	575	574	572	571
0892269	0971829	1051387	570	568	567	565	563	563	560	560	558	556
1687797	1767342	1846885	555	554	552	550	549	548	546	545	543	542
2483179	2562709	2642238	79540	539	538	536	534	534	531	530	529	527
3278416	3357931	3437445	526	525	522	522	520	518	518	515	514	513
4073506	4153007	4232507	511	510	508	507	506	504	502	501	500	498
4868452	4947938	5027423	497	495	494	492	491	490	488	486	485	484
5663251	5742723	5822194	482	481	479	478	476	475	473	472	471	469
6457906	6537363	6616819	467	467	464	464	461	461	459	457	456	455
7252415	7331857	7411299	453	451	450	449	447	446	445	442	442	440
8046778	8126207	8205633	438	438	435	434	433	431	430	429	426	426
8840997	8920410	8999823	424	423	421	419	419	416	416	413	413	411
9635070	9714469	9793867	409	408	407	405	404	402	401	399	398	396
0428998	0508383	0587766	79395	394	392	391	389	387	387	385	383	382
1222781	1302151	1381520	380	379	378	376	375	373	372	370	369	367
2016418	2095774	2175129	366	365	363	361	360	359	357	356	355	352
2809911	2889252	2968592	352	350	348	348	345	344	343	341	340	339
3603259	3682586	3761911	337	335	334	333	331	330	328	327	325	324
4396462	4475774	4555085	323	321	319	318	317	315	314	312	311	310
5189520	5268818	5348114	308	306	305	304	302	301	299	298	296	295
5982433	6061717	6140999	294	292	290	290	287	287	284	284	282	280
6775202	6854471	6933738	279	278	276	275	273	272	270	269	267	266
7567826	7647080	7726333	265	263	262	260	259	257	256	254	253	252
8360305	8439545	8518784	79250	249	247	246	244	243	241	240	239	237
9152640	9231865	9311089	235	235	232	232	229	229	227	225	224	223
9944830	0024041	0103251	221	220	218	217	216	213	213	211	210	208
0736876	0816072	0895267	207	205	204	202	201	200	198	196	195	194
1528777	1607959	1687140	192	191	190	188	186	185	184	182	181	179
2320534	2399702	2478868	178	176	175	174	172	171	169	168	166	165
3112146	3191300	3270452	163	162	161	159	157	157	154	154	152	150
3903615	3982754	4061891	149	148	146	144	144	141	141	139	137	136
4694939	4774063	4853186	135	133	131	131	128	128	126	124	123	122
5486119	5565229	5644337	120	119	117	116	114	113	112	110	108	108
6277154	6356250	6435344	79105	105	102	102	100	098	097	096	094	093
7068046	7147127	7226207	091	090	089	087	085	085	082	081	080	079
7858794	7937861	8016926	077	075	074	073	071	070	068	067	065	064
8649398	8728450	8807501	063	061	060	058	057	055	054	052	051	050
9439858	9518896	9597932	048	047	045	044	042	041	040	038	036	036
0230174	0309197	0388220	033	033	031	029	028	027	025	023	023	021
1020346	1099355	1178363	019	018	016	015	014	012	011	009	008	007
1810375	1889369	1968363	005	003	002	001	999	998	997	994	994	992
2600259	2679240	2758219	78991	989	988	986	985	983	982	981	979	978
3390001	3468967	3547932	976	975	973	972	971	969	968	966	965	963
4179598	4258550	4337501	962	960	959	958	956	955	953	952	951	949

Numbers 55000–55609.

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5500	7403626895	3705857	3784817	3863776	3942734	4021690	4100645
1	4416450	4495397	4574343	4653288	4732231	4811173	4890113
2	5205861	5284794	5363726	5442656	5521585	5600512	5679438
3	5995128	6074047	6152964	6231880	6310795	6389708	6468620
4	6784252	6863157	6942060	7020962	7099862	7178761	7257658
5	7573233	7652123	7731012	7809899	7888785	7967670	8046553
6	8362071	8440946	8519821	8598694	8677565	8756436	8835304
7	9150765	9229626	9308486	9387345	9466202	9545058	9623913
8	9939316	0018163	0097009	0175853	0254696	0333538	0412378
9	7410727724	0806557	0885388	0964218	1043047	1121874	1200700
5510	7411515989	1594807	1673624	1752440	1831254	1910067	1988879
11	2304110	2382915	2461717	2540519	2619319	2698118	2776915
12	3092089	3170879	3249668	3328455	3407240	3486025	3564808
13	3879925	3958701	4037475	4116248	4195019	4273789	4352558
14	4667618	4746379	4825139	4903898	4982655	5061411	5140165
15	5455168	5533915	5612661	5691405	5770148	5848889	5927629
16	6242575	6321308	6400039	6478769	6557498	6636225	6714951
17	7029840	7108558	7187275	7265991	7344705	7423418	7502130
18	7816961	7895666	7974369	8053070	8131770	8210469	8289166
19	8603941	8682631	8761319	8840007	8918692	8997377	9076060
5520	7419390777	9469453	9548128	9626800	9705472	9784142	9862811
21	7420177471	0256133	0334793	0413452	0492109	0570765	0649419
22	0964023	1042670	1121316	1199961	1278604	1357245	1435886
23	1750432	1829065	1907697	1986327	2064956	2143583	2222209
24	2536699	2615318	2693935	2772551	2851166	2929779	3008391
25	3322824	3401428	3480031	3558633	3637234	3715832	3794430
26	4108806	4187396	4265985	4344573	4423159	4501744	4580327
27	4894646	4973222	5051797	5130370	5208942	5287513	5366082
28	5680344	5758906	5837466	5916025	5994583	6073139	6151694
29	6465899	6544447	6622993	6701538	6780082	6858624	6937165
5530	7427251313	7329847	7408379	7486909	7565439	7643967	7722493
31	8036585	8115104	8193622	8272139	8350654	8429167	8507680
32	8821714	8900220	8978723	9057226	9135727	9214226	9292724
33	9606702	9685193	9763683	9842171	9920658	9999143	0077627
34	7430391548	0470025	0548500	0626974	0705447	0783918	0862388
35	1176252	1254715	1333176	1411636	1490094	1568551	1647007
36	1960814	2039263	2117710	2196156	2274600	2353043	2431484
37	2745235	2823669	2902102	2980534	3058964	3137392	3215820
38	3529514	3607934	3686353	3764770	3843186	3921600	4000014
39	4313651	4392057	4470462	4548865	4627267	4705667	4784066
5540	7435097647	5176039	5254429	5332818	5411206	5489592	5567977
41	5881502	5959879	6038255	6116630	6195004	6273376	6351746
42	6665214	6743578	6821940	6900301	6978660	7057018	7135374
43	7448786	7527135	7605483	7683830	7762175	7840519	7918861
44	8232216	8310551	8388885	8467218	8545549	8623878	8702206
45	9015505	9093826	9172146	9250464	9328781	9407096	9485410
46	9798652	9876959	9955265	0033569	0111872	0190173	0268473
47	7440581659	0659952	0738243	0816533	0894822	0973109	1051395
48	1364524	1442803	1521080	1599356	1677631	1755904	1834175
49	2147248	2225513	2303776	2382038	2460298	2538557	2616815
5550	7442929831	3008082	3086331	3164579	3242825	3321070	3399313
51	3712273	3790510	3868745	3946978	4025211	4103442	4181671
52	4494574	4572797	4651018	4729237	4807455	4885672	4963888
53	5276735	5354943	5433150	5511355	5589559	5667762	5745963
54	6058754	6136948	6215141	6293333	6371522	6449711	6527898
55	6840633	6918813	6996992	7075169	7153345	7231519	7309692
56	7622371	7700537	7778701	7856865	7935026	8013187	8091346
57	8403968	8482120	8560270	8638420	8716567	8794714	8872859
58	9185424	9263562	9341699	9419834	9497968	9576100	9654231
59	9966740	0044864	0122987	0201108	0279227	0357346	0435463
5560	7450747916	0826026	0904134	0982241	1060347	1138451	1216554

OF NUMBERS. Logarithms 7403626895-7451450854.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4179598	4258550	4337501	78962	960	959	958	956	955	953	952	951	949
4969052	5047990	5126926	947	946	945	943	942	940	939	938	936	935
5758363	5837286	5916208	933	932	930	929	927	926	925	923	922	920
6547530	6626439	6705346	919	917	916	915	913	912	910	909	907	906
7336554	7415448	7494341	905	903	902	900	899	897	896	894	893	892
8125434	8204315	8283193	890	889	887	886	885	883	881	881	878	878
8914172	8993037	9071902	875	875	873	871	871	868	868	865	865	863
9702766	9781617	9860467	861	860	859	857	856	855	853	851	850	849
0491216	0570054	0648889	847	846	844	843	842	840	838	838	835	835
1279524	1358347	1437168	833	831	830	829	827	826	824	823	821	821
2067689	2146497	2225305	78818	817	816	814	813	812	810	808	808	805
2855710	2934505	3013298	805	802	802	800	799	797	795	795	793	791
3643589	3722369	3801148	790	789	787	785	785	783	781	780	779	777
4431325	4510091	4588855	776	774	773	771	770	769	767	766	764	763
5218918	5297669	5376419	761	760	759	757	756	754	753	751	750	749
6006368	6085105	6163841	747	746	744	743	741	740	739	737	736	734
6793675	6872398	6951120	733	731	730	729	727	726	724	723	722	720
7580840	7659548	7738256	718	717	716	714	713	712	710	708	708	705
8367862	8446556	8525249	705	703	701	700	699	697	696	694	693	692
9154741	9233421	9312100	690	688	688	685	685	683	681	680	679	677
9941478	0020144	0098808	78676	675	672	672	670	669	667	666	664	663
0728073	0806724	0885374	662	660	659	657	656	654	654	651	650	649
1514524	1593162	1671798	647	646	645	643	641	641	638	638	636	634
2300834	2379457	2458079	633	632	630	629	627	626	625	623	622	620
3087001	3165610	3244218	619	617	616	615	613	612	610	609	608	606
3873026	3951621	4030214	604	603	602	601	598	598	596	595	593	592
4658909	4737489	4816068	590	589	588	586	585	583	582	580	579	578
5444649	5523215	5601780	576	575	573	572	571	569	567	566	565	564
6230248	6308800	6387350	562	560	559	558	556	555	554	552	550	549
7015704	7094242	7172778	548	546	545	544	542	541	539	538	536	535
7801018	7879542	7958064	78534	532	530	530	528	526	525	524	522	521
8586190	8664700	8743208	519	518	517	515	513	513	510	510	508	506
9371221	9449716	9528210	506	503	503	501	499	498	497	495	494	492
0156109	0234590	0313070	491	490	488	487	485	484	482	481	480	478
0940856	1019323	1097788	477	475	474	473	471	470	468	467	465	464
1725461	1803913	1882365	463	461	460	458	457	456	454	452	452	449
2509924	2588362	2666799	449	447	446	444	443	441	440	438	437	436
3294245	3372670	3451093	434	433	432	430	428	428	425	425	423	421
4078425	4156835	4235244	420	419	417	416	414	414	411	410	409	407
4862463	4940859	5019254	406	405	403	402	400	399	397	396	395	393
5646360	5724742	5803123	78392	390	389	388	386	385	383	382	381	379
6430115	6508483	6586850	377	376	375	374	372	370	369	368	367	364
7213729	7292083	7370435	364	362	361	359	358	356	355	354	352	351
7997202	8075541	8153879	349	348	347	345	344	342	341	339	338	337
8780533	8858858	8937182	335	334	333	331	329	328	327	325	324	323
9563723	9642034	9720344	321	320	318	317	315	314	313	311	310	308
0346772	0425069	0503365	307	306	304	303	301	300	299	297	296	294
1129679	1207962	1286244	293	291	290	289	287	286	284	283	282	280
1912446	1990715	2068982	279	277	276	275	273	271	271	269	267	266
2695071	2773326	2851579	265	263	262	260	259	258	256	255	253	252
3477555	3555796	3634035	78251	249	248	246	245	243	242	241	239	238
4259899	4338126	4416351	237	235	233	233	231	229	228	227	225	223
5042101	5120314	5198525	223	221	219	218	217	216	213	213	211	210
5824163	5902362	5980559	208	207	205	204	203	201	200	199	197	195
6606084	6684268	6762451	194	193	192	189	189	187	186	184	183	182
7387864	7466034	7544203	180	179	177	176	174	173	172	170	169	168
8169503	8247660	8325814	166	164	164	161	161	159	157	157	154	154
8951002	9029144	9107285	152	150	150	147	147	145	143	142	141	139
9732360	9810488	9888615	138	137	135	134	132	131	129	128	127	125
0513578	0591692	0669805	124	123	121	119	119	117	115	114	113	111
1294655	1372755	1450854	110	108	107	106	104	103	101	100	099	097

Numbers 55600–56209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5560	7450747916	0826026	0904134	0982241	1060347	1138451	1216554
61	1528951	1607047	1685141	1763234	1841325	1919416	1997504
62	2309845	2387927	2466007	2544086	2622164	2700240	2778315
63	3090599	3168667	3246733	3324798	3402862	3480924	3558985
64	3871213	3949267	4027319	4105370	4183419	4261467	4339514
65	4651687	4729726	4807765	4885801	4963837	5041871	5119903
66	5432020	5510046	5588070	5666093	5744114	5822134	5900153
67	6212213	6290225	6368235	6446244	6524251	6602257	6680262
68	6992266	7070264	7148260	7226255	7304248	7382240	7460231
69	7772179	7850162	7928145	8006125	8084105	8162083	8240059
5570	7458551952	8629921	8707890	8785856	8863822	8941786	9019748
71	9331585	9409540	9487494	9565447	9643399	9721349	9799297
72	7460111078	0189019	0266959	0344898	0422836	0500772	0578706
73	0890431	0968358	1046284	1124209	1202133	1280055	1357975
74	1669644	1747557	1825470	1903380	1981290	2059198	2137105
75	2448717	2526617	2604515	2682412	2760307	2838202	2916094
76	3227651	3305537	3383421	3461304	3539185	3617065	3694944
77	4006445	4084317	4162187	4240056	4317923	4395790	4473654
78	4785099	4862957	4940813	5018668	5096522	5174374	5252225
79	5563614	5641458	5719300	5797141	5874981	5952819	6030656
5580	7466341989	6419819	6497648	6575475	6653300	6731125	6808948
81	7120225	7198041	7275856	7353669	7431480	7509291	7587100
82	7898322	7976123	8053924	8131723	8209521	8287317	8365112
83	8676279	8754067	8831853	8909638	8987422	9065205	9142986
84	9454096	9531870	9609643	9687414	9765184	9842953	9920720
85	7470231775	0309535	0387293	0465051	0542807	0620561	0698315
86	1009314	1087060	1164805	1242548	1320290	1398031	1475770
87	1786714	1864446	1942177	2019906	2097635	2175361	2253087
88	2563974	2641693	2719410	2797126	2874840	2952553	3030264
89	3341096	3418801	3496504	3574206	3651906	3729605	3807302
5590	7474118079	4195769	4273459	4351147	4428833	4506518	4584202
91	4894923	4972599	5050275	5127949	5205621	5283292	5360962
92	5671627	5749290	5826952	5904612	5982270	6059928	6137584
93	6448193	6525842	6603490	6681136	6758781	6836424	6914066
94	7224620	7302255	7379889	7457521	7535152	7612782	7690410
95	8000909	8078530	8156150	8233768	8311385	8389001	8466615
96	8777058	8854666	8932271	9009876	9087479	9165081	9242681
97	9553069	9630663	9708255	9785845	9863435	9941023	0018609
98	7480328941	0406521	0484099	0561676	0639251	0716825	0794398
99	1104675	1182241	1259805	1337368	1414930	1492490	1570049
5600	7481880270	1957822	2035372	2112922	2190469	2268016	2345561
1	2655727	2733265	2810801	2888337	2965871	3043403	3120934
2	3431045	3508569	3586092	3663613	3741133	3818652	3896169
3	4206225	4283735	4361244	4438752	4516258	4593763	4671266
4	4981266	5058763	5136258	5213752	5291244	5368735	5446225
5	5756169	5833652	5911133	5988613	6066092	6143569	6221045
6	6530934	6608403	6685871	6763337	6840802	6918265	6995727
7	7305561	7383016	7460470	7537922	7615373	7692823	7770271
8	8080050	8157491	8234931	8312369	8389806	8467242	8544676
9	8854400	8931828	9009254	9086678	9164102	9241524	9318944
5610	7489628613	9706026	9783438	9860849	9938259	0015667	0093074
11	7490402687	0480087	0557485	0634882	0712278	0789673	0867066
12	1176624	1254010	1331394	1408778	1486160	1563540	1640919
13	1950422	2027794	2105165	2182535	2259903	2337270	2414635
14	2724083	2801441	2878799	2956154	3033509	3110862	3188213
15	3497606	3574951	3652294	3729636	3806977	3884316	3961654
16	4270991	4348322	4425652	4502980	4580307	4657632	4734956
17	5044239	5121556	5198872	5276186	5353499	5430811	5508121
18	5817349	5894652	5971954	6049255	6126554	6203852	6281149
19	6590321	6667611	6744899	6822186	6899471	6976756	7054038
5620	7363156	7440432	7517706	7594979	7672251	7749521	7826791

OF NUMBERS. Logarithms 7450747916–7498058589.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1294655	1372755	1450854	78110	108	107	106	104	103	101	100	099	097
2075592	2153678	2231762	096	094	093	091	091	088	088	086	084	083
2856388	2934460	3012530	082	080	079	078	076	075	073	072	070	069
3637044	3715102	3793158	068	066	065	064	062	061	059	058	056	055
4417559	4495603	4573646	054	052	051	049	048	047	045	044	043	041
5197935	5275965	5353993	039	039	036	036	034	032	032	030	028	027
5978170	6056186	6134200	026	024	023	021	020	019	017	016	014	013
6758265	6836267	6914267	012	010	009	007	006	005	003	002	000	999
7538220	7616208	7694194	77998	996	995	993	992	991	989	988	986	985
8318035	8396008	8473981	983	983	980	980	978	976	976	973	973	971
9097709	9175669	9253628	77969	969	966	966	964	962	961	960	959	957
9877244	9955190	0033135	955	954	953	952	950	948	947	946	945	943
0656639	0734571	0812502	941	940	939	938	936	934	933	932	931	929
1435894	1513812	1591729	927	926	925	924	922	920	919	918	917	915
2215010	2292914	2370816	913	913	910	910	908	907	905	904	902	901
2993985	3071875	3149764	900	898	897	895	895	892	891	890	889	887
3772821	3850697	3928572	886	884	883	881	880	879	877	876	875	873
4551518	4629380	4707240	872	870	869	867	867	864	864	862	860	859
5330074	5407922	5485769	858	856	855	854	852	851	849	848	847	845
6108491	6186325	6264158	844	842	841	840	838	837	835	834	833	831
6886769	6964589	7042408	77830	829	827	825	825	823	821	820	819	817
7664907	7742713	7820518	816	815	813	811	811	809	807	806	805	804
8442906	8520698	8598489	801	801	799	798	796	795	794	792	791	790
9220765	9298544	9376321	788	786	785	784	783	781	779	779	777	775
9998486	0076250	0154013	774	773	771	770	769	767	766	764	763	762
0776067	0853817	0931566	760	758	758	756	754	754	752	750	749	748
1553508	1631245	1708980	746	745	743	742	741	739	738	737	735	734
2330811	2408533	2486255	732	731	729	729	726	726	724	722	722	719
3107974	3185683	3263390	719	717	716	714	713	711	710	709	707	706
3884999	3962693	4040387	705	703	702	700	699	697	697	694	694	692
4661884	4739565	4817244	77690	690	688	686	685	684	682	681	679	679
5438631	5516298	5593963	676	676	674	672	671	670	669	667	665	664
6215238	6292891	6370543	663	662	660	658	658	656	654	653	652	650
6991707	7069346	7146984	649	648	646	645	643	642	641	639	638	636
7768037	7845662	7923286	635	634	632	631	630	628	627	625	624	623
8544228	8621839	8699449	621	620	618	617	616	614	613	611	610	609
9320280	9397878	9475474	608	605	605	603	602	600	599	598	596	595
0096194	0173778	0251360	594	592	590	590	588	586	585	584	582	581
0871969	0949539	1027108	580	578	577	575	574	573	571	570	569	567
1647606	1725162	1802717	566	564	563	562	560	559	557	556	555	553
2423104	2500646	2578187	77552	550	550	547	547	545	543	542	541	540
3198464	3275992	3353519	538	536	536	534	532	531	530	528	527	526
3973685	4051200	4128713	524	523	521	520	519	517	516	515	513	512
4748768	4826269	4903768	510	509	508	506	505	503	502	501	499	498
5523713	5601200	5678685	497	495	494	492	491	490	488	487	485	484
6298519	6375992	6453464	483	481	480	479	477	476	474	473	472	470
7073187	7150647	7228105	469	468	466	465	463	462	460	460	458	456
7847718	7925163	8002607	455	454	452	451	450	448	447	445	444	443
8622109	8699541	8776971	441	440	438	437	436	434	433	432	430	429
9396363	9473781	9551198	428	426	424	424	422	420	419	418	417	415
0170479	0247883	0325286	77413	412	411	410	408	407	405	404	403	401
0944457	1021847	1099236	400	398	397	396	395	393	391	390	389	388
1718297	1795673	1873049	386	384	384	382	380	379	378	376	376	373
2491999	2569362	2646723	372	371	370	368	367	365	364	363	361	360
3265564	3342912	3420260	358	358	355	355	353	351	351	348	348	346
4038990	4116325	4193659	345	343	342	341	339	338	336	335	334	332
4812279	4889600	4966920	331	330	328	327	325	324	323	321	320	319
5585430	5662738	5740044	317	316	314	313	312	310	309	308	306	305
6358444	6435737	6513030	303	302	301	299	298	297	295	293	293	291
7131320	7208600	7285878	290	288	287	285	285	282	282	280	278	278
7904058	7981324	8058589	276	274	273	272	270	270	267	266	265	264

Numbers 56200–56809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5620	7497363156	7440432	7517706	7594979	7672251	7749521	7826791
21	8135853	8213115	8290376	8367635	8444893	8522150	8599405
22	8908413	8985661	9062908	9140154	9217398	9294641	9371883
23	9680835	9758070	9835303	9912535	9989766	0066995	0144223
24	7500453120	0530341	0607561	0684779	0761996	0839211	0916425
25	1225268	1302475	1379681	1456885	1534088	1611290	1688491
26	1997278	2074472	2151664	2228855	2306044	2383232	2460419
27	2769152	2846331	2923510	3000687	3077862	3155037	3232210
28	3540888	3618054	3695218	3772382	3849544	3926704	4003863
29	4312487	4389639	4466790	4543940	4621088	4698235	4775380
5630	7505083949	5161087	5238224	5315360	5392495	5469628	5546760
31	5855273	5932398	6009522	6086644	6163765	6240884	6318003
32	6626461	6703573	6780682	6857791	6934898	7012004	7089108
33	7397512	7474610	7551706	7628801	7705894	7782987	7860077
34	8168426	8245510	8322593	8399674	8476754	8553832	8630909
35	8939204	9016274	9093343	9170410	9247476	9324541	9401605
36	9709844	9786901	9863956	9941010	0018062	0095113	0172163
37	7510480348	0557391	0634433	0711473	0788511	0865549	0942585
38	1250715	1327745	1404772	1481799	1558824	1635848	1712870
39	2020946	2097961	2174976	2251988	2329000	2406010	2483019
5640	7512791040	2868042	2945042	3022041	3099039	3176036	3253031
41	3560997	3637985	3714972	3791958	3868942	3945925	4022906
42	4330818	4407793	4484766	4561738	4638708	4715677	4792645
43	5100503	5177464	5254423	5331381	5408338	5485294	5562248
44	5870051	5946998	6023944	6100889	6177832	6254774	6331714
45	6639463	6716396	6793329	6870260	6947189	7024117	7101044
46	7408738	7485658	7562577	7639494	7716410	7793325	7870238
47	8177877	8254784	8331689	8408593	8485495	8562396	8639296
48	8946880	9023773	9100665	9177555	9254444	9331331	9408217
49	9715747	9792627	9869504	9946381	0023256	0100130	0177002
5650	7520484478	0561344	0638208	0715071	0791932	0868793	0945651
51	1253073	1329925	1406776	1483625	1560473	1637319	1714165
52	2021532	2098370	2175207	2252043	2328877	2405710	2482542
53	2789855	2866679	2943503	3020325	3097146	3173965	3250783
54	3558042	3634853	3711663	3788471	3865278	3942084	4018888
55	4326093	4402890	4479687	4556481	4633275	4710067	4786858
56	5094008	5170792	5247575	5324356	5401136	5477915	5554692
57	5861787	5938558	6015327	6092095	6168861	6245626	6322390
58	6629431	6706188	6782944	6859698	6936451	7013202	7089952
59	7396939	7473683	7550425	7627165	7703905	7780643	7857379
5660	7528164312	8241042	8317770	8394497	8471223	8547947	8624670
61	8931549	9008265	9084980	9161694	9238406	9315117	9391826
62	9698650	9775353	9852054	9928754	0005453	0082150	0158846
63	7530465616	0542305	0618993	0695680	0772365	0849048	0925731
64	1232447	1309122	1385797	1462470	1539141	1615811	1692480
65	1999142	2075804	2152465	2229124	2305782	2382439	2459094
66	2765702	2842350	2918998	2995643	3072288	3148931	3225573
67	3532126	3608761	3685395	3762027	3838658	3915288	3991916
68	4298416	4375037	4451657	4528276	4604894	4681510	4758124
69	5064570	5141178	5217785	5294390	5370994	5447596	5524198
5670	7535830589	5907183	5983777	6060368	6136959	6213548	6290135
71	6596473	6673054	6749633	6826212	6902789	6979364	7055938
72	7362222	7438789	7515355	7591920	7668484	7745046	7821606
73	8127836	8204390	8280942	8357493	8434043	8510592	8587139
74	8893315	8969855	9046394	9122932	9199468	9276003	9352537
75	9658659	9735186	9811711	9888236	9964759	0041280	0117800
76	7540423868	0500381	0576894	0653404	0729914	0806422	0882929
77	1188942	1265442	1341941	1418438	1494934	1571429	1647922
78	1953882	2030368	2106854	2183338	2259820	2336301	2412781
79	2718687	2795160	2871632	2948102	3024571	3101039	3177505
5680	3483357	3559817	3636275	3712732	3789188	3865642	3942095

OF NUMBERS. Logarithms 7497363156–7544171445.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7904058	7981324	8058589	77276	274	273	272	270	270	267	266	265	264
8676659	8753912	8831163	262	261	259	258	257	255	254	253	251	250
9449123	9526362	9603599	248	247	246	244	243	242	240	239	237	236
0221449	0298674	0375898	235	233	232	231	229	228	226	225	224	222
0993638	1070849	1148059	221	220	218	217	215	214	213	211	210	209
1765690	1842887	1920083	207	206	204	203	202	201	199	197	196	195
2537604	2614788	2691970	194	192	191	189	188	187	185	184	182	182
3309381	3386551	3463720	179	179	177	175	175	173	171	170	169	168
4081021	4158178	4235333	166	164	164	162	160	159	158	157	155	154
4852524	4929667	5006808	152	151	150	148	147	145	144	143	141	141
5623890	5701019	5778147	77138	137	136	135	133	132	130	129	128	126
6395119	6472235	6549349	125	124	122	121	119	119	116	116	114	112
7166211	7243313	7320413	112	109	109	107	106	104	103	102	100	099
7937167	8014255	8091341	098	096	095	093	093	090	090	088	086	085
8707985	8785059	8862132	084	083	081	080	078	077	076	074	073	072
9478667	9555727	9632786	070	069	067	066	065	064	062	060	059	058
0249211	0326258	0403304	057	055	054	052	051	050	048	047	046	044
1019620	1096653	1173685	043	042	040	038	038	036	035	033	032	030
1789891	1866911	1943929	030	027	027	025	024	022	021	020	018	017
2560026	2637032	2714037	015	015	012	012	010	009	007	006	005	003
3330024	3407017	3484008	77002	000	999	998	997	995	993	993	991	989
4099886	4176865	4253842	76988	987	986	984	983	981	980	979	977	976
4869612	4946577	5023540	975	973	972	970	969	968	967	965	963	963
5639201	5716152	5793102	961	959	958	957	956	954	953	951	950	949
6408653	6485591	6562528	947	946	945	943	942	940	939	938	937	935
7177970	7254894	7331817	933	933	931	929	928	927	926	924	923	921
7947150	8024060	8100970	920	919	917	916	915	913	912	910	910	907
8716194	8793091	8869986	907	905	904	902	901	900	898	897	895	894
9485102	9561985	9638867	893	892	890	889	887	886	885	883	882	880
0253873	0330743	0407611	880	877	877	875	874	872	871	870	868	867
1022509	1099365	1176220	76866	864	863	861	861	858	858	856	855	853
1791008	1867851	1944692	852	851	849	848	846	846	843	843	841	840
2559372	2636201	2713028	838	837	836	834	833	832	830	829	827	827
3327600	3404415	3481229	824	824	822	821	819	818	817	815	814	813
4095692	4172493	4249294	811	810	808	807	806	804	804	801	801	799
4863648	4940436	5017222	797	797	794	794	792	791	790	788	786	786
5631468	5708242	5785016	784	783	781	780	779	777	776	774	774	771
6399152	6475913	6552673	771	769	768	766	765	764	762	761	760	758
7166701	7243449	7320195	757	756	754	753	751	750	749	748	746	744
7934114	8010848	8087581	744	742	740	740	738	736	735	734	733	731
8701392	8778112	8854831	76730	728	727	726	724	723	722	720	719	718
9468534	9545241	9621946	716	715	714	712	711	709	708	707	705	704
0235541	0312234	0388926	703	701	700	699	697	696	695	693	692	690
1002412	1079092	1155770	689	688	687	685	683	683	681	680	678	677
1769148	1845814	1922479	675	675	673	671	670	669	668	666	665	663
2535748	2612401	2689052	662	661	659	658	657	655	654	653	651	650
3302213	3378852	3455490	648	648	645	645	643	642	640	639	638	636
4068543	4145169	4221793	635	634	632	631	630	628	627	626	624	623
4834738	4911350	4987961	621	620	619	618	616	614	614	612	611	609
5600797	5677396	5753993	608	607	605	604	602	602	599	599	597	596
6366722	6443307	6519891	76594	594	591	591	589	587	587	585	584	582
7132511	7209083	7285653	581	579	579	577	575	574	573	572	570	569
7898166	7974724	8051280	567	566	565	564	562	560	560	558	556	556
8663685	8740230	8816773	554	552	551	550	549	547	546	545	543	542
9429070	9505601	9582130	540	539	538	536	535	534	533	531	529	529
0194319	0270837	0347353	527	525	525	523	521	520	519	518	516	515
0959434	1035938	1112441	513	513	510	510	508	507	505	504	503	501
1724414	1800905	1877394	500	499	497	496	495	493	492	491	489	488
2489259	2565737	2642212	486	486	484	482	481	480	478	478	475	475
3253970	3330434	3406896	473	472	470	469	468	466	465	464	462	461
4018546	4094996	4171445	460	458	457	456	454	453	451	450	449	448

Numbers 56800–57409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5680	7543483357	3559817	3636275	3712732	3789188	3865642	3942095
81	4247893	4324339	4400784	4477227	4553669	4630110	4706550
82	5012294	5088727	5165158	5241588	5318017	5394444	5470870
83	5776560	5852980	5929398	6005814	6082229	6158643	6235056
84	6540693	6617098	6693503	6769906	6846308	6922708	6999107
85	7304690	7381083	7457474	7533863	7610252	7686639	7763024
86	8068554	8144932	8221310	8297686	8374061	8450435	8526807
87	8832283	8908648	8985012	9061375	9137737	9214097	9290455
88	9595877	9672229	9748580	9824929	9901278	9977624	0053970
89	7550359338	0435676	0512014	0588350	0664684	0741018	0817350
5690	7551122664	1198989	1275313	1351636	1427957	1504277	1580595
91	1885856	1962168	2038478	2114788	2191095	2267402	2343707
92	2648914	2725213	2801510	2877805	2954100	3030393	3106685
93	3411838	3488123	3564407	3640689	3716970	3793250	3869528
94	4174628	4250900	4327170	4403439	4479707	4555973	4632238
95	4937284	5013542	5089799	5166055	5242309	5318562	5394813
96	5699806	5776051	5852295	5928537	6004778	6081017	6157255
97	6462195	6538426	6614656	6690885	6767112	6843339	6919563
98	7224449	7300667	7376884	7453099	7529313	7605526	7681738
99	7986570	8062774	8138978	8215180	8291381	8367580	8443778
5700	7558748557	8824748	8900938	8977127	9053314	9129500	9205685
1	9510410	9586588	9662765	9738940	9815114	9891287	9967458
2	7560272130	0348294	0424458	0500620	0576780	0652939	0729097
3	1033716	1109867	1186017	1262166	1338313	1414459	1490603
4	1795168	1871306	1947443	2023578	2099712	2175845	2251976
5	2556488	2632612	2708735	2784857	2860978	2937097	3013215
6	3317673	3393784	3469894	3546003	3622110	3698216	3774321
7	4078725	4154823	4230920	4307015	4383109	4459202	4535293
8	4839644	4915729	4991812	5067894	5143975	5220054	5296132
9	5600430	5676501	5752571	5828640	5904707	5980773	6056837
5710	7566361082	6437140	6513197	6589252	6665306	6741359	6817410
11	7121602	7197646	7273690	7349731	7425772	7501811	7577849
12	7881988	7958019	8034049	8110078	8186105	8262131	8338155
13	8642241	8718259	8794275	8870291	8946305	9022317	9098328
14	9402360	9478365	9554368	9630370	9706371	9782371	9858369
15	7570162347	0238339	0314329	0390317	0466305	0542291	0618276
16	0922201	0998179	1074156	1150131	1226106	1302078	1378050
17	1681922	1757887	1833850	1909813	1985773	2061733	2137691
18	2441510	2517462	2593412	2669361	2745308	2821254	2897199
19	3200965	3276904	3352841	3428776	3504710	3580643	3656575
5720	7573960288	4036213	4112137	4188059	4263980	4339899	4415818
21	4719478	4795389	4871300	4947209	5023116	5099023	5174928
22	5478535	5554433	5630330	5706226	5782120	5858013	5933905
23	6237459	6313344	6389228	6465111	6540992	6616872	6692750
24	6996251	7072123	7147993	7223863	7299730	7375597	7451462
25	7754910	7830769	7906626	7982482	8058337	8134190	8210042
26	8513437	8589282	8665126	8740969	8816810	8892651	8968489
27	9271831	9347663	9423494	9499324	9575152	9650979	9726804
28	7580030093	0105912	0181729	0257546	0333361	0409174	0484987
29	0788222	0864028	0939833	1015636	1091437	1167238	1243037
5730	7581546220	1622012	1697803	1773593	1849382	1925169	2000954
31	2304085	2379864	2455642	2531418	2607194	2682967	2758740
32	3061817	3137583	3213348	3289111	3364873	3440634	3516393
33	3819418	3895171	3970922	4046672	4122421	4198168	4273915
34	4576886	4652626	4728364	4804101	4879836	4955571	5031304
35	5334222	5409949	5485674	5561398	5637120	5712841	5788561
36	6091427	6167140	6242852	6318562	6394271	6469979	6545686
37	6848499	6924199	6999897	7075595	7151291	7226985	7302679
38	7605439	7681126	7756811	7832495	7908178	7983860	8059540
39	8362247	8437921	8513593	8589264	8664934	8740602	8816269
5740	9118924	9194584	9270243	9345901	9421558	9497213	9572867

OF NUMBERS. Logarithms 7543483357-7589799820.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4018546	4094996	4171445	76460	458	457	456	454	453	451	450	449	448
4782988	4859424	4935860	446	445	443	442	441	440	438	436	436	434
5547295	5623718	5700140	433	431	430	429	427	426	425	423	422	420
6311467	6387877	6464285	420	418	416	415	414	413	411	410	408	408
7075505	7151901	7228297	405	405	403	402	400	399	398	396	396	393
7839409	7915792	7992173	393	391	389	389	387	385	385	383	381	381
8603178	8679547	8755916	378	378	376	375	374	372	371	369	369	367
9366813	9443169	9519524	365	364	363	362	360	358	358	356	355	353
0130314	0206656	0282998	352	351	349	349	346	346	344	342	342	340
0893680	0970009	1046337	338	338	336	334	334	332	330	329	328	327
1656913	1733228	1809543	76325	324	323	321	320	318	318	315	315	313
2420011	2496313	2572614	312	310	310	307	307	305	304	302	301	300
3182975	3259264	3335552	299	297	295	295	293	292	290	289	288	286
3945805	4022081	4098355	285	284	282	281	280	278	277	276	274	273
4708501	4784764	4861025	272	270	269	268	266	265	263	263	261	259
5471064	5547313	5623560	258	257	256	254	253	251	251	249	247	246
6233492	6309728	6385962	245	244	242	241	239	238	237	236	234	233
6995787	7072009	7148230	231	230	229	227	227	224	224	222	221	219
7757948	7834156	7910364	218	217	215	214	213	212	210	208	208	206
8519975	8596170	8672364	204	204	202	201	199	198	197	195	194	193
9281868	9358050	9434231	76191	190	189	187	186	185	183	182	181	179
0043628	0119796	0195964	178	177	175	174	173	171	170	168	168	166
0805254	0881409	0957563	164	164	162	160	159	158	157	155	154	153
1566747	1642889	1719029	151	150	149	147	146	144	144	142	140	139
2328106	2404234	2480362	138	137	135	134	133	131	130	128	128	126
3089332	3165447	3241561	124	123	122	121	119	118	117	115	114	112
3850424	3926526	4002626	111	110	109	107	106	105	103	102	100	099
4611383	4687471	4763559	098	097	095	094	093	091	090	088	088	085
5372208	5448284	5524358	085	083	082	081	079	078	076	076	074	072
6132901	6208963	6285023	071	070	069	067	066	064	064	062	060	059
6893460	6969508	7045556	76058	057	055	054	053	051	050	048	048	046
7653886	7729921	7805955	044	044	041	041	039	038	037	035	034	033
8414179	8490201	8566221	031	030	029	027	026	024	024	022	020	020
9174338	9250347	9326354	018	016	016	014	012	011	010	009	007	006
9934365	0010361	0086355	005	003	002	001	000	998	996	996	994	992
0694259	0770241	0846222	75992	990	988	988	986	985	983	982	981	979
1454020	1529989	1605956	978	977	975	975	972	972	970	969	967	966
2213648	2289603	2365557	965	963	963	960	960	958	957	955	954	953
2973143	3049085	3125026	952	950	949	947	946	945	944	942	941	939
3732505	3808434	3884362	939	937	935	934	933	932	930	929	928	926
4491735	4567650	4643565	75925	924	922	921	919	919	917	915	915	913
5250832	5326734	5402635	911	911	909	907	907	905	904	902	901	900
6009796	6085685	6161573	898	897	896	894	893	892	891	889	888	886
6768627	6844503	6920378	885	884	883	881	880	878	877	876	875	873
7527326	7603189	7679050	872	870	870	867	867	865	864	863	861	860
8285893	8361742	8437590	859	857	856	855	853	852	851	849	848	847
9044327	9120163	9195998	845	844	843	841	841	838	838	836	835	833
9802628	9878451	9954273	832	831	830	828	827	825	824	823	822	820
0560798	0636607	0712416	819	817	817	815	813	813	811	809	809	806
1318834	1394631	1470426	806	805	803	801	801	799	797	797	795	794
2076739	2152522	2228304	75792	791	790	789	787	785	785	783	782	781
2834511	2910281	2986050	779	778	776	776	773	773	771	770	769	767
3592151	3667908	3743664	766	765	763	762	761	759	758	757	756	754
4349659	4425403	4501145	753	751	750	749	747	747	744	744	742	741
5107035	5182766	5258495	740	738	737	735	735	733	731	731	729	727
5864279	5939996	6015712	727	725	724	722	721	720	718	717	716	715
6621391	6697095	6772798	713	712	710	709	708	707	705	704	703	701
7378371	7454062	7529751	700	698	698	696	694	694	692	691	689	688
8135219	8210896	8286573	687	685	684	683	682	680	679	677	677	674
8891935	8967599	9043262	674	672	671	670	668	667	666	664	663	662
9648519	9724170	9799820	660	659	658	657	655	654	652	651	650	649

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5740	7589118924	9194584	9270243	9345901	9421558	9497213	9572867
41	9875469	9951116	0026762	0102406	0178050	0253692	0329332
42	7590631882	0707516	0783148	0858780	0934410	1010039	1085666
43	1388163	1463784	1539403	1615021	1690638	1766254	1841868
44	2144312	2219920	2295526	2371132	2446735	2522338	2597939
45	2900330	2975925	3051518	3127110	3202701	3278290	3353878
46	3656217	3731798	3807378	3882957	3958534	4034110	4109685
47	4411971	4487540	4563107	4638672	4714236	4789799	4865361
48	5167595	5243150	3318704	5394256	5469807	5545357	5620906
49	5923086	5998628	6074169	6149708	6225246	6300783	6376318
5750	7596678447	6753976	6829503	6905029	6980554	7056078	7131600
51	7433676	7509192	7584706	7660219	7735731	7811241	7886750
52	8188774	8264276	8339778	8415277	8490776	8566273	8641769
53	8943740	9019230	9094718	9170205	9245690	9321174	9396657
54	9698576	9774052	9849527	9925001	0000473	0075944	0151414
55	7600453280	0528743	0604205	0679665	0755125	0830583	0906039
56	1207853	1283303	1358752	1434199	1509645	1585090	1660534
57	1962295	2037732	2113167	2188602	2264035	2339466	2414897
58	2716605	2792029	2867452	2942873	3018293	3093712	3169129
59	3470785	3546196	3621606	3697014	3772421	3847826	3923230
5760	7604224834	4300232	4375628	4451023	4526417	4601810	4677201
61	4978752	5054137	5129520	5204902	5280283	5355662	5431040
62	5732539	5807911	5883281	5958650	6034018	6109384	6184749
63	6486196	6561554	6636911	6712267	6787622	6862975	6938327
64	7239721	7315067	7390411	7465754	7541095	7616435	7691774
65	7993116	8068449	8143780	8219109	8294438	8369765	8445091
66	8746381	8821700	8897018	8972334	9047650	9122964	9198276
67	9499514	9574820	9650125	9725429	9800731	9876032	9951332
68	7610252517	0327810	0403102	0478393	0553682	0628970	0704256
69	1005390	1080670	1155948	1231226	1306502	1381777	1457050
5770	7611758132	1833399	1908664	1983929	2059192	2134454	2209714
71	2510743	2585997	2661250	2736501	2811751	2887000	2962247
72	3263224	3338465	3413705	3488943	3564180	3639416	3714650
73	4015575	4090803	4166030	4241255	4316479	4391702	4466923
74	4767795	4843010	4918224	4993436	5068647	5143857	5219065
75	5519886	5595088	5670288	5745487	5820685	5895882	5971077
76	6271846	6347034	6422222	6497408	6572593	6647777	6722959
77	7023675	7098851	7174026	7249199	7324371	7399542	7474711
78	7775375	7850538	7925699	8000860	8076019	8151176	8226332
79	8526945	8602094	8677243	8752390	8827536	8902681	8977824
5780	7619278384	9353521	9428657	9503791	9578924	9654055	9729186
81	7620029694	0104818	0179940	0255061	0330181	0405300	0480417
82	0780873	0855984	0931094	1006202	1081309	1156414	1231519
83	1531923	1607021	1682117	1757213	1832307	1907399	1982491
84	2282843	2357928	2433011	2508093	2583174	2658254	2733332
85	3033633	3108705	3183775	3258845	3333913	3408979	3484045
86	3784293	3859352	3934410	4009466	4084521	4159575	4234627
87	4534824	4609870	4684914	4759958	4835000	4910040	4985080
88	5285224	5360257	5435289	5510319	5585349	5660376	5735403
89	6035496	6110516	6185534	6260552	6335568	6410583	6485596
5790	7626785637	6860644	6935650	7010654	7085658	7160659	7235660
91	7535649	7610643	7685636	7760628	7835618	7910607	7985594
92	8285532	8360513	8435493	8510471	8585449	8660425	8735399
93	9035285	9110253	9185220	9260186	9335150	9410113	9485075
94	9784909	9859864	9934818	0009771	0084722	0159672	0234621
95	7630534403	0609345	0684286	0759226	0834165	0909102	0984038
96	1283768	1358697	1433625	1508552	1583478	1658402	1733325
97	2033004	2107920	2182835	2257749	2332662	2407573	2482483
98	2782110	2857014	2931916	3006817	3081717	3156615	3231512
99	3531087	3605978	3680867	3755755	3830642	3905528	3980412
5800	4279936	4354813	4429690	4504565	4579439	4654311	4729183

OF NUMBERS.

Logarithms 7589118924-7634953789.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9648519	9724170	9799820	75660	659	658	657	655	654	652	651	650	649
0404972	0480610	0556246	647	646	644	644	642	640	640	638	636	636
1161292	1236917	1312541	634	632	632	630	629	627	626	625	624	622
1917481	1993093	2068703	621	619	618	617	616	614	613	612	610	609
2673539	2749137	2824734	608	606	606	603	603	601	600	598	597	596
3429464	3505050	3580634	595	593	592	591	589	588	586	586	584	583
4185259	4260831	4336402	581	580	579	577	576	575	574	572	571	569
4940921	5016480	5092038	569	567	565	564	563	562	560	559	558	557
5696453	5771999	5847543	555	554	552	551	550	549	547	546	544	543
6451853	6527385	6602917	542	541	539	538	537	535	535	532	532	530
7207121	7282641	7358159	75529	527	526	525	524	522	521	520	518	517
7962258	8037765	8113270	516	514	513	512	510	509	508	507	505	504
8717264	8792757	8868250	502	502	499	499	497	496	495	493	493	490
9472139	9547619	9623098	490	488	487	485	484	483	482	480	479	478
0226882	0302349	0377815	476	475	474	472	471	470	468	467	466	465
0981495	1056949	1132401	463	462	460	460	458	456	456	454	452	452
1735976	1811417	1886856	450	449	447	446	445	444	442	441	439	439
2490326	2565754	2641180	437	435	435	436	431	431	429	428	426	425
3244545	3319960	3395373	424	423	421	420	419	417	416	415	413	412
3998633	4074035	4149435	411	410	408	407	405	404	403	402	400	399
4752591	4827979	4903366	75398	396	395	394	393	391	390	388	387	386
5506417	5581792	5657167	385	383	382	381	379	378	377	375	375	372
6260113	6335475	6410836	372	370	369	368	366	365	364	362	361	360
7013677	7089027	7164375	358	357	356	355	353	352	350	350	348	346
7767112	7842448	7917783	346	344	343	341	340	339	338	336	335	333
8520415	8595738	8671060	333	331	329	329	327	326	324	323	322	321
9273588	9348898	9424207	319	318	316	316	314	312	312	310	309	307
0026630	0101927	0177223	306	305	304	302	301	300	298	297	296	294
0779542	0854826	0930108	293	292	291	289	288	286	286	284	282	282
1532323	1607594	1682863	280	278	278	276	275	273	273	271	269	269
2284973	2360231	2435488	75267	265	265	263	262	260	259	258	257	255
3037494	3112738	3187982	254	253	251	250	249	247	247	244	244	242
3789883	3865115	3940346	241	240	238	237	236	234	233	232	231	229
4542143	4617362	4692579	228	227	225	224	223	221	220	219	217	216
5294272	5369478	5444682	215	214	212	211	210	208	207	206	204	204
6046271	6121464	6196655	202	200	199	198	197	195	194	193	191	191
6798140	6873320	6948498	188	188	186	185	184	182	181	180	178	177
7549879	7625046	7700211	176	175	173	172	171	169	168	167	165	164
8301487	8376641	8451794	163	161	161	159	157	156	155	154	153	151
9052966	9128107	9203246	149	149	147	146	145	143	142	141	139	138
9804315	9879442	9954569	75137	136	134	133	131	131	129	127	127	125
0555533	0630648	0705761	124	122	121	120	119	117	116	115	113	112
1306622	1381723	1456824	111	110	108	107	105	105	103	101	101	099
2057581	2132669	2207757	098	096	096	094	092	092	090	088	088	086
2808410	2883485	2958560	085	083	082	081	080	078	078	075	075	073
3559109	3634171	3709233	072	070	070	068	066	066	064	062	062	060
4309678	4384728	4459776	059	058	056	055	054	052	051	050	048	048
5060118	5135155	5210190	046	044	044	042	040	040	038	037	035	034
5810428	5885452	5960474	033	032	030	030	027	027	025	024	022	022
6560608	6635619	6710629	020	018	018	016	015	013	012	011	010	008
7310659	7385657	7460654	75007	006	004	004	001	001	999	998	997	995
8060581	8135566	8210549	74994	993	992	990	989	987	987	985	983	983
8810373	8885345	8960316	981	980	978	978	976	974	974	972	971	969
9560035	9634994	9709952	968	967	966	964	963	962	960	959	958	957
0309568	0384514	0459459	955	954	953	951	950	949	947	946	945	944
1058972	1133905	1208837	942	941	940	939	937	936	934	933	932	931
1808247	1883167	1958086	929	928	927	926	924	923	922	920	919	918
2557392	2632299	2707205	916	915	914	913	911	910	909	907	906	905
3306408	3381302	3456196	904	902	901	900	898	897	896	894	894	891
4055295	4130176	4205057	891	889	888	887	886	884	883	881	881	879
4804053	4878921	4953789	877	877	875	874	872	872	870	868	868	866

Numbers 58000–58609. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5800	7634279936	4354813	4429690	4504565	4579439	4654311	4729183
1	5028655	5103519	5178383	5253245	5328106	5402966	5477824
2	5777245	5852097	5926947	6001797	6076645	6151491	6226337
3	6525706	6600545	6675382	6750219	6825054	6899888	6974720
4	7274038	7348864	7423689	7498512	7573334	7648155	7722975
5	8022241	8097054	8171866	8246677	8321486	8396294	8471101
6	8770315	8845115	8919914	8994712	9069509	9144304	9219098
7	9518260	9593048	9667834	9742619	9817402	9892185	9966966
8	7640266077	0340852	0415625	0490397	0565168	0639937	0714705
9	1013765	1088526	1163287	1238046	1312804	1387560	1462316
5810	7641761324	1836073	1910820	1985567	2060312	2135055	2209798
11	2508754	2583490	2658225	2732958	2807691	2882421	2957151
12	3256056	3330779	3405501	3480222	3554941	3629659	3704376
13	4003230	4077940	4152649	4227356	4302063	4376768	4451472
14	4750274	4824972	4899668	4974363	5049056	5123749	5198440
15	5497191	5571875	5646558	5721240	5795921	5870601	5945279
16	6243979	6318650	6393321	6467990	6542658	6617324	6691990
17	6990638	7065297	7139954	7214611	7289266	7363920	7438572
18	7737169	7811815	7886460	7961103	8035746	8110387	8185026
19	8483572	8558205	8632837	8707468	8782097	8856725	8931352
5820	7649229846	9304467	9379086	9453704	9528320	9602936	9677550
21	9975993	0050600	0125207	0199812	0274416	0349018	0423619
22	7650722011	0796606	0871199	0945792	1020382	1094972	1169560
23	1467901	1542483	1617064	1691643	1766221	1840798	1915374
24	2213663	2288232	2362800	2437367	2511932	2586496	2661059
25	2959297	3033853	3108408	3182962	3257515	3332066	3406616
26	3704803	3779346	3853889	3928430	4002969	4077508	4152045
27	4450181	4524712	4599241	4673769	4748296	4822822	4897346
28	5195431	5269949	5344466	5418981	5493495	5568008	5642520
29	5940553	6015058	6089562	6164065	6238566	6313066	6387565
5830	7656685548	6760041	6834531	6909021	6983510	7057997	7132483
31	7430414	7504894	7579372	7653849	7728325	7802800	7877273
32	8175153	8249620	8324086	8398550	8473013	8547475	8621935
33	8919764	8994218	9068671	9143123	9217573	9292022	9366470
34	9664248	9738689	9813129	9887568	9962006	0036442	0110877
35	7660408604	0483032	0557460	0631886	0706310	0780734	0855156
36	1152832	1227248	1301663	1376076	1450488	1524899	1599308
37	1896933	1971336	2045738	2120139	2194538	2268936	2343332
38	2640907	2715297	2789686	2864074	2938460	3012845	3087229
39	3384753	3459130	3533506	3607881	3682255	3756628	3830999
5840	7664128471	4202836	4277200	4351562	4425923	4500283	4574641
41	4872062	4946415	5020765	5095115	5169463	5243810	5318156
42	5615526	5689866	5764204	5838541	5912876	5987211	6061544
43	6358863	6433190	6507515	6581839	6656162	6730484	6804804
44	7102073	7176387	7250699	7325011	7399321	7473630	7547937
45	7845155	7919456	7993756	8068055	8142352	8216648	8290943
46	8588110	8662399	8736686	8810972	8885257	8959540	9033822
47	9330938	9405214	9479489	9553762	9628034	9702305	9776574
48	7670073639	0147903	0222164	0296425	0370684	0444942	0519199
49	0816214	0890464	0964713	1038961	1113208	1187453	1261697
5850	7671558661	1632899	1707135	1781370	1855604	1929837	2004068
51	2300981	2375206	2449430	2523652	2597874	2672094	2746312
52	3043175	3117387	3191598	3265808	3340016	3414224	3488430
53	3785241	3859441	3933639	4007836	4082032	4156227	4230420
54	4527181	4601368	4675554	4749738	4823921	4898103	4972284
55	5268994	5343168	5417342	5491513	5565684	5639853	5714021
56	6010681	6084842	6159003	6233162	6307320	6381476	6455632
57	6752240	6826389	6900537	6974684	7048829	7122973	7197115
58	7493673	7567810	7641945	7716079	7790211	7864343	7938473
59	8234980	8309104	8383226	8457347	8531467	8605586	8679703
5860	8976160	9050271	9124381	9198490	9272597	9346703	9420808

OF NUMBERS. Logarithms 7634279936–7679643114.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4804053	4878921	4953789	74877	877	875	874	872	872	870	868	868	866
5552681	5627537	5702391	864	864	862	861	860	858	857	856	854	854
6301181	6376024	6450865	852	850	850	848	846	846	844	843	841	841
7049552	7124382	7199210	839	837	837	835	834	832	832	830	828	828
7797793	7872610	7947426	826	825	823	822	821	820	818	817	816	815
8545906	8620710	8695513	813	812	811	809	808	807	805	804	803	802
9293890	9368682	9443472	800	799	798	797	795	794	792	792	790	788
0041745	0116524	0191301	788	786	785	783	783	781	779	779	777	776
0789472	0864237	0939002	775	773	772	771	769	768	767	765	765	763
1537070	1611822	1686574	761	761	759	758	756	756	754	752	752	750
2284539	2359279	2434017	74749	747	747	745	743	743	741	740	738	737
3031879	3106606	3181332	736	735	733	733	730	730	728	727	726	724
3779091	3853805	3928518	723	722	721	719	718	717	715	714	713	712
4526174	4600876	4675576	710	709	707	707	705	704	702	702	700	698
5273129	5347818	5422505	698	696	695	693	693	691	689	689	687	686
6019956	6094631	6169306	684	683	682	681	680	678	677	675	675	673
6766654	6841316	6915978	671	671	669	668	666	666	664	662	662	660
7513223	7587873	7662522	659	657	657	655	654	652	651	650	649	647
8259665	8334302	8408937	646	645	643	643	641	639	639	637	635	635
9005978	9080602	9155225	633	632	631	629	628	627	626	624	623	621
9752162	9826774	9901384	74621	619	618	616	616	614	612	612	610	609
0498219	0572818	0647415	607	607	605	604	602	601	600	599	597	596
1244148	1318733	1393318	595	593	593	590	590	588	588	585	585	583
1989948	2064521	2139093	582	581	579	578	577	576	574	573	572	570
2735620	2810180	2884739	569	568	567	565	564	563	561	560	559	558
3481165	3555712	3630258	556	555	554	553	551	550	549	547	546	545
4226581	4301116	4375649	543	543	541	539	539	537	536	535	533	532
4971869	5046391	5120912	531	529	528	527	526	524	523	522	521	519
5717030	5791539	5866047	518	517	515	514	513	512	510	509	508	506
6462063	6536559	6611054	505	504	503	501	500	499	498	496	495	494
7206968	7281451	7355933	74493	490	490	489	487	486	485	483	482	481
7951745	8026216	8100685	480	478	477	476	475	473	472	471	469	468
8696394	8770852	8845309	467	466	464	463	462	460	459	458	457	455
9440916	9515361	9589805	454	453	452	450	449	448	446	445	444	443
0185310	0259743	0334174	441	440	439	438	436	435	433	433	431	430
0929577	1003997	1078415	428	428	426	424	424	422	421	420	418	417
1673716	1748123	1822529	416	415	413	412	411	409	408	407	406	404
2417728	2492122	2566515	403	402	401	399	398	396	396	394	393	392
3161612	3235994	3310374	390	389	388	386	385	384	383	382	380	379
3905369	3979738	4054105	377	376	375	374	373	371	370	369	367	366
4648998	4723354	4797709	74365	364	362	361	360	358	357	356	355	353
5392501	5466844	5541186	353	350	350	348	347	346	345	343	342	340
6135875	6210206	6284535	340	338	337	335	335	333	331	331	329	328
6879123	6953441	7027757	327	325	324	323	322	320	319	318	316	316
7622244	7696549	7770852	314	312	312	310	309	307	307	305	303	303
8365237	8439529	8513820	301	300	299	297	296	295	294	292	291	290
9108103	9182383	9256661	289	287	286	285	283	282	281	280	278	277
9850843	9925109	9999375	276	275	273	272	271	269	269	266	266	264
0593455	0667709	0741962	264	261	261	259	258	257	256	254	253	252
1335940	1410182	1484422	250	249	248	247	245	244	243	242	240	239
2078298	2152527	2226755	74238	236	235	234	233	231	230	229	228	226
2820530	2894746	2968961	225	224	222	222	220	218	218	216	215	214
3562634	3636838	3711040	212	211	210	208	208	206	204	204	202	201
4304612	4378803	4452993	200	198	197	196	195	193	192	191	190	188
5046463	5120642	5194818	187	186	184	183	182	181	179	179	176	176
5788188	5862353	5936518	174	174	171	171	169	168	167	165	165	163
6529786	6603938	6678090	161	161	159	158	156	156	154	152	152	150
7271257	7345397	7419536	149	148	147	145	144	142	142	140	139	137
8012601	8086729	8160855	137	135	134	132	132	130	128	128	126	125
8753819	8827934	8902048	124	122	121	120	119	117	116	115	114	112
9494911	9569013	9643114	111	110	109	107	106	105	103	102	101	100

Numbers 58600–59209. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5860	7678976160	9050271	9124381	9198490	9272597	9346703	9420808
61	9717214	9791312	9865409	9939505	0013600	0087693	0161785
62	7680458141	0532227	0606311	0680395	0754477	0828557	0902637
63	1198942	1273015	1347087	1421157	1495227	1569295	1643362
64	1939616	2013677	2087736	2161794	2235851	2309906	2383960
65	2680165	2754212	2828259	2902304	2976348	3050391	3124433
66	3420586	3494622	3568656	3642688	3716720	3790750	3864779
67	4160882	4234905	4308926	4382946	4456965	4530983	4604999
68	4901052	4975062	5049070	5123078	5197084	5271089	5345093
69	5641095	5715093	5789089	5863084	5937077	6011070	6085061
5870	7686381012	6454997	6528981	6602963	6676944	6750924	6824902
71	7120804	7194776	7268747	7342717	7416685	7490652	7564618
72	7860469	7934429	8008387	8082344	8156300	8230254	8304208
73	8600008	8673955	8747901	8821846	8895789	8969731	9043672
74	9339422	9413356	9487289	9561221	9635152	9709081	9783010
75	7690078709	0152631	0226552	0300471	0374389	0448306	0522222
76	0817871	0891780	0965688	1039595	1113501	1187405	1261308
77	1556907	1630804	1704699	1778593	1852486	1926378	2000268
78	2295817	2369701	2443584	2517466	2591346	2665225	2739103
79	3034602	3108473	3182344	3256213	3330081	3403947	3477812
5880	7693773261	3847120	3920977	3994834	4068689	4142543	4216396
81	4511794	4585640	4659486	4733330	4807172	4881014	4954854
82	5250202	5324036	5397868	5471700	5545530	5619358	5693186
83	5988484	6062305	6136125	6209944	6283762	6357578	6431393
84	6726641	6800449	6874257	6948063	7021868	7095672	7169474
85	7464672	7538468	7612263	7686057	7759849	7833640	7907430
86	8202578	8276361	8350144	8423925	8497705	8571484	8645261
87	8940358	9014129	9087899	9161668	9235435	9309201	9382966
88	9678013	9751772	9825529	9899285	9973040	0046794	0120546
89	7700415543	0489289	0563034	0636778	0710520	0784261	0858001
5890	7701152948	1226681	1300414	1374145	1447875	1521603	1595331
91	1890227	1963948	2037668	2111387	2185104	2258820	2332535
92	2627382	2701090	2774798	2848504	2922208	2995912	3069614
93	3364411	3438107	3511802	3585495	3659188	3732879	3806568
94	4101315	4174999	4248681	4322362	4396042	4469720	4543398
95	4838094	4911765	4985435	5059104	5132771	5206437	5280102
96	5574749	5648407	5722064	5795720	5869375	5943029	6016681
97	6311278	6384924	6458569	6532212	6605855	6679496	6753135
98	7047682	7121316	7194948	7268579	7342209	7415838	7489465
99	7783962	7857583	7931203	8004821	8078439	8152055	8225670
5900	7708520116	8593725	8667332	8740939	8814543	8888147	8961749
1	9256146	9329743	9403337	9476931	9550523	9624115	9697705
2	9992052	0065635	0139218	0212799	0286379	0359958	0433536
3	7710727832	0801403	0874973	0948542	1022110	1095676	1169241
4	1463488	1537047	1610604	1684161	1757716	1831269	1904822
5	2199019	2272566	2346111	2419655	2493197	2566738	2640279
6	2934426	3007960	3081493	3155024	3228554	3302083	3375611
7	3669709	3743230	3816750	3890269	3963787	4037303	4110818
8	4404866	4478375	4551883	4625389	4698895	4772399	4845901
9	5139900	5213396	5286892	5360386	5433878	5507370	5580860
5910	7715874809	5948293	6021776	6095257	6168738	6242217	6315695
11	6609593	6683065	6756536	6830005	6903473	6976939	7050405
12	7344254	7417713	7491171	7564628	7638083	7711537	7784990
13	8078790	8152237	8225682	8299127	8372570	8446011	8519452
14	8813202	8886636	8960069	9033501	9106932	9180361	9253789
15	9547490	9620912	9694332	9767752	9841170	9914587	9988003
16	7720281653	0355063	0428471	0501878	0575284	0648689	0722092
17	1015693	1089090	1162486	1235880	1309274	1382666	1456057
18	1749608	1822993	1896376	1969759	2043140	2116519	2189898
19	2483400	2556772	2630143	2703513	2776882	2850249	2923615
5920	3217067	3290427	3363786	3437143	3510500	3583855	3657208

OF NUMBERS. Logarithms 7678976160–7723877262

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9494911	9569013	9643114	74111	110	109	107	106	105	103	102	101	100
0235876	0309966	0384054	098	097	096	095	093	092	091	090	088	087
0976715	1050792	1124867	086	084	084	082	080	080	078	077	075	075
1717427	1791492	1865555	073	072	070	070	068	067	065	065	063	061
2458013	2532065	2606115	061	059	058	057	055	054	053	052	050	050
3198473	3272512	3346550	047	047	045	044	043	042	040	039	038	036
3938807	4012833	4086858	036	034	032	032	030	029	028	026	025	024
4679014	4753028	4827040	023	021	020	019	018	016	015	014	012	012
5419095	5493097	5567096	010	008	008	006	005	004	002	002	999	999
6159051	6233039	6307026	73998	996	995	993	993	991	990	988	987	986
6898880	6972856	7046830	73985	984	982	981	980	978	978	976	974	974
7638583	7712546	7786508	972	971	970	968	967	966	965	963	962	961
8378160	8452111	8526060	960	958	957	956	954	954	952	951	949	948
9117611	9191549	9265486	947	946	945	943	942	941	939	938	937	936
9856936	9930862	0004786	934	933	932	931	929	929	926	926	924	923
0596136	0670049	0743961	922	921	919	918	917	916	914	913	912	910
1335210	1409110	1483009	909	908	907	906	904	903	902	900	899	898
2074157	2148045	2221932	897	895	894	893	892	890	889	888	887	885
2812980	2886855	2960729	884	883	882	880	879	878	877	875	874	873
3551676	3625539	3699401	871	871	869	868	866	865	864	863	862	860
4290247	4364097	4437946	73859	857	857	855	854	853	851	850	849	848
5028693	5102530	5176367	846	846	844	842	842	840	839	837	837	835
5767012	5840837	5914661	834	832	832	830	828	828	826	825	824	823
6505207	6579019	6652831	821	820	819	818	816	815	814	812	812	810
7243276	7317076	7390874	808	808	806	805	804	802	802	800	798	798
7981219	8055007	8128793	796	795	794	792	791	790	789	788	786	785
8719037	8792812	8866586	783	783	781	780	779	777	776	775	774	772
9456730	9530492	9604253	771	770	769	767	766	765	764	762	761	760
0194297	0268047	0341796	759	757	756	755	754	752	751	750	749	747
0931740	1005477	1079213	746	745	744	742	741	740	739	737	736	735
1669057	1742781	1816505	73733	733	731	730	728	728	726	724	724	722
2406249	2479961	2553672	721	720	719	717	716	715	714	712	711	710
3143315	3217015	3290714	708	708	706	704	704	702	701	700	699	697
3880257	3953944	4027630	696	695	693	693	691	689	689	687	686	685
4617074	4690748	4764422	684	682	681	680	678	678	676	674	674	672
5353765	5427428	5501089	671	670	669	667	666	665	663	663	661	660
6090332	6163982	6237630	658	657	656	655	654	652	651	650	648	648
6826774	6900411	6974047	646	645	643	643	641	639	639	637	636	635
7563091	7636716	7710339	634	632	631	630	629	627	626	625	623	623
8299283	8372895	8446507	621	620	618	618	616	615	613	612	612	609
9035351	9108950	9182549	73609	607	607	604	604	602	602	599	599	597
9771293	9844881	9918467	597	594	594	592	592	590	588	588	586	585
0507111	0580686	0654260	583	583	581	580	579	577	576	575	574	572
1242804	1316367	1389928	571	570	569	568	566	565	563	563	561	560
1978373	2051923	2125472	559	557	557	555	553	553	551	550	549	547
2713817	2787355	2860891	547	545	544	542	541	541	538	538	536	535
3449137	3522662	3596186	534	533	531	530	529	528	526	525	524	523
4184332	4257845	4331356	521	520	519	518	516	515	514	513	511	510
4919403	4992903	5066402	509	508	506	506	504	502	502	500	499	498
5654349	5727837	5801324	496	496	494	492	492	490	489	488	487	485
6389171	6462646	6536121	73484	483	481	481	479	478	476	475	475	472
7123869	7197332	7270793	472	471	469	468	466	466	464	463	461	461
7858442	7931893	8005342	459	458	457	455	454	453	452	451	449	448
8592891	8666329	8739766	447	445	445	443	441	441	439	438	437	436
9327216	9400642	9474066	434	433	432	431	429	428	427	426	424	424
0061417	0134830	0208242	422	420	420	418	417	416	414	413	412	411
0795494	0868895	0942294	410	408	407	406	405	403	402	401	399	399
1529447	1602835	1676222	397	396	394	394	392	391	390	388	387	386
2263275	2336651	2410026	385	383	383	381	379	379	377	376	375	374
2996980	3070344	3143706	372	371	370	369	367	366	365	364	362	361
3730561	3803912	3877262	360	359	357	357	355	353	353	351	350	349

Numbers 59200–59809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5920	7723217067	3290427	3363786	3437143	3510500	3583855	3657208
21	3950611	4023958	4097305	4170650	4243994	4317336	4390678
22	4684031	4757366	4830700	4904032	4977364	5050694	5124023
23	5417326	5490649	5563971	5637291	5710610	5783928	5857245
24	6150498	6223809	6297118	6370426	6443733	6517038	6590342
25	6883547	6956845	7030142	7103437	7176732	7250025	7323316
26	7616471	7689757	7763042	7836325	7909607	7982887	8056167
27	8349272	8422546	8495818	8569089	8642358	8715627	8788894
28	9081950	9155211	9228470	9301729	9374986	9448242	9521497
29	9814503	9887752	9960999	0034245	0107490	0180734	0253976
5930	7730546934	0620170	0693405	0766639	0839871	0913102	0986332
31	1279240	1352464	1425687	1498908	1572128	1645347	1718565
32	2011424	2084635	2157845	2231054	2304262	2377469	2450674
33	2743483	2816683	2889881	2963077	3036273	3109467	3182660
34	3475420	3548607	3621792	3694977	3768160	3841342	3914522
35	4207233	4280407	4353581	4426753	4499924	4573093	4646262
36	4938923	5012085	5085246	5158406	5231564	5304721	5377877
37	5670489	5743639	5816788	5889935	5963081	6036226	6109370
38	6401933	6475070	6548206	6621342	6694475	6767608	6840739
39	7133253	7206378	7279502	7352625	7425746	7498867	7571986
5940	7737864450	7937563	8010674	8083785	8156894	8230002	8303109
41	8595524	8668624	8741724	8814822	8887919	8961015	9034109
32	9326475	9399563	9472650	9545736	9618821	9691904	9764986
43	7740057303	0130379	0203453	0276527	0349599	0422670	0495740
44	0788008	0861071	0934134	1007195	1080255	1153314	1226371
45	1518590	1591641	1664691	1737740	1810788	1883834	1956880
46	2249049	2322088	2395126	2468162	2541198	2614232	2687265
47	2979385	3052412	3125438	3198462	3271485	3344507	3417528
48	3709598	3782613	3855626	3928639	4001650	4074659	4147668
49	4439689	4512692	4585693	4658693	4731691	4804689	4877685
5950	7745169657	5242647	5315636	5388624	5461610	5534595	5607579
51	5899503	5972480	6045457	6118432	6191406	6264379	6337351
52	6629225	6702191	6775155	6848118	6921080	6994041	7067000
53	7358826	7431779	7504731	7577682	7650631	7723580	7796527
54	8088303	8161244	8234184	8307122	8380060	8452996	8525931
55	8817658	8890587	8963515	9036441	9109366	9182290	9255212
56	9546891	9619807	9692723	9765637	9838550	9911461	9984372
57	7750276001	0348905	0421808	0494710	0567611	0640510	0713408
58	1004989	1077881	1150772	1223661	1296550	1369437	1442323
59	1733854	1806734	1879613	1952490	2025366	2098241	2171115
5960	7752462597	2535465	2608331	2681197	2754060	2826923	2899785
61	3191218	3264074	3336928	3409781	3482632	3555483	3628332
62	3919717	3992560	4065402	4138243	4211082	4283920	4356758
63	4648093	4720924	4793754	4866583	4939410	5012236	5085061
64	5376348	5449167	5521984	5594800	5667615	5740429	5813242
65	6104480	6177287	6250092	6322896	6395699	6468500	6541301
66	6832490	6905285	6978078	7050870	7123660	7196450	7269238
67	7560378	7633161	7705941	7778721	7851500	7924277	7997053
68	8288145	8360915	8433683	8506451	8579217	8651982	8724746
69	9015789	9088547	9161303	9234058	9306812	9379565	9452317
5970	7759743311	9816057	9888801	9961544	0034286	0107027	0179766
71	7760470712	0543445	0616177	0688908	0761638	0834366	0907094
72	1197991	1270712	1343432	1416150	1488868	1561584	1634299
73	1925147	1997856	2070564	2143271	2215976	2288680	2361383
74	2652183	2724880	2797575	2870270	2942963	3015655	3088345
75	3379096	3451781	3524464	3597147	3669828	3742507	3815186
76	4105888	4178561	4251232	4323902	4396571	4469238	4541905
77	4832558	4905219	4977878	5050536	5123192	5195848	5268502
78	5559107	5631755	5704402	5777048	5849692	5922336	5994978
79	6285534	6358170	6430805	6503439	6576071	6648702	6721332
5980	7011840	7084464	7157086	7229708	7302328	7374947	7447565

OF NUMBERS. Logarithms 7723217067–7767665411.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3730561	3803912	3877262	73360	359	357	357	355	353	353	351	350	349
4464018	4537356	4610694	347	347	345	344	342	342	340	338	338	337
5197351	5270677	5344002	335	334	332	332	330	329	328	326	325	324
5930560	6003874	6077187	323	322	320	319	318	317	315	314	313	311
6663645	6736947	6810248	311	309	308	307	305	304	303	302	301	299
7396607	7469896	7543185	298	297	295	295	293	291	291	289	289	286
8129445	8202722	8275998	286	285	283	282	280	280	278	277	276	274
8862159	8935424	9008688	274	272	271	269	269	267	265	265	264	262
9594750	9668003	9741254	261	259	259	257	256	255	253	253	251	249
0327218	0400457	0473696	249	247	246	245	244	242	242	239	239	238
1059561	1132789	1206015	73236	235	234	232	231	230	229	228	226	225
1791782	1864997	1938211	224	223	221	220	219	218	217	215	214	213
2523878	2597081	2670283	211	210	209	208	207	205	204	203	202	200
3255852	3329042	3402232	200	198	196	196	194	193	192	190	190	188
3987702	4060880	4134057	187	185	185	183	182	180	180	178	177	176
4719429	4792595	4865759	174	174	172	171	169	169	167	166	164	164
5451032	5524186	5597338	162	161	160	158	157	156	155	154	152	151
6182513	6255654	6328794	150	149	147	146	145	144	143	141	140	139
6913870	6986999	7060126	137	136	136	133	133	131	131	129	127	127
7645104	7718220	7791336	125	124	123	121	121	119	118	116	116	114
8376215	8449319	8522422	73113	111	111	109	108	107	106	104	103	102
9107202	9180294	9253385	100	100	098	097	096	094	093	092	091	090
9838067	9911147	9984225	088	087	086	085	083	082	081	080	078	078
0568809	0641876	0714943	076	074	074	072	071	070	069	067	067	065
1299428	1372483	1445537	063	063	061	060	059	057	057	055	054	053
2029924	2102967	2176008	051	050	049	048	046	046	044	043	041	041
2760297	2833328	2906357	039	038	036	036	034	033	032	031	029	028
3490547	3563566	3636583	027	026	024	023	022	021	019	019	017	015
4220675	4293681	4366686	015	013	013	011	009	009	007	006	005	003
4950680	5023674	5096666	003	001	000	998	998	996	995	994	992	991
5680562	5753543	5826524	72990	989	988	986	985	984	983	981	981	979
6410321	6483291	6556259	977	977	975	974	973	972	970	970	968	966
7139958	7212915	7285871	966	964	963	962	961	959	958	957	956	955
7869473	7942417	8015361	953	952	951	949	949	947	946	944	944	942
8598865	8671797	8744728	941	940	938	938	936	935	934	932	931	930
9328134	9401054	9473973	929	928	926	925	924	922	922	920	919	918
0057281	0130189	0203095	916	916	914	913	911	911	909	908	906	906
0786305	0859201	0932096	904	903	902	901	899	898	897	896	895	893
1515207	1588091	1660973	892	891	889	889	887	886	884	884	882	881
2243987	2316859	2389729	880	879	877	876	875	874	872	872	870	868
2972645	3045504	3118362	72868	866	866	863	863	862	860	859	858	856
3701180	3774027	3846873	856	854	853	851	851	849	848	847	846	844
4429593	4502428	4575261	843	842	841	839	838	838	835	835	833	832
5157884	5230707	5303528	831	830	829	827	826	825	823	823	821	820
5886053	5958863	6031672	819	817	816	815	814	813	811	810	809	808
6614100	6686898	6759695	807	805	804	803	801	801	799	798	797	795
7342025	7414811	7487595	795	793	792	790	790	788	787	786	784	783
8069828	8142601	8215374	783	780	780	779	777	776	775	773	773	771
8797508	8870270	8943030	770	768	768	766	765	764	762	762	760	759
9525067	9597817	9670565	758	756	755	754	753	752	750	750	748	746
0252504	0325241	0397977	72746	744	743	742	741	739	738	737	736	735
0979820	1052545	1125268	733	732	731	730	728	728	726	725	723	723
1707013	1779726	1852437	721	720	718	718	716	715	714	713	711	710
2434085	2506785	2579485	709	708	707	705	704	703	702	700	700	698
3161035	3233723	3306410	697	695	695	693	692	690	690	688	687	686
3887863	3960539	4033214	685	683	683	681	679	679	677	676	675	674
4614570	4687234	4759897	673	671	670	669	667	667	665	664	663	661
5341155	5413807	5486458	661	659	658	656	656	654	653	652	651	649
6067619	6140258	6212897	648	647	646	644	644	642	641	639	639	637
6793961	6866588	6939215	636	635	634	632	631	630	629	627	627	625
7520182	7592797	7665411	624	622	622	620	619	618	617	615	614	613

Numbers 59800–60409. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
5980	7767011840	7084464	7157086	7229708	7302328	7374947	7447565
81	7738024	7810636	7883246	7955856	8028464	8101071	8173676
82	8464087	8536687	8609285	8681882	8754478	8827073	8899666
83	9190028	9262616	9335202	9407787	9480371	9552954	9625535
84	9915849	9988424	0060998	0133571	0206143	0278713	0351282
85	7770641547	0714111	0786673	0859233	0931793	1004351	1076909
86	1367125	1439676	1512226	1584775	1657322	1729868	1802413
87	2092581	2165120	2237658	2310195	2382730	2455264	2527797
88	2817917	2890444	2962969	3035494	3108017	3180539	3253060
89	3543131	3615646	3688159	3760671	3833183	3905693	3978201
5990	7774268224	4340727	4413228	4485728	4558227	4630725	4703222
91	4993196	5065686	5138176	5210664	5283151	5355637	5428121
92	5718047	5790525	5863003	5935479	6007953	6080427	6152899
93	6442777	6515243	6587708	6660172	6732635	6805097	6877557
94	7167386	7239840	7312293	7384745	7457196	7529645	7602094
95	7891874	7964317	8036757	8109197	8181636	8254073	8326509
96	8616242	8688672	8761101	8833528	8905955	8978380	9050804
97	9340488	9412906	9485323	9557739	9630153	9702566	9774978
98	7780064614	0137020	0209425	0281828	0354231	0426632	0499032
99	0788619	0861013	0933406	1005797	1078188	1150577	1222965
6000	7781512504	1584886	1657266	1729646	1802024	1874401	1946777
1	2236268	2308637	2381006	2453373	2525739	2598104	2670468
2	2959911	3032269	3104625	3176980	3249334	3321687	3394039
3	3683434	3755779	3828124	3900467	3972809	4045150	4117489
4	4406836	4479169	4551502	4623833	4696163	4768492	4840819
5	5130117	5202439	5274759	5347078	5419396	5491713	5564029
6	5853279	5925588	5997896	6070204	6142509	6214814	6287118
7	6576319	6648617	6720913	6793208	6865502	6937795	7010086
8	7299240	7371525	7443810	7516093	7588374	7660655	7732934
9	8022040	8094314	8166586	8238857	8311127	8383395	8455662
6010	7788744720	8816981	8889242	8961501	9033758	9106015	9178270
11	9467280	9539529	9611777	9684024	9756270	9828514	9900758
12	7790189719	0261956	0334193	0406428	0478661	0550894	0623125
13	0912038	0984264	1056488	1128711	1200933	1273153	1345372
14	1634238	1706451	1778663	1850874	1923084	1995292	2067500
15	2356317	2428518	2500718	2572917	2645115	2717311	2789507
16	3078276	3150465	3222653	3294840	3367026	3439210	3511394
17	3800115	3872292	3944468	4016643	4088817	4160989	4233161
18	4521834	4593999	4666163	4738326	4810488	4882649	4954808
19	5243433	5315587	5387739	5459890	5532039	5604188	5676335
6020	7795964913	6037054	6109194	6181333	6253471	6325607	6397743
21	6686272	6758401	6830530	6902657	6974782	7046907	7119030
22	7407512	7479629	7551745	7623860	7695974	7768087	7840198
23	8128632	8200737	8272841	8344944	8417046	8489147	8561246
24	8849632	8921725	8993818	9065909	9137999	9210087	9282175
25	9570512	9642594	9714674	9786753	9858831	9930908	0002983
26	7800291273	0363343	0435411	0507478	0579544	0651609	0723673
27	1011915	1083972	1156029	1228084	1300138	1372190	1444242
28	1732436	1804482	1876526	1948570	2020612	2092652	2164692
29	2452839	2524872	2596905	2668936	2740966	2812995	2885023
6030	7803173121	3245143	3317164	3389183	3461201	3533218	3605234
31	3893285	3965294	4037303	4109310	4181317	4253322	4325325
32	4613329	4685326	4757323	4829319	4901313	4973306	5045298
33	5333253	5405239	5477224	5549207	5621190	5693171	5765151
34	6053058	6125032	6197005	6268977	6340947	6412916	6484884
35	6772744	6844706	6916667	6988627	7060585	7132543	7204499
36	7492311	7564261	7636210	7708158	7780104	7852050	7923994
37	8211759	8283697	8355634	8427570	8499504	8571438	8643370
38	8931087	9003013	9074938	9146862	9218785	9290706	9362627
39	9650296	9722210	9794124	9866036	9937946	0009856	0081764
6040	7810369386	0441288	0513190	0585090	0656989	0728887	0800783

OF NUMBERS.

Logarithms 7767011840-7811016466.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7520182	7592797	7665411	72624	622	622	620	619	618	617	615	614	613
8246281	8318884	8391486	612	610	610	608	607	605	605	603	602	601
8972259	9044850	9117440	600	598	597	596	595	593	593	591	590	588
9698115	9770694	9843272	588	586	585	584	583	581	580	579	578	577
0423850	0496417	0568983	575	574	573	572	570	569	568	567	566	564
1149464	1222019	1294573	564	562	560	560	558	558	555	555	554	552
1874957	1947500	2020041	551	550	549	547	546	545	544	543	541	540
2600329	2672859	2745389	539	538	537	535	534	533	532	530	530	528
3325579	3398098	3470615	527	525	525	523	522	521	519	519	517	516
4050709	4123215	4195720	515	513	512	512	510	508	508	506	505	504
4775717	4848211	4920704	72503	501	500	499	498	497	495	494	493	492
5500604	5573086	5645567	490	490	488	487	486	484	483	482	481	480
6225371	6297841	6370309	478	478	476	474	474	472	472	470	468	468
6950016	7022474	7094931	466	465	464	463	462	460	459	458	457	455
7674541	7746986	7819431	454	453	452	451	449	449	447	445	445	443
8398944	8471378	8543810	443	440	440	439	437	436	435	434	432	432
9123227	9195649	9268069	430	429	427	427	425	424	423	422	420	419
9847389	9919799	9992207	418	417	416	414	413	412	411	410	408	407
0571431	0643828	0716224	406	405	403	403	401	400	399	397	396	395
1295351	1367737	1440121	394	393	391	391	389	388	386	386	384	383
2019151	2091525	2163897	72382	380	380	378	377	376	374	374	372	371
2742831	2815192	2887552	369	369	367	366	365	364	363	361	360	359
3466389	3538739	3611087	358	356	355	354	353	352	350	350	348	347
4189828	4262165	4334501	345	345	343	342	341	339	339	337	336	335
4913146	4985471	5057795	333	333	331	330	329	327	327	325	324	322
5636343	5708656	5780968	322	320	319	318	317	316	314	313	312	311
6359420	6431721	6504021	309	308	308	305	305	304	302	301	300	298
7082376	7154665	7226953	298	296	295	294	293	291	290	289	288	287
7805213	7877490	7949766	285	285	283	281	281	279	279	277	276	274
8527929	8600194	8672457	274	272	271	270	268	267	267	265	263	263
9250524	9322777	9395029	72261	261	259	257	257	255	254	253	252	251
9973000	0045241	0117481	249	248	247	246	244	244	242	241	240	238
0695355	0767584	0839812	237	237	235	233	233	231	230	229	228	226
1417590	1489807	1562023	226	224	223	222	220	219	218	217	216	215
2139706	2211911	2284114	213	212	211	210	208	208	206	205	203	203
2861701	2933894	3006085	201	200	199	198	196	196	194	193	191	191
3583576	3655757	3727936	189	188	187	186	184	184	182	181	179	179
4305331	4377500	4449668	177	176	175	174	172	172	170	169	168	166
5026966	5099123	5171279	165	164	163	162	161	159	158	157	156	154
5748481	5820626	5892770	154	152	151	149	149	147	146	145	144	143
6469877	6542010	6614142	72141	140	139	138	136	136	134	133	132	130
7191152	7263273	7335393	129	129	127	125	125	123	122	121	120	119
7912308	7984417	8056525	117	116	115	114	113	111	110	109	108	107
8633344	8705441	8777537	105	104	103	102	101	099	098	097	096	095
9354261	9426346	9498430	093	093	091	090	088	088	086	085	084	082
0075058	0147131	0219203	082	080	079	078	077	075	075	073	072	070
0795735	0867796	0939856	070	068	067	066	065	064	062	061	060	059
1516292	1588342	1660390	057	057	055	054	052	052	050	050	048	046
2236731	2308768	2380804	046	044	044	042	040	040	039	037	036	035
2957049	3029074	3101099	033	033	031	030	029	028	026	025	025	022
3677248	3749262	3821274	72022	021	019	018	017	016	014	014	012	011
4397328	4469329	4541330	009	009	007	007	005	003	003	001	001	999
5117288	5189278	5261266	71997	997	996	994	993	992	990	990	988	987
5837129	5909107	5981083	986	985	983	983	981	980	978	978	976	975
6556851	6628817	6700781	974	973	972	970	969	968	967	966	964	963
7276454	7348407	7420360	962	961	960	958	958	956	955	953	953	951
7995937	8067879	8139819	950	949	948	946	946	944	943	942	940	940
8715301	8787231	8859159	938	937	936	934	934	932	931	930	928	928
9434546	9506464	9578381	926	925	924	923	921	921	919	918	917	915
0153672	0225578	0297483	914	914	912	910	910	908	908	906	905	903
0872678	0944573	1016466	902	902	900	899	898	896	895	895	893	891

Numbers 60400–61009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6040	7810369386	0441288	0513190	0585090	0656989	0728887	0800783
41	1088357	1160248	1232137	1304025	1375912	1447798	1519683
42	1807209	1879088	1950966	2022842	2094717	2166591	2238464
43	2525942	2597809	2669675	2741539	2813402	2885264	2957125
44	3244557	3316412	3388265	3460118	3531969	3603819	3675668
45	3963052	4034895	4106737	4178577	4250417	4322255	4394092
46	4681428	4753260	4825089	4896918	4968746	5040572	5112397
47	5399686	5471505	5543323	5615140	5686956	5758770	5830584
48	6117825	6189632	6261438	6333243	6405047	6476850	6548651
49	6835845	6907641	6979435	7051228	7123020	7194811	7266600
6050	7817553747	7625530	7697313	7769094	7840874	7912653	7984430
51	8271529	8343301	8415072	8486841	8558609	8630376	8702142
52	8989194	9060953	9132712	9204470	9276226	9347981	9419735
53	9706739	9778487	9850234	9921980	9993724	0065467	0137210
54	7820424166	0495902	0567637	0639371	0711104	0782835	0854566
55	1141475	1213199	1284922	1356644	1428365	1500085	1571803
56	1858665	1930377	2002089	2073799	2145508	2217216	2288922
57	2575737	2647437	2719137	2790835	2862532	2934228	3005923
58	3292690	3364379	3436066	3507753	3579438	3651122	3722805
59	4009525	4081202	4152878	4224552	4296226	4367898	4439569
6060	7824726242	4797907	4869571	4941234	5012895	5084556	5156215
61	5442840	5514493	5586146	5657797	5729446	5801095	5872742
62	6159320	6230962	6302602	6374241	6445879	6517516	6589152
63	6875682	6947312	7018941	7090568	7162194	7233819	7305443
64	7591926	7663544	7735161	7806776	7878391	7950004	8021616
65	8308052	8379658	8451263	8522867	8594469	8666071	8737671
66	9024060	9095654	9167247	9238839	9310430	9382019	9453608
67	9739949	9811532	9883113	9954693	0026272	0097850	0169427
68	7830455721	0527292	0598861	0670430	0741997	0813563	0885128
69	1171375	1242934	1314492	1386048	1457603	1529158	1600711
6070	7831886911	1958458	2030004	2101549	2173092	2244634	2316176
71	2602329	2673864	2745398	2816931	2888463	2959994	3031523
72	3317629	3389152	3460675	3532196	3603716	3675235	3746752
73	4032811	4104323	4175834	4247343	4318851	4390358	4461864
74	4747876	4819376	4890875	4962372	5033869	5105364	5176858
75	5462823	5534311	5605798	5677284	5748769	5820252	5891734
76	6177652	6249128	6320604	6392078	6463551	6535022	6606493
77	6892363	6963828	7035292	7106754	7178215	7249675	7321134
78	7606957	7678410	7749862	7821313	7892762	7964210	8035657
79	8321434	8392875	8464315	8535754	8607192	8678628	8750063
6080	7839035793	9107222	9178650	9250077	9321503	9392928	9464352
81	9750034	9821452	9892868	9964284	0035698	0107111	0178523
82	7840464158	0535564	0606969	0678372	0749775	0821176	0892576
83	1178165	1249559	1320952	1392344	1463734	1535124	1606512
84	1892054	1963436	2034818	2106198	2177577	2248954	2320331
85	2605826	2677196	2748566	2819934	2891302	2962668	3034032
86	3319480	3390839	3462197	3533554	3604909	3676264	3747617
87	4033018	4104365	4175711	4247056	4318400	4389742	4461084
88	4746438	4817773	4889108	4960441	5031773	5103104	5174433
89	5459741	5531064	5602387	5673709	5745029	5816348	5887666
6090	7846172926	6244238	6315549	6386859	6458168	6529475	6600782
91	6885995	6957295	7028595	7099893	7171190	7242485	7313780
92	7598947	7670235	7741523	7812809	7884095	7955379	8026661
93	8311781	8383058	8454334	8525609	8596882	8668155	8739426
94	9024499	9095764	9167028	9238291	9309553	9380814	9452073
95	9737100	9808353	9879606	9950857	0022107	0093356	0164604
96	7850449583	0520825	0592066	0663306	0734544	0805781	0877017
97	1161950	1233180	1304410	1375638	1446864	1518090	1589314
98	1874200	1945419	2016636	2087853	2159068	2230282	2301494
99	2586334	2657540	2728746	2799951	2871154	2942356	3013558
6100	3298350	3369545	3440739	3511932	3583124	3654315	3725504

OF NUMBERS. Logarithms 78103693̄86–78539390̄65.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0872678	0944573	1016466	71902	902	900	899	898	896	895	895	893	891
1591566	1663448	1735330	891	889	888	887	886	885	883	882	882	879
2310335	2382205	2454075	879	878	876	875	874	873	871	870	870	867
3028985	3100843	3172701	867	866	864	863	862	861	860	858	858	856
3747516	3819362	3891208	855	853	853	851	850	849	848	846	846	844
4465928	4537763	4609596	843	842	840	840	838	837	836	835	833	832
5184221	5256044	5327866	832	829	829	828	826	825	824	823	822	820
5902396	5974207	6046016	819	818	817	816	814	814	812	811	809	809
6620452	6692251	6764048	807	806	805	804	803	801	801	799	797	797
7338389	7410176	7481962	796	794	793	792	791	789	789	787	786	785
8056207	8127982	8199756	71783	783	781	780	779	777	777	775	774	773
8773907	8845670	8917432	772	771	769	768	767	766	765	763	762	762
9491488	9563239	9634990	759	759	758	756	755	754	753	751	751	749
0208951	0280690	0352429	748	747	746	744	743	743	741	739	739	737
0926295	0998023	1069749	736	735	734	733	731	731	729	728	726	726
1643520	1715236	1786951	724	723	722	721	720	718	717	716	715	714
2360628	2432332	2504035	712	712	710	709	708	706	706	704	703	702
3077616	3149309	3221000	700	700	698	697	696	695	693	693	691	690
3794487	3866167	3937847	689	687	687	685	684	683	682	680	680	678
4511239	4582908	4654575	677	676	674	674	672	671	670	669	667	667
5227873	5299530	5371186	71665	664	663	661	661	659	658	657	656	654
5944389	6016034	6087678	653	653	651	649	649	647	647	645	644	642
6660786	6732419	6804051	642	640	639	638	637	636	634	633	632	631
7377065	7448687	7520307	630	629	627	626	625	624	622	622	620	619
8093227	8164836	8236445	618	617	615	615	613	612	611	609	609	607
8809270	8880868	8952464	606	605	604	602	602	600	599	598	596	596
9525195	9596781	9668366	594	593	592	591	589	589	587	586	585	583
0241002	0312576	0384149	583	581	580	579	578	577	575	574	573	572
0956691	1028254	1099815	571	569	569	567	566	565	563	563	561	560
1672262	1743813	1815362	559	558	556	555	555	553	551	551	549	549
2387716	2459255	2530792	71547	546	545	543	542	542	540	539	537	537
3103051	3174578	3246104	535	534	533	532	531	529	528	527	526	525
3818269	3889784	3961298	523	523	521	520	519	517	517	515	514	513
4533369	4604872	4676375	512	511	509	508	507	506	505	503	503	501
5248351	5319843	5391333	500	499	497	497	495	494	493	492	490	490
5963216	6034695	6106174	488	487	486	485	483	482	482	479	479	478
6677962	6749431	6820898	476	476	474	473	471	471	469	469	467	465
7392592	7464048	7535503	465	464	462	461	460	459	458	456	455	454
8107103	8178548	8249991	453	452	451	449	448	447	446	445	443	443
8821497	8892930	8964362	441	440	439	438	436	435	434	433	432	431
9535774	9607195	9678615	71429	428	427	426	425	424	422	421	420	419
0249933	0321343	0392751	418	416	416	414	413	412	410	410	408	407
0963975	1035373	1106769	406	405	403	403	401	400	399	398	396	396
1677899	1749285	1820670	394	393	392	390	390	388	387	386	385	384
2391706	2463081	2534454	382	382	380	379	377	377	375	375	373	372
3105396	3176759	3248120	370	370	368	368	366	364	364	363	361	360
3818969	3890319	3961669	359	358	357	355	355	353	352	350	350	349
4532424	4603763	4675101	347	346	345	344	342	342	340	339	338	337
5245762	5317089	5388416	335	335	333	332	331	329	329	327	327	325
5958983	6030299	6101613	323	323	322	320	319	318	317	316	314	313
6672087	6743391	6814693	71312	311	310	309	307	307	305	304	302	302
7385073	7456366	7527657	300	300	298	297	295	295	293	293	291	290
8097943	8169224	8240503	288	288	286	286	284	282	282	281	279	278
8810696	8881965	8953232	277	276	275	273	273	271	270	269	267	267
9523332	9594589	9665845	265	264	263	262	261	259	259	257	256	255
0235850	0307096	0378340	253	253	251	250	249	248	246	246	244	243
0948252	1019486	1090719	242	241	240	238	237	236	235	234	233	231
1660538	1731760	1802981	230	230	228	226	226	224	224	222	221	219
2372706	2443916	2515126	219	217	217	215	214	212	212	210	210	208
3084757	3155956	3227154	206	206	205	203	202	202	199	199	198	196
3796692	3867879	3939065	195	194	193	192	191	189	188	187	186	185

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6100	7853298350	3369545	3440739	3511932	3583124	3654315	3725504
1	4010250	4081434	4152616	4223797	4294977	4366156	4437334
2	4722033	4793205	4864376	4935545	5006714	5077881	5149047
3	5433700	5504860	5576019	5647177	5718334	5789489	5860643
4	6145249	6216398	6287545	6358692	6429837	6500981	6572123
5	6856683	6927820	6998955	7070090	7141224	7212356	7283487
6	7568000	7639125	7710249	7781372	7852494	7923614	7994734
7	8279200	8350314	8421426	8492537	8563647	8634756	8705864
8	8990284	9061386	9132487	9203586	9274685	9345782	9416878
9	9701251	9772342	9843431	9914519	9985606	0056691	0127776
6110	7860412102	0483181	0554259	0625335	0696410	0767484	0838557
11	1122837	1193904	1264970	1336035	1407099	1478161	1549222
12	1833456	1904511	1975565	2046619	2117671	2188721	2259771
13	2543958	2615002	2686044	2757086	2828126	2899165	2970203
14	3254344	3325376	3396407	3467437	3538466	3609493	3680520
15	3964614	4035634	4106654	4177672	4248689	4319705	4390720
16	4674767	4745776	4816784	4887791	4958796	5029801	5100804
17	5384805	5455802	5526799	5597794	5668788	5739780	5810772
18	6094726	6165712	6236697	6307680	6378663	6449644	6520624
19	6804532	6875506	6946479	7017451	7088422	7159391	7230360
6120	7867514221	7585184	7656145	7727106	7798065	7869023	7939979
21	8223795	8294746	8365696	8436644	8507592	8578538	8649483
22	8933253	9004192	9075130	9146067	9217003	9287938	9358872
23	9642594	9713522	9784449	9855374	9926299	9997222	0068144
24	7870351820	0422736	0493652	0564565	0635478	0706390	0777300
25	1060930	1131835	1202738	1273641	1344542	1415442	1486341
26	1769925	1840818	1911710	1982600	2053490	2124378	2195266
27	2478803	2549685	2620565	2691444	2762322	2833199	2904075
28	3187566	3258436	3329305	3400173	3471039	3541904	3612768
29	3896214	3967072	4037929	4108785	4179640	4250494	4321346
6130	7874604745	4675592	4746438	4817282	4888125	4958968	5029809
31	5313161	5383997	5454831	5525664	5596495	5667326	5738155
32	6021462	6092286	6163108	6233929	6304750	6375569	6446387
33	6729647	6800459	6871270	6942080	7012889	7083696	7154502
34	7437716	7508517	7579317	7650115	7720912	7791708	7862503
35	8145671	8216460	8287248	8358034	8428820	8499604	8570388
36	8853509	8924287	8995063	9065839	9136613	9207386	9278157
37	9561233	9631999	9702764	9773527	9844290	9915051	9985812
38	7880268841	0339595	0410349	0481101	0551852	0622602	0693350
39	0976334	1047077	1117819	1188559	1259299	1330037	1400774
6140	7881683711	1754443	1825173	1895902	1966630	2037357	2108083
41	2390974	2461694	2532412	2603130	2673847	2744562	2815276
42	3098121	3168829	3239537	3310243	3380948	3451652	3522354
43	3805153	3875850	3946546	4017240	4087934	4158626	4229317
44	4512070	4582756	4653440	4724123	4794805	4865486	4936165
45	5218872	5289546	5360219	5430890	5501561	5572230	5642898
46	5925559	5996222	6066883	6137543	6208202	6278860	6349516
47	6632131	6702782	6773432	6844080	6914728	6985374	7056019
48	7338588	7409228	7479866	7550503	7621139	7691774	7762407
49	8044930	8115558	8186185	8256811	8327435	8398058	8468681
6150	7888751158	8821774	8892389	8963004	9033617	9104228	9174839
51	9457270	9527875	9598479	9669082	9739683	9810283	9880883
52	7890163268	0233861	0304454	0375045	0445635	0516224	0586811
53	0869151	0939733	1010314	1080893	1151472	1222049	1292626
54	1574919	1645490	1716059	1786627	1857194	1927760	1998325
55	2280573	2351132	2421690	2492246	2562802	2633356	2703910
56	2986112	3056659	3127206	3197751	3268295	3338838	3409380
57	3691536	3762072	3832607	3903141	3973674	4044205	4114736
58	4396846	4467370	4537894	4608416	4678938	4749458	4819977
59	5102041	5172554	5243066	5313577	5384087	5454596	5525103
6160	5807122	5877623	5948124	6018624	6089122	6159619	6230115

OF NUMBERS. Logarithms 7853298350–7896441596.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3796692	3867879	3939065	71195	194	193	192	191	189	188	187	186	185
4508510	4579686	4650860	184	182	181	180	179	178	176	176	174	173
5220212	5291376	5362538	172	171	169	169	167	166	165	164	162	162
5931797	6002949	6074100	160	159	158	157	155	154	154	152	151	149
6643265	6714405	6785545	149	147	147	145	144	142	142	140	140	138
7354617	7425746	7496873	137	135	135	134	132	131	130	129	127	127
8065852	8136969	8208085	125	124	123	122	120	120	118	117	116	115
8776971	8848076	8919181	114	112	111	110	109	108	107	105	105	103
9487973	9559067	9630160	102	101	099	099	097	096	095	094	093	091
0198859	0269942	0341023	091	089	088	087	085	085	083	083	081	079
0909629	0980700	1051769	71079	078	076	075	074	073	072	071	069	068
1620282	1691341	1762399	067	066	065	064	062	061	060	059	058	057
2330819	2401867	2472913	055	054	054	052	050	050	048	048	046	045
3041240	3112276	3183311	044	042	042	040	039	038	037	036	035	033
3751545	3822569	3893592	032	031	030	029	027	027	025	024	023	022
4461734	4532746	4603757	020	020	018	017	016	015	014	012	011	010
5171806	5242807	5313806	009	008	007	005	005	003	002	001	999	999
5881762	5952751	6023740	70997	997	995	994	992	992	990	989	989	986
6591603	6662580	6733557	986	985	983	983	981	980	979	977	977	975
7301327	7372293	7443258	974	973	972	971	969	969	967	966	965	963
8010935	8081890	8152843	70963	961	961	959	958	956	956	955	953	952
8720427	8791370	8862312	951	950	948	948	946	945	944	943	942	941
9429804	9500735	9571665	939	938	937	936	935	934	932	931	930	929
0139065	0209984	0280903	928	927	925	925	923	922	921	919	919	917
0848209	0919118	0990025	916	916	913	913	912	910	909	909	907	905
1557239	1628135	1699030	905	903	903	901	900	899	898	896	895	895
2266152	2337037	2407921	893	892	890	890	888	888	886	885	884	882
2974950	3045823	3116695	882	880	879	878	877	876	875	873	872	871
3683631	3754493	3825354	870	869	868	866	865	864	863	862	861	860
4392198	4463048	4533897	858	857	856	855	854	852	852	850	849	848
5100649	5171487	5242325	70847	846	844	843	843	841	840	838	838	836
5808984	5879811	5950637	836	834	833	831	831	829	829	827	826	825
6517203	6588019	6658834	824	822	821	821	819	818	816	816	815	813
7225308	7296112	7366915	812	811	810	809	807	806	806	804	803	801
7933296	8004089	8074880	801	800	798	797	796	795	793	793	791	791
8641170	8711951	8782731	789	788	786	786	784	784	782	781	780	778
9348928	9419697	9490466	778	776	776	774	773	771	771	769	769	767
0056571	0127329	0198085	766	765	763	763	761	761	759	758	756	756
0764098	0834844	0905590	754	754	752	751	750	748	748	746	746	744
1471510	1542245	1612979	743	742	740	740	738	737	736	735	734	732
2178807	2249531	2320253	70732	730	729	728	727	726	724	724	722	721
2885989	2956701	3027412	720	718	718	717	715	714	713	712	711	709
3593056	3663756	3734455	708	708	706	705	704	702	702	700	699	698
4300007	4370696	4441384	697	696	694	694	692	691	690	689	688	686
5006844	5077521	5148197	686	684	683	682	681	679	679	677	676	675
5713565	5784231	5854896	674	673	671	671	669	668	667	666	665	663
6420172	6490826	6561479	663	661	660	659	658	656	656	654	653	652
7126663	7197306	7267948	651	650	648	648	646	645	644	643	642	640
7833040	7903671	7974301	640	638	637	636	635	633	633	631	630	629
8539302	8609921	8680540	628	627	626	624	623	623	621	619	619	618
9245449	9316057	9386664	70616	615	615	613	611	611	610	608	607	606
9951481	0022078	0092673	605	604	603	601	600	600	598	597	595	595
0657398	0727983	0798568	593	593	591	590	589	587	587	585	585	583
1363201	1433775	1504347	582	581	579	579	577	577	575	574	572	572
2068889	2139451	2210012	571	569	568	567	566	565	564	562	561	561
2774462	2845013	2915563	559	558	556	556	554	554	552	551	550	549
3479921	3550460	3620999	547	547	545	544	543	542	541	539	539	537
4185265	4255793	4326320	536	535	534	533	531	531	529	528	527	526
4890494	4961011	5031527	524	524	522	522	520	519	517	517	516	514
5595609	5666115	5736619	513	512	511	510	509	507	506	506	504	503
6300610	6371104	6441596	501	501	500	498	497	496	495	494	492	492

Numbers 61600–62209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6169	7895807122	5877623	5948124	6018624	6089122	6159619	6230115
61	6512088	6582578	6653067	6723556	6794042	6864528	6935013
62	7216940	7287419	7357896	7428373	7498849	7569323	7639796
63	7921677	7992145	8062611	8133076	8203540	8274003	8344465
64	8626300	8696756	8767211	8837665	8908118	8978569	9049019
65	9330809	9401254	9471697	9542140	9612581	9683021	9753460
66	7900035204	0105637	0176069	0246500	0316930	0387358	0457786
67	0739484	0809906	0880327	0950746	1021164	1091582	1161998
68	1443650	1514061	1584470	1654878	1725285	1795691	1866095
69	2147702	2218101	2288499	2358896	2429291	2499686	2570079
6170	7902851640	2922028	2992414	3062799	3133184	3203566	3273948
71	3555464	3625840	3696215	3766589	3836962	3907333	3977704
72	4259174	4329539	4399902	4470265	4540626	4610986	4681345
73	4962770	5033123	5103475	5173826	5244176	5314525	5384872
74	5666251	5736593	5806934	5877274	5947612	6017950	6088286
75	6369619	6439950	6510279	6580607	6650935	6721261	6791585
76	7072873	7143192	7213510	7283827	7354143	7424458	7494771
77	7776013	7846321	7916628	7986933	8057238	8127541	8197843
78	8479040	8549336	8619631	8689925	8760218	8830510	8900801
79	9181952	9252237	9322521	9392804	9463085	9533366	9603645
6180	7909884751	9955025	0025297	0095568	0165839	0236108	0306376
81	7910587436	0657698	0727959	0798219	0868478	0938736	1008992
82	1290007	1360258	1430508	1500757	1571004	1641250	1711496
83	1992465	2062705	2132943	2203180	2273416	2343651	2413885
84	2694809	2765037	2835264	2905490	2975715	3045939	3116161
85	3397040	3467256	3537472	3607687	3677900	3748112	3818323
86	4099157	4169362	4239566	4309770	4379972	4450173	4520372
87	4801160	4871354	4941547	5011739	5081930	5152119	5222308
88	5503050	5573233	5643415	5713595	5783775	5853953	5924130
89	6204827	6274998	6345169	6415338	6485506	6555673	6625838
6190	7916906490	6976650	7046809	7116967	7187124	7257279	7327434
91	7608040	7678189	7748337	7818483	7888628	7958773	8028916
92	8309477	8379614	8449750	8519886	8590020	8660153	8730284
93	9010800	9080926	9151051	9221175	9291298	9361419	9431540
94	9712010	9782125	9852239	9922351	9992463	0062573	0132682
95	7920413107	0483211	0553313	0623414	0693514	0763613	0833711
96	1114091	1184183	1254274	1324364	1394453	1464540	1534627
97	1814961	1885042	1955122	2025201	2095278	2165354	2235430
98	2515719	2585789	2655857	2725924	2795990	2866055	2936119
99	3216364	3286422	3356479	3426535	3496590	3566643	3636696
6200	7923916895	3986942	4056988	4127032	4197076	4267118	4337160
1	4617313	4687349	4757384	4827417	4897449	4967480	5037510
2	5317619	5387643	5457667	5527689	5597710	5667729	5737748
3	6017812	6087825	6157837	6227847	6297857	6367866	6437873
4	6717891	6787893	6857894	6927893	6997892	7067889	7137885
5	7417858	7487849	7557838	7627826	7697814	7767800	7837784
6	8117712	8187692	8257670	8327647	8397623	8467597	8537571
7	8817454	8887422	8957389	9027354	9097319	9167282	9237245
8	9517083	9587039	9656995	9726949	9796902	9866855	9936806
9	7930216598	0286544	0356488	0426431	0496373	0566314	0636254
6210	7930916002	0985936	1055869	1125801	1195732	1265661	1335590
11	1615292	1685215	1755137	1825058	1894977	1964896	2034813
12	2314471	2384382	2454293	2524202	2594110	2664017	2733923
13	3013536	3083437	3153336	3223234	3293131	3363027	3432921
14	3712489	3782378	3852266	3922153	3992039	4061924	4131807
15	4411330	4481208	4551084	4620960	4690835	4760708	4830580
16	5110058	5179925	5249790	5319654	5389518	5459380	5529241
17	5808674	5878529	5948383	6018237	6088089	6157939	6227789
18	6507177	6577021	6646864	6716706	6786547	6856387	6926225
19	7205568	7275401	7345233	7415064	7484893	7554722	7624549
6220	7903847	7973669	8043489	8113309	8183127	8252944	8322760

OF NUMBERS. Logarithms 7895807122–7938532202.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6300610	6371104	6441596	70501	501	500	498	497	496	495	494	492	492
7005496	7075979	7146460	490	489	489	486	486	485	483	483	481	480
7710268	7780739	7851209	479	477	477	476	474	473	472	471	470	468
8414926	8485385	8555843	468	466	465	464	463	462	461	459	458	457
9119469	9189917	9260364	456	455	454	453	451	450	450	448	447	445
9823898	9894334	9964770	445	443	443	441	440	439	438	436	436	434
0528212	0598637	0669061	433	432	431	430	428	428	426	425	424	423
1232413	1302826	1373239	422	421	419	418	418	416	415	413	413	411
1936499	2006901	2077302	411	409	408	407	406	404	404	402	401	400
2640471	2710862	2781252	399	398	397	395	395	393	392	391	390	388
3344329	3414709	3485087	70388	386	385	385	382	382	381	380	378	377
4048073	4118441	4188808	376	375	374	373	371	371	369	368	367	366
4751703	4822060	4892415	365	363	363	361	360	359	358	357	355	355
5455219	5525564	5595908	353	352	351	350	349	347	347	345	344	343
6158621	6228955	6299288	342	341	340	338	338	336	335	334	333	331
6861909	6932232	7002553	331	329	328	328	326	324	324	323	321	320
7565083	7635394	7705704	319	318	317	316	315	313	312	311	310	309
8268144	8338444	8408742	308	307	305	305	303	302	301	300	298	298
8971090	9041379	9111666	296	295	294	293	292	291	289	289	287	286
9673923	9744200	9814476	285	284	283	281	281	279	278	277	276	275
0376642	0446908	0517173	70274	272	271	271	269	268	266	266	265	263
1079248	1149502	1219755	262	261	260	259	258	256	256	254	253	252
1781740	1851983	1922224	251	250	249	247	246	246	244	243	241	241
2484118	2554349	2624580	240	238	237	236	235	234	233	231	231	229
3186382	3256603	3326822	228	227	226	225	224	222	221	221	219	218
3888533	3958742	4028950	216	216	215	213	212	211	210	209	208	207
4590571	4660769	4730965	205	204	204	202	201	199	199	198	196	195
5292495	5362681	5432866	194	193	192	191	189	189	187	186	185	184
5994306	6064481	6134654	183	182	180	180	178	177	176	175	173	173
6696003	6766167	6836329	171	171	169	168	167	165	165	164	162	161
7397587	7467739	7537890	70160	159	158	157	155	155	153	152	151	150
8099058	8169198	8239338	149	148	146	145	145	143	142	140	140	139
8800415	8870544	8940673	137	136	136	134	133	131	131	129	129	127
9501659	9571777	9641894	126	125	124	123	121	121	119	118	117	116
0202790	0272897	0343003	115	114	112	112	110	109	108	107	106	104
0903808	0973903	1043998	104	102	101	100	099	098	097	095	095	093
1604712	1674796	1744880	092	091	090	089	087	087	085	084	084	081
2305504	2375577	2445648	081	080	079	077	076	076	074	073	071	071
3006182	3076244	3146304	070	068	067	066	065	064	063	062	060	060
3706747	3776798	3846847	058	057	056	055	053	053	051	051	049	048
4407200	4477239	4547277	70047	046	044	044	042	042	040	039	038	036
5107539	5177567	5247594	036	035	033	032	031	030	029	028	027	025
5807766	5877782	5947797	024	024	022	021	019	019	018	016	015	015
6507879	6577885	6647889	013	012	010	010	009	007	006	006	004	002
7207880	7277874	7347867	002	001	999	999	997	996	995	994	993	991
7907768	7977751	8047732	69991	989	988	988	986	984	984	983	981	980
8607543	8677515	8747485	980	978	977	976	974	974	972	972	970	969
9307206	9377166	9447125	968	967	965	965	963	963	961	960	959	958
0006756	0076704	0146652	956	956	954	953	953	951	950	948	948	946
0706193	0776130	0846067	946	944	943	942	941	940	939	937	937	935
1405517	1475443	1545368	69934	933	932	931	929	929	927	926	925	924
2104729	2174644	2244558	923	922	921	919	919	917	916	915	914	913
2803828	2873732	2943635	911	911	909	908	907	906	905	904	903	901
3502815	3572708	3642599	901	899	898	897	896	894	894	893	891	890
4201689	4271571	4341451	889	888	887	886	885	883	882	882	880	879
4900451	4970321	5040190	878	876	876	875	873	872	871	870	869	868
5599101	5668960	5738817	867	865	864	864	862	861	860	859	857	857
6297638	6367485	6437332	855	854	854	852	850	850	849	847	847	845
6996063	7065899	7135734	844	843	842	841	840	838	838	836	835	834
7694375	7764200	7834024	833	832	831	829	829	827	826	825	824	823
8392575	8462389	8532202	822	820	820	818	817	816	815	814	813	811

Numbers 62200–62809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6220	7937903847	7973669	8043489	8113309	8183127	8252944	8322760
21	8602013	8671824	8741633	8811441	8881249	8951055	9020859
22	9300068	9369867	9439665	9509462	9579258	9649053	9718846
23	9998010	0067798	0137585	0207371	0277155	0346939	0416721
24	7940695840	0765617	0835392	0905167	0974940	1044713	1114484
25	1393558	1463323	1533088	1602851	1672613	1742375	1812135
26	2091163	2160918	2230671	2300423	2370174	2439924	2509673
27	2788657	2858400	2928143	2997884	3067623	3137362	3207100
28	3486039	3555771	3625502	3695232	3764960	3834688	3904414
29	4183309	4253030	4322749	4392468	4462185	4531902	4601617
6230	7944880467	4950176	5019885	5089592	5159298	5229004	5298708
31	5577513	5647211	5716908	5786605	5856300	5925994	5995686
32	6274447	6344134	6413820	6483505	6553189	6622872	6692553
33	6971269	7040945	7110620	7180294	7249967	7319638	7389309
34	7667979	7737644	7807308	7876971	7946632	8016293	8085952
35	8364578	8434232	8503884	8573536	8643186	8712836	8782484
36	9061065	9130708	9200349	9269989	9339629	9409267	9478904
37	9757441	9827072	9896702	9966331	0035959	0105586	0175212
38	7950453704	0523324	0592944	0662562	0732178	0801794	0871409
39	1149856	1219465	1289073	1358680	1428286	1497891	1567494
6240	7951845897	1915495	1985092	2054687	2124282	2193875	2263468
41	2541826	2611413	2680998	2750583	2820166	2889748	2959330
42	3237643	3307219	3376793	3446367	3515939	3585510	3655080
43	3933349	4002914	4072477	4142039	4211601	4281161	4350719
44	4628944	4698497	4768049	4837601	4907151	4976699	5046247
45	5324427	5393969	5463510	5533050	5602589	5672127	5741664
46	6019799	6089330	6158860	6228389	6297917	6367443	6436969
47	6715059	6784579	6854098	6923616	6993133	7062648	7132162
48	7410209	7479717	7549225	7618732	7688237	7757742	7827245
49	8105247	8174744	8244241	8313736	8383231	8452724	8522216
6250	7958800173	8869660	8939145	9008630	9078113	9147595	9217076
51	9494989	9564464	9633939	9703412	9772884	9842355	9911825
52	7960189693	0259158	0328621	0398083	0467544	0537004	0606463
53	0884287	0953740	1023192	1092643	1162093	1231542	1300989
54	1578769	1648211	1717652	1787092	1856531	1925969	1995405
55	2273140	2342571	2412001	2481430	2550858	2620284	2689710
56	2967401	3036820	3106239	3175657	3245074	3314489	3383903
57	3661550	3730959	3800366	3869773	3939178	4008583	4077986
58	4355588	4424986	4494382	4563778	4633172	4702566	4771958
59	5049516	5118902	5188288	5257672	5327055	5396438	5465819
6260	7965743332	5812708	5882082	5951455	6020828	6090199	6159569
61	6437038	6506402	6575766	6645128	6714489	6783849	6853208
62	7130633	7199986	7269339	7338690	7408040	7477389	7546737
63	7824117	7893459	7962801	8032141	8101480	8170818	8240154
64	8517490	8586822	8656152	8725481	8794809	8864136	8933461
65	9210753	9280073	9349393	9418711	9488027	9557343	9626658
66	9903905	9973215	0042523	0111830	0181135	0250440	0319744
67	7970596947	0666245	0735542	0804838	0874133	0943426	1012719
68	1289878	1359165	1428451	1497736	1567019	1636302	1705583
69	1982698	2051974	2121249	2190523	2259796	2329067	2398338
6270	7972675408	2744673	2813937	2883200	2952461	3021722	3090981
71	3368008	3437262	3506514	3575766	3645017	3714266	3783514
72	4060497	4129740	4198981	4268222	4337461	4406700	4475937
73	4752875	4822107	4891338	4960567	5029796	5099023	5168250
74	5445144	5514364	5583584	5652803	5722020	5791236	5860452
75	6137302	6206511	6275720	6344927	6414134	6483339	6552543
76	6829349	6898548	6967745	7036942	7106137	7175332	7244525
77	7521287	7590474	7659661	7728846	7798031	7867214	7936396
78	8213114	8282290	8351466	8420640	8489814	8558986	8628157
79	8904831	8973996	9043161	9112324	9181487	9250648	9319808
6280	9596437	9665592	9734746	9803898	9873049	9942199	0011349

OF NUMBERS. Logarithms 7937903847-7980218789.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8392575	8462389	8532202	69822	820	820	818	817	816	815	814	813	811
9090663	9160466	9230267	811	809	808	808	806	804	804	803	801	801
9788639	9858430	9928221	799	798	797	796	795	793	793	791	791	789
0486503	0556283	0626062	788	787	786	784	784	782	782	780	779	778
1184254	1254023	1323791	777	775	775	773	773	771	770	769	768	767
1881894	1951651	2021408	765	765	763	762	762	760	759	757	757	755
2579421	2649167	2718913	755	753	752	751	750	749	748	746	746	744
3276836	3346572	3416306	743	743	741	739	739	738	736	736	734	733
3974140	4043864	4113587	732	731	730	728	728	726	726	724	723	722
4671331	4741044	4810756	721	719	719	717	717	715	714	713	712	711
5368411	5438112	5507813	69709	709	707	706	706	704	703	701	701	700
6065378	6135069	6204758	698	697	697	695	694	692	692	691	689	689
6762234	6831913	6901592	687	686	685	684	683	681	681	679	679	677
7458978	7528646	7598313	676	675	674	673	671	671	669	668	667	666
8155610	8225267	8294923	665	664	663	661	661	659	658	657	656	655
8852131	8921777	8991421	654	652	652	650	650	648	647	646	644	644
9548540	9618174	9687808	643	641	640	640	638	637	636	634	634	633
0244837	0314460	0384083	631	630	629	628	627	626	625	623	623	621
0941022	1010635	1080246	620	620	618	616	616	615	613	613	611	610
1637096	1706698	1776298	609	608	607	606	605	603	602	602	600	599
2333059	2402649	2472238	69598	597	595	595	593	593	591	590	589	588
3028910	3098489	3168067	587	585	585	583	582	582	580	579	578	576
3724649	3794217	3863784	576	574	574	572	571	570	569	568	567	565
4420277	4489834	4559389	565	563	562	562	560	558	558	557	555	555
5115794	5185339	5254884	553	552	552	550	548	548	547	545	545	543
5811199	5880733	5950267	542	541	540	539	538	537	535	534	534	532
6506493	6576016	6645538	531	530	529	528	526	526	524	523	522	521
7201676	7271188	7340699	520	519	518	517	515	514	514	512	511	510
7896747	7966248	8035748	508	508	507	505	505	503	502	501	500	499
8591707	8661197	8730686	497	497	495	495	493	492	491	490	489	487
9286556	9356035	9425512	69487	485	485	483	482	481	480	479	477	477
9981294	0050761	0120228	475	475	473	472	471	470	469	467	467	465
0675920	0745377	0814832	465	463	462	461	460	459	457	457	455	455
1370436	1439882	1509326	453	452	451	450	449	447	447	446	444	443
2064841	2134275	2203708	442	441	440	439	438	436	436	434	433	432
2759134	2828557	2897979	431	430	429	428	426	426	424	423	422	422
3453317	3522729	3592140	419	419	418	417	415	414	414	412	411	410
4147388	4216789	4286189	409	407	407	405	405	403	402	401	400	399
4841349	4910739	4980128	398	396	396	394	394	392	391	390	389	388
5535199	5604578	5673955	386	386	384	383	383	381	380	379	377	377
6228938	6298306	6367672	69376	374	373	373	371	370	369	368	366	366
6922566	6991923	7061278	364	364	362	361	360	359	358	357	355	355
7616083	7685429	7754774	353	353	351	350	349	348	346	346	345	343
8309490	8378825	8448158	342	342	340	339	338	336	336	335	333	332
9002786	9072110	9141432	332	330	329	328	327	325	325	324	322	321
9695971	9765284	9834595	320	320	318	316	316	315	313	313	311	310
0389046	0458348	0527648	310	308	307	305	305	304	302	302	300	299
1082010	1151301	1220590	298	297	296	295	293	293	291	291	289	288
1774864	1844143	1913421	287	286	285	283	283	281	281	279	278	277
2467607	2536875	2606142	276	275	274	273	271	271	269	268	267	266
3160240	3229497	3298753	69265	264	263	261	261	259	259	257	256	255
3852762	3922008	3991253	254	252	252	251	249	248	248	246	245	244
4545173	4614408	4683642	243	241	241	239	239	237	236	235	234	233
5237475	5306699	5375922	232	231	229	229	227	227	225	224	223	222
5929666	5998879	6068091	220	220	219	217	216	216	214	213	212	211
6621746	6690948	6760149	209	209	207	207	205	204	203	202	201	200
7313717	7382908	7452098	199	197	197	195	195	193	192	191	190	189
8005577	8074757	8143936	187	187	185	185	183	182	181	180	179	178
8697327	8766496	8835664	176	176	174	174	172	171	170	169	168	167
9388967	9458125	9527282	165	165	163	163	161	160	159	158	157	155
0080497	0149644	0218789	155	154	152	151	150	150	148	147	145	145

Numbers 62800–63409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6280	7979596437	9665592	9734746	9803898	9873049	9942199	0011349
81	7980287934	0357078	0426220	0495362	0564502	0633641	0702779
82	0979321	1048453	1117585	1186715	1255844	1324973	1394100
83	1670597	1739719	1808839	1877959	1947077	2016194	2085310
84	2361764	2430874	2499984	2569092	2638199	2707306	2776411
85	3052820	3121920	3191018	3260116	3329212	3398307	3467401
86	3743767	3812855	3881943	3951029	4020115	4089199	4158282
87	4434604	4503681	4572758	4641833	4710907	4779981	4849053
88	5125330	5194397	5263462	5332527	5401590	5470653	5539714
89	5815947	5885003	5954058	6023111	6092163	6161215	6230265
6290	7986506454	6575499	6644543	6713585	6782627	6851667	6920706
91	7196852	7265886	7334918	7403950	7472980	7542009	7611038
92	7887140	7956162	8025184	8094204	8163224	8232242	8301259
93	8577317	8646329	8715340	8784350	8853358	8922365	8991372
94	9267386	9336387	9405386	9474385	9543382	9612379	9681374
95	9957344	0026334	0095323	0164311	0233297	0302283	0371267
96	7990647194	0716172	0785150	0854127	0923102	0992077	1061050
97	1336933	1405901	1474868	1543834	1612798	1681762	1750724
98	2026563	2095520	2164476	2233431	2302384	2371337	2440288
99	2716083	2785030	2853974	2922918	2991861	3060803	3129743
6300	7993405495	3474430	3543364	3612297	3681228	3750159	3819089
1	4094796	4163720	4232643	4301565	4370486	4439406	4508325
2	4783988	4852902	4921814	4990725	5059635	5128543	5197451
3	5473071	5541974	5610875	5679775	5748674	5817572	5886469
4	6162045	6230936	6299826	6368716	6437604	6506491	6575376
5	6850909	6919790	6988669	7057547	7126424	7195300	7264175
6	7539664	7608534	7677402	7746269	7815136	7884001	7952865
7	8228310	8297169	8366026	8434882	8503738	8572592	8641445
8	8916847	8985694	9054541	9123386	9192231	9261074	9329916
9	9605274	9674111	9742946	9811781	9880615	9949447	0018278
6310	8000293592	0362418	0431243	0500067	0568889	0637711	0706531
11	0981802	1050617	1119431	1188243	1257055	1325866	1394675
12	1669902	1738706	1807509	1876311	1945112	2013911	2082710
13	2357893	2426686	2495478	2564269	2633059	2701848	2770636
14	3045776	3114558	3183339	3252119	3320898	3389676	3458453
15	3733549	3802320	3871091	3939860	4008628	4077395	4146161
16	4421213	4489974	4558733	4627491	4696249	4765005	4833760
17	5108769	5177519	5246267	5315014	5383761	5452506	5521250
18	5796216	5864954	5933692	6002429	6071164	6139898	6208632
19	6483554	6552281	6621008	6689734	6758458	6827182	6895904
6320	8007170783	7239500	7308216	7376930	7445644	7514357	7583068
21	7857903	7926609	7995314	8064018	8132721	8201423	8270123
22	8544915	8613610	8682304	8750997	8819689	8888380	8957070
23	9231818	9300502	9369186	9437868	9506549	9575229	9643908
24	9918613	9987286	0055958	0124630	0193300	0261969	0330637
25	8010605298	0673961	0742623	0811283	0879942	0948601	1017258
26	1291876	1360528	1429178	1497828	1566476	1635124	1703770
27	1978345	2046986	2115625	2184264	2252902	2321538	2390174
28	2664705	2733335	2801964	2870592	2939219	3007844	3076469
29	3350957	3419576	3488194	3556811	3625427	3694042	3762656
6330	8014037100	4105709	4174316	4242922	4311527	4380131	4448734
31	4723135	4791733	4860329	4928925	4997519	5066112	5134704
32	5409062	5477649	5546234	5614819	5683402	5751985	5820566
33	6094880	6163456	6232031	6300605	6369177	6437749	6506319
34	6780590	6849155	6917719	6986282	7054844	7123405	7191964
35	7466192	7534746	7603300	7671852	7740403	7808953	7877501
36	8151686	8220229	8288772	8357313	8425853	8494392	8562930
37	8837071	8905604	8974135	9042666	9111195	9179723	9248251
38	9522349	9590870	9659391	9727911	9796429	9864947	9933463
39	8020207518	0276029	0344539	0413047	0481555	0550062	0618567
6340	0892579	0961079	1029578	1098076	1166573	1235069	1303564

OF NUMBERS. Logarithms 7979596437–8021509041.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0080497	0149644	0218789	69155	154	152	151	150	150	148	147	145	145
0771916	0841052	0910187	144	142	142	140	139	138	137	136	135	134
1463226	1532351	1601474	132	132	130	129	129	127	126	125	123	123
2154425	2223539	2292652	122	120	120	118	117	116	115	114	113	112
2845515	2914618	2983720	110	110	108	107	107	105	104	103	102	100
3536494	3605586	3674677	100	098	098	096	095	094	093	092	091	090
4227364	4296445	4365525	088	088	086	086	084	083	082	081	080	079
4918124	4987194	5056263	077	077	075	074	074	072	071	070	069	067
5608774	5677833	5746891	067	065	065	063	063	061	060	059	058	056
6299314	6368362	6437409	056	055	053	052	052	050	049	048	047	045
6989744	7058781	7127817	69045	044	042	042	040	039	038	037	036	035
7680065	7749091	7818116	034	032	032	030	029	029	027	026	025	024
8370276	8439291	8508305	022	022	020	020	018	017	017	015	014	012
9060377	9129381	9198384	012	011	010	008	007	007	005	004	003	002
9750368	9819361	9888354	001	999	999	997	997	995	994	993	993	990
0440250	0509232	0578214	68990	989	988	986	986	984	983	982	982	980
1130023	1198994	1267964	978	978	977	975	975	973	973	971	970	969
1819686	1888646	1957605	968	967	966	964	964	962	962	960	959	958
2509239	2578188	2647136	957	956	955	953	953	951	951	949	948	947
3198683	3267621	3336558	947	944	944	943	942	940	940	938	937	937
3888017	3956945	4025871	68935	934	933	931	931	930	928	928	926	925
4577242	4646159	4715074	924	923	922	921	920	919	917	917	915	914
5266358	5335263	5404168	914	912	911	910	908	908	907	905	905	903
5955364	6024259	6093152	903	901	900	899	898	897	895	895	893	893
6644261	6713145	6782028	891	890	890	888	887	885	885	884	883	881
7333049	7401922	7470794	881	879	878	877	876	875	874	873	872	870
8021728	8090590	8159450	870	868	867	867	865	864	863	862	860	860
8710297	8779148	8847998	859	857	856	856	854	853	852	851	850	849
9398757	9467597	9536436	847	847	845	845	843	842	841	840	839	838
0087108	0155937	0224766	837	835	835	834	832	831	830	829	829	826
0775350	0844169	0912986	68826	825	824	822	822	820	819	819	817	816
1463483	1532291	1601097	815	814	812	812	811	809	808	808	806	805
2151507	2220304	2289099	804	803	802	801	799	799	797	797	795	794
2839422	2908208	2976992	793	792	791	790	789	788	786	786	784	784
3527228	3596003	3664776	782	781	780	779	778	777	775	775	773	773
4214925	4283689	4352452	771	771	769	768	767	766	764	764	763	761
4902514	4971267	5040018	761	759	758	758	756	755	754	753	751	751
5589993	5658735	5727476	750	748	747	747	745	744	743	742	741	740
6277364	6346095	6414825	738	738	737	735	734	734	732	731	730	729
6964625	7033346	7102065	727	727	726	724	724	722	721	721	719	718
7651779	7720488	7789196	68717	716	714	714	713	711	711	709	708	707
8338823	8407521	8476219	706	705	704	703	702	700	700	698	698	696
9025759	9094446	9163133	695	694	693	692	691	690	689	687	687	685
9712586	9781262	9849938	684	684	682	681	680	679	678	676	676	675
0399304	0467970	0536635	673	672	672	670	669	668	667	666	665	663
1085914	1154569	1223223	663	662	660	659	659	657	656	655	654	653
1772415	1841060	1909703	652	650	650	648	648	646	645	645	643	642
2458808	2527442	2596074	641	639	639	638	636	636	634	634	632	631
3145093	3213715	3282336	630	629	628	627	625	625	624	622	621	621
3831269	3899880	3968491	619	618	617	616	615	614	613	611	611	609
4517336	4585937	4654537	68609	607	606	605	604	603	602	601	600	598
5203295	5271885	5340474	598	596	596	594	593	592	591	590	589	588
5889146	5957725	6026303	587	585	585	583	583	581	580	579	578	577
6574889	6643457	6712024	576	575	574	572	572	570	570	568	567	566
7260523	7329080	7397637	565	564	563	562	561	559	559	557	557	555
7946050	8014596	8083141	554	554	552	551	550	548	549	546	545	545
8631467	8700003	8768538	543	543	541	540	539	538	537	536	535	533
9316777	9385302	9453826	533	531	531	529	528	528	526	525	524	523
0001978	0070493	0139006	521	521	520	518	518	516	515	515	513	512
0687072	0755575	0824078	511	510	508	508	507	505	505	503	503	501
1372057	1440550	1509041	500	499	498	497	496	495	493	493	491	491

Numbers 63400–64009.

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6340	8020892579	0961079	1029578	1098076	1166573	1235069	1303564
41	1577532	1646021	1714510	1782997	1851483	1919968	1988452
42	2262377	2330855	2399333	2467809	2536285	2604759	2673232
43	2947114	3015582	3084048	3152514	3220979	3289442	3357904
44	3631743	3700200	3768656	3837111	3905565	3974017	4042469
45	4316264	4384710	4453156	4521600	4590043	4658484	4726925
46	5000678	5069113	5137547	5205981	5274413	5342844	5411271
47	5684983	5753408	5821831	5890254	5958675	6027095	6095515
48	6369181	6437595	6506007	6574419	6642830	6711239	6779648
49	7053271	7121674	7190076	7258477	7326877	7395275	7463673
6350	8027737253	7805645	7874036	7942427	8010816	8079204	8147591
51	8421127	8489509	8557889	8626269	8694647	8763024	8831400
52	9104894	9173265	9241635	9310003	9378371	9446737	9515103
53	9788553	9856913	9925272	9993630	0061987	0130343	0198697
54	8030472105	0540454	0608802	0677149	0745495	0813840	0882184
55	1155549	1223887	1292225	1360561	1428896	1497231	1565564
56	1838885	1907213	1975540	2043865	2112190	2180513	2248836
57	2522114	2590431	2658747	2727062	2795376	2863688	2932000
58	3205236	3273542	3341847	3410151	3478454	3546756	3615057
59	3888250	3956545	4024840	4093133	4161425	4229717	4298007
6360	8034571156	4639441	4707725	4776008	4844289	4912570	4980849
61	5253956	5322230	5390503	5458775	5527045	5595315	5663584
62	5936648	6004911	6073173	6141434	6209694	6277953	6346211
63	6619232	6687485	6755736	6823987	6892236	6960484	7028732
64	7301710	7369952	7438192	7506432	7574671	7642908	7711145
65	7984080	8052311	8120541	8188770	8256998	8325225	8393451
66	8666343	8734563	8802783	8871001	8939218	9007434	9075649
67	9348499	9416708	9484917	9553124	9621331	9689536	9757741
68	8040030547	0098746	0166944	0235141	0303337	0371531	0439725
69	0712489	0780677	0848864	0917050	0985236	1053419	1121602
6370	8041394323	1462501	1530677	1598853	1667027	1735200	1803373
71	2076051	2144218	2212383	2280548	2348712	2416874	2485036
72	2757671	2825827	2893983	2962137	3030290	3098441	3166592
73	3439185	3507330	3575475	3643618	3711760	3779901	3848042
74	4120591	4188726	4256860	4324993	4393124	4461255	4529384
75	4801891	4870015	4938138	5006260	5074381	5142501	5210620
76	5483084	5551197	5619310	5687421	5755531	5823640	5891748
77	6164170	6232273	6300374	6368475	6436574	6504673	6572770
78	6845149	6913241	6981332	7049422	7117511	7185599	7253685
79	7526022	7594103	7662183	7730262	7798341	7866418	7934494
6380	8048206787	8274858	8342928	8410996	8479064	8547130	8615195
81	8887446	8955506	9023565	9091623	9159680	9227736	9295790
82	9567999	9636048	9704096	9772143	9840190	9908235	9976279
83	8050248444	0316483	0384521	0452557	0520593	0588627	0656661
84	0928783	0996811	1064838	1132864	1200889	1268913	1336936
85	1609016	1677033	1745050	1813065	1881079	1949092	2017104
86	2289142	2357149	2425154	2493159	2561163	2629165	2697167
87	2969162	3037158	3105153	3173147	3241140	3309131	3377122
88	3649075	3717060	3785045	3853028	3921010	3988991	4056971
89	4328881	4396856	4464830	4532803	4600774	4668745	4736714
6390	8055008582	5076546	5144509	5212471	5280432	5348392	5416351
91	5688175	5756129	5824082	5892033	5959983	6027933	6095881
92	6367663	6435606	6503548	6571489	6639428	6707367	6775305
93	7047044	7114977	7182908	7250838	7318767	7386695	7454622
94	7726319	7794241	7862162	7930081	7998000	8065917	8133833
95	8405488	8473399	8541309	8609218	8677126	8745033	8812938
96	9084551	9152451	9220351	9288249	9356146	9424042	9491937
97	9763507	9831397	9899286	9967173	0035060	0102946	0170830
98	8060442357	0510237	0578115	0645992	0713868	0781743	0849617
99	1121102	1188970	1256838	1324704	1392570	1460434	1528297
6400	1799740	1867598	1935455	2003311	2071165	2139019	2206872

OF NUMBERS. Logarithms 8020892579–8062410424.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1372057	1440550	1509041	68500	499	498	497	496	495	493	493	491	491
2056935	2125417	2193897	489	489	487	486	485	484	483	482	480	480
2741704	2810175	2878645	478	478	476	476	474	473	472	471	470	469
3426366	3494826	3563285	468	466	466	465	463	462	462	460	459	458
4110919	4179369	4247817	457	456	455	454	452	452	450	450	448	447
4795365	4863804	4932241	446	446	444	443	441	441	440	439	437	437
5479703	5548131	5616557	435	434	434	432	431	430	429	428	426	426
6163933	6232350	6300766	425	423	423	421	420	420	418	417	416	415
6848055	6916461	6984867	414	412	412	411	409	409	407	406	406	404
7532070	7600465	7668860	403	402	401	400	398	398	397	395	395	393
8215976	8284361	8352745	68392	391	391	389	388	387	385	385	384	382
8899775	8968149	9036522	382	380	380	378	377	376	375	374	373	372
9583467	9651830	9720192	371	370	368	368	366	366	364	363	362	361
0267051	0335403	0403755	360	359	358	357	356	354	354	352	352	350
0950527	1018869	1087209	349	348	347	346	345	344	343	342	340	340
1633896	1702227	1770557	338	338	336	335	335	333	332	331	330	328
2317157	2385477	2453796	328	327	325	325	323	323	321	320	319	318
3000311	3068620	3136928	317	316	315	314	312	312	311	309	308	308
3683357	3751656	3819953	306	305	304	303	302	301	300	299	297	297
4366296	4434584	4502871	295	295	293	292	292	290	289	288	287	285
5049127	5117404	5185681	68285	284	283	281	281	279	278	277	277	275
5731851	5800118	5868383	274	273	272	270	270	269	267	267	265	265
6414468	6482724	6550979	263	262	261	260	259	258	257	256	255	253
7096978	7165223	7233467	253	251	251	249	248	248	246	245	244	243
7779380	7847614	7915848	242	240	240	239	237	237	235	234	234	232
8461675	8529899	8598121	231	230	229	228	227	226	224	224	222	222
9143863	9212076	9280288	220	220	218	217	216	215	214	213	212	211
9825944	9894146	9962347	209	209	207	207	205	205	203	202	201	200
0507918	0576109	0644300	199	198	197	196	194	194	193	191	191	189
1189784	1257965	1326145	188	187	186	186	183	183	182	181	180	178
1871544	1939714	2007883	68178	176	176	174	173	173	171	170	169	168
2553196	2621356	2689514	167	165	165	164	162	162	160	160	158	157
3234742	3302891	3371038	156	156	154	153	151	151	150	149	147	147
3916181	3984319	4052456	145	145	143	142	141	141	139	138	137	135
4597512	4665640	4733766	135	134	133	131	131	129	128	128	126	125
5278737	5346854	5414969	124	123	122	121	120	119	117	117	115	115
5959855	6027961	6096066	113	113	111	110	109	108	107	106	105	104
6640867	6708962	6777056	103	101	101	099	099	097	097	095	094	093
7321771	7389856	7457939	092	091	090	089	088	086	086	085	083	083
8002569	8070643	8138715	081	080	079	079	077	076	075	074	072	072
8683260	8751323	8819385	68071	070	068	068	066	065	065	063	062	061
9363844	9431897	9499948	060	059	058	057	056	054	054	053	051	051
0044322	0112364	0180405	049	048	047	047	045	044	043	042	041	039
0724693	0792724	0860754	039	038	036	036	034	034	032	031	030	029
1404957	1472978	1540998	028	027	026	025	024	023	021	021	020	018
2085115	2153125	2221134	017	017	015	014	013	012	011	010	009	008
2765167	2833166	2901164	007	005	005	004	002	002	000	999	998	998
3445112	3513101	3581088	67996	995	994	993	991	991	990	989	987	987
4124951	4192929	4260905	985	985	983	982	981	980	980	978	976	976
4804683	4872650	4940616	975	974	973	971	971	969	969	967	966	966
5484308	5552265	5620221	67964	963	962	961	960	959	957	957	956	954
6163828	6231774	6299719	954	953	951	950	950	948	947	946	945	944
6843241	6911177	6979111	943	942	941	939	939	938	936	936	934	933
7522548	7590473	7658397	933	931	930	929	928	927	926	925	924	922
8201749	8269663	8337576	922	921	919	919	917	916	916	914	913	912
8880843	8948747	9016649	911	910	909	908	907	905	905	904	902	902
9559831	9627724	9695616	900	900	898	897	896	895	894	893	892	891
0238714	0306596	0374477	890	889	887	887	886	884	884	882	881	880
0917490	0985361	1053232	880	878	877	876	875	874	873	871	871	870
1596160	1664021	1731881	868	868	866	866	864	863	863	861	860	859
2274723	2342574	2410424	858	857	856	854	854	853	851	851	850	848

Numbers 64000–64609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6400	8061799740	1867598	1935455	2003311	2071165	2139019	2206872
1	2478272	2546119	2613966	2681811	2749655	2817498	2885340
2	3156698	3224535	3292371	3360205	3428039	3495871	3563703
3	3835018	3902844	3970670	4038494	4106317	4174139	4241959
4	4513232	4581048	4648863	4716676	4784489	4852300	4920110
5	5191341	5259146	5326950	5394753	5462554	5530355	5598155
6	5869343	5937138	6004931	6072723	6140515	6208305	6276094
7	6547240	6615024	6682807	6750588	6818369	6886149	6953927
8	7225031	7292804	7360576	7428347	7496117	7563887	7631655
9	7902716	7970479	8038240	8106001	8173760	8241519	8309276
6410	8068580295	8648047	8715798	8783548	8851297	8919045	8986792
11	9257769	9325510	9393251	9460990	9528729	9596466	9664202
12	9935137	0002868	0070598	0138327	0206054	0273781	0341507
13	8070612399	0680120	0747839	0815557	0883275	0950991	1018706
14	1289556	1357266	1424975	1492682	1560389	1628095	1695799
15	1966607	2034306	2102005	2169702	2237398	2305093	2372787
16	2643553	2711242	2778929	2846616	2914301	2981986	3049670
17	3320393	3388071	3455748	3523424	3591099	3658773	3726446
18	3997128	4064795	4132462	4200127	4267792	4335455	4403118
19	4673757	4741414	4809070	4876725	4944379	5012032	5079684
6420	8075350281	5417927	5485573	5553217	5620861	5688503	5756144
21	6026699	6094335	6161970	6229604	6297237	6364869	6432500
22	6703012	6770638	6838262	6905886	6973508	7041129	7108750
23	7379220	7446835	7514449	7582062	7649674	7717285	7784894
24	8055323	8122927	8190531	8258133	8325734	8393335	8460934
25	8731320	8798914	8866507	8934099	9001690	9069279	9136868
26	9407212	9474796	9542378	9609959	9677540	9745119	9812697
27	8080082999	0150572	0218144	0285715	0353284	0420853	0488421
28	0758681	0826243	0893805	0961365	1028924	1096482	1164040
29	1434258	1501810	1569360	1636910	1704459	1772007	1839553
6430	8082109729	2177271	2244811	2312350	2379888	2447426	2514962
31	2785096	2852627	2920157	2987685	3055213	3122740	3190265
32	3460357	3527878	3595397	3662915	3730433	3797949	3865464
33	4135514	4203024	4270533	4338041	4405547	4473053	4540558
34	4810566	4878065	4945563	5013061	5080557	5148052	5215546
35	5485512	5553001	5620489	5687976	5755462	5822946	5890430
36	6160354	6227833	6295310	6362786	6430262	6497736	6565209
37	6835091	6902559	6970026	7037492	7104957	7172420	7239883
38	7509723	7577181	7644637	7712093	7779547	7847000	7914453
39	8184251	8251698	8319144	8386589	8454033	8521475	8588917
6440	8088858674	8926110	8993546	9060980	9128413	9195846	9263277
41	9532992	9600418	9667843	9735267	9802689	9870111	9937532
42	8090207205	0274620	0342035	0409448	0476861	0544272	0611683
43	0881313	0948719	1016123	1083526	1150928	1218329	1285728
44	1555317	1622712	1690106	1757498	1824890	1892280	1959670
45	2229217	2296601	2363984	2431366	2498747	2566127	2633506
46	2903012	2970386	3037758	3105130	3172500	3239870	3307239
47	3576702	3644065	3711428	3778789	3846149	3913508	3980866
48	4250288	4317641	4384993	4452343	4519693	4587042	4654389
49	4923769	4991112	5058453	5125793	5193133	5260471	5327808
6450	8095597146	5664478	5731809	5799139	5866468	5933796	6001122
51	6270419	6337740	6405061	6472380	6539699	6607016	6674332
52	6943587	7010898	7078208	7145517	7212825	7280132	7347438
53	7616651	7683952	7751251	7818550	7885847	7953144	8020439
54	8289611	8356901	8424190	8491478	8558765	8626051	8693336
55	8962466	9029746	9097025	9164302	9231579	9298855	9366129
56	9635217	9702487	9769755	9837022	9904288	9971554	0038818
57	8100307864	0375123	0442381	0509638	0576894	0644148	0711402
58	0980407	1047655	1114903	1182149	1249395	1316639	1383882
59	1652845	1720084	1787321	1854557	1921792	1989026	2056259
6460	2325180	2392408	2459634	2526860	2594085	2661308	2728531

OF NUMBERS.

Logarithms 8061799740-8102930192.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2274723	2342574	2410424	67858	857	856	854	854	853	851	851	850	848
2953181	3021021	3088860	847	847	845	844	843	842	841	840	839	838
3631533	3699363	3767191	837	836	834	834	832	832	830	830	828	827
4309779	4377598	4445416	826	826	824	823	822	820	820	819	818	816
4987919	5055728	5123535	816	815	813	813	811	810	809	809	807	806
5665954	5733751	5801548	805	804	803	801	801	800	799	797	797	795
6343882	6411669	6479455	795	793	792	792	790	789	788	787	786	785
7021705	7089481	7157256	784	783	781	781	780	778	778	776	775	775
7699421	7767187	7834952	773	772	771	770	770	768	766	766	765	764
8377032	8444788	8512542	763	761	761	759	759	757	756	756	754	753
9054538	9122283	9190026	67752	751	750	749	748	747	746	745	743	743
9731938	9799672	9867405	741	741	739	739	737	736	736	734	733	732
0409232	0476955	0544678	731	730	729	727	727	726	725	723	723	721
1086420	1154133	1221845	721	719	718	718	716	715	714	713	712	711
1763503	1831205	1898907	710	709	707	707	706	704	704	702	702	700
2440480	2508172	2575863	699	699	697	696	695	694	693	692	691	690
3117352	3185033	3252714	689	687	687	685	685	684	682	681	681	679
3794118	3861789	3929459	678	677	676	675	674	673	672	671	670	669
4470779	4538439	4606099	667	667	665	665	663	663	661	660	660	658
5147335	5214984	5282633	657	656	655	654	653	652	651	649	649	648
5823785	5891424	5959062	67646	646	644	644	642	641	641	639	638	637
6500129	6567758	6635386	636	635	634	633	632	631	629	629	628	626
7176369	7243987	7311604	626	624	624	622	621	621	619	618	617	616
7852503	7920111	7987717	615	614	613	612	611	609	609	608	606	606
8528532	8596129	8663725	604	604	602	601	601	599	598	597	596	595
9204456	9272042	9339628	594	593	592	591	589	589	588	586	586	584
9880274	9947850	0015425	584	582	581	581	579	578	577	576	575	574
0555987	0623553	0691117	573	572	571	569	569	568	566	566	564	564
1231596	1299151	1366705	562	562	560	559	558	558	556	555	554	553
1907099	1974643	2042187	552	550	550	549	548	546	546	544	544	542
2582497	2650031	2717564	67542	540	539	538	538	536	535	534	533	532
3257790	3325313	3392836	531	530	528	528	527	525	525	523	523	521
3932978	4000491	4068003	521	519	518	518	516	515	514	513	512	511
4608061	4675564	4743065	510	509	508	506	506	505	503	503	501	501
5283039	5350531	5418022	499	498	498	496	495	494	493	492	491	490
5957913	6025394	6092875	489	488	487	486	484	484	483	481	481	479
6632681	6700152	6767622	479	477	476	476	474	473	472	471	470	469
7307345	7374805	7442265	468	467	466	465	463	463	462	460	460	458
7981904	8049354	8116803	458	456	456	454	453	453	451	450	449	448
8656358	8723797	8791236	447	446	445	444	442	442	441	439	439	438
9330707	9398136	9465564	67436	436	434	433	433	431	430	429	428	428
0004952	0072371	0139788	426	425	424	422	422	421	420	419	417	417
0679092	0746500	0813907	415	415	413	413	411	411	409	408	407	406
1353127	1420525	1487922	406	404	403	402	401	399	399	398	397	395
2027058	2094445	2161832	395	394	392	392	390	390	388	387	387	385
2700884	2768261	2835637	384	383	382	381	380	379	378	377	376	375
3374606	3441972	3509338	374	372	372	370	370	369	367	366	366	364
4048223	4115579	4182934	363	363	361	360	359	358	357	356	355	354
4721736	4789081	4856426	353	352	350	350	349	347	347	345	345	343
5395144	5462479	5529813	343	341	340	340	338	337	336	335	334	333
6068448	6135773	6203096	67332	331	330	329	328	326	326	325	323	323
6741648	6808962	6876275	321	321	319	319	317	316	316	314	313	312
7414743	7482047	7549349	311	310	309	308	307	306	305	304	302	302
8087734	8155027	8222319	301	299	299	297	297	295	295	293	292	292
8760620	8827903	8895185	290	289	288	287	286	285	284	283	282	281
9433403	9500675	9567947	280	279	277	277	276	274	274	272	272	270
0106081	0173343	0240604	270	268	267	266	266	264	263	262	261	260
0778655	0845907	0913157	259	258	257	256	254	254	253	252	250	250
1451125	1518366	1585606	248	248	246	246	244	243	243	241	240	239
2123491	2190721	2257951	239	237	236	235	234	233	232	230	230	229
2795752	2862973	2930192	228	226	226	225	223	223	221	221	219	218

Numbers 64600–65209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6460	8102325180	2392408	2459634	2526860	2594085	2661308	2728531
61	2997410	3064628	3131844	3199059	3266273	3333487	3400699
62	3669537	3736744	3803950	3871154	3938358	4005561	4072763
63	4341559	4408756	4475951	4543146	4610339	4677531	4744723
64	5013478	5080664	5147849	5215033	5282216	5349398	5416579
65	5685292	5752468	5819643	5886816	5953989	6021160	6088331
66	6357003	6424168	6491332	6558496	6625658	6692819	6759979
67	7028609	7095764	7162918	7230071	7297223	7364374	7431524
68	7700112	7767257	7834400	7901543	7968684	8035825	8102964
69	8371511	8438646	8505779	8572911	8640042	8707172	8774301
6470	8109042807	9109931	9177053	9244175	9311296	9378415	9445534
71	9713998	9781112	9848224	9915335	9982446	0049555	0116663
72	8110385086	0452189	0519291	0586392	0653492	0720591	0787689
73	1056070	1123163	1190255	1257345	1324435	1391523	1458611
74	1726951	1794033	1861114	1928195	1995274	2062352	2129429
75	2397728	2464800	2531870	2598940	2666009	2733077	2800144
76	3068401	3135462	3202523	3269583	3336641	3403699	3470755
77	3738971	3806022	3873072	3940121	4007169	4074217	4141263
78	4409437	4476478	4543518	4610556	4677594	4744631	4811667
79	5079799	5146830	5213860	5280888	5347916	5414942	5481967
6480	8115750059	5817079	5884098	5951116	6018133	6085150	6152165
81	6420215	6487224	6554233	6621241	6688248	6755254	6822258
82	7090267	7157267	7224265	7291263	7358259	7425254	7492249
83	7760216	7827205	7894193	7961181	8028167	8095152	8162136
84	8430062	8497041	8564019	8630995	8697971	8764946	8831920
85	9099804	9166773	9233740	9300707	9367672	9434637	9501600
86	9769443	9836402	9903359	9970315	0037270	0104224	0171177
87	8120438979	0505927	0572874	0639820	0706765	0773709	0840651
88	1108412	1175350	1242286	1309222	1376156	1443090	1510022
89	1777742	1844669	1911595	1978520	2045445	2112368	2179290
6490	8122446968	2513885	2580801	2647716	2714630	2781543	2848454
91	3116091	3182998	3249904	3316808	3383712	3450614	3517516
92	3785112	3852008	3918903	3985798	4052691	4119583	4186474
93	4454029	4520915	4587800	4654684	4721567	4788449	4855330
94	5122843	5189719	5256593	5323467	5390340	5457211	5524082
95	5791554	5858420	5925284	5992147	6059010	6125871	6192731
96	6460162	6527017	6593872	6660725	6727577	6794428	6861278
97	7128668	7195513	7262356	7329199	7396041	7462882	7529721
98	7797070	7863905	7930738	7997571	8064402	8131233	8198062
99	8465370	8532194	8599017	8665840	8732661	8799481	8866300
6500	8129133566	9200380	9267193	9334005	9400816	9467626	9534435
1	9801660	9868464	9935267	0002069	0068869	0135669	0202467
2	8130469652	0536445	0603238	0670029	0736819	0803609	0870397
3	1137540	1204323	1271105	1337887	1404667	1471446	1538224
4	1805326	1872099	1938871	2005642	2072411	2139180	2205948
5	2473009	2539772	2606533	2673294	2740053	2806812	2873570
6	3140589	3207342	3274093	3340844	3407593	3474341	3541088
7	3808067	3874809	3941551	4008291	4075030	4141768	4208505
8	4475443	4542175	4608905	4675635	4742364	4809092	4875819
9	5142715	5209437	5276158	5342877	5409596	5476313	5543030
6510	8135809886	5876597	5943307	6010017	6076725	6143432	6210139
11	6476953	6543655	6610355	6677054	6743752	6810449	6877145
12	7143919	7210610	7277300	7343988	7410676	7477363	7544049
13	7810782	7877462	7944142	8010821	8077498	8144175	8210850
14	8477542	8544213	8610882	8677551	8744218	8810884	8877549
15	9144200	9210861	9277520	9344178	9410835	9477491	9544146
16	9810756	9877406	9944055	0010703	0077350	0143996	0210641
17	8140477210	0543850	0610488	0677126	0743763	0810398	0877033
18	1143561	1210191	1276819	1343447	1410073	1476698	1543323
19	1809810	1876430	1943048	2009665	2076281	2142897	2209511
6520	2475957	2542566	2609174	2675781	2742387	2808992	2875596

OF NUMBERS. Logarithms 8102325180–8143075402.

Mantissæ.			Differences.									
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2795752	2862973	2930192	67228	226	226	225	223	223	221	221	219	218
3467910	3535120	3602329	218	216	215	214	214	212	211	210	209	208
4139963	4207163	4274362	207	206	204	204	203	202	200	200	199	197
4811913	4879102	4946291	197	195	195	193	192	192	190	189	189	187
5483759	5550938	5618115	186	185	184	183	182	181	180	179	177	177
6155500	6222669	6289836	176	175	173	173	171	171	169	169	167	167
6827138	6894296	6961453	165	164	164	162	161	160	159	158	157	156
7498672	7565820	7632967	155	154	153	152	151	150	148	148	147	145
8170103	8237240	8304376	145	143	143	141	141	139	139	137	136	135
8841429	8908556	8975682	135	133	132	131	130	129	128	127	126	125
9512652	9579768	9646884	67124	122	122	121	119	119	118	116	116	114
0183771	0250877	0317982	114	112	111	111	109	108	108	106	105	104
0854786	0921882	0988976	103	102	101	100	099	098	097	096	094	094
1525697	1592783	1659867	093	092	090	090	088	088	086	086	084	084
2196505	2263580	2330655	082	081	081	079	078	077	076	075	075	073
2867210	2934274	3001338	072	070	070	069	068	067	066	064	064	063
3537810	3604865	3671918	061	061	060	058	058	056	055	055	053	053
4208308	4275352	4342395	051	050	049	048	048	046	045	044	043	042
4878702	4945735	5012768	041	040	038	038	037	036	035	033	033	031
5548992	5616015	5683037	031	030	028	028	026	025	025	023	022	022
6219179	6286192	6353204	67020	019	018	017	017	015	014	013	012	011
6889262	6956265	7023266	009	009	008	007	006	004	004	003	001	001
7559242	7626234	7693226	000	998	998	996	995	995	993	992	992	990
8229119	8296101	8363082	66989	988	988	986	985	984	983	982	981	980
8898892	8965864	9032835	979	978	976	976	975	974	972	972	971	969
9568562	9635524	9702484	969	967	967	965	965	963	962	962	960	959
0238129	0305080	0372030	959	957	956	955	954	953	952	951	950	949
0907593	0974534	1041473	948	947	946	945	944	942	942	941	939	939
1576954	1643884	1710813	938	936	936	934	934	932	932	930	929	929
2246211	2313131	2380050	927	926	925	925	923	922	921	920	919	918
2915365	2982275	3049184	66917	916	915	914	913	911	911	910	909	907
3584416	3651316	3718214	907	906	904	904	902	902	900	900	898	898
4253364	4320254	4387142	896	895	895	893	892	891	890	890	888	887
4922209	4989088	5055966	886	885	884	883	882	881	879	879	878	877
5590952	5657820	5724688	876	874	874	873	871	871	870	868	868	866
6259591	6326449	6393306	866	864	863	863	861	860	860	858	857	856
6928127	6994975	7061822	855	855	853	852	851	850	849	848	847	846
7596560	7663398	7730234	845	843	843	842	841	839	839	838	836	836
8264891	8331718	8398544	835	833	833	831	831	829	829	827	826	826
8933118	8999935	9066751	824	823	823	821	820	819	818	817	816	815
9601243	9668050	9734856	66814	813	812	811	810	809	808	807	806	804
0269265	0336062	0402857	804	803	802	800	800	798	798	797	795	795
0937184	1003971	1070756	793	793	791	790	790	788	787	787	785	784
1605001	1671777	1738552	783	782	782	780	779	778	777	776	775	774
2272715	2339481	2406245	773	772	771	769	769	768	767	766	764	764
2940326	3007082	3073836	763	761	761	759	759	758	756	756	754	753
3607835	3674580	3741324	753	751	751	749	748	747	747	745	744	743
4275241	4341976	4408710	742	742	740	739	738	737	736	735	734	733
4942544	5009269	5075993	732	730	730	729	728	727	725	725	724	722
5609745	5676460	5743173	722	721	719	719	717	717	715	715	713	713
6276844	6343548	6410251	66711	710	710	708	707	707	705	704	703	702
6943840	7010534	7077227	702	700	699	698	697	696	695	694	693	692
7610734	7677417	7744100	691	690	688	688	687	686	685	683	683	682
8277525	8344198	8410871	680	680	679	677	677	675	675	673	673	671
8944214	9010877	9077539	671	669	669	667	666	665	665	663	662	661
9610800	9677453	9744105	661	659	658	657	656	655	654	653	652	651
0277285	0343927	0410569	650	649	648	647	646	645	644	642	642	641
0943667	1010299	1076931	640	638	638	637	635	635	634	632	632	630
1609946	1676569	1743190	630	628	628	626	625	625	623	623	621	620
2276124	2342736	2409347	620	618	617	616	616	614	613	612	611	610
2942199	3008801	3075402	609	608	607	606	605	604	603	602	601	600

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6520	8142475957	2542566	2609174	2675781	2742387	2808992	2875596
21	3142002	3208601	3275199	3341796	3408391	3474986	3541580
22	3807945	3874533	3941121	4007708	4074293	4140878	4207461
23	4473785	4540364	4606941	4673517	4740093	4806667	4873241
24	5139524	5206092	5272659	5339225	5405790	5472355	5538918
25	5805160	5871718	5938275	6004831	6071386	6137940	6204493
26	6470695	6537242	6603789	6670335	6736880	6803423	6869966
27	7136127	7202665	7269201	7335737	7402271	7468805	7535337
28	7801457	7867985	7934511	8001037	8067561	8134084	8200607
29	8466686	8533203	8599720	8666235	8732749	8799262	8865774
6530	8149131813	9198320	9264826	9331331	9397835	9464338	9530840
31	9796838	9863335	9929830	9996325	0062819	0129312	0195804
32	8150461761	0528247	0594733	0661218	0727701	0794184	0860666
33	1126582	1193058	1259534	1326008	1392482	1458954	1525426
34	1791301	1857768	1924233	1990697	2057161	2123623	2190084
35	2455919	2522375	2588831	2655285	2721738	2788190	2854641
36	3120435	3186881	3253326	3319770	3386213	3452655	3519096
37	3784850	3851286	3917720	3984154	4050587	4117019	4183450
38	4449162	4515588	4582013	4648436	4714859	4781281	4847701
39	5113374	5179789	5246204	5312617	5379030	5445441	5511852
6540	8155777483	5843889	5910293	5976696	6043099	6109500	6175900
41	6441491	6507887	6574281	6640674	6707066	6773457	6839847
42	7105398	7171783	7238167	7304550	7370932	7437313	7503693
43	7769203	7835578	7901952	7968325	8034697	8101067	8167437
44	8432907	8499271	8565635	8631998	8698360	8764720	8831080
45	9096509	9162864	9229217	9295570	9361921	9428272	9494622
46	9760010	9826354	9892698	9959040	0025382	0091722	0158062
47	8160423409	0489744	0556077	0622409	0688741	0755071	0821400
48	1086707	1153032	1219355	1285677	1351998	1418319	1484638
49	1749904	1816218	1882532	1948844	2015155	2081465	2147774
6550	8162413000	2479304	2545607	2611909	2678210	2744510	2810809
51	3075994	3142288	3208581	3274873	3341164	3407454	3473742
52	3738888	3805171	3871454	3937736	4004016	4070296	4136575
53	4401680	4467953	4534226	4600497	4666768	4733038	4799306
54	5064370	5130634	5196897	5263158	5329419	5395678	5461936
55	5726960	5793214	5859466	5925717	5991968	6058217	6124466
56	6389449	6455692	6521935	6588176	6654416	6720655	6786894
57	7051837	7118070	7184302	7250533	7316763	7382993	7449221
58	7714123	7780346	7846569	7912790	7979010	8045229	8111447
59	8376309	8442522	8508734	8574945	8641155	8707364	8773572
6560	8169038394	9104597	9170799	9236999	9303199	9369398	9435596
61	9700378	9766570	9832762	9898953	9965143	0031332	0097519
62	8170362261	0428443	0494625	0560806	0626985	0693164	0759342
63	1024043	1090215	1156387	1222558	1288727	1354896	1421063
64	1685724	1751886	1818048	1884209	1950368	2016527	2082684
65	2347304	2413457	2479608	2545759	2611908	2678057	2744204
66	3008784	3074926	3141068	3207208	3273348	3339486	3405623
67	3670163	3736295	3802427	3868557	3934686	4000815	4066942
68	4331441	4397563	4463685	4529805	4595924	4662042	4728160
69	4992619	5058731	5124842	5190952	5257062	5323170	5389277
6570	8175653696	5719798	5785899	5851999	5918098	5984196	6050293
71	6314672	6380764	6446855	6512945	6579034	6645122	6711209
72	6975548	7041630	7107711	7173791	7239870	7305948	7372025
73	7636323	7702395	7768466	7834536	7900605	7966673	8032740
74	8296997	8363059	8429120	8495180	8561239	8627297	8693354
75	8957572	9023624	9089674	9155724	9221773	9287821	9353868
76	9618045	9684087	9750128	9816168	9882207	9948245	0014281
77	8180278419	0344450	0410481	0476511	0542540	0608568	0674594
78	0938691	1004713	1070734	1136754	1202773	1268790	1334807
79	1598864	1664876	1730886	1796896	1862905	1928913	1994919
6580	2258936	2324938	2390939	2456938	2522937	2588935	2654931

OF NUMBERS. Logarithms 8142475957-8182852915.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2942199	3008801	3075402	66609	608	607	606	605	604	603	602	601	600
3608173	3674764	3741355	599	598	597	595	595	594	593	591	591	590
4274044	4340625	4407206	588	588	587	585	585	583	583	581	581	579
4939813	5006384	5072954	579	577	576	576	574	574	572	571	570	570
5605480	5672041	5738601	568	567	566	565	565	563	562	561	560	559
6271045	6337596	6404146	558	557	556	555	554	553	552	551	550	549
6936508	7003049	7069588	547	547	546	545	543	543	542	541	539	539
7601869	7668400	7734929	538	536	536	534	534	532	532	531	529	528
8267128	8333648	8400168	528	526	526	524	523	523	521	520	520	518
8932285	8998796	9065305	517	517	515	514	513	512	511	511	509	508
9597341	9663841	9730340	66507	506	505	504	503	502	501	500	499	498
0262294	0328784	0395273	497	495	495	494	493	492	490	490	489	488
0927146	0993626	1060104	486	486	485	483	483	482	480	480	478	478
1591896	1658366	1724834	476	476	474	474	472	472	470	470	468	467
2256545	2323004	2389462	467	465	464	464	462	461	461	459	458	457
2921091	2987540	3053988	456	456	454	453	452	451	450	449	448	447
3585536	3651975	3718413	446	445	444	443	442	441	440	439	438	437
4249879	4316308	4382736	436	434	434	433	432	431	429	429	428	426
4914121	4980540	5046957	426	425	423	423	422	420	420	419	417	417
5578261	5644669	5711077	415	415	413	413	411	411	409	408	408	406
6242300	6308698	6375095	66406	404	403	403	401	400	400	398	397	396
6906237	6972625	7039012	396	394	393	392	391	390	390	388	387	386
7570072	7636450	7702827	385	384	383	382	381	380	379	378	377	376
8233806	8300174	8366541	375	374	373	372	370	370	369	368	367	366
8897439	8963797	9030153	364	364	363	362	360	360	359	358	356	356
9560970	9627318	9693664	355	353	353	351	351	350	348	348	346	346
0224400	0290737	0357074	344	344	342	342	340	340	338	337	337	335
0887729	0954056	1020382	335	333	332	332	330	329	329	327	326	325
1550956	1617273	1683589	325	323	322	321	321	319	318	317	316	315
2214082	2280389	2346695	314	314	312	311	310	309	308	307	306	305
2877107	2943404	3009699	66304	303	302	301	300	299	298	297	295	295
3540030	3606317	3672603	294	293	292	291	290	288	288	287	286	285
4202853	4269129	4335405	283	283	282	280	280	279	278	276	276	275
4865574	4931840	4998106	273	273	271	271	270	268	268	266	266	264
5528194	5594450	5660706	264	263	261	261	259	258	258	256	256	254
6190713	6256959	6323205	254	252	251	551	249	249	247	246	246	244
6853131	6919367	6985602	243	243	241	240	239	239	237	236	235	235
7515448	7581674	7647899	233	232	231	230	230	228	227	226	225	224
8177664	8243880	8310095	223	223	221	220	219	218	217	216	215	214
8839779	8905985	8972190	213	212	211	210	209	208	207	206	205	204
9501793	9567989	9634184	66203	202	200	200	199	198	197	196	195	194
0163706	0229892	0296077	192	192	191	190	189	187	187	186	185	184
0825519	0891694	0957869	182	182	181	179	179	178	177	175	175	174
1487230	1553396	1619560	172	172	171	169	169	167	167	166	164	164
2148841	2214996	2281151	162	162	161	159	159	157	157	155	155	153
2810351	2876496	2942641	153	151	151	149	149	147	147	145	145	143
3471760	3537895	3604030	142	142	140	140	138	137	137	135	135	133
4133068	4199194	4265318	132	132	130	129	129	127	126	126	124	123
4794276	4860391	4926505	122	122	120	119	118	118	116	115	114	114
5455383	5521488	5587592	112	111	110	110	108	107	106	105	104	104
6116390	6182485	6248579	66102	101	100	099	098	097	097	095	094	093
6777295	6843381	6909465	092	091	090	089	088	087	086	086	084	083
7438101	7504176	7570250	082	081	080	079	078	077	076	075	074	073
8098806	8164871	8230935	072	071	070	069	068	067	066	065	064	062
8759410	8825465	8891519	062	061	060	059	058	057	056	055	054	053
9419914	9485959	9552002	052	050	050	049	048	047	046	045	043	043
0080317	0146352	0212386	042	041	040	039	038	036	036	035	034	033
0740620	0806645	0872669	031	031	030	029	028	026	026	025	024	022
1400823	1466837	1532851	022	021	020	019	017	017	016	014	014	013
2060925	2126930	2192933	012	010	010	009	008	006	006	005	003	003
2720927	2786922	2852915	002	001	999	999	998	996	996	995	993	993

Numbers 65800-66409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6580	8182258936	2324938	2390939	2456938	2522937	2588935	2654931
81	2918908	2984900	3050890	3116880	3182869	3248856	3314843
82	3578780	3644761	3710742	3776722	3842700	3908678	3974654
83	4238551	4304523	4370493	4436463	4502431	4568399	4634366
84	4898222	4964184	5030144	5096104	5162062	5228020	5293977
85	5557793	5623745	5689695	5755645	5821593	5887541	5953487
86	6217264	6283205	6349146	6415085	6481024	6546962	6612898
87	6876634	6942566	7008497	7074426	7140355	7206282	7272209
88	7535905	7601827	7667747	7733667	7799585	7865503	7931419
89	8195075	8260987	8326898	8392807	8458716	8524623	8590530
6590	8188854146	8920047	8985948	9051848	9117746	9183644	9249540
91	9513116	9579008	9644898	9710788	9776677	9842564	9908451
92	8190171987	0237868	0303749	0369629	0435507	0501385	0567261
93	0830757	0896629	0962500	1028369	1094238	1160105	1225972
94	1489428	1555290	1621150	1687010	1752868	1818726	1884582
95	2147999	2213850	2279701	2345551	2411399	2477247	2543093
96	2806470	2872311	2938152	3003992	3069830	3135668	3201504
97	3464841	3530672	3596503	3662333	3728161	3793989	3859816
98	4123112	4188934	4254754	4320574	4386393	4452210	4518027
99	4781284	4847095	4912906	4978716	5044524	5110332	5176139
6600	8195439355	5505157	5570958	5636758	5702556	5768354	5834151
1	6097328	6163119	6228910	6294700	6360488	6426276	6492063
2	6755200	6820982	6886762	6952542	7018321	7084099	7149876
3	7412973	7478745	7544515	7610285	7676054	7741822	7807589
4	8070646	8136408	8202169	8267928	8333687	8399445	8465202
5	8728220	8793971	8859722	8925472	8991221	9056969	9122716
6	9385694	9451435	9517176	9582916	9648655	9714393	9780130
7	8200043068	0108800	0174531	0240261	0305990	0371718	0437445
8	0700343	0766065	0831786	0897506	0963225	1028943	1094660
9	1357519	1423231	1488942	1554652	1620361	1686069	1751776
6610	8202014595	2080297	2145998	2211698	2277397	2343096	2408793
11	2671572	2737264	2802955	2868645	2934334	3000023	3065710
12	3328449	3394131	3459813	3525493	3591172	3656851	3722528
13	3985227	4050899	4116571	4182241	4247910	4313579	4379246
14	4641906	4707568	4773230	4838890	4904549	4970208	5035865
15	5298485	5364138	5429789	5495440	5561089	5626738	5692385
16	5954965	6020608	6086250	6151890	6217530	6283168	6348806
17	6611346	6676979	6742611	6808241	6873871	6939500	7005127
18	7267628	7333251	7398873	7464493	7530113	7595732	7661350
19	7923811	7989424	8055036	8120646	8186256	8251865	8317473
6620	8208579894	8645497	8711099	8776700	8842300	8907899	8973497
21	9235879	9301472	9367064	9432655	9498245	9563834	9629422
22	9891764	9957347	0022929	0088510	0154091	0219670	0285248
23	8210547550	0613124	0678696	0744267	0809837	0875406	0940975
24	1203238	1268801	1334363	1399925	1465485	1531044	1596603
25	1858826	1924379	1989932	2055483	2121034	2186583	2252132
26	2514315	2579859	2645401	2710943	2776484	2842023	2907562
27	3169706	3235240	3300772	3366304	3431834	3497364	3562893
28	3824997	3890521	3956044	4021566	4087086	4152606	4218125
29	4480190	4545704	4611217	4676729	4742240	4807749	4873258
6630	8215135284	5200788	5266291	5331793	5397294	5462794	5528293
31	5790279	5855773	5921266	5986758	6052249	6117740	6183229
32	6445175	6510660	6576143	6641625	6707106	6772587	6838066
33	7099973	7165447	7230921	7296393	7361864	7427335	7492804
34	7754672	7820136	7885600	7951062	8016524	8081984	8147444
35	8409272	8474727	8540180	8605633	8671084	8736535	8801985
36	9063774	9129218	9194662	9260105	9325547	9390987	9456427
37	9718176	9783611	9849045	9914478	9979910	0045341	0110771
38	8220372481	0437906	0503330	0568753	0634175	0699596	0765016
39	1026686	1092102	1157516	1222929	1288341	1353752	1419163
6640	1680794	1746199	1811603	1877007	1942409	2007810	2073211

OF NUMBERS. Logarithms 8182258936–8222269406.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2720927	2786922	2852915	66002	001	999	999	998	996	996	995	993	993
3380829	3446813	3512797	65992	990	990	989	987	987	986	984	984	983
4040630	4106605	4172578	981	981	980	978	978	976	976	975	973	973
4700331	4766296	4832259	972	970	970	968	968	967	965	965	963	963
5359932	5425887	5491840	962	960	960	958	958	957	955	955	953	953
6019433	6085378	6151321	952	950	950	948	948	946	946	945	943	943
6678834	6744768	6810702	941	941	939	939	938	936	936	934	934	932
7338134	7404059	7469982	932	931	929	929	927	927	925	925	923	923
7997335	8063249	8129163	922	920	920	918	918	916	916	914	914	912
8656435	8722340	8788243	912	911	909	909	907	907	905	905	903	903
9315436	9381330	9447224	65901	901	900	898	898	896	896	894	894	892
9974336	0040221	0106104	892	890	890	889	887	887	885	885	883	883
0633137	0699011	0764885	881	881	880	878	878	876	876	874	874	872
1291837	1357702	1423566	872	871	869	869	867	867	865	865	864	862
1950438	2016293	2082146	862	860	860	858	858	856	856	855	853	853
2608939	2674784	2740627	851	851	850	848	848	846	846	845	843	843
3267340	3333175	3399008	841	841	840	838	838	836	836	835	833	833
3925641	3991466	4057289	831	831	830	828	828	827	825	825	823	823
4583843	4649657	4715471	822	820	820	819	817	817	816	814	814	813
5241944	5307749	5373553	811	811	810	808	808	807	805	805	804	802
5899946	5965741	6031535	65802	801	800	798	798	797	795	795	794	793
6557849	6623633	6689417	791	791	790	788	788	787	786	784	784	783
7215651	7281426	7347200	782	780	780	779	778	777	775	775	774	773
7873354	7939119	8004883	772	770	770	769	768	767	765	765	764	763
8530958	8596713	8662467	762	761	759	759	758	757	756	755	754	753
9188462	9254207	9319951	751	751	750	749	748	747	746	745	744	743
9845866	9911601	9977335	741	741	740	739	738	737	736	735	734	733
0503171	0568896	0634620	732	731	730	729	728	727	726	725	724	723
1160376	1226092	1291806	722	721	720	719	718	717	716	716	714	713
1817482	1883188	1948892	712	711	710	709	708	707	706	706	704	703
2474489	2540184	2605878	65702	701	700	699	699	697	696	695	694	694
3131396	3197081	3262766	692	691	690	689	689	687	686	685	685	683
3788204	3853879	3919554	682	682	680	679	679	677	676	675	675	673
4444913	4510578	4576242	672	672	670	669	669	667	667	665	664	664
5101522	5167177	5232832	662	662	660	659	659	657	657	655	655	653
5758032	5823677	5889322	653	651	651	649	649	647	647	645	645	643
6414443	6480078	6545713	643	642	640	640	638	638	637	635	635	633
7070754	7136380	7202005	633	632	630	630	629	627	627	626	625	623
7726967	7792582	7858197	623	622	620	620	619	618	617	615	615	614
8383080	8448686	8514291	613	612	610	610	609	608	607	606	605	603
9039094	9104690	9170285	65603	602	601	600	599	598	597	596	595	594
9695009	9760595	9826180	593	592	591	590	589	588	587	586	585	584
0350825	0416401	0481976	583	582	581	581	579	578	577	576	575	574
1006542	1072108	1137674	574	572	571	570	569	569	567	566	566	564
1662160	1727716	1793272	563	562	562	560	559	559	557	556	556	554
2317679	2383225	2448771	553	553	551	551	549	549	547	546	546	544
2973099	3038636	3104171	544	542	542	541	539	539	537	537	535	535
3628420	3693947	3759473	534	532	532	530	530	529	527	527	526	524
4283643	4349160	4414675	524	523	522	520	520	519	518	517	515	515
4938766	5004273	5069779	514	513	512	511	509	509	508	507	506	505
5593791	5659288	5724784	65504	503	502	501	500	499	498	497	496	495
6248717	6314204	6379690	494	493	492	491	491	489	488	487	486	485
6903544	6969021	7034498	485	483	482	481	481	479	478	477	477	475
7558273	7623740	7689206	474	474	472	471	471	469	469	467	466	466
8212902	8278360	8343816	464	464	462	462	460	460	458	458	456	456
8867433	8932881	8998328	455	453	453	451	451	450	448	448	447	446
9521866	9587304	9652741	444	444	443	442	440	440	439	438	437	435
0176200	0241628	0307055	435	434	433	432	431	430	429	428	427	426
0830435	0895853	0961270	425	424	423	422	421	420	419	418	417	416
1484572	1549980	1615387	416	414	413	412	411	411	409	408	407	407
2138610	2204009	2269406	405	404	404	402	401	401	399	399	397	396

Numbers 66400-67009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6640	8221680794	1746199	1811603	1877007	1942409	2007810	2073211
41	2334802	2400198	2465592	2530986	2596378	2661770	2727160
42	2988713	3054098	3119483	3184867	3250249	3315631	3381012
43	3642524	3707900	3773275	3838649	3904022	3969393	4034764
44	4296238	4361604	4426969	4492333	4557696	4623058	4688419
45	4949853	5015209	5080564	5145918	5211271	5276623	5341975
46	5603369	5668716	5734061	5799405	5864749	5930091	5995432
47	6256788	6322124	6387460	6452794	6518128	6583460	6648792
48	6910108	6975434	7040760	7106085	7171408	7236731	7302053
49	7563330	7628646	7693962	7759277	7824591	7889904	7955215
6650	8228216453	8281760	8347066	8412371	8477675	8542978	8608280
51	8869478	8934775	9000072	9065367	9130661	9195954	9261246
52	9522405	9587693	9652979	9718264	9783549	9848832	9914115
53	8230175234	0240512	0305788	0371064	0436339	0501612	0566885
54	0827965	0893233	0958500	1023765	1089030	1154294	1219557
55	1480598	1545856	1611113	1676369	1741624	1806878	1872131
56	2133133	2198381	2263628	2328874	2394119	2459363	2524607
57	2785570	2850808	2916045	2981281	3046517	3111751	3176984
58	3437908	3503137	3568364	3633591	3698816	3764041	3829264
59	4090149	4155368	4220585	4285802	4351018	4416233	4481446
6660	8234742292	4807501	4872709	4937915	5003121	5068326	5133530
61	5394337	5459536	5524734	5589931	5655127	5720322	5785517
62	6046284	6111473	6176661	6241849	6307035	6372220	6437405
63	6698133	6763312	6828491	6893668	6958845	7024021	7089195
64	7349884	7415054	7480223	7545390	7610557	7675723	7740888
65	8001537	8066697	8131856	8197014	8262172	8327328	8392483
66	8653093	8718243	8783393	8848541	8913688	8978834	9043980
67	9304551	9369692	9434831	9499970	9565107	9630244	9695379
68	9955912	0021042	0086172	0151301	0216428	0281555	0346681
69	8240607174	0672295	0737415	0802534	0867652	0932769	0997885
6670	8241258339	1323450	1388560	1453670	1518778	1583885	1648991
71	1909407	1974508	2039608	2104708	2169806	2234904	2300000
72	2560376	2625468	2690559	2755648	2820737	2885825	2950911
73	3211249	3276330	3341411	3406491	3471570	3536648	3601725
74	3862023	3927095	3992166	4057237	4122306	4187374	4252441
75	4512700	4577763	4642824	4707885	4772944	4838002	4903060
76	5163280	5228333	5293384	5358435	5423485	5488533	5553581
77	5813762	5878805	5943847	6008888	6073928	6138967	6204005
78	6464147	6529180	6594212	6659244	6724274	6789303	6854331
79	7114435	7179458	7244480	7309502	7374522	7439542	7504560
6680	8247764625	7829638	7894651	7959663	8024674	8089683	8154692
81	8414718	8479721	8544724	8609726	8674727	8739727	8804727
82	9064713	9129707	9194700	9259693	9324684	9389674	9454664
83	9714611	9779596	9844579	9909562	9974543	0039524	0104503
84	8250364412	0429387	0494361	0559334	0624305	0689276	0754246
85	1014116	1079081	1144045	1209008	1273970	1338931	1403892
86	1663723	1728678	1793632	1858586	1923538	1988489	2053440
87	2313232	2378178	2443122	2508066	2573009	2637950	2702891
88	2962644	3027580	3092515	3157449	3222382	3287314	3352245
89	3611960	3676886	3741811	3806735	3871658	3936581	4001502
6690	8254261178	4326094	4391010	4455924	4520838	4585750	4650662
91	4910299	4975206	5040111	5105016	5169920	5234823	5299725
92	5559323	5624220	5689116	5754011	5818905	5883799	5948691
93	6208250	6273137	6338024	6402909	6467794	6532677	6597560
94	6857080	6921958	6986835	7051710	7116585	7181459	7246332
95	7505813	7570681	7635549	7700415	7765280	7830144	7895007
96	8154450	8219308	8284166	8349022	8413877	8478732	8543585
97	8802989	8867838	8932686	8997532	9062378	9127223	9192067
98	9451432	9516271	9581109	9645946	9710782	9775617	9840451
99	8260099778	0164607	0229435	0294263	0359089	0423915	0488739
6700	0748027	0812847	0877665	0942483	1007300	1072115	1136930

OF NUMBERS. Logarithms 8221680794-8261331368.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2138610	2204009	2269406	65405	404	404	402	401	401	399	399	397	396
2792550	2857938	2923326	396	394	394	392	392	390	390	388	388	387
3446391	3511770	3577148	385	385	384	382	382	381	379	379	378	376
4100134	4165503	4230871	376	375	374	373	371	371	370	369	368	367
4753779	4819138	4884496	366	365	364	363	362	361	360	359	358	357
5407325	5472674	5538022	356	355	354	353	352	352	350	349	348	347
6060773	6126112	6191450	347	345	344	344	342	341	341	339	338	338
6714122	6779452	6844780	336	336	334	334	332	332	330	330	328	328
7367373	7432693	7498012	326	326	325	323	323	322	320	320	319	318
8020526	8085836	8151145	316	316	315	314	313	311	311	310	309	308
8673581	8738881	8804180	65307	306	305	304	303	302	301	300	299	298
9326538	9391828	9457117	297	297	295	294	293	292	292	290	289	288
9979396	0044677	0109956	288	286	285	285	283	283	281	281	279	278
0632156	0697427	0762697	278	276	276	275	273	273	271	271	270	268
1284819	1350079	1415339	268	267	265	265	264	263	262	260	260	259
1937383	2002634	2067884	258	257	256	255	254	253	252	251	250	249
2589849	2655090	2720330	248	247	246	245	244	244	242	241	240	240
3242217	3307448	3372679	238	237	236	236	234	233	233	231	231	229
3894487	3959709	4024929	229	227	227	225	225	223	223	222	220	220
4546659	4611871	4677082	219	217	217	216	215	213	213	212	211	210
5198733	5263935	5329136	65209	208	206	206	205	204	203	202	201	201
5850710	5915902	5981093	199	198	197	196	195	195	193	192	191	191
6502588	6567771	6632952	189	188	188	186	185	185	183	183	181	181
7154369	7219542	7284713	179	179	177	177	176	174	174	173	171	171
7806052	7871215	7936377	170	169	167	167	166	165	164	163	162	160
8457637	8522790	8587942	160	159	158	158	156	155	154	153	152	151
9109124	9174267	9239410	150	150	148	147	146	146	144	143	143	141
9760514	9825647	9890780	141	139	139	137	137	135	135	133	133	132
0411806	0476929	0542052	130	130	129	127	127	126	125	123	123	122
1063000	1128114	1193227	121	120	119	118	117	116	115	114	113	112
1714097	1779201	1844304	65111	110	110	108	107	106	106	104	103	103
2365096	2430190	2495284	101	100	100	098	098	096	096	094	094	092
3015997	3081082	3146166	092	091	089	089	088	086	086	085	084	083
3666801	3731876	3796950	081	081	080	079	078	077	076	075	074	073
4317507	4382573	4447637	072	071	071	069	068	067	066	066	064	063
4968116	5033172	5098226	063	061	061	059	058	058	056	056	054	054
5618628	5683674	5748718	053	051	051	050	048	048	047	046	044	044
6269042	6334078	6399113	043	042	041	040	039	038	037	036	035	034
6919359	6984385	7049410	033	032	032	030	029	028	028	026	025	025
7569578	7634595	7699610	023	022	022	020	020	018	018	017	015	015
8219700	8284707	8349713	65013	013	012	011	009	009	008	007	006	005
8869725	8934722	8999718	003	003	002	001	000	000	998	997	996	995
9519652	9584639	9649626	64994	993	993	991	990	990	988	987	987	985
0169482	0234460	0299436	985	983	983	981	981	979	979	978	976	976
0819215	0884183	0949150	975	974	973	971	971	970	969	968	967	966
1468851	1533809	1598766	965	964	963	962	961	961	959	958	957	957
2118389	2183338	2248285	955	954	954	952	951	951	949	949	947	947
2767831	2832770	2897707	946	944	944	943	941	941	940	939	937	937
3417175	3482104	3547032	936	935	934	933	932	931	930	929	928	928
4066422	4131342	4196260	926	925	924	923	923	921	920	920	918	918
4715573	4780482	4845391	64916	916	914	914	912	912	911	909	909	908
5364626	5429526	5494425	907	905	905	904	903	902	901	900	899	898
6013582	6078472	6143362	897	896	895	894	894	892	891	890	890	888
6662441	6727322	6792202	887	887	885	885	883	883	881	881	880	878
7311204	7376075	7440945	878	877	875	875	874	873	872	871	870	868
7959869	8024730	8089591	868	868	866	865	864	863	862	861	861	859
8608438	8673289	8738140	858	858	856	855	855	853	853	851	851	849
9256909	9321751	9386592	849	848	846	846	845	844	842	842	841	840
9905284	9970116	0034948	839	838	837	836	835	834	833	832	832	830
0553562	0618385	0683206	829	828	828	826	826	824	823	823	821	821
1201744	1266557	1331368	820	818	818	817	815	815	814	813	811	811

Numbers 67000-67609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6700	8260748027	0812847	0877665	0942483	1007300	1072115	1136930
1	1396179	1460989	1525798	1590606	1655413	1720219	1785024
2	2044235	2109035	2173835	2238633	2303430	2368227	2433022
3	2692194	2756985	2821774	2886563	2951350	3016137	3080923
4	3340056	3404837	3469617	3534396	3599174	3663951	3728727
5	3987822	4052593	4117363	4182133	4246901	4311668	4376435
6	4635491	4700253	4765013	4829773	4894532	4959289	5024046
7	5283063	5347815	5412566	5477316	5542065	5606813	5671561
8	5930539	5995282	6060023	6124763	6189503	6254241	6318979
9	6577919	6642651	6707383	6772114	6836844	6901572	6966300
6710	8267225202	7289925	7354647	7419368	7484088	7548807	7613525
11	7872388	7937102	8001814	8066525	8131236	8195945	8260654
12	8519478	8584182	8648885	8713586	8778287	8842987	8907686
13	9166472	9231166	9295859	9360551	9425242	9489933	9554622
14	9813369	9878054	9942737	0007420	0072101	0136782	0201461
15	8270460170	0524845	0589519	0654192	0718863	0783534	0848204
16	1106875	1171540	1236204	1300867	1365530	1430191	1494851
17	1753483	1818139	1882793	1947447	2012099	2076751	2141402
18	2399995	2464641	2529286	2593930	2658573	2723215	2787856
19	3046411	3111047	3175683	3240317	3304950	3369583	3434214
6720	8273692731	3757357	3821983	3886608	3951231	4015854	4080476
21	4338954	4403571	4468187	4532802	4597416	4662030	4726642
22	4985081	5049689	5114295	5178901	5243505	5308109	5372712
23	5631113	5695710	5760307	5824903	5889498	5954092	6018685
24	6277048	6341636	6406223	6470809	6535395	6599979	6664563
25	6922887	6987465	7052043	7116620	7181195	7245770	7310344
26	7568630	7633199	7697767	7762334	7826900	7891465	7956030
27	8214277	8278836	8343395	8407952	8472509	8537064	8601619
28	8859828	8924378	8988927	9053475	9118021	9182567	9247112
29	9505283	9569823	9634363	9698901	9763438	9827975	9892510
6730	8280150642	0215173	0279703	0344231	0408759	0473286	0537812
31	0795906	0860427	0924947	0989466	1053984	1118501	1183018
32	1441073	1505585	1570095	1634605	1699113	1763621	1828128
33	2086145	2150647	2215148	2279647	2344147	2408645	2473142
34	2731121	2795613	2860104	2924595	2989084	3053573	3118060
35	3376001	3440483	3504965	3569446	3633926	3698405	3762883
36	4020785	4085258	4149730	4214202	4278672	4343141	4407610
37	4665474	4729937	4794400	4858861	4923322	4987782	5052241
38	5310066	5374520	5438974	5503426	5567877	5632327	5696776
39	5954564	6019008	6083452	6147894	6212336	6276776	6341216
6740	8286598965	6663400	6727834	6792267	6856699	6921130	6985560
41	7243271	7307697	7372121	7436545	7500967	7565389	7629809
42	7887482	7951898	8016312	8080726	8145139	8209551	8273962
43	8531597	8596003	8660408	8724813	8789216	8853618	8918020
44	9175616	9240013	9304409	9368803	9433197	9497590	9561982
45	9819540	9883927	9948313	0012699	0077083	0141466	0205849
46	8290463369	0527746	0592123	0656498	0720873	0785247	0849620
47	1107102	1171470	1235837	1300203	1364568	1428932	1493296
48	1750739	1815098	1879455	1943812	2008168	2072522	2136876
49	2394281	2458630	2522978	2587325	2651672	2716017	2780361
6750	8293037728	3102068	3166406	3230744	3295080	3359416	3423751
51	3681080	3745410	3809739	3874067	3938394	4002720	4067045
52	4324336	4388657	4452976	4517294	4581612	4645929	4710244
53	4967497	5031808	5096118	5160427	5224735	5289042	5353348
54	5610563	5674864	5739165	5803464	5867763	5932060	5996357
55	6253534	6317825	6382116	6446406	6510695	6574983	6639270
56	6896409	6960691	7024973	7089253	7153533	7217811	7282089
57	7539189	7603462	7667734	7732005	7796275	7860544	7924812
58	8181874	8246138	8310400	8374661	8438922	8503181	8567440
59	8824464	8888718	8952971	9017223	9081474	9145724	9209973
6760	9466959	9531204	9595447	9659689	9723931	9788171	9852411

OF NUMBERS.

Logarithms 8260748027–8300045124.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1201744	1266557	1331368	64820	818	818	817	815	815	814	813	811	811
1849828	1914632	1979434	810	809	808	807	806	805	804	804	802	801
2497816	2562610	2627402	800	800	798	797	797	795	794	794	792	792
3145708	3210491	3275274	791	789	789	787	787	786	785	783	783	782
3793502	3858276	3923050	781	780	779	778	777	776	775	774	774	772
4441200	4505965	4570728	771	770	770	768	767	767	765	765	763	763
5088802	5153557	5218311	762	760	760	759	757	757	756	755	754	752
5736307	5801052	5865796	752	751	750	749	748	748	746	745	744	743
6383715	6448451	6513185	743	741	740	740	738	738	736	736	734	734
7031027	7095753	7160478	732	732	731	730	728	728	727	726	725	724
7678242	7742959	7807674	64723	722	721	720	719	718	717	717	715	714
8325361	8390068	8454774	714	712	711	711	709	709	707	707	706	704
8972384	9037081	9101777	704	703	701	701	700	699	698	697	696	695
9619310	9683997	9748684	694	693	692	691	691	689	688	687	687	685
0266140	0330818	0395494	685	683	683	681	681	679	679	678	676	676
0912873	0977541	1042209	675	674	673	671	671	670	669	668	668	666
1559511	1624169	1688826	665	664	663	663	661	660	660	658	657	657
2206052	2270700	2335348	656	654	654	652	652	651	650	648	648	647
2852496	2917135	2981774	646	645	644	643	642	641	640	639	639	637
3498845	3563474	3628103	636	636	634	633	633	631	631	629	629	628
4145097	4209717	4274336	64626	626	625	623	623	622	621	620	619	618
4791253	4855864	4920473	617	616	615	614	614	612	611	611	609	608
5437313	5501914	5566514	608	606	606	604	604	603	601	601	600	599
6083277	6147868	6212458	597	597	596	595	594	593	592	591	590	590
6729145	6793727	6858307	588	587	586	586	584	584	582	582	580	580
7374917	7439489	7504060	578	578	577	575	575	574	573	572	571	570
8020593	8085155	8149716	569	568	567	566	565	565	563	562	561	561
8666173	8730725	8795277	559	559	557	557	555	555	554	552	552	551
9311657	9376200	9440742	550	549	548	546	546	545	545	543	542	541
9957045	0021578	0086111	540	540	538	537	537	535	535	533	533	531
0602337	0666861	0731384	64531	530	528	528	527	526	525	524	523	522
1247533	1312047	1376561	521	520	519	518	517	517	515	514	514	512
1892633	1957138	2021642	512	510	510	508	508	507	505	505	504	503
2537638	2602133	2666627	502	501	499	500	498	497	496	495	494	494
3182547	3247032	3311517	492	491	491	489	489	487	487	485	485	484
3827360	3891836	3956311	482	482	481	480	479	478	477	476	475	474
4472077	4536543	4601009	473	472	472	470	469	469	467	466	466	465
5116699	5181156	5245611	463	463	461	461	460	459	458	457	455	455
5761225	5825672	5890118	454	454	452	451	450	449	449	447	446	446
6405655	6470093	6534530	444	444	442	442	440	440	439	438	437	435
7049990	7114418	7178845	64435	434	433	432	431	430	430	428	427	426
7694229	7758647	7823065	426	424	424	422	422	420	420	418	418	417
8338372	8402781	8467190	416	414	414	413	412	411	410	409	409	407
8982420	9046820	9111219	406	405	405	403	402	402	400	400	399	397
9626373	9690763	9755152	397	396	394	394	393	392	391	390	389	388
0270230	0334610	0398990	387	386	386	384	383	383	381	380	380	379
0913992	0978363	1042733	377	377	375	375	374	373	372	371	370	369
1557658	1622019	1686380	368	367	366	365	364	364	362	361	361	359
2201229	2265581	2329931	359	357	357	356	354	354	353	352	350	350
2844704	2909047	2973388	349	348	347	347	345	344	343	343	341	340
3488084	3552417	3616749	64340	338	338	336	336	335	333	333	332	331
4131369	4195693	4260015	330	329	328	327	326	325	324	324	322	321
4774559	4838873	4903185	321	319	318	318	317	315	315	314	312	312
5417653	5481957	5546261	311	310	309	308	307	306	305	304	304	302
6060652	6124947	6189241	301	301	299	299	297	297	295	295	294	293
6703556	6767842	6832126	291	291	290	289	288	287	286	286	284	283
7346365	7410641	7474916	282	282	280	280	278	278	276	276	275	273
7989079	8053345	8117610	273	272	271	270	269	268	267	266	265	264
8631697	8695954	8760210	264	262	261	261	259	259	257	257	256	254
9274221	9338468	9402714	254	253	252	251	250	249	248	247	246	245
9916649	9980887	0045124	245	243	242	242	240	240	238	238	237	235

Numbers 67600–68209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6760	8299466959	9531204	9595447	9659689	9723931	9788171	9852411
61	8300109359	0173594	0237828	0302061	0366293	0430524	0494754
62	0751664	0815890	0880114	0944337	1008560	1072781	1137002
63	1393874	1458090	1522305	1586519	1650732	1714944	1779155
64	2035989	2100196	2164401	2228605	2292809	2357011	2421213
65	2678009	2742206	2806402	2870597	2934791	2998984	3063176
66	3319935	3384122	3448308	3512494	3576678	3640862	3705044
67	3961765	4025943	4090120	4154295	4218470	4282644	4346817
68	4603500	4667669	4731836	4796002	4860168	4924332	4988496
69	5245141	5309300	5373458	5437615	5501771	5565926	5630080
6770	8305886687	5950836	6014985	6079132	6143279	6207424	6271569
71	6528138	6592278	6656417	6720555	6784692	6848828	6912963
72	7169494	7233625	7297754	7361883	7426010	7490137	7554263
73	7810756	7874877	7938997	8003116	8067234	8131351	8195468
74	8451923	8516035	8580145	8644255	8708363	8772471	8836578
75	9092995	9157097	9221199	9285299	9349398	9413496	9477593
76	9733973	9798066	9862157	9926248	9990338	0054427	0118514
77	8310374856	0438940	0503022	0567103	0631183	0695263	0759341
78	1015645	1079719	1143791	1207863	1271934	1336004	1400073
79	1656339	1720403	1784467	1848529	1912590	1976651	2040710
6780	8312296939	2360993	2425047	2489100	2553152	2617203	2681253
81	2937444	3001489	3065533	3129577	3193619	3257661	3321701
82	3577854	3641890	3705925	3769959	3833992	3898024	3962055
83	4218171	4282197	4346223	4410247	4474271	4538293	4602315
84	4858392	4922409	4986426	5050441	5114455	5178468	5242480
85	5498520	5562528	5626534	5690540	5754545	5818548	5882551
86	6138553	6202551	6266548	6330545	6394540	6458534	6522528
87	6778492	6842481	6906468	6970455	7034441	7098426	7162410
88	7418336	7482316	7546294	7610271	7674248	7738223	7802198
89	8058087	8122057	8186025	8249993	8313960	8377927	8441892
6790	8318697743	8761703	8825663	8889621	8953579	9017536	9081491
91	9337305	9401256	9465206	9529155	9593103	9657050	9720997
92	9976772	0040714	0104655	0168594	0232533	0296471	0360408
93	8320616146	0680078	0744009	0807940	0871869	0935797	0999725
94	1255425	1319348	1383270	1447191	1511111	1575030	1638948
95	1894611	1958524	2022436	2086348	2150258	2214168	2278077
96	2533702	2597606	2661509	2725411	2789312	2853212	2917112
97	3172699	3236594	3300487	3364380	3428272	3492163	3556052
98	3811602	3875488	3939372	4003255	4067137	4131019	4194899
99	4450412	4514288	4578162	4642036	4705909	4769781	4833652
6800	8325089127	5152993	5216859	5280723	5344587	5408450	5472311
1	5727748	5791605	5855461	5919317	5983171	6047024	6110876
2	6366276	6430124	6493970	6557816	6621661	6685505	6749347
3	7004710	7068548	7132385	7196221	7260057	7323891	7387725
4	7643049	7706878	7770706	7834533	7898359	7962184	8026008
5	8281295	8345115	8408933	8472751	8536568	8600383	8664198
6	8919448	8983258	9047067	9110875	9174682	9238489	9302294
7	9557506	9621307	9685106	9748905	9812703	9876500	9940296
8	8330195471	0259262	0323052	0386842	0450630	0514418	0578205
9	0833342	0897124	0960905	1024685	1088464	1152242	1216019
6810	8331471119	1534892	1598663	1662434	1726204	1789973	1853741
11	2108803	2172566	2236328	2300090	2363850	2427610	2491368
12	2746393	2810147	2873900	2937652	3001403	3065153	3128902
13	3383889	3447634	3511377	3575120	3638862	3702603	3766342
14	4021292	4085027	4148762	4212495	4276227	4339959	4403689
15	4658602	4722328	4786052	4849776	4913499	4977221	5040942
16	5295818	5359534	5423250	5486964	5550678	5614390	5678102
17	5932940	5996647	6060353	6124058	6187763	6251466	6315169
18	6569969	6633667	6697364	6761059	6824754	6888448	6952141
19	7206904	7270593	7334280	7397967	7461653	7525337	7589021
6820	7843747	7907426	7971104	8034781	8098457	8162133	8225807

OF NUMBERS.

Logarithms 8299466959–8338416825.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9916649	9980887	0045124	64245	243	242	242	240	240	238	238	237	235
0558983	0623211	0687438	235	234	233	232	231	230	229	228	227	226
1201221	1265440	1329658	226	224	223	223	221	221	219	219	218	216
1843365	1907574	1971782	216	215	214	213	212	211	210	209	208	207
2485413	2549613	2613812	207	205	204	204	202	202	200	200	199	197
3127367	3191557	3255746	197	196	195	194	193	192	191	190	189	189
3769226	3833406	3897586	187	186	186	184	184	182	182	180	180	179
4410990	4475161	4539331	178	177	175	175	174	173	173	171	170	169
5052659	5116820	5180981	169	167	166	166	164	164	163	161	161	160
5694233	5758385	5822537	159	158	157	156	155	154	153	152	152	150
6335713	6399855	6463997	64149	149	147	147	145	145	144	142	142	141
6977097	7041231	7105363	140	139	138	137	136	135	134	134	132	131
7618387	7682511	7746634	131	129	129	127	127	126	124	124	123	122
8259583	8323697	8387811	121	120	119	118	117	117	115	114	114	112
8900684	8964789	9028892	112	110	110	108	108	107	106	105	103	103
9541690	9605785	9669880	102	102	100	099	098	097	097	095	095	093
0182601	0246687	0310772	093	091	091	090	089	087	087	086	085	084
0823418	0887495	0951570	084	082	081	080	080	078	077	077	075	075
1464141	1528208	1592274	074	072	072	071	070	069	068	067	066	065
2104769	2168826	2232883	064	064	062	061	061	059	059	057	057	056
2745302	2809350	2873398	64054	054	053	052	051	050	049	048	048	046
3385741	3449780	3513818	045	044	044	042	042	040	040	039	038	036
4026086	4090115	4154143	036	035	034	033	032	031	031	029	028	028
4666336	4730356	4794375	026	026	024	024	022	022	021	020	019	017
5306492	5370502	5434511	017	017	015	014	013	012	012	010	009	009
5946553	6010554	6074554	008	006	006	005	003	003	002	001	000	999
6586520	6650512	6714502	63998	997	997	995	994	994	992	992	990	990
7226393	7290375	7354356	989	987	987	986	985	984	983	982	981	980
7866172	7930144	7994116	980	978	977	977	975	975	974	972	972	971
8505856	8569819	8633781	970	968	968	967	967	965	964	963	962	962
9145446	9209400	9273353	63960	960	958	958	957	955	955	954	953	952
9784942	9848886	9912830	951	950	949	948	947	947	945	944	944	942
0424344	0488279	0552213	942	941	939	939	938	937	936	935	934	933
1063651	1127577	1191502	932	931	931	929	928	928	926	926	925	923
1702865	1766781	1830696	923	922	921	920	919	918	917	916	915	915
2341984	2405891	2469797	913	912	912	910	910	909	907	907	906	905
2981010	3044907	3108804	904	903	902	901	900	900	898	897	897	895
3619941	3683829	3747716	895	893	893	892	891	889	889	888	887	886
4258779	4322657	4386535	886	884	883	882	882	880	880	878	878	877
4897522	4961392	5025260	876	874	874	873	872	871	870	870	868	867
5536172	5600032	5663891	63866	866	864	864	863	861	861	860	859	857
6174728	6238578	6302427	857	856	856	854	853	852	852	850	849	849
6813189	6877030	6940870	848	846	846	845	844	842	842	841	840	840
7451557	7515389	7579220	838	837	836	836	834	834	832	832	831	829
8089831	8153654	8217475	829	828	827	826	825	824	823	823	821	820
8728012	8791825	8855637	820	818	818	817	815	815	814	813	812	811
9366098	9429902	9493704	810	809	808	807	807	805	804	804	802	802
0004091	0067885	0131679	801	799	799	798	797	796	795	794	794	792
0641990	0705775	0769559	791	790	790	788	788	787	785	785	784	783
1279796	1343571	1407346	782	781	780	779	778	777	777	775	775	773
1917508	1981274	2045039	63773	771	771	770	769	768	767	766	765	764
2555126	2618882	2682638	763	762	762	760	760	758	758	756	756	755
3192650	3256398	3320144	754	753	752	751	750	749	748	748	746	745
3830081	3893819	3957556	745	743	743	742	741	739	739	738	737	736
4467419	4531147	4594875	735	735	733	732	732	730	730	728	728	727
5104663	5168382	5232100	726	724	724	723	722	721	721	719	718	718
5741813	5805523	5869232	716	716	714	714	712	712	711	710	709	708
6378870	6442571	6506270	707	706	705	705	703	703	701	701	699	699
7015834	7079525	7143215	698	697	695	695	694	693	693	691	690	689
7652704	7716386	7780067	689	687	687	686	684	684	683	682	681	680
8289480	8353153	8416825	679	678	677	676	676	674	673	673	672	670

NUMBERS 68200—68809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6820	8337843747	7907426	7971104	8034781	8098457	8162133	8225807
21	8480495	8544165	8607834	8671502	8735169	8798835	8862500
22	9117151	9180811	9244471	9308129	9371787	9435443	9499099
23	9753713	9817364	9881014	9944663	0008312	0071959	0135605
24	8340390182	0453823	0517464	0581104	0644743	0708381	0772018
25	1026557	1090190	1153821	1217452	1281081	1344710	1408338
26	1662839	1726463	1790085	1853706	1917326	1980946	2044564
27	2299029	2362642	2426255	2489867	2553478	2617088	2680697
28	2935124	2998729	3062332	3125935	3189537	3253137	3316737
29	3571127	3634722	3698317	3761910	3825502	3889094	3952684
6830	8344207037	4270623	4334208	4397792	4461375	4524957	4588538
31	4842853	4906430	4970005	5033580	5097154	5160727	5224299
32	5478577	5542144	5605710	5669276	5732840	5796404	5859966
33	6114207	6177765	6241322	6304878	6368433	6431988	6495541
34	6749745	6813293	6876841	6940388	7003934	7067478	7131022
35	7385189	7448728	7512267	7575804	7639341	7702876	7766411
36	8020540	8084071	8147600	8211128	8274655	8338181	8401707
37	8655799	8719320	8782840	8846358	8909876	8973393	9036910
38	9290965	9354476	9417987	9481496	9545005	9608513	9672019
39	9926037	9989539	0053041	0116541	0180040	0243539	0307036
6840	8350561017	0624510	0688002	0751493	0814983	0878472	0941961
41	1195904	1259388	1322871	1386352	1449833	1513313	1576792
42	1830698	1894173	1957646	2021119	2084590	2148061	2211531
43	2465400	2528865	2592329	2655792	2719255	2782716	2846176
44	3100009	3163464	3226919	3290373	3353826	3417278	3480729
45	3734525	3797971	3861417	3924861	3988305	4051748	4115190
46	4368948	4432385	4495822	4559257	4622691	4686125	4749558
47	5003279	5066707	5130134	5193560	5256985	5320409	5383833
48	5637517	5700935	5764353	5827770	5891186	5954601	6018015
49	6271662	6335072	6398480	6461888	6525294	6588700	6652105
6850	8356905715	6969115	7032514	7095913	7159310	7222707	7286102
51	7539675	7603066	7666456	7729845	7793233	7856621	7920007
52	8173543	8236925	8300305	8363685	8427064	8490442	8553819
53	8807318	8870691	8934062	8997433	9060802	9124171	9187539
54	9441001	9504364	9567726	9631088	9694448	9757808	9821166
55	8360074591	0137945	0201298	0264650	0328002	0391352	0454701
56	0708089	0771434	0834778	0898121	0961462	1024803	1088144
57	1341495	1404830	1468165	1531498	1594831	1658163	1721494
58	1974808	2038134	2101459	2164784	2228107	2291430	2354751
59	2608029	2671346	2734662	2797977	2861291	2924604	2987917
6860	8363241157	3304465	3367772	3431078	3494383	3557687	3620990
61	3874193	3937492	4000789	4064086	4127382	4190677	4253971
62	4507137	4570427	4633715	4697002	4760289	4823575	4886859
63	5139989	5203269	5266548	5329826	5393104	5456380	5519656
64	5772748	5836019	5899289	5962558	6025826	6089094	6152360
65	6405416	6468677	6531938	6595198	6658457	6721715	6784972
66	7037991	7101243	7164495	7227745	7290995	7354244	7417492
67	7670474	7733717	7796959	7860201	7923441	7986681	8049920
68	8302865	8366099	8429332	8492564	8555795	8619026	8682255
69	8935164	8998389	9061612	9124835	9188058	9251279	9314499
6870	8369567371	9630586	9693801	9757015	9820228	9883440	9946651
71	8370199485	0262692	0325897	0389102	0452306	0515508	0578710
72	0831508	0894705	0957902	1021097	1084292	1147485	1210678
73	1463439	1526627	1589814	1653000	1716186	1779370	1842553
74	2095278	2158457	2221635	2284812	2347988	2411163	2474337
75	2727025	2790195	2853363	2916531	2979698	3042864	3106029
76	3358680	3421841	3485000	3548159	3611316	3674473	3737629
77	3990243	4053395	4116545	4179694	4242843	4305991	4369137
78	4621715	4684857	4747998	4811138	4874278	4937416	5000554
79	5253094	5316227	5379359	5442490	5505621	5568750	5631878
6880	5884382	5947506	6010629	6073751	6136872	6199992	6263111

OF NUMBERS. Logarithms 8337843747-8376452463.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8289480	8353153	8416825	63679	678	677	676	676	674	673	673	672	670
8926164	8989827	9053489	670	669	668	667	666	665	664	663	662	662
9562754	9626408	9690061	660	660	658	658	656	656	655	654	653	652
0199251	0262895	0326539	651	650	649	649	647	646	646	644	644	643
0835654	0899289	0962924	641	641	640	639	638	637	636	635	635	633
1471965	1535590	1599215	633	631	631	629	629	628	627	625	625	624
2108182	2171798	2235414	624	622	621	620	620	618	618	616	616	615
2744305	2807913	2871519	613	613	612	611	610	609	608	608	606	605
3380336	3443934	3507531	605	603	603	602	600	600	599	598	597	596
4016274	4079862	4143450	595	595	593	592	592	590	590	588	588	587
4652118	4715697	4779276	63586	585	584	583	582	581	580	579	579	577
5287870	5351440	5415009	577	575	575	574	573	572	571	570	569	568
5923528	5987089	6050648	567	566	566	564	564	562	562	561	559	559
6559093	6622645	6686195	558	557	556	555	555	553	552	552	550	550
7194565	7258108	7321649	548	548	547	546	544	544	543	543	541	540
7829945	7893478	7957010	539	539	537	537	535	535	534	533	532	530
8465231	8528755	8592277	531	529	528	527	526	526	524	524	522	522
9100425	9163939	9227452	521	520	518	518	517	517	515	514	513	513
9735525	9799030	9862534	511	511	509	509	508	506	506	505	504	503
0370533	0434029	0497523	502	502	500	499	499	497	497	496	494	494
1005448	1068934	1132420	63493	492	491	490	489	489	487	486	486	484
1640270	1703747	1767223	484	483	481	481	480	479	478	477	476	475
2274999	2338467	2401934	475	473	473	471	471	470	468	468	467	466
2909636	2973094	3036552	465	464	463	463	461	460	460	458	458	457
3544180	3607629	3671077	455	455	454	453	452	451	451	449	448	448
4178631	4242071	4305510	446	446	444	444	443	442	441	440	439	438
4812989	4876420	4939850	437	437	435	434	434	433	431	431	430	429
5447255	5510676	5574097	428	427	426	425	424	424	422	421	421	420
6081428	6144840	6208252	418	418	417	416	415	414	413	412	412	410
6715509	6778912	6842314	410	408	408	406	406	405	404	403	402	401
7349497	7412891	7476283	63400	399	399	397	397	395	395	394	392	392
7983392	8046777	8110160	391	390	389	388	388	386	385	385	383	383
8617195	8680571	8743945	382	380	380	379	378	377	376	376	374	373
9250906	9314272	9377637	373	371	371	369	369	368	367	366	365	364
9884524	9947881	0011236	363	362	362	360	360	358	358	357	355	355
0518049	0581397	0644744	354	353	352	352	350	349	348	348	347	345
1151483	1214821	1278158	345	344	343	341	341	341	339	338	337	337
1784824	1848153	1911481	335	335	333	333	332	331	330	329	328	327
2418072	2481392	2544711	326	325	325	323	323	321	321	320	319	318
3051228	3114539	3177848	317	316	315	314	313	313	311	311	309	309
3684292	3747593	3810894	63308	307	306	305	304	303	302	301	301	299
4317264	4380556	4443847	299	297	297	296	295	294	293	292	291	290
4950143	5013426	5076708	290	288	287	287	286	284	284	283	282	281
5582930	5646204	5709477	280	279	278	278	276	276	274	274	273	271
6215625	6278890	6342153	271	270	269	268	268	266	265	265	263	263
6848228	6911483	6974738	261	261	260	259	258	257	256	255	255	253
7480739	7543985	7607230	252	252	250	250	249	248	247	246	245	244
8113157	8176394	8239630	243	242	242	240	240	239	237	237	236	235
8745484	8808711	8871938	234	233	232	231	231	229	229	227	227	226
9377718	9440937	9504154	225	223	223	223	221	220	219	219	217	217
0009861	0073070	0136278	63215	215	214	213	212	211	210	209	208	207
0641911	0705111	0768310	207	205	205	204	202	202	201	200	199	198
1273869	1337060	1400250	197	197	195	195	193	193	191	191	190	189
1905736	1968918	2032098	188	187	186	186	184	183	183	182	180	180
2537511	2600683	2663854	179	178	177	176	175	174	174	172	171	171
3169193	3232356	3295519	170	168	168	167	166	165	164	163	163	161
3800784	3863938	3927091	161	159	159	157	157	156	155	154	153	152
4432283	4495428	4558572	152	150	149	149	148	146	146	145	144	143
5063690	5126826	5189961	142	141	140	140	138	138	136	136	135	133
5695006	5758132	5821258	133	132	131	131	129	128	128	126	126	124
6326229	6389347	6452463	124	123	122	121	120	119	118	118	116	115

Numbers 68800–69409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6880	8375884382	5947506	6010629	6073751	6136872	6199992	6263111
81	6515578	6578693	6641807	6704919	6768031	6831142	6894252
82	7146683	7209788	7272893	7335996	7399099	7462201	7525301
83	7777696	7840792	7903887	7966981	8030075	8093168	8156259
84	8408617	8471704	8534790	8597875	8660959	8724043	8787125
85	9039446	9102524	9165601	9228677	9291752	9354826	9417900
86	9670184	9733252	9796320	9859387	9922453	9985518	0048582
87	8380300830	0363889	0426948	0490006	0553063	0616119	0679174
88	0931384	0994435	1057484	1120533	1183581	1246627	1309673
89	1561848	1624889	1687929	1750969	1814007	1877045	1940081
6890	8382192219	2255251	2318282	2381313	2444342	2507371	2570398
91	2822499	2885522	2948544	3011565	3074586	3137605	3200623
92	3452688	3515702	3578715	3641727	3704738	3767748	3830757
93	4082785	4145790	4208793	4271796	4334798	4397799	4460799
94	4712791	4775786	4838781	4901775	4964767	5027759	5090750
95	5342705	5405692	5468677	5531662	5594645	5657628	5720610
96	5972528	6035505	6098482	6161457	6224432	6287405	6350378
97	6602260	6665228	6728195	6791162	6854127	6917092	6980055
98	7231900	7294859	7357817	7420775	7483731	7546686	7609641
99	7861449	7924399	7987348	8050296	8113244	8176190	8239135
6900	8388490907	8553848	8616788	8679727	8742665	8805602	8868538
1	9120274	9183206	9246136	9309066	9371995	9434923	9497850
2	9749550	9812472	9875394	9938314	0001234	0064153	0127071
3	8390378734	0441647	0504560	0567471	0630382	0693292	0756201
4	1007827	1070731	1133635	1196537	1259439	1322339	1385239
5	1636829	1699724	1762619	1825512	1888404	1951296	2014187
6	2265740	2328626	2391511	2454396	2517279	2580161	2643043
7	2894560	2957437	3020313	3083188	3146063	3208936	3271808
8	3523289	3586157	3649024	3711890	3774755	3837619	3900483
9	4151927	4214786	4277643	4340500	4403357	4466212	4529066
6910	8394780474	4843323	4906172	4969020	5031867	5094713	5157558
11	5408930	5471770	5534610	5597449	5660287	5723124	5785960
12	6037295	6100126	6162957	6225786	6288615	6351443	6414270
13	6665569	6728391	6791213	6854033	6916853	6979672	7042490
14	7293752	7356565	7419378	7482189	7545000	7607810	7670618
15	7921844	7984649	8047452	8110254	8173056	8235857	8298656
16	8549846	8612641	8675435	8738229	8801021	8863813	8926603
17	9177757	9240543	9303328	9366112	9428896	9491678	9554460
18	9805577	9868354	9931130	9993905	0056679	0119453	0182225
19	8400433306	0496074	0558841	0621607	0684372	0747137	0809900
6920	8401060945	1123703	1186461	1249218	1311975	1374730	1437484
21	1688492	1751242	1813991	1876739	1939486	2002232	2064978
22	2315950	2378690	2441430	2504169	2566907	2629644	2692380
23	2943316	3006048	3068779	3131508	3194237	3256965	3319693
24	3570592	3633315	3696036	3758757	3821477	3884196	3946914
25	4197777	4260491	4323204	4385915	4448626	4511336	4574045
26	4824872	4887577	4950280	5012983	5075685	5138386	5201086
27	5451876	5514572	5577266	5639960	5702653	5765345	5828035
28	6078790	6141476	6204162	6266847	6329530	6392213	6454895
29	6705613	6768291	6830967	6893643	6956317	7018991	7081664
6930	8407332346	7395014	7457682	7520348	7583014	7645679	7708342
31	7958988	8021647	8084306	8146964	8209620	8272276	8334930
32	8585540	8648191	8710840	8773488	8836136	8898782	8961428
33	9212002	9274643	9337283	9399923	9462561	9525199	9587836
34	9838373	9901005	9963637	0026267	0088896	0151525	0214153
35	8410464654	0527277	0589899	0652521	0715141	0777761	0840379
36	1090845	1153459	1216072	1278684	1341296	1403906	1466516
37	1716945	1779550	1842154	1904757	1967360	2029961	2092562
38	2342955	2405551	2468146	2530740	2593334	2655926	2718518
39	2968875	3031462	3094048	3156633	3219218	3281801	3344384
6940	3594705	3657283	3719860	3782436	3845011	3907586	3970159

OF NUMBERS. Logarithms 837588438²–8414157874.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6326229	6389347	6452463	63124	123	122	121	120	119	118	118	116	115
6957361	7020469	7083577	115	114	112	112	111	110	109	108	108	106
7588401	7651500	7714598	105	105	103	103	102	100	100	099	098	098
8219350	8282440	8345529	096	095	094	094	093	091	091	090	089	088
8850207	8913287	8976367	087	086	085	084	084	082	082	080	080	079
9480972	9544043	9607114	078	077	076	075	074	074	072	071	071	070
0111646	0174708	0237769	068	068	067	066	065	064	064	062	061	061
0742228	0805281	0868333	059	059	058	057	056	055	054	053	052	051
1372718	1435762	1498805	051	049	049	048	046	046	045	044	043	043
2003117	2066152	2129186	041	040	040	038	038	036	036	035	034	033
2633425	2696450	2759475	63032	031	031	029	029	027	027	025	025	024
3263641	3326657	3389673	023	022	021	021	019	018	018	016	016	015
3893765	3956773	4019779	014	013	012	011	010	009	008	008	006	006
4523799	4586797	4649794	005	003	003	002	001	000	000	998	997	997
5153740	5216730	5279718	62995	995	994	992	992	991	990	990	988	987
5783591	5846571	5909550	987	985	985	983	983	982	981	980	979	978
6413350	6476321	6539291	977	977	975	975	973	973	972	971	970	969
7043018	7105980	7168940	968	967	967	965	965	963	963	962	960	960
7672594	7735547	7798499	959	958	958	956	955	955	953	953	952	950
8302080	8365023	8427966	950	949	948	948	946	945	945	943	943	941
8931474	8994408	9057342	62941	940	939	938	937	936	936	934	934	932
9560776	9623702	9686626	932	930	930	929	928	927	926	926	924	924
0189988	0252904	0315820	922	922	920	920	919	918	917	916	916	914
0819109	0882016	0944922	913	913	911	911	910	909	908	907	906	905
1448138	1511036	1573933	904	904	902	902	900	900	899	898	897	896
2077076	2139965	2202853	895	895	893	892	892	891	889	889	888	887
2705924	2768803	2831682	886	885	885	883	882	882	881	879	879	878
3334680	3397550	3460420	877	876	875	875	873	872	872	870	870	869
3963345	4026207	4089067	868	867	866	865	864	864	862	862	860	860
4591919	4654772	4717623	859	857	857	857	855	854	853	853	851	851
5220402	5283246	5346088	62849	849	848	847	846	845	844	844	842	842
5848795	5911629	5974462	840	840	839	838	837	836	835	834	833	833
6477096	6539921	6602746	831	831	829	829	828	827	826	825	825	823
7105307	7168123	7230938	822	822	820	820	819	818	817	816	815	814
7733426	7796233	7859039	813	813	811	811	810	808	808	807	806	805
8361455	8424253	8487050	805	803	802	802	801	799	799	798	797	796
8989393	9052182	9114970	795	794	794	792	792	790	790	789	788	787
9617240	9680020	9742799	786	785	784	784	782	782	780	780	779	778
0244997	0307767	0370537	777	776	775	774	774	772	772	770	770	769
0872663	0935424	0998185	768	767	766	765	765	763	763	761	761	760
1500238	1562990	1625742	62758	758	757	757	755	754	754	752	752	750
2127722	2190465	2253208	750	749	748	747	746	746	744	743	743	742
2755116	2817850	2880584	740	740	739	738	737	736	736	734	734	732
3382419	3445144	3507869	732	731	729	729	728	728	726	725	725	723
4009631	4072348	4135063	723	721	721	720	719	718	717	717	715	714
4636753	4699460	4762167	714	713	711	711	710	709	708	707	707	705
5263785	5326483	5389180	705	703	703	702	701	700	699	698	697	696
5890725	5953415	6016103	696	694	694	693	692	690	690	690	688	687
6517576	6580256	6642935	686	686	685	683	683	682	681	680	679	678
7144336	7207007	7269677	678	676	676	674	674	673	672	671	670	669
7771005	7833667	7896328	62668	668	666	666	665	663	663	662	661	660
8397584	8460237	8522889	659	659	658	656	656	654	654	653	652	651
9024073	9086717	9149360	651	649	648	648	646	646	645	644	643	642
9650471	9713106	9775740	641	640	640	638	638	637	635	635	634	633
0276779	0339405	0402030	632	632	630	629	629	628	626	626	625	624
0902997	0965614	1028230	623	622	622	620	620	618	618	617	616	615
1529124	1591732	1654339	614	613	612	612	610	610	608	608	607	606
2155162	2217760	2280358	605	604	603	603	601	601	600	598	598	597
2781108	2843698	2906287	596	595	594	594	592	592	590	590	589	588
3406965	3469546	3532126	587	586	585	585	583	583	581	581	580	579
4032732	4095303	4157874	578	577	576	575	575	573	573	571	571	570

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
6940	8413594705	3657283	3719860	3782436	3845011	3907586	3970159
41	4220444	4283013	4345581	4408148	4470715	4533280	4595844
42	4846093	4908653	4971212	5033771	5096328	5158884	5221440
43	5471653	5534204	5596754	5659303	5721851	5784398	5846945
44	6097122	6159664	6222205	6284745	6347284	6409822	6472360
45	6722501	6785034	6847566	6910097	6972627	7035156	7097685
46	7347790	7410314	7472837	7535359	7597880	7660400	7722920
47	7972989	8035504	8098018	8160531	8223043	8285554	8348065
48	8598098	8660604	8723109	8785613	8848116	8910619	8973120
49	9223117	9285614	9348110	9410605	9473099	9535593	9598085
6950	8419848046	9910534	9973021	0035507	0097992	0160477	0222960
51	8420472885	0535364	0597842	0660319	0722796	0785271	0847745
52	1097634	1160104	1222573	1285042	1347509	1409975	1472441
53	1722294	1784755	1847215	1909674	1972132	2034590	2097046
54	2346863	2409315	2471767	2534217	2596666	2659115	2721562
55	2971343	3033786	3096228	3158670	3221110	3283550	3345988
56	3595733	3658167	3720601	3783033	3845464	3907895	3970324
57	4220034	4282459	4344883	4407306	4469729	4532150	4594571
58	4844244	4906660	4969075	5031490	5093903	5156316	5218727
59	5468365	5530772	5593178	5655584	5717988	5780392	5842794
6960	8426092396	6154794	6217192	6279588	6341983	6404378	6466772
61	6716338	6778727	6841115	6903503	6965889	7028275	7090659
62	7340189	7402570	7464949	7527328	7589705	7652082	7714458
63	7963952	8026323	8088693	8151063	8213432	8275799	8338166
64	8587624	8649987	8712348	8774709	8837068	8899427	8961785
65	9211208	9273561	9335913	9398265	9460616	9522966	9585315
66	9834701	9897046	9959389	0021732	0084074	0146414	0208754
67	8430458105	0520441	0582775	0645109	0707442	0769774	0832105
68	1081420	1143747	1206072	1268397	1330721	1393044	1455366
69	1704645	1766963	1829280	1891595	1953910	2016224	2078537
6970	8432327781	2390090	2452397	2514704	2577010	2639315	2701620
71	2950827	3013127	3075426	3137724	3200021	3262317	3324612
72	3573784	3636075	3698365	3760654	3822942	3885229	3947516
73	4196652	4258934	4321215	4383495	4445774	4508052	4570330
74	4819430	4881703	4943975	5006246	5068517	5130786	5193055
75	5442119	5504383	5566647	5628909	5691170	5753431	5815690
76	6064719	6126974	6189228	6251482	6313734	6375986	6438236
77	6687230	6749476	6811721	6873966	6936209	6998452	7060693
68	7309651	7371888	7434125	7496360	7558595	7620828	7683061
79	7931983	7994212	8056439	8118666	8180891	8243116	8305340
6980	8438554226	8616446	8678664	8740882	8803098	8865314	8927529
81	9176380	9238591	9300800	9363009	9425217	9487424	9549630
82	9798445	9860646	9922847	9985047	0047246	0109444	0171641
83	8440420420	0482613	0544805	0606996	0669186	0731375	0793563
84	1042307	1104491	1166674	1228856	1291037	1353217	1415396
85	1664105	1726279	1788453	1850626	1912799	1974970	2037140
86	2285813	2347979	2410144	2472308	2534472	2596634	2658795
87	2907433	2969590	3031746	3093901	3156055	3218209	3280362
88	3528963	3591111	3653259	3715405	3777550	3839695	3901839
89	4150405	4212544	4274682	4336820	4398956	4461092	4523227
6990	8444771757	4833888	4896017	4958146	5020274	5082400	5144526
91	5393021	5455143	5517263	5579383	5641502	5703620	5765737
92	6014196	6076309	6138421	6200531	6262641	6324750	6386859
93	6635282	6697386	6759489	6821591	6883692	6945792	7007891
94	7256280	7318375	7380469	7442562	7504654	7566745	7628836
95	7877188	7939274	8001359	8063444	8125527	8187609	8249691
96	8498008	8560085	8622161	8684237	8746311	8808385	8870457
97	9118739	9180807	9242875	9304941	9367007	9429071	9491135
98	9739381	9801441	9863499	9925557	9987614	0049669	0111724
99	8450359935	0421986	0484035	0546084	0608132	0670179	0732225
7000	0980400	1042442	1104483	1166522	1228561	1290599	1352637

OF NUMBERS. Logarithms 8413594705-8451538743.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4032732	4095303	4157874	62578	577	576	575	575	573	573	571	571	570
4658408	4720971	4783532	569	568	567	567	565	564	564	563	561	561
5283994	5346548	5409101	560	559	559	557	556	556	554	554	553	552
5909490	5972035	6034579	551	550	549	548	547	547	545	545	544	543
6534896	6597432	6659967	542	541	540	539	538	538	536	536	535	534
7160213	7222739	7285265	533	532	531	530	529	529	528	526	526	525
7785438	7847956	7910473	524	523	522	521	520	520	518	518	517	516
8410575	8473083	8535591	515	514	513	512	511	511	510	508	508	507
9035621	9098120	9160619	506	505	504	503	503	501	501	499	499	498
9660577	9723067	9785557	497	496	495	494	494	492	492	490	490	489
0285443	0347924	0410405	62488	487	486	485	485	483	483	481	481	480
0910219	0972692	1035164	479	478	477	477	475	474	474	473	472	470
1534905	1597369	1659832	470	469	469	467	466	466	464	464	463	462
2159502	2221957	2284411	461	460	459	458	458	456	456	455	454	452
2784009	2846455	2908899	452	452	450	449	449	447	447	446	444	444
3408426	3470862	3533298	443	442	442	440	440	438	438	436	436	435
4032753	4095181	4157608	434	434	432	431	431	429	429	428	427	426
4656990	4719409	4781827	425	424	423	423	421	421	419	419	418	417
5281138	5343548	5405957	416	415	415	413	413	411	411	410	409	408
5905196	5967597	6029997	407	406	406	404	404	402	402	401	400	399
6529165	6591556	6653947	62398	398	396	395	395	394	393	391	391	391
7153043	7215426	7277808	389	388	388	386	386	384	384	383	382	381
7776832	7839206	7901580	381	379	379	377	377	376	374	374	374	372
8400532	8462897	8525261	371	370	370	369	367	367	366	365	364	363
9024142	9086498	9148853	363	361	361	359	359	358	357	356	355	355
9647663	9710010	9772356	353	352	352	351	350	349	348	347	346	345
0271094	0333432	0395769	345	343	343	342	340	340	340	338	337	336
0894435	0956764	1019093	336	334	334	333	332	331	330	229	329	327
1517687	1580007	1642327	327	325	325	324	323	322	321	320	320	318
2140850	2203161	2265471	318	317	315	315	314	313	313	311	310	310
2763923	2826225	2888527	62309	307	307	306	305	305	303	302	302	300
3386907	3449200	3511493	300	299	298	297	296	295	295	293	293	291
4009801	4072086	4134369	291	290	289	288	287	287	285	285	283	283
4632606	4694882	4757157	282	281	280	279	278	278	276	276	275	273
5255322	5317589	5379855	273	272	271	271	269	269	267	267	266	264
5877949	5940206	6002463	264	264	262	261	261	259	259	257	257	256
6500486	6562735	6624983	255	254	254	252	252	250	250	249	248	247
7122934	7185174	7247413	246	245	245	243	243	241	241	240	239	238
7745293	7807524	7869754	237	237	235	235	233	233	232	231	230	229
8367563	8429785	8492006	229	227	227	225	225	224	223	222	221	220
8989743	9051956	9114169	62220	218	218	216	216	215	214	213	213	211
9611835	9674039	9736242	211	209	209	208	207	206	205	204	203	203
0233837	0296032	0358227	201	201	200	199	198	197	196	195	195	193
0855750	0917937	0980122	193	192	191	190	189	188	187	187	185	185
1477575	1539752	1601929	184	183	182	181	180	179	179	177	177	176
2099310	2161478	2223646	174	174	173	173	171	170	170	168	168	167
2720956	2783116	2845275	166	165	164	164	162	161	161	160	159	158
3342513	3404664	3466814	157	156	155	154	154	153	151	151	150	149
3963982	4026124	4088265	148	148	146	145	145	144	143	142	141	140
4585361	4647494	4709626	139	138	138	136	136	135	134	133	132	131
5206651	5268776	5330899	62131	129	129	128	126	126	125	125	123	122
5827853	5889968	5952083	122	120	120	119	118	117	116	115	115	113
6448966	6511072	6573178	113	112	110	110	109	109	107	106	106	104
7069990	7132087	7194184	104	103	102	101	100	099	099	097	097	096
7690925	7753014	7815101	095	094	093	092	091	091	089	089	087	087
8311771	8373851	8435930	086	085	085	083	082	082	080	080	079	078
8932529	8994600	9056670	077	076	076	074	074	072	072	071	070	069
9553198	9615260	9677321	068	068	066	066	064	064	063	062	061	060
0173778	0235832	0297884	060	058	058	057	055	055	054	054	052	051
0794270	0856314	0918358	051	049	049	048	047	046	045	044	044	042
1414673	1476708	1538743	042	041	039	039	038	038	036	035	035	034

Numbers 70000–70609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7000	8450980400	1042442	1104483	1166522	1228561	1290599	1352637
1	1600777	1662809	1724841	1786872	1848902	1910931	1972960
2	2221064	2283088	2345111	2407133	2469155	2531175	2593194
3	2841263	2903279	2965293	3027306	3089318	3151330	3213340
4	3461373	3523380	3585386	3647391	3709394	3771396	3833398
5	4081396	4143394	4205390	4267386	4329380	4391374	4453367
6	4701330	4763318	4825306	4887293	4949278	5011263	5073247
7	5321175	5383155	5445133	5507111	5569088	5631064	5693040
8	5940932	6002902	6064872	6126841	6188810	6250777	6312743
9	6560600	6622562	6684523	6746483	6808442	6870401	6932358
7010	8457180180	7242133	7304085	7366036	7427987	7489936	7551885
11	7799671	7861615	7923559	7985501	8047443	8109384	8171324
12	8419074	8481010	8542944	8604878	8666811	8728743	8790674
13	9038389	9100316	9162241	9224166	9286090	9348013	9409935
14	9657615	9719533	9781450	9843366	9905281	9967196	0029109
15	8460276754	0338663	0400571	0462478	0524384	0586290	0648194
16	0895804	0957704	1019603	1081501	1143399	1205295	1267191
17	1514765	1576657	1638547	1700437	1762325	1824213	1886100
18	2133639	2195521	2257403	2319284	2381164	2443042	2504921
19	2752424	2814298	2876171	2938043	2999914	3061784	3123653
7020	8463371121	3432986	3494850	3556713	3618575	3680437	3742297
21	3989730	4051586	4113442	4175296	4237149	4299002	4360853
22	4608251	4670099	4731945	4793790	4855635	4917479	4979322
23	5226684	5288523	5350360	5412197	5474033	5535868	5597702
24	5845029	5906859	5968687	6030515	6092342	6154168	6215994
25	6463286	6525107	6586927	6648746	6710564	6772381	6834198
26	7081455	7143267	7205078	7266888	7328697	7390506	7452314
27	7699535	7761339	7823141	7884942	7946743	8008543	8070342
28	8317528	8379323	8441116	8502909	8564701	8626492	8688282
29	8935433	8997219	9059004	9120788	9182571	9244353	9306134
7030	8469553250	9615027	9676803	9738578	9800352	9862126	9923898
31	8470170979	0232747	0294515	0356281	0418046	0479811	0541575
32	0788621	0850380	0912138	0973896	1035653	1097408	1159163
33	1406174	1467925	1529674	1591423	1653171	1714918	1776664
34	2023640	2085382	2147122	2208862	2270602	2332340	2394077
35	2641018	2702751	2764483	2826214	2887944	2949674	3011402
36	3258308	3320032	3381755	3443478	3505199	3566920	3628640
37	3875510	3937226	3998940	4060654	4122367	4184079	4245790
38	4492625	4554332	4616037	4677742	4739446	4801149	4862852
39	5109652	5171350	5233047	5294743	5356438	5418133	5479826
7040	8475726591	5788281	5849969	5911656	5973343	6035028	6096713
41	6343443	6405124	6466803	6528482	6590159	6651836	6713512
42	6960207	7021879	7083550	7145220	7206888	7268557	7330224
43	7576884	7638547	7700209	7761870	7823530	7885189	7946848
44	8193473	8255127	8316780	8378433	8440084	8501735	8563384
45	8809974	8871620	8933264	8994908	9056551	9118192	9179833
46	9426388	9488025	9549661	9611296	9672930	9734563	9796195
47	8480042715	0104343	0165970	0227596	0289221	0350845	0412469
48	0658954	0720573	0782191	0843809	0905425	0967041	1028656
49	1275106	1336716	1398326	1459934	1521542	1583149	1644755
7050	8481891170	1952772	2014372	2075972	2137571	2199169	2260767
51	2507147	2568740	2630332	2691923	2753513	2815102	2876691
52	3123036	3184620	3246204	3307786	3369368	3430948	3492528
53	3738838	3800414	3861988	3923562	3985135	4046707	4108278
54	4354553	4416120	4477686	4539251	4600815	4662378	4723940
55	4970181	5031739	5093296	5154852	5216408	5277962	5339516
56	5585721	5647270	5708819	5770366	5831913	5893459	5955004
57	6201174	6262715	6324254	6385793	6447331	6508868	6570404
58	6816540	6878072	6939603	7001133	7062662	7124190	7185718
59	7431819	7493342	7554864	7616386	7677906	7739426	7800944
7060	8047011	8108525	8170038	8231551	8293063	8354574	8416084

OF NUMBERS. Logarithms 845098400–848860608.

Mantissæ.			Differences.								
7	8	9	0	1	2	3	4	5	6	7	8	9
1414673	1476708	1538743	62042	041	039	039	038	038	036	035	035	034
2034987	2097014	2159040	032	032	031	030	029	029	027	027	026	024
2655213	2717231	2779248	024	023	022	022	020	019	019	018	017	015
3275350	3337359	3399367	016	014	013	012	012	010	010	009	008	006
3895399	3957399	4019398	007	006	005	003	002	002	001	000	999	998
4515359	4577350	4639340	61998	996	996	994	994	993	992	991	990	990
5135231	5197213	5259194	988	988	987	985	985	984	984	982	981	981
5755014	5816987	5878960	980	978	978	977	976	976	974	973	973	972
6374709	6436673	6498637	970	970	969	969	967	966	966	964	964	963
6994315	7056271	7118226	962	961	960	959	959	957	957	956	955	954
7613833	7675780	7737726	61953	952	951	951	949	949	948	947	946	945
8233263	8295201	8357138	944	944	942	942	941	940	939	938	937	936
8852604	8914533	8976461	936	934	934	933	932	931	930	929	928	928
9471857	9533777	9595697	927	925	925	924	923	922	922	920	920	918
0091021	0152933	0214844	918	917	916	915	915	913	912	912	911	910
0710098	0772001	0833903	909	908	907	906	906	904	904	903	902	901
1329086	1390980	1452873	900	899	898	898	896	896	895	894	893	892
1947986	2009871	2071755	892	890	890	888	888	887	886	885	884	884
2566798	2628674	2690550	882	882	881	880	878	879	877	876	876	874
3185521	3247389	3309256	874	873	872	871	870	869	868	868	867	865
3804157	3866016	3927873	61865	864	863	862	862	860	860	859	857	857
4422704	4484[illegible]54	4546403	856	856	854	853	853	851	851	850	849	848
5041164	5103[illegible]5	5164845	848	846	845	845	844	843	842	841	840	839
5659535	5721367	5783198	839	837	837	836	835	834	833	832	831	831
6277818	6339641	6401464	830	828	828	827	826	826	824	823	823	822
6896013	6957828	7019642	821	820	819	818	817	817	815	815	814	813
7514120	7575926	7637731	812	811	810	809	809	808	806	806	805	804
8132140	8193937	8255733	804	802	801	801	800	799	798	797	796	795
8750071	8811859	8873647	795	793	793	792	791	790	789	788	788	786
9367914	9429694	9491472	786	785	784	783	782	781	780	780	778	778
9985670	0047441	0109210	61777	776	775	774	774	772	772	771	769	769
0603337	0665099	0726860	768	768	766	765	765	764	762	762	761	761
1220917	1282670	1344423	759	758	758	757	755	755	754	753	753	751
1838409	1900154	1961897	751	749	749	748	747	746	745	745	743	743
2455814	2517549	2579284	742	740	740	740	738	737	737	735	735	734
3073130	3134857	3196583	733	732	731	730	730	728	728	727	726	725
3690359	3752077	3813794	724	723	723	721	721	720	719	718	717	716
4307500	4369209	4430917	716	714	714	713	712	711	710	709	708	708
4924553	4986254	5047953	707	705	705	704	703	703	701	701	699	699
5541519	5603211	5664901	698	697	696	695	695	693	693	692	690	690
6158397	6220080	6281762	61690	688	687	687	685	685	684	683	682	681
6775187	6836862	6898535	681	679	679	677	677	676	675	675	673	672
7391890	7453556	7515220	672	671	670	668	669	667	666	666	664	664
8008505	8070162	8131818	663	662	661	660	659	659	657	657	656	655
8625033	8686681	8748328	654	653	653	651	651	649	649	648	647	646
9241473	9303113	9364751	646	644	644	643	641	641	640	640	638	637
9857826	9919457	9981086	637	636	635	634	633	632	631	631	629	629
0474092	0535713	0597334	628	627	626	625	624	624	623	621	621	620
1090269	1151882	1213494	619	618	618	616	616	615	613	613	612	612
1706360	1767964	1829567	610	610	608	608	607	606	605	604	603	603
2322363	2383958	2445553	61602	600	600	599	598	598	596	595	595	594
2938279	2999865	3061451	593	592	591	590	589	589	588	586	586	585
3554107	3615685	3677262	584	584	582	582	580	580	579	578	577	576
4169848	4231417	4292986	576	574	574	573	572	571	570	569	569	567
4785502	4847062	4908622	567	566	565	564	563	562	562	560	560	559
5401068	5462620	5524171	558	557	556	556	554	554	552	552	551	550
6016548	6078091	6139633	549	549	547	547	546	545	544	543	542	541
6631940	6693474	6755008	541	539	539	538	537	536	536	534	534	532
7247244	7308770	7370295	532	531	530	529	528	528	526	526	525	524
7862462	7923979	7985496	523	522	522	520	520	518	518	517	517	515
8477593	8539101	8600608	514	513	513	512	511	510	509	508	507	507

Numbers 70600–71209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7060	8488047011	8108525	8170038	8231551	8293063	8354574	8416084
61	8662115	8723621	8785125	8846629	8908132	8969634	9031136
62	9277132	9338629	9400125	9461620	9523115	9584608	9646101
63	9892063	9953551	0015038	0076525	0138010	0199495	0260979
64	8490506906	0568385	0629864	0691342	0752819	0814295	0875770
65	1121662	1183133	1244603	1306072	1367540	1429007	1490474
66	1736331	1797793	1859254	1920715	1982174	2043633	2105091
67	2350913	2412367	2473819	2535271	2596722	2658172	2719621
68	2965408	3026853	3088297	3149740	3211182	3272623	3334064
69	3579817	3641253	3702688	3764122	3825556	3886988	3948420
7070	8494194138	4255565	4316992	4378417	4439842	4501266	4562689
71	4808372	4869791	4931209	4992626	5054042	5115457	5176871
72	5422520	5483930	5545339	5606747	5668155	5729561	5790967
73	6036581	6097982	6159383	6220782	6282181	6343579	6404976
74	6650555	6711947	6773339	6834730	6896120	6957509	7018898
75	7264442	7325826	7387209	7448591	7509973	7571353	7632733
76	7878242	7939618	8000992	8062366	8123738	8185110	8246481
77	8491956	8553323	8614688	8676053	8737417	8798780	8860143
78	9105583	9166941	9228298	9289654	9351010	9412364	9473718
79	9719123	9780473	9841821	9903168	9964515	0025861	0087206
7080	8500332577	0393917	0455257	0516596	0577934	0639271	0700607
81	0945944	1007276	1068607	1129937	1191266	1252595	1313922
82	1559224	1620547	1681870	1743191	1804512	1865832	1927151
83	2172418	2233733	2295046	2356359	2417671	2478982	2540293
84	2785525	2846831	2908136	2969440	3030744	3092046	3153348
85	3398546	3459843	3521140	3582435	3643730	3705024	3766317
86	4011480	4072769	4134056	4195343	4256629	4317915	4379199
87	4624328	4685608	4746887	4808165	4869442	4930719	4991995
88	5237089	5298360	5359631	5420900	5482169	5543437	5604704
89	5849764	5911026	5972288	6033549	6094809	6156068	6217327
7090	8506462352	6523606	6584859	6646111	6707363	6768614	6829863
91	7074854	7136099	7197344	7258587	7319830	7381072	7442313
92	7687269	7748506	7809742	7870977	7932211	7993445	8054677
93	8299598	8360827	8422054	8483280	8544506	8605731	8666955
94	8911841	8973061	9034280	9095497	9156714	9217930	9279146
95	9523998	9585209	9646419	9707628	9768836	9830044	9891250
96	8510136068	0197271	0258472	0319673	0380872	0442071	0503269
97	0748052	0809246	0870439	0931631	0992822	1054012	1115201
98	1359950	1421135	1482319	1543503	1604685	1665867	1727047
99	1971762	2032938	2094114	2155288	2216462	2277635	2338807
7100	8512583487	2644655	2705822	2766988	2828153	2889318	2950481
1	3195126	3256286	3317444	3378601	3439758	3500914	3562069
2	3806680	3867830	3928980	3990129	4051277	4112424	4173570
3	4418147	4479289	4540430	4601570	4662709	4723848	4784986
4	5029528	5090661	5151794	5212925	5274056	5335186	5396315
5	5640823	5701947	5763071	5824194	5885317	5946438	6007558
6	6252032	6313148	6374263	6435377	6496491	6557604	6618716
7	6863154	6924262	6985369	7046475	7107580	7168684	7229787
8	7474191	7535290	7596388	7657486	7718582	7779678	7840772
9	8085142	8146233	8207322	8268411	8329499	8390586	8451672
7110	8518696007	8757089	8818170	8879250	8940329	9001408	9062485
11	9306786	9367860	9428932	9490003	9551074	9612144	9673213
12	9917480	9978544	0039608	0100671	0161733	0222794	0283854
13	8520528087	0589143	0650198	0711252	0772306	0833358	0894410
14	1138609	1199656	1260703	1321748	1382793	1443837	1504880
15	1749044	1810083	1871121	1932158	1993194	2054230	2115264
16	2359394	2420424	2481454	2542482	2603510	2664537	2725563
17	2969658	3030680	3091701	3152721	3213740	3274758	3335776
18	3579837	3640850	3701862	3762873	3823884	3884894	3945903
19	4189929	4250934	4311938	4372940	4433942	4494944	4555944
7120	4799936	4860932	4921927	4982922	5043915	5104908	5165899

OF NUMBERS. Logarithms 8488047011–8525348869.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8477593	8539101	8600608	61514	513	513	512	511	510	509	508	507	507
9092636	9154136	9215634	506	504	504	503	502	502	500	500	498	498
9707593	9769083	9830573	497	496	495	495	493	493	492	490	490	490
0322462	0383944	0445425	488	487	487	485	485	484	483	482	481	481
0937244	0998718	1060190	479	479	478	477	476	475	474	474	472	472
1551939	1613404	1674868	471	470	469	468	467	467	465	465	464	463
2166548	2228004	2289459	462	461	461	459	459	458	457	456	455	454
2781069	2842516	2903963	454	452	452	451	450	449	448	447	447	445
3395503	3456942	3518380	445	444	443	442	441	441	439	439	438	437
4009851	4071281	4132710	436	435	434	434	432	432	431	430	429	428
4624111	4685532	4746953	61427	427	425	425	424	423	422	421	421	419
5238285	5299697	5361109	419	418	417	416	415	414	414	412	412	411
5852372	5913776	5975179	410	409	408	408	406	406	405	404	403	402
6466372	6527767	6589161	401	401	399	399	398	397	396	395	394	394
7080285	7141671	7203057	392	392	391	390	389	389	387	386	386	385
7694111	7755489	7816866	384	383	382	382	380	380	378	378	377	376
8307851	8369220	8430589	376	374	374	372	372	371	370	369	369	367
8921504	8982865	9044224	367	365	365	364	363	363	361	361	359	359
9535070	9596422	9657773	358	357	356	356	354	354	352	352	351	350
0148550	0209893	0271235	350	348	347	347	346	345	344	343	342	342
0761943	0823277	0884611	61340	340	339	338	337	336	336	334	334	333
1375249	1436575	1497900	332	331	330	329	329	327	327	326	325	324
1988469	2049786	2111103	323	323	321	321	320	319	318	317	317	315
2601602	2662911	2724218	315	313	313	312	311	311	309	309	307	307
3214649	3275949	3337248	306	305	304	304	302	302	301	300	299	298
3827609	3888900	3950190	297	297	295	295	294	293	292	291	290	290
4440482	4501765	4563047	289	287	287	286	286	284	283	283	282	281
5053270	5114543	5175817	280	279	278	277	277	276	275	273	274	272
5665970	5727235	5788500	271	271	269	269	268	267	266	265	265	264
6278584	6339841	6401097	262	262	261	260	259	259	257	257	256	255
6891112	6952360	7013607	61254	253	252	252	251	249	249	248	247	247
7503554	7564793	7626032	245	245	243	243	242	241	241	239	239	237
8115909	8177140	8238369	237	236	235	234	234	232	232	231	229	229
8728178	8789400	8850621	229	227	226	226	225	224	223	222	221	220
9340360	9401574	9462786	220	219	217	217	216	216	214	214	212	212
9952456	0013661	0074865	211	210	209	208	208	206	206	205	204	203
0564466	0625662	0686858	203	201	201	199	199	198	197	196	196	194
1176390	1237577	1298764	194	193	192	191	190	189	189	187	187	186
1788227	1849406	1910584	185	184	184	182	182	180	180	179	178	178
2399979	2461149	2522319	176	176	174	174	173	172	172	170	170	168
3011644	3072806	3133966	61168	167	166	165	165	163	163	162	160	160
3623223	3684376	3745528	160	158	157	157	156	155	154	153	152	152
4234716	4295860	4357004	150	150	149	148	147	146	146	144	144	143
4846122	4907258	4968393	142	141	140	139	139	138	136	136	135	135
5457443	5518571	5579697	133	133	131	131	130	129	128	128	126	126
6068678	6129797	6190915	124	124	123	123	121	120	120	119	118	117
6679827	6740937	6802046	116	115	114	114	113	112	111	110	109	108
7290889	7351991	7413092	108	107	106	105	104	103	102	102	101	099
7901866	7962959	8024051	099	098	098	096	096	094	094	093	092	091
8512757	8573841	8634925	091	089	089	088	087	086	085	084	084	082
9123562	9184637	9245712	61082	081	080	079	079	077	077	075	075	074
9734281	9795348	9856414	074	072	071	071	070	069	068	067	066	066
0344914	0405972	0467030	064	064	063	062	061	060	060	058	058	057
0955461	1016511	1077560	056	055	054	054	052	052	051	050	049	049
1565923	1626964	1688004	047	047	045	045	044	043	043	041	040	040
2176298	2237331	2298363	039	038	037	036	036	034	034	033	032	031
2786588	2847612	2908636	030	030	028	028	027	026	025	024	024	022
3396792	3457808	3518823	022	021	020	019	018	018	016	016	015	014
4006911	4067918	4128924	013	012	011	011	010	009	008	007	006	005
4616943	4677942	4738940	005	004	002	002	002	000	999	999	998	996
5226890	5287880	5348869	60996	995	995	993	993	991	991	990	989	989

Numbers 71200–71809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7120	8524799936	4860932	4921927	4982922	5043915	5104908	5165899
21	5409858	5470845	5531832	5592817	5653802	5714786	5775769
22	6019693	6080672	6141650	6202627	6263604	6324579	6385554
23	6629443	6690414	6751383	6812352	6873320	6934286	6995252
24	7239108	7300070	7361031	7421991	7482950	7543908	7604866
25	7848687	7909640	7970592	8031544	8092494	8153444	8214393
26	8458180	8519125	8580069	8641011	8701954	8762895	8823835
27	9067588	9128524	9189459	9250394	9311327	9372260	9433192
28	9676910	9737838	9798764	9859690	9920615	9981539	0042463
29	8530286147	0347066	0407984	0468902	0529818	0590734	0651648
7130	8530895299	0956209	1017119	1078027	1138935	1199842	1260749
31	1504364	1565266	1626167	1687068	1747967	1808865	1869763
32	2113345	2174238	2235131	2296023	2356913	2417803	2478692
33	2722240	2783125	2844009	2904892	2965774	3026656	3087536
34	3331050	3391926	3452802	3513676	3574550	3635423	3696295
35	3939775	4000642	4061509	4122375	4183240	4244105	4304968
36	4548414	4609273	4670131	4730989	4791845	4852701	4913556
37	5156968	5217818	5278668	5339517	5400365	5461213	5522059
38	5765436	5826278	5887120	5947960	6008800	6069639	6130476
39	6373820	6434653	6495486	6556318	6617149	6677979	6738809
7140	8536982118	7042943	7103767	7164591	7225413	7286235	7347056
41	7590331	7651147	7711963	7772778	7833592	7894405	7955218
42	8198459	8259267	8320074	8380880	8441686	8502491	8563294
43	8806501	8867301	8928100	8988897	9049694	9110491	9171286
44	9414459	9475250	9536040	9596829	9657618	9718406	9779192
45	8540022331	0083114	0143896	0204676	0265456	0326236	0387014
46	0630119	0690893	0751666	0812438	0873210	0933980	0994750
47	1237821	1298587	1359351	1420115	1480878	1541640	1602402
48	1845438	1906195	1966952	2027707	2088461	2149215	2209968
49	2452971	2513719	2574467	2635214	2695960	2756705	2817449
7150	8543060418	3121158	3181897	3242636	3303373	3364110	3424846
51	3667780	3728512	3789243	3849973	3910702	3971430	4032157
52	4275058	4335781	4396503	4457225	4517945	4578665	4639384
53	4882250	4942965	5003679	5064392	5125104	5185815	5246525
54	5489358	5550064	5610769	5671474	5732177	5792880	5853582
55	6096381	6157079	6217775	6278471	6339166	6399861	6460554
56	6703319	6764008	6824696	6885384	6946070	7006756	7067441
57	7310172	7370853	7431533	7492212	7552890	7613567	7674243
58	7916941	7977613	8038284	8098955	8159624	8220293	8280961
59	8523624	8584288	8644951	8705613	8766274	8826934	8887594
7160	8549130223	9190878	9251533	9312186	9372839	9433491	9494142
61	9736737	9797384	9858030	9918675	9979319	0039963	0100605
62	8550343167	0403805	0464442	0525079	0585715	0646350	0706984
63	0949512	1010141	1070770	1131399	1192026	1252652	1313278
64	1555772	1616393	1677014	1737633	1798252	1858870	1919487
65	2161947	2222560	2283172	2343783	2404394	2465003	2525612
66	2768038	2828643	2889246	2949849	3010451	3071052	3131652
67	3374045	3434641	3495236	3555830	3616424	3677016	3737608
68	3979967	4040554	4101141	4161727	4222312	4282896	4343479
69	4585804	4646383	4706961	4767539	4828115	4888691	4949266
7170	8555191557	5252127	5312697	5373266	5433834	5494401	5554968
71	5797225	5857787	5918349	5978909	6039469	6100028	6160585
72	6402809	6463363	6523916	6584468	6645019	6705569	6766119
73	7008308	7068854	7129398	7189942	7250485	7311026	7371568
74	7613723	7674260	7734796	7795331	7855866	7916399	7976932
75	8219054	8279582	8340110	8400637	8461163	8521688	8582212
76	8824300	8884820	8945339	9005858	9066376	9126892	9187408
77	9429462	9489974	9550485	9610994	9671503	9732012	9792519
78	8560034540	0095043	0155545	0216047	0276547	0337047	0397546
79	0639533	0700028	0760522	0821015	0881507	0941998	1002489
7180	1244442	1304929	1365414	1425899	1486382	1546865	1607347

OF NUMBERS. Logarithms 8524799936–8561788789.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5226890	5287880	5348869	60996	995	995	993	993	991	991	990	989	989
5836752	5897733	5958714	987	987	985	985	984	983	983	981	981	979
6446527	6507500	6568472	979	978	977	977	975	975	973	973	972	971
7056218	7117182	7178145	971	969	969	968	966	966	966	964	963	963
7665822	7726778	7787733	962	961	960	959	958	958	956	956	955	954
8275341	8336288	8397235	953	952	952	950	950	949	948	947	947	945
8884775	8945713	9006651	945	944	942	943	941	940	940	938	938	937
9494123	9555053	9615982	936	935	935	933	933	932	931	930	929	928
0103385	0164307	0225227	928	926	926	925	924	924	922	922	920	920
0712562	0773475	0834387	919	918	918	916	916	914	914	913	912	912
1321654	1382558	1443462	60910	910	908	908	907	907	905	904	904	902
1930660	1991556	2052451	902	901	901	899	898	898	897	896	895	894
2539581	2600468	2661355	893	893	892	890	890	889	889	887	887	885
3148416	3209295	3270173	885	884	883	882	882	880	880	879	878	877
3757166	3818036	3878906	876	876	874	874	873	872	871	870	870	869
4365831	4426693	4487554	867	867	866	865	865	863	863	862	861	860
4974410	5035264	5096116	859	858	858	856	856	855	854	854	852	852
5582905	5643749	5704593	850	850	849	848	848	846	846	844	844	843
6191314	6252150	6312985	842	842	840	840	839	837	838	836	835	835
6799637	6860465	6921292	833	833	832	831	830	830	828	828	827	826
7407876	7468695	7529513	60825	824	824	822	822	821	820	819	818	818
8016029	8076840	8137650	816	816	815	814	813	813	811	811	810	809
8624097	8684900	8745701	808	807	806	806	805	803	803	803	801	800
9232080	9292874	9353667	800	799	797	797	797	795	794	794	793	792
9839978	9900764	9961548	791	790	789	789	788	786	786	786	784	783
0447791	0508568	0569344	783	782	780	780	780	778	777	777	776	775
1055519	1116287	1177055	774	773	772	772	770	770	769	768	768	766
1663162	1723922	1784680	766	764	764	763	762	762	760	760	758	758
2270720	2331471	2392221	757	757	755	754	754	753	752	751	750	750
2878193	2938935	2999677	748	748	747	746	745	744	744	742	742	741
3485581	3546315	3607048	60740	739	739	737	737	736	735	734	733	732
4092884	4153609	4214334	732	731	730	729	728	727	727	725	725	724
4700102	4760819	4821535	723	722	722	720	720	719	718	717	716	715
5307235	5367943	5428651	715	714	713	712	711	710	710	708	708	707
5914283	5974983	6035682	706	705	705	703	703	702	701	700	699	699
6521246	6581938	6642629	698	696	696	695	695	693	692	692	691	690
7128125	7188808	7249490	689	688	688	686	686	685	684	683	682	682
7734919	7795594	7856268	681	680	679	678	677	676	676	675	674	673
8341628	8402294	8462960	672	671	671	669	669	668	667	666	666	664
8948252	9008910	9069567	664	663	662	661	660	660	658	658	657	656
9554792	9615441	9676090	60655	655	653	653	652	651	650	649	649	647
0161247	0221888	0282528	647	646	645	644	644	642	642	641	640	639
0767617	0828249	0888881	638	637	637	636	635	634	633	632	632	631
1373903	1434527	1495150	629	629	629	627	626	626	625	624	623	622
1980104	2040719	2101334	621	621	619	619	618	617	617	615	615	613
2586220	2646827	2707433	613	612	611	611	609	609	608	607	606	605
3192252	3252850	3313448	605	603	603	602	601	600	600	598	598	597
3798199	3858789	3919378	596	595	594	594	592	592	591	590	589	589
4404062	4464643	4525224	587	587	586	585	584	583	583	581	581	580
5009840	5070413	5130985	579	578	578	576	576	575	574	573	572	572
5615533	5676098	5736662	60570	570	569	568	567	567	565	565	564	563
6221143	6281699	6342254	562	562	560	560	559	557	558	556	555	555
6826667	6887215	6947762	554	553	552	551	550	550	548	548	547	546
7432108	7492647	7553186	546	544	544	543	541	542	540	539	539	537
8037464	8097995	8158525	537	536	535	535	533	533	532	531	530	529
8642735	8703258	8763780	528	528	527	526	525	524	523	523	522	520
9247923	9308437	9368950	520	519	519	518	516	516	515	514	513	512
9853026	9913531	9974036	512	511	509	509	509	507	507	505	505	504
0458044	0518541	0579038	503	502	502	500	500	499	498	497	497	495
1062979	1123467	1183955	495	494	493	492	491	491	490	488	488	487
1667829	1728309	1788789	487	485	485	483	483	482	482	480	480	478

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7180	8561244442	1304929	1365414	1425899	1486382	1546865	1607347
81	1849267	1909745	1970222	2030698	2091174	2151648	2212122
82	2454008	2514477	2574946	2635414	2695881	2756347	2816812
83	3058664	3119125	3179586	3240045	3300503	3360961	3421418
84	3663237	3723689	3784141	3844592	3905042	3965491	4025940
85	4267725	4328169	4388612	4449055	4509496	4569937	4630377
86	4872129	4932564	4992999	5053433	5113867	5174299	5234731
87	5476449	5536876	5597302	5657728	5718153	5778577	5839000
88	6080684	6141103	6201521	6261939	6322355	6382771	6443186
89	6684836	6745247	6805656	6866065	6926473	6986880	7047287
7190	8567288904	7349306	7409707	7470108	7530507	7590906	7651304
91	7892888	7953281	8013674	8074066	8134457	8194848	8255237
92	8496787	8557173	8617557	8677941	8738324	8798706	8859087
93	9100603	9160980	9221356	9281731	9342106	9402479	9462852
94	9704335	9764703	9825071	9885438	9945804	0006169	0066534
95	8570307983	0368343	0428702	0489061	0549418	0609775	0670131
96	0911547	0971899	1032249	1092600	1152949	1213297	1273645
97	1515027	1575370	1635713	1696055	1756395	1816736	1877075
98	2118423	2178758	2239092	2299426	2359758	2420090	2480421
99	2721736	2782062	2842388	2902713	2963037	3023360	3083683
7200	8573324964	3385283	3445600	3505917	3566232	3626547	3686861
1	3928109	3988419	4048728	4109036	4169344	4229650	4289956
2	4531170	4591472	4651773	4712072	4772371	4832670	4892967
3	5134148	5194441	5254733	5315025	5375315	5435605	5495894
4	5737041	5797326	5857610	5917893	5978176	6038457	6098738
5	6339852	6400128	6460403	6520678	6580952	6641225	6701497
6	6942578	7002846	7063113	7123379	7183645	7243910	7304174
7	7545221	7605480	7665739	7725997	7786254	7846511	7906766
8	8147780	8208031	8268282	8328531	8388780	8449028	8509275
9	8750255	8810498	8870740	8930982	8991222	9051462	9111700
7210	8579352647	9412882	9473116	9533349	9593581	9653812	9714042
11	9954956	0015182	0075407	0135632	0195856	0256078	0316301
12	8580557181	0617398	0677615	0737832	0798047	0858262	0918475
13	1159322	1219531	1279740	1339948	1400155	1460361	1520567
14	1761380	1821581	1881781	1941981	2002180	2062377	2122575
15	2363354	2423547	2483739	2543930	2604121	2664310	2724499
16	2965245	3025430	3085614	3145796	3205978	3266160	3326340
17	3567053	3627229	3687404	3747579	3807753	3867926	3928098
18	4168777	4228945	4289112	4349278	4409444	4469608	4529772
19	4770418	4830578	4890736	4950894	5011051	5071207	5131363
7220	8585371976	5432127	5492277	5552427	5612575	5672723	5732870
21	5973450	6033593	6093735	6153876	6214016	6274156	6334295
22	6574841	6634975	6695109	6755242	6815374	6875505	6935636
23	7176149	7236275	7296400	7356525	7416648	7476771	7536893
24	7777373	7837491	7897608	7957724	8017840	8077954	8138068
25	8378514	8438624	8498733	8558840	8618947	8679054	8739159
26	8979572	9039674	9099774	9159874	9219972	9280070	9340167
27	9580547	9640640	9700732	9760823	9820914	9881003	9941092
28	8590181439	0241523	0301607	0361690	0421772	0481854	0541934
29	0782247	0842324	0902399	0962474	1022548	1082621	1142693
7230	8591382973	1443041	1503108	1563174	1623240	1683305	1743368
31	1983615	2043675	2103734	2163792	2223849	2283905	2343961
32	2584175	2644226	2704277	2764326	2824375	2884423	2944470
33	3184651	3244694	3304736	3364778	3424818	3484858	3544897
34	3785044	3845079	3905113	3965146	4025178	4085210	4145240
35	4385355	4445381	4505407	4565431	4625455	4685479	4745501
36	4985582	5045600	5105617	5165634	5225650	5285664	5345678
37	5585726	5645736	5705745	5765753	5825761	5885767	5945773
38	6185788	6245789	6305790	6365790	6425789	6485787	6545785
39	6785766	6845760	6905752	6965744	7025735	7085724	7145714
7240	7385662	7445647	7505631	7565615	7625597	7685579	7745560

OF NUMBERS. Logarithms 8561244442–8597925497.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1667829	1728309	1788789	60487	485	485	483	483	482	482	480	480	478
2272595	2333067	2393538	478	477	476	476	474	474	473	472	471	470
2877276	2937740	2998202	469	469	468	467	466	465	464	464	462	462
3481874	3542329	3602783	461	461	459	458	458	457	456	455	454	454
4086387	4146834	4207280	452	452	451	450	449	449	447	447	446	445
4690816	4751255	4811692	444	443	443	441	441	440	439	439	437	437
5295161	5355591	5416020	435	435	434	434	432	432	430	430	429	429
5899422	5959844	6020265	427	426	426	425	424	423	422	422	421	419
6503599	6564012	6624425	419	418	418	416	416	415	413	413	413	411
7107692	7168097	7228501	411	409	409	408	407	407	405	405	404	403
7711701	7772098	7832493	60402	401	401	399	399	398	397	397	395	395
8315626	8376014	8436401	393	393	392	391	391	389	389	388	387	386
8919467	8979847	9040225	386	384	384	383	382	381	380	380	378	378
9523224	9583595	9643965	377	376	375	375	373	373	372	371	370	370
0126897	0187260	0247622	368	368	367	366	365	365	363	363	362	361
0730486	0790841	0851194	360	359	359	357	357	356	355	355	353	353
1333992	1394338	1454683	352	350	351	349	348	348	347	346	345	344
1937413	1997751	2058087	343	343	342	340	341	339	338	338	336	336
2540751	2601080	2661408	335	334	334	332	332	331	330	329	328	328
3144005	3204325	3264645	326	326	325	324	323	323	322	320	320	319
3747175	3807487	3867798	60319	317	317	315	315	314	314	312	311	311
4350261	4410565	4470868	310	309	308	308	306	306	305	304	303	302
4953263	5013559	5073854	302	301	299	299	299	297	296	296	295	294
5556182	5616469	5676756	293	292	292	290	290	289	288	287	287	285
6159017	6219296	6279574	285	284	283	283	281	281	279	279	278	278
6761769	6822039	6882309	276	275	275	274	273	272	272	270	270	269
7364437	7424699	7484960	268	267	266	266	265	264	263	262	261	261
7967021	8027275	8087528	259	259	258	257	257	255	255	254	253	252
8569521	8629767	8690011	251	251	249	249	248	247	246	246	244	244
9171938	9232175	9292412	243	242	242	240	240	238	238	237	237	235
9774272	9834501	9894729	60235	234	233	232	231	230	230	229	228	227
0376522	0436742	0496962	226	225	225	224	222	223	221	220	220	219
0978688	1038900	1099112	217	217	217	215	215	213	213	212	212	210
1580771	1640975	1701178	209	209	208	207	206	206	204	204	203	202
2182771	2242966	2303161	201	200	200	199	197	198	196	195	195	193
2784687	2844874	2905060	193	192	191	191	189	189	188	187	186	185
3386519	3446698	3506876	185	184	182	182	182	180	179	179	178	177
3988269	4048439	4108609	176	175	175	174	173	172	171	170	170	168
4589935	4650097	4710258	168	167	166	166	164	164	163	162	161	160
5191517	5251671	5311824	160	158	158	157	156	156	154	154	153	152
5793016	5853162	5913306	60151	150	150	148	148	147	146	146	144	144
6394432	6454569	6514706	143	142	141	140	140	139	137	137	137	135
6995765	7055894	7116022	134	134	133	132	131	131	129	129	128	127
7597014	7657135	7717254	126	125	125	123	123	122	121	121	119	119
8198181	8258293	8318404	118	117	116	116	114	114	113	112	111	110
8799264	8859367	8919470	110	109	107	107	107	105	105	103	103	102
9400263	9460359	9520453	102	100	100	098	098	097	096	096	094	094
0001180	0061267	0121353	093	092	091	091	089	089	088	087	086	086
0602014	0662092	0722170	084	084	083	082	082	080	080	078	078	077
1202764	1262835	1322904	077	075	075	074	073	072	071	071	069	069
1803431	1863494	1923555	60068	067	066	066	065	063	063	063	061	060
2404016	2464069	2524122	060	059	058	057	056	056	055	053	053	053
3004517	3064562	3124607	051	051	049	049	048	047	047	045	045	044
3604935	3664972	3725009	043	042	042	040	040	039	038	037	037	035
4205270	4265299	4325327	035	034	033	032	032	030	030	029	028	028
4805522	4865543	4925563	026	026	024	024	024	022	021	021	020	019
5405692	5465704	5525716	018	017	017	016	014	014	014	012	012	010
6005778	6065782	6125785	010	009	008	008	006	006	005	004	003	003
6605781	6665777	6725772	001	001	000	999	998	998	996	996	995	994
7205702	7265689	7325676	59994	992	992	991	989	990	988	987	987	986
7805540	7865519	7925497	985	984	984	982	982	981	980	979	978	978

Numbers 72400–73009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7240	8597385662	7445647	7505631	7565615	7625597	7685579	7745560
41	7985475	8045452	8105427	8165403	8225377	8285350	8345323
42	8585205	8645173	8705141	8765108	8825074	8885039	8945003
43	9184852	9244812	9304772	9364730	9424688	9484645	9544601
44	9784416	9844368	9904319	9964270	0024219	0084168	0144115
45	8600383898	0443842	0503784	0563726	0623668	0683608	0743547
46	0983297	1043232	1103167	1163101	1223033	1282965	1342897
47	1582613	1642540	1702466	1762392	1822317	1882240	1942163
48	2181847	2241765	2301683	2361601	2421517	2481432	2541347
49	2780998	2840908	2900818	2960727	3020635	3080542	3140448
7250	8603380066	3439968	3499869	3559770	3619670	3679569	3739467
51	3979051	4038945	4098838	4158731	4218622	4278513	4338403
52	4577954	4637840	4697725	4757609	4817492	4877375	4937256
53	5176775	5236652	5296529	5356405	5416280	5476154	5536027
54	5775512	5835382	5895250	5955118	6014984	6074850	6134716
55	6374168	6434029	6493889	6553748	6613607	6673464	6733321
56	6972741	7032593	7092445	7152296	7212147	7271996	7331845
57	7571231	7631075	7690919	7750762	7810604	7870445	7930285
58	8169639	8229475	8289310	8349145	8408979	8468812	8528644
59	8767964	8827792	8887619	8947446	9007271	9067096	9126920
7260	8609366207	9426027	9485846	9545664	9605481	9665298	9725113
61	9964368	0024179	0083990	0143800	0203609	0263417	0323224
62	8610562446	0622249	0682052	0741853	0801654	0861454	0921253
63	1160442	1220237	1280031	1339824	1399617	1459409	1519200
64	1758355	1818142	1877928	1937713	1997497	2057281	2117064
65	2356186	2415965	2475743	2535520	2595296	2655071	2714846
66	2953935	3013706	3073475	3133244	3193012	3252779	3312545
67	3551602	3611364	3671125	3730886	3790646	3850405	3910162
68	4149186	4208940	4268693	4328446	4388197	4447948	4507698
69	4746689	4806434	4866179	4925923	4985666	5045409	5105150
7270	8615344109	5403846	5463583	5523319	5583054	5642788	5702521
71	5941446	6001176	6060904	6120632	6180359	6240085	6299810
72	6538702	6598423	6658143	6717863	6777581	6837299	6897016
73	7135876	7195589	7255301	7315012	7374722	7434432	7494140
74	7732967	7792672	7852376	7912079	7971781	8031482	8091183
75	8329977	8389673	8449369	8509063	8568757	8628451	8688143
76	8926904	8986592	9046280	9105966	9165652	9225337	9285021
77	9523749	9583429	9643108	9702787	9762464	9822141	9881817
78	8620120513	0180184	0239855	0299525	0359195	0418863	0478531
79	0717194	0776857	0836520	0896182	0955843	1015504	1075163
7280	8621313793	1373449	1433103	1492757	1552410	1612062	1671713
81	1910311	1969958	2029604	2089250	2148895	2208538	2268182
82	2506746	2566385	2626023	2685661	2745297	2804933	2864568
83	3103100	3162730	3222360	3281990	3341618	3401246	3460872
84	3699371	3758994	3818616	3878237	3937857	3997476	4057095
85	4295561	4355176	4414789	4474402	4534014	4593625	4653236
86	4891669	4951275	5010881	5070486	5130089	5189692	5249295
87	5487695	5547293	5606891	5666487	5726083	5785678	5845272
88	6083640	6143230	6202819	6262407	6321995	6381581	6441167
89	6679502	6739084	6798665	6858245	6917824	6977403	7036981
7290	8627275283	7334857	7394430	7454002	7513573	7573143	7632712
91	7870982	7930548	7990112	8049676	8109239	8168801	8228363
92	8466600	8526157	8585714	8645269	8704824	8764378	8823931
93	9062136	9121685	9181233	9240780	9300327	9359873	9419418
94	9657590	9717131	9776671	9836210	9895749	9955286	0014823
95	8630252962	0312495	0372027	0431558	0491088	0550618	0610147
96	0848253	0907778	0967302	1026825	1086347	1145868	1205389
97	1443463	1502979	1562495	1622009	1681523	1741037	1800549
98	2038590	2098099	2157606	2217113	2276619	2336124	2395628
99	2633637	2693137	2752636	2812134	2871632	2931129	2990625
7300	3228601	3288093	3347584	3407075	3466564	3526053	3585541

OF NUMBERS. Logarithms 8597385662–8633764000.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7805540	7865519	7925497	59985	984	984	982	982	981	980	979	978	978
8405295	8465265	8525236	977	975	976	974	973	973	972	970	971	969
9004967	9064929	9124891	968	968	967	966	965	964	964	962	962	961
9604556	9664510	9724464	960	960	958	958	957	956	955	954	954	952
0204062	0264008	0323954	952	951	951	949	949	947	947	946	946	944
0803486	0863424	0923361	944	942	942	942	940	939	939	938	937	936
1402827	1462757	1522685	935	935	934	932	932	932	930	930	928	928
2002085	2062007	2121927	927	926	926	925	923	923	922	922	920	920
2601261	2661174	2721086	918	918	918	916	915	915	914	913	912	912
3200354	3260259	3320163	910	910	909	908	907	906	906	905	904	903
3799364	3859261	3919156	59902	901	901	900	899	898	897	897	895	895
4398292	4458180	4518068	894	893	893	891	891	890	889	888	888	886
4997137	5057017	5116896	886	885	884	883	883	881	881	880	879	879
5595900	5655772	5715642	877	877	876	875	874	873	873	872	870	870
6194580	6254443	6314306	870	868	868	866	866	866	864	863	863	862
6793177	6853033	6912887	861	860	859	859	857	857	856	856	854	854
7391692	7451539	7511385	852	852	851	851	849	849	847	847	846	846
7990125	8049964	8109802	844	844	843	842	841	840	840	839	838	837
8588475	8648306	8708135	836	835	835	834	833	832	831	831	829	829
9186743	9246565	9306386	828	827	827	825	825	824	823	822	821	821
9784928	9844742	9904555	59820	819	818	817	817	815	815	814	813	813
0383031	0442837	0502642	811	811	810	809	808	807	807	806	805	804
0981052	1040849	1100646	803	803	801	801	800	799	799	797	797	796
1578990	1638779	1698567	795	794	793	793	792	791	790	789	788	788
2176846	2236627	2296407	787	786	785	784	784	783	782	781	780	779
2774619	2834392	2894164	779	778	777	776	775	775	773	773	772	771
3372311	3432075	3491839	771	769	769	768	767	766	766	764	764	763
3969920	4029676	4089432	762	761	761	760	759	757	758	756	756	754
4567447	4627195	4686942	754	753	753	751	751	750	749	748	747	747
5164891	5224631	5284370	745	745	744	743	743	741	741	740	739	739
5762254	5821985	5881716	59737	737	736	735	734	733	733	731	731	730
6359534	6419258	6478980	730	728	728	727	726	725	724	724	722	722
6956732	7016448	7076162	721	720	720	718	718	717	716	716	714	714
7553848	7613555	7673262	713	712	711	710	710	708	708	707	707	705
8150882	8210581	8270279	705	704	703	702	701	701	699	699	698	698
8747834	8807525	8867215	696	696	694	694	694	692	691	691	690	689
9344704	9404387	9464068	688	688	686	686	685	684	683	683	681	681
9941492	0001166	0060840	680	679	679	677	677	676	675	674	674	673
0538198	0597864	0657529	671	671	670	670	668	668	667	666	665	665
1134822	1194480	1254137	663	663	662	661	661	659	659	658	657	656
1731364	1791014	1850662	59656	654	654	653	652	651	651	650	648	649
2327824	2387465	2447106	647	646	646	645	643	644	642	641	641	640
2924202	2983835	3043468	639	638	638	636	636	635	634	633	633	632
3520498	3580123	3639748	630	630	630	628	628	626	626	625	625	623
4116713	4176330	4235946	623	622	621	620	619	619	618	617	616	615
4712845	4772454	4832062	615	613	613	612	611	611	609	609	608	607
5308896	5368497	5428096	606	606	605	603	603	603	601	601	599	599
5904865	5964457	6024049	598	598	596	596	595	594	593	592	592	591
6500752	6560336	6619920	590	589	588	588	586	586	585	584	584	582
7096557	7156134	7215709	582	581	580	579	579	578	576	577	575	574
7692281	7751849	7811416	59574	573	572	571	570	569	569	568	567	566
8287923	8347483	8407042	566	564	564	563	562	562	560	560	559	558
8883483	8943035	9002586	557	557	555	555	554	553	552	552	551	550
9478962	9538505	9598048	549	548	547	547	546	545	544	543	543	542
0074359	0133894	0193429	541	540	539	539	537	537	536	535	535	533
0669674	0729202	0788728	533	532	531	530	530	529	527	528	526	525
1264908	1324427	1383945	525	524	523	522	521	521	519	519	518	518
1860061	1919571	1979081	516	516	514	514	514	512	512	510	510	509
2455131	2514634	2574136	509	507	507	506	505	504	503	503	502	501
3050120	3109615	3169108	500	499	498	498	497	496	495	495	493	493
3645028	3704514	3764000	492	491	491	489	489	488	487	486	486	484

Numbers 73000–73609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7300	8633228601	3288093	3347584	3407075	3466564	3526053	3585541
1	3823484	3882968	3942451	4001933	4061415	4120895	4180375
2	4418286	4477762	4537237	4596711	4656184	4715656	4775128
3	5013006	5072474	5131941	5191407	5250872	5310336	5369799
4	5607645	5667105	5726563	5786021	5845478	5904934	5964390
5	6202203	6261654	6321104	6380554	6440003	6499451	6558898
6	6796679	6856122	6915564	6975006	7034446	7093886	7153325
7	7391073	7450508	7509943	7569376	7628809	7688240	7747671
8	7985387	8044814	8104240	8163665	8223089	8282513	8341936
9	8579619	8639038	8698455	8757873	8817289	8876704	8936119
7310	8639173770	9233180	9292590	9351999	9411407	9470814	9530221
11	9767839	9827242	9886643	9946044	0005444	0064843	0124242
12	8640361827	0421222	0480615	0540008	0599400	0658791	0718181
13	0955734	1015120	1074506	1133891	1193274	1252657	1312039
14	1549560	1608938	1668315	1727692	1787068	1846442	1905817
15	2143305	2202675	2262044	2321412	2380780	2440146	2499512
16	2736968	2796330	2855691	2915051	2974411	3033769	3093127
17	3330550	3389904	3449257	3508609	3567961	3627311	3686661
18	3924052	3983397	4042742	4102086	4161429	4220772	4280113
19	4517472	4576809	4636146	4695482	4754817	4814151	4873485
7320	8645110811	5170140	5229469	5288796	5348123	5407450	5466775
21	5704069	5763390	5822710	5882030	5941349	6000667	6059984
22	6297245	6356559	6415871	6475183	6534494	6593804	6653113
23	6890341	6949647	7008951	7068254	7127557	7186859	7246160
24	7483356	7542653	7601950	7661245	7720540	7779833	7839126
25	8076290	8135579	8194867	8254155	8313441	8372727	8432012
26	8669143	8728424	8787704	8846983	8906262	8965539	9024816
27	9261915	9321188	9380460	9439731	9499002	9558271	9617540
28	9854607	9913871	9973135	0032398	0091660	0150922	0210182
29	8650447217	0506474	0565729	0624984	0684238	0743492	0802744
7330	8651039746	1098995	1158243	1217490	1276736	1335981	1395225
31	1632195	1691435	1750675	1809914	1869152	1928389	1987625
32	2224563	2283795	2343027	2402257	2461487	2520717	2579945
33	2816850	2876074	2935298	2994520	3053742	3112963	3172183
34	3409056	3468272	3527488	3586702	3645916	3705129	3764341
35	4001182	4060390	4119597	4178804	4238009	4297214	4356418
36	4593227	4652427	4711626	4770824	4830022	4889219	4948415
37	5185191	5244383	5303574	5362764	5421954	5481143	5540330
38	5777074	5836258	5895441	5954624	6013805	6072986	6132166
39	6368877	6428053	6487228	6546402	6605576	6664748	6723920
7340	8656960599	7019767	7078934	7138100	7197266	7256430	7315594
41	7552241	7611400	7670559	7729717	7788875	7848031	7907187
42	8143802	8202953	8262104	8321254	8380404	8439552	8498700
43	8735282	8794426	8853568	8912710	8971852	9030992	9090132
44	9326682	9385818	9444952	9504086	9563219	9622352	9681483
45	9918001	9977129	0036255	0095381	0154506	0213631	0272754
46	8660509240	0568360	0627478	0686596	0745713	0804829	0863945
47	1100398	1159510	1218620	1277730	1336839	1395947	1455055
48	1691476	1750580	1809682	1868784	1927885	1986985	2046084
49	2282474	2341569	2400664	2459757	2518850	2577942	2637034
7350	8662873391	2932479	2991565	3050650	3109735	3168819	3227902
51	3464227	3523307	3582385	3641463	3700540	3759616	3818691
52	4054984	4114055	4173125	4232195	4291264	4350332	4409399
53	4645660	4704723	4763785	4822847	4881908	4940968	5000027
54	5236255	5295310	5354365	5413418	5472471	5531523	5590574
55	5826771	5885818	5944864	6003910	6062954	6121998	6181041
56	6417206	6476245	6535283	6594321	6653357	6712393	6771428
57	7007561	7066592	7125622	7184651	7243680	7302708	7361735
58	7597835	7656858	7715880	7774902	7833922	7892942	7951961
59	8188029	8247044	8306058	8365072	8424085	8483096	8542107
7360	8778143	8837150	8896157	8955162	9014167	9073170	9132173

OF NUMBERS. Logarithms 863228601-8669309178.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3645028	3704514	3764000	59492	491	491	489	489	488	487	486	486	484
4239854	4299332	4358810	484	483	482	482	480	480	479	478	478	476
4834599	4894069	4953538	476	475	474	473	472	472	471	470	469	468
5429262	5488724	5548185	468	467	466	465	464	463	463	462	461	460
6023844	6083298	6142751	460	458	458	457	456	456	454	454	453	452
6618344	6677790	6737234	451	450	450	449	448	447	446	446	444	445
7212764	7272201	7331638	443	442	442	440	440	439	439	437	437	435
7807101	7866531	7925959	435	435	433	433	431	431	430	430	428	428
8401358	8460779	8520199	427	426	425	424	424	423	422	421	420	420
8995533	9054946	9114358	419	417	418	416	415	415	414	413	412	412
9589627	9649032	9708436	59410	410	409	408	407	407	406	405	404	403
0183639	0243036	0302432	403	401	401	400	399	399	397	397	396	395
0777571	0836959	0896347	395	393	393	392	391	390	390	388	388	387
1371421	1430801	1490181	386	386	385	383	383	382	382	380	380	379
1965190	2024562	2083934	378	377	377	376	374	375	373	372	372	371
2558878	2618242	2677605	370	369	368	368	366	366	366	364	363	363
3152484	3211840	3271196	362	361	360	360	358	358	357	356	356	354
3746010	3805358	3864705	354	353	352	352	350	350	349	348	347	347
4339454	4398794	4458133	345	345	344	343	343	341	341	340	339	339
4932817	4992149	5051480	337	337	336	335	334	334	332	332	331	331
5526100	5585423	5644746	59329	329	327	327	327	325	325	323	323	323
6119301	6178617	6237931	321	320	320	319	318	317	317	316	314	314
6712421	6771729	6831035	314	312	312	311	310	309	308	308	306	306
7305460	7364760	7424058	306	304	303	303	302	301	300	300	298	298
7898419	7957710	8017001	297	297	295	295	293	293	293	291	291	289
8491296	8550579	8609862	289	288	288	286	286	285	284	283	283	281
9084092	9143367	9202642	281	280	279	279	277	277	276	275	275	273
9676808	9736075	9795341	273	272	271	271	269	269	268	267	266	266
0269442	0328701	0387960	264	264	263	262	262	260	260	259	259	257
0861996	0921247	0980497	257	255	255	254	254	252	252	251	250	249
1454469	1513712	1572954	59249	248	247	246	245	244	244	243	242	241
2046861	2106096	2165330	240	240	239	238	237	236	236	235	234	233
2639172	2698399	2757625	232	232	230	230	230	228	227	227	226	225
3231403	3290621	3349839	224	224	222	222	221	220	220	218	218	217
3823553	3882763	3941973	216	216	214	214	213	212	212	210	210	209
4415622	4474824	4534026	208	207	207	205	205	204	204	202	202	201
5007610	5066804	5125998	200	199	198	198	197	196	195	194	194	193
5599518	5658704	5717889	192	191	190	190	189	187	188	186	185	185
6191345	6250523	6309700	184	183	183	181	181	180	179	178	177	177
6783091	6842261	6901431	176	175	174	174	172	172	171	170	170	168
7374757	7433919	7493080	59168	167	166	166	164	164	163	162	161	161
7966342	8025496	8084649	159	159	158	158	156	156	155	154	153	153
8557846	8616992	8676138	151	151	150	150	148	148	146	146	146	144
9149270	9208408	9267546	144	142	142	142	140	140	138	138	138	136
9740614	9799744	9858873	136	134	134	133	133	131	131	130	129	128
0331877	0390999	0450120	128	126	126	125	125	123	123	122	121	120
0923059	0982173	1041286	120	118	118	117	116	116	114	114	113	112
1514161	1573267	1632372	112	110	110	109	108	108	106	106	105	104
2105183	2164281	2223378	104	102	102	101	100	099	099	098	097	096
2696124	2755214	2814303	095	095	093	093	092	092	090	090	089	088
3286985	3346067	3405147	59087	086	085	085	084	083	083	082	080	080
3877765	3936839	3995912	080	078	078	077	076	075	074	074	073	072
4468465	4527531	4586596	071	070	070	069	068	067	066	066	065	064
5059085	5118143	5177199	063	062	062	061	060	059	058	058	056	056
5649624	5708674	5767723	055	055	053	053	052	051	050	050	049	048
6240084	6299125	6358166	047	046	046	044	044	043	043	041	041	040
6830462	6889496	6948529	039	038	038	036	036	035	034	034	033	032
7420761	7479786	7538811	031	030	029	029	028	027	026	025	025	024
8010979	8069997	8129013	023	022	022	020	020	019	018	018	016	016
8601118	8660127	8719136	015	014	014	013	011	011	011	009	009	007
9191176	9250177	9309178	007	007	005	005	003	003	003	001	001	999

Numbers 73600–74209. **LOGARITHMS**

Numbers.	Mantissæ.						
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7360	8668778143	8837150	8896157	8955162	9014167	9073170	9132173
61	9368177	9427176	9486174	9545172	9604168	9663164	9722159
62	9958131	0017122	0076112	0135102	0194090	0253078	0312065
63	8670548005	0606988	0665970	0724951	0783932	0842912	0901891
64	1137798	1196773	1255747	1314721	1373693	1432665	1491636
65	1727512	1786479	1845445	1904410	1963375	2022339	2081301
66	2317145	2376104	2435062	2494020	2552976	2611932	2670887
67	2906699	2965649	3024600	3083549	3142497	3201445	3260392
68	3496172	3555115	3614057	3672998	3731939	3790879	3849817
69	4085565	4144500	4203434	4262368	4321300	4380232	4439163
7370	8674674879	4733806	4792732	4851657	4910582	4969505	5028428
71	5264112	5323031	5381949	5440866	5499783	5558699	5617614
72	5853265	5912176	5971087	6029996	6088904	6147812	6206719
73	6442339	6501242	6560144	6619046	6677946	6736846	6795745
74	7031333	7090228	7149122	7208015	7266908	7325800	7384691
75	7620247	7679133	7738020	7796905	7855790	7914673	7973556
76	8209080	8267959	8326838	8385715	8444592	8503467	8562343
77	8797835	8856706	8915576	8974445	9033314	9092182	9151049
78	9386509	9445372	9504234	9563096	9621956	9680816	9739675
79	9975103	0033959	0092813	0151666	0210519	0269371	0328222
7380	8680563618	0622465	0681312	0740157	0799002	0857846	0916689
81	1152053	1210892	1269731	1328568	1387405	1446241	1505076
82	1740409	1799240	1858070	1916900	1975728	2034556	2093384
83	2328684	2387507	2446330	2505151	2563972	2622792	2681611
84	2916880	2975695	3034510	3093323	3152136	3210948	3269760
85	3504996	3563804	3622610	3681416	3740221	3799025	3857828
86	4093033	4151832	4210631	4269429	4328226	4387022	4445817
87	4680990	4739782	4798572	4857362	4916151	4974939	5033726
88	5268868	5327651	5386434	5445215	5503996	5562777	5621556
89	5856666	5915441	5974216	6032989	6091762	6150535	6209306
7390	8686444384	6503151	6561918	6620684	6679449	6738213	6796977
91	7032023	7090782	7149541	7208299	7267056	7325812	7384568
92	7619582	7678334	7737084	7795834	7854584	7913332	7972080
93	8207062	8265806	8324548	8383290	8442032	8500772	8559512
94	8794462	8853198	8911933	8970667	9029400	9088133	9146864
95	9381783	9440511	9499238	9557964	9616689	9675414	9734138
96	9969025	0027745	0086464	0145182	0203899	0262616	0321332
97	8690556187	0614899	0673610	0732320	0791030	0849738	0908446
98	1143270	1201974	1260677	1319379	1378081	1436781	1495481
99	1730273	1788969	1847664	1906359	1965052	2023745	2082437
7400	8692317197	2375885	2434573	2493259	2551945	2610630	2669314
1	2904042	2962722	3021402	3080080	3138758	3197435	3256111
2	3490808	3549480	3608151	3666822	3725492	3784161	3842829
3	4077494	4136158	4194822	4253484	4312146	4370807	4429468
4	4664101	4722757	4781413	4840067	4898721	4957375	5016027
5	5250629	5309277	5367925	5426571	5485218	5543863	5602507
6	5837077	5895718	5954357	6012996	6071634	6130272	6188908
7	6423447	6482079	6540711	6599342	6657972	6716602	6775230
8	7009737	7068361	7126985	7185608	7244231	7302852	7361473
9	7595948	7654565	7713181	7771796	7830410	7889024	7947636
7410	8698182080	8240689	8299297	8357904	8416510	8475116	8533721
11	8768133	8826734	8885334	8943933	9002532	9061129	9119726
12	9354106	9412700	9471292	9529883	9588474	9647064	9705653
13	9940001	9998586	0057171	0115754	0174337	0232919	0291500
14	8700525817	0584394	0642971	0701546	0760121	0818695	0877268
15	1111554	1170123	1228692	1287259	1345826	1404392	1462958
16	1697211	1755773	1814333	1872893	1931452	1990011	2048568
17	2282790	2341344	2399896	2458448	2517000	2575550	2634099
18	2868290	2926836	2985380	3043924	3102468	3161010	3219552
19	3453711	3512249	3570786	3629322	3687857	3746392	3804925
7420	4039053	4097583	4156112	4214640	4273167	4331694	4390220

OF NUMBERS. Logarithms 8668776143–8704565793.

Mantissæ.			Differences.									
7	8.	9	0	1	2	3	4	5	6	7	8	9
9191176	9250177	9309178	59007	007	005	005	003	003	003	001	001	999
9781153	9840147	9899139	58999	998	998	996	996	995	994	994	992	992
0371051	0430036	0489021	991	990	990	988	988	987	986	985	985	984
0960869	1019846	1078823	983	982	981	981	980	979	978	977	977	975
1550606	1609575	1668544	975	974	974	972	972	971	970	969	969	968
2140264	2199225	2258185	967	966	965	965	964	962	963	961	960	960
2729841	2788794	2847747	959	958	958	956	956	955	954	953	953	952
3319338	3378284	3437228	950	951	949	948	948	947	946	946	944	944
3908756	3967693	4026629	943	942	941	941	940	938	939	937	936	936
4498093	4557022	4615951	935	934	934	932	932	931	930	929	929	928
5087350	5146272	5205192	58927	926	925	925	923	923	922	922	920	920
5676528	5735441	5794354	919	918	917	917	916	915	914	913	913	911
6265625	6324531	6383435	911	911	909	908	908	907	906	906	904	904
6854643	6913540	6972437	903	902	902	900	900	899	898	897	897	896
7443581	7502470	7561359	895	894	893	893	892	891	890	889	889	888
8032439	8091320	8150201	886	887	885	885	883	883	883	881	881	879
8621217	8680090	8738963	879	879	877	877	875	876	874	873	873	872
9209915	9268780	9327645	871	870	869	869	868	867	866	865	865	864
9798533	9857391	9916248	863	862	862	860	860	859	858	858	857	855
0387072	0445922	0504770	856	854	853	853	852	851	850	850	848	848
0975531	1034373	1093213	58847	847	845	845	844	843	842	842	840	840
1563910	1622744	1681577	839	839	837	837	836	835	834	834	833	832
2152210	2211035	2269860	831	830	830	828	828	828	826	825	825	824
2740430	2799247	2858064	823	823	821	821	820	819	819	817	817	816
3328570	3387380	3446188	815	815	813	813	812	812	810	810	808	808
3916631	3975432	4034233	808	806	806	805	804	803	803	801	801	800
4504611	4563405	4622198	799	799	798	797	796	795	794	794	793	792
5092513	5151299	5210084	792	790	790	789	788	787	787	786	785	784
5680335	5739112	5797889	783	783	781	781	781	779	779	777	777	777
6268077	6326847	6385616	775	775	773	773	773	771	771	770	769	768
6855739	6914501	6973262	58767	767	766	765	764	764	762	762	761	761
7443323	7502077	7560830	759	759	758	757	756	756	755	754	753	752
8030826	8089572	8148318	752	750	750	750	748	748	746	746	746	744
8618251	8676989	8735726	744	742	742	742	740	740	739	738	737	736
9205595	9264325	9323055	736	735	734	733	733	731	731	730	730	728
9792861	9851583	9910304	728	727	726	725	725	724	723	722	721	721
0380047	0438761	0497474	720	719	718	717	717	716	715	714	713	713
0967153	1025860	1084565	712	711	710	710	708	708	707	707	705	705
1554181	1612879	1671576	704	703	702	702	700	700	700	698	697	697
2141128	2199819	2258508	696	695	695	693	693	692	691	691	689	689
2727997	2786679	2845361	58688	688	686	686	685	684	683	682	682	681
3314786	3373461	3432135	680	680	678	678	677	676	675	675	674	673
3901496	3960163	4018829	672	671	671	670	669	668	667	667	666	665
4488127	4546786	4605444	664	664	662	662	661	661	659	659	658	657
5074679	5133329	5191979	656	656	654	654	654	652	652	650	650	650
5661151	5719794	5778436	648	648	646	647	645	644	644	643	642	641
6247544	6306179	6364813	641	639	639	638	638	636	636	635	634	634
6833858	6892485	6951111	632	632	631	630	630	628	628	627	626	626
7420093	7478712	7537330	624	624	623	623	621	621	620	619	618	618
8006249	8064860	8123470	617	616	615	614	614	612	613	611	610	610
8592325	8650928	8709531	58609	608	607	606	606	605	604	603	603	602
9178323	9236918	9295513	601	600	599	599	597	597	597	595	595	593
9764241	9822829	9881415	594	592	591	591	590	589	588	588	586	586
0350081	0408660	0467239	585	585	583	583	582	581	581	579	579	578
0935841	0994413	1052984	577	577	575	575	574	573	573	572	571	570
1521522	1580086	1638649	569	569	567	567	566	566	564	564	563	562
2107125	2165681	2224236	562	560	560	559	559	557	557	556	555	554
2692648	2751196	2809743	554	552	552	552	550	549	549	548	547	547
3278093	3336633	3395172	546	544	544	544	542	542	541	540	539	539
3863458	3921991	3980522	538	537	536	535	535	533	533	533	531	531
4448745	4507270	4565793	530	529	528	527	527	526	525	525	523	523

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7420	8704039053	4097583	4156112	4214640	4273167	4331694	4390220
21	4624316	4682838	4741359	4799879	4858399	4916918	4975436
22	5209500	5268014	5326528	5385040	5443552	5502063	5560573
23	5794606	5853112	5911617	5970122	6028626	6087129	6145631
24	6379632	6438130	6496628	6555125	6613621	6672116	6730610
25	6964580	7023070	7081560	7140049	7198537	7257024	7315511
26	7549449	7607931	7666413	7724894	7783374	7841854	7900333
27	8134239	8192714	8251188	8309661	8368133	8426605	8485076
28	8718951	8777418	8835884	8894349	8952813	9011277	9069740
29	9303583	9362042	9420501	9478958	9537415	9595870	9654325
7430	8709888138	9946589	0005039	0063488	0121937	0180385	0238832
31	8710472613	0531056	0589499	0647940	0706381	0764821	0823261
32	1057010	1115445	1173880	1232314	1290747	1349179	1407610
33	1641328	1699756	1758182	1816608	1875033	1933458	1991881
34	2225568	2283987	2342406	2400824	2459241	2517658	2576074
35	2809729	2868140	2926551	2984962	3043371	3101780	3160187
36	3393811	3452215	3510618	3569020	3627422	3685823	3744223
37	3977815	4036211	4094606	4153001	4211394	4269787	4328180
38	4561740	4620128	4678516	4736903	4795288	4853673	4912058
39	5145587	5203967	5262347	5320726	5379104	5437481	5495858
7440	8715729355	5787728	5846100	5904471	5962841	6021210	6079579
41	6313045	6371410	6429774	6488137	6546499	6604861	6663222
42	6896657	6955014	7013370	7071725	7130079	7188433	7246786
43	7480190	7538539	7596887	7655235	7713581	7771927	7830272
44	8063645	8121986	8180326	8238666	8297005	8355343	8413680
45	8647021	8705354	8763687	8822018	8880349	8938680	8997009
46	9230319	9288644	9346969	9405293	9463616	9521938	9580260
47	9813538	9871856	9930173	9988489	0046804	0105119	0163433
48	8720396680	0454990	0513299	0571607	0629914	0688221	0746527
49	0979743	1038045	1096346	1154646	1212946	1271245	1329543
7450	8721562727	1621022	1679315	1737608	1795899	1854191	1912481
51	2145634	2203920	2262206	2320491	2378775	2437058	2495340
52	2728462	2786741	2845019	2903295	2961572	3019847	3078122
53	3311212	3369483	3427753	3486022	3544290	3602558	3660825
54	3893884	3952147	4010409	4068670	4126931	4185191	4243450
55	4476478	4534733	4592987	4651241	4709493	4767745	4825997
56	5058993	5117241	5175487	5233733	5291978	5350222	5408465
57	5641431	5699670	5757909	5816147	5874384	5932620	5990856
58	6223790	6282022	6340253	6398483	6456712	6514941	6573168
59	6806072	6864295	6922518	6980741	7038962	7097183	7155403
7460	8727388275	7446491	7504706	7562920	7621134	7679347	7737559
61	7970400	8028608	8086816	8145022	8203228	8261433	8319638
62	8552447	8610647	8668847	8727046	8785244	8843441	8901638
63	9134416	9192609	9250801	9308992	9367182	9425372	9483560
64	9716307	9774492	9832676	9890860	9949042	0007224	0065405
65	8730298121	0356298	0414474	0472649	0530824	0588998	0647171
66	0879856	0938025	0996194	1054361	1112528	1170694	1228860
67	1461513	1519675	1577835	1635995	1694154	1752313	1810470
68	2043093	2101246	2159399	2217551	2275703	2333853	2392003
69	2624594	2682740	2740885	2799030	2857173	2915316	2973458
7470	8733206018	3264156	3322294	3380430	3438566	3496701	3554835
71	3787364	3845494	3903624	3961753	4019881	4078008	4136134
72	4368632	4426755	4484877	4542998	4601118	4659237	4717356
73	4949823	5007937	5066051	5124165	5182277	5240389	5298499
74	5530935	5589042	5647148	5705254	5763358	5821462	5879565
75	6111970	6170069	6228168	6286265	6344362	6402458	6460554
76	6692927	6751019	6809109	6867199	6925288	6983376	7041464
77	7273806	7331890	7389973	7448055	7506136	7564217	7622297
78	7854608	7912684	7970759	8028834	8086907	8144980	8203052
79	8435332	8493400	8551468	8609534	8667600	8725665	8783729
7480	9015979	9074039	9132099	9190157	9248215	9306273	9364329

OF NUMBERS. Logarithms 8704039053–8739538494.

Mantissæ.			Differences.									
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4448745	4507270	4565793	58530	529	528	527	527	526	525	525	523	523
5033953	5092470	5150985	522	521	520	520	519	518	517	517	515	515
5619082	5677591	5736099	514	514	512	512	511	510	509	509	508	507
6204132	6262633	6321133	506	505	505	504	503	502	501	501	500	499
6789104	6847597	6906089	498	498	497	496	495	494	494	493	492	491
7373996	7432481	7490966	490	490	489	488	487	487	485	485	485	483
7958810	8017287	8075764	482	482	481	480	480	479	477	477	477	475
8543545	8602015	8660483	475	474	473	472	472	471	469	470	468	468
9128202	9186663	9245124	467	466	465	464	464	463	462	461	461	459
9712780	9771233	9829686	459	459	457	457	455	455	455	453	453	452
0297279	0355724	0414169	58451	450	449	449	448	447	447	445	445	444
0881699	0940137	0998574	443	443	441	441	440	440	438	438	437	436
1466041	1524471	1582900	435	435	434	433	432	431	431	430	429	428
2050304	2108726	2167147	428	426	426	425	425	423	423	422	421	421
2634489	2692903	2751316	419	419	418	417	417	416	415	414	413	413
3218595	3277001	3335406	411	411	411	409	409	407	408	406	405	405
3802622	3861020	3919418	404	403	402	402	401	400	399	398	398	397
4386571	4444961	4503351	396	395	395	393	393	393	391	390	390	389
4970441	5028824	5087206	388	388	387	385	385	385	383	383	382	381
5554233	5612608	5670982	380	380	379	378	377	377	375	375	374	373
6137947	6196314	6254680	58373	372	371	370	369	369	368	367	366	365
6721582	6779941	6838299	365	364	363	362	362	361	360	359	358	358
7305138	7363490	7421840	357	356	355	354	354	353	352	352	350	350
7888616	7946960	8005303	349	348	348	346	346	345	344	344	343	342
8472016	8530352	8588687	341	340	340	339	338	337	336	336	335	334
9055338	9113666	9171993	333	333	331	331	331	329	329	328	327	326
9638581	9696901	9755220	325	325	324	323	322	322	321	320	319	318
0221746	0280058	0338369	318	317	316	315	315	314	313	312	311	311
0804832	0863136	0921440	310	309	308	307	307	306	305	304	304	303
1387840	1446137	1504433	302	301	300	300	299	298	297	297	296	294
1970770	2029059	2087347	58295	293	293	291	292	290	289	289	288	287
2553622	2611903	2670183	286	286	285	284	283	282	282	281	280	279
3136396	3194669	3252941	279	278	276	277	275	275	274	273	272	271
3719091	3777356	3835621	271	270	269	268	268	267	266	265	265	263
4301708	4359965	4418222	263	262	261	261	260	259	258	257	257	256
4884247	4942497	5000745	255	254	254	252	252	252	250	250	248	248
5466708	5524950	5583191	248	246	246	245	244	243	243	242	241	240
6049091	6107325	6165558	239	239	238	237	236	236	235	234	233	232
6631395	6689622	6747847	232	231	230	229	229	227	227	227	225	225
7213622	7271840	7330058	223	223	223	221	221	220	219	218	218	217
7795771	7853981	7912191	58216	215	214	214	213	212	212	210	210	209
8377841	8436044	8494246	208	208	206	206	205	205	203	203	202	201
8959834	9018029	9076223	200	200	199	198	197	197	196	195	194	193
9541748	9599935	9658122	193	192	191	190	190	188	188	187	187	185
0123585	0181764	0239943	185	184	184	182	182	181	180	179	179	178
0705343	0763515	0821686	177	176	175	175	174	173	172	172	171	170
1287024	1345188	1403351	169	169	167	167	166	166	164	164	163	162
1868627	1926783	1984938	162	160	160	159	159	157	157	156	155	155
2450152	2508300	2566448	153	153	152	152	150	150	149	148	148	146
3031599	3089740	3147879	146	145	145	143	143	142	141	141	139	139
3612968	3671101	3729233	58138	138	136	136	135	134	133	133	132	131
4194260	4252385	4310509	130	130	129	128	127	126	126	125	124	123
4775474	4833591	4891707	123	122	121	120	119	119	118	117	116	116
5356610	5414719	5472827	114	114	114	112	112	110	111	109	108	108
5937668	5995769	6053870	107	106	106	104	104	103	103	101	101	100
6518648	6576742	6634835	099	099	097	097	096	096	094	094	093	092
7099551	7157637	7215722	092	090	090	089	088	088	087	086	085	084
7680376	7738454	7796532	084	083	082	081	081	080	079	078	078	076
8261123	8319194	8377263	076	075	075	073	073	072	071	071	069	069
8841793	8899856	8957917	068	068	066	066	065	064	064	063	061	062
9422385	9480440	9538494	060	060	058	058	058	056	056	055	054	053

Numbers 74800–75409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7480	8739015979	9074039	9132099	9190157	9248215	9306273	9364329
81	9596547	9654600	9712652	9770703	9828753	9886803	9944851
82	8740177039	0235083	0293128	0351171	0409213	0467255	0525296
83	0757452	0815489	0873526	0931561	0989596	1047630	1105663
84	1337788	1395818	1453846	1511874	1569901	1627927	1685953
85	1918047	1976068	2034089	2092109	2150128	2208147	2266165
86	2498228	2556242	2614255	2672267	2730278	2788289	2846299
87	3078331	3136337	3194343	3252347	3310351	3368354	3426356
88	3658357	3716356	3774353	3832350	3890346	3948341	4006336
89	4238306	4296296	4354286	4412275	4470264	4528251	4586238
7490	8744818177	4876160	4934142	4992123	5050104	5108084	5166063
91	5397971	5455946	5513920	5571894	5629867	5687839	5745810
92	5977687	6035654	6093621	6151587	6209552	6267516	6325480
93	6557326	6615286	6673245	6731203	6789160	6847116	6905072
94	7136888	7194840	7252791	7310741	7368691	7426639	7484587
95	7716372	7774316	7832259	7890202	7948144	8006085	8064025
96	8295779	8353715	8411651	8469586	8527520	8585453	8643386
97	8875108	8933037	8990965	9048892	9106819	9164744	9222669
98	9454361	9512282	9570202	9628122	9686040	9743958	9801875
99	8750033536	0091449	0149362	0207273	0265184	0323095	0381004
7500	8750612634	0670539	0728444	0786348	0844251	0902154	0960056
1	1191655	1249552	1307450	1365346	1423241	1481136	1539030
2	1770598	1828488	1886378	1944266	2002154	2060041	2117927
3	2349465	2407347	2465229	2523109	2580989	2638869	2696747
4	2928254	2986128	3044002	3101875	3159748	3217619	3275490
5	3506966	3564833	3622699	3680564	3738429	3796293	3854156
6	4085601	4143460	4201319	4259176	4317033	4374889	4432745
7	4664159	4722010	4779861	4837711	4895560	4953409	5011256
8	5242639	5300483	5358326	5416169	5474010	5531851	5589691
9	5821043	5878879	5936715	5994549	6052383	6110216	6168049
7510	8756399370	6457198	6515026	6572853	6630679	6688505	6746329
11	6977620	7035441	7093261	7151080	7208898	7266716	7324533
12	7555793	7613606	7671418	7729229	7787040	7844850	7902659
13	8133888	8191694	8249498	8307302	8365105	8422907	8480709
14	8711907	8769705	8827502	8885298	8943093	9000888	9058682
15	9289849	9347639	9405428	9463217	9521004	9578791	9636577
16	9867714	9925497	9983278	0041059	0098839	0156618	0214396
17	8760445502	0503277	0561051	0618824	0676596	0734368	0792138
18	1023214	1080981	1138747	1196512	1254277	1312041	1369804
19	1600848	1658607	1716366	1774124	1831881	1889637	1947392
7520	8762178406	2236157	2293908	2351658	2409407	2467156	2524904
21	2755887	2813631	2871374	2929116	2986858	3044598	3102338
22	3333291	3391027	3448762	3506497	3564231	3621964	3679696
23	3910618	3968347	4026074	4083801	4141528	4199253	4256978
24	4487869	4545590	4603310	4661029	4718748	4776465	4834182
25	5065043	5122756	5180468	5238180	5295891	5353601	5411310
26	5642140	5699845	5757550	5815254	5872957	5930660	5988361
27	6219160	6276858	6334555	6392252	6449947	6507642	6565336
28	6796104	6853794	6911484	6969172	7026860	7084547	7142234
29	7372971	7430654	7488336	7546017	7603697	7661376	7719055
7530	8767949762	8007437	8065111	8122784	8180457	8238129	8295800
31	8526476	8584143	8641810	8699475	8757140	8814804	8872468
32	9103113	9160773	9218432	9276090	9333747	9391403	9449059
33	9679674	9737326	9794977	9852628	9910277	9967926	0025574
34	8770256159	0313803	0371446	0429089	0486731	0544372	0602013
35	0832567	0890203	0947839	1005474	1063108	1120742	1178374
36	1408898	1466527	1524155	1581782	1639409	1697035	1754660
37	1985153	2042774	2100395	2158014	2215633	2273251	2330869
38	2561331	2618945	2676558	2734170	2791781	2849392	2907002
39	3137433	3195039	3252644	3310249	3367853	3425456	3483058
7540	3713459	3771057	3828655	3886251	3943848	4001443	4059037

OF NUMBERS. Logarithms 8739015979–8774231816.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9422385	9480440	9538494	58060	060	058	058	058	056	056	055	054	053
0002899	0060947	0118993	053	052	051	050	050	048	048	048	046	046
0583336	0641376	0699414	044	045	043	042	042	041	040	040	038	038
1163696	1221727	1279758	037	037	035	035	034	033	033	031	031	030
1743977	1802001	1860024	030	028	028	027	026	026	024	024	023	023
2324182	2382198	2440213	021	021	020	019	019	018	017	016	015	015
2904308	2962317	3020324	014	013	012	011	011	010	009	009	007	007
3484358	3542358	3600358	006	006	004	004	003	002	002	000	000	999
4064329	4122322	4180314	57999	997	997	996	995	995	993	993	992	992
4644224	4702209	4760193	990	990	989	989	987	987	986	985	984	984
5224041	5282018	5339995	57983	982	981	981	980	979	978	977	977	976
5803780	5861750	5919719	975	974	974	973	972	971	970	970	969	968
6383442	6441404	6499366	967	967	966	965	964	964	962	962	962	960
6963027	7020981	7078935	960	959	958	957	956	956	955	954	954	953
7542535	7600481	7658427	952	951	950	950	948	948	948	946	946	945
8121965	8179904	8237842	944	943	943	942	941	940	940	939	938	937
8701318	8759249	8817179	936	936	935	934	933	933	932	931	930	929
9280593	9338517	9396439	929	928	927	927	925	925	924	924	922	922
9859792	9917707	9975622	921	920	920	918	918	917	917	915	915	914
0438913	0496821	0554728	913	913	911	911	911	909	909	908	907	906
1017957	1075857	1133756	57905	905	904	903	903	902	901	900	899	899
1596923	1654816	1712707	897	898	896	895	895	894	893	893	891	891
2175813	2233697	2291581	890	890	888	888	887	886	886	884	884	884
2754625	2812502	2870378	882	882	880	880	880	878	878	877	876	876
3333360	3391230	3449098	874	874	873	873	871	871	870	870	868	868
3912018	3969880	4027741	867	866	865	865	864	863	862	862	861	860
4490599	4548453	4606306	859	859	857	857	856	856	854	854	853	853
5069103	5126949	5184795	851	851	850	849	849	847	847	846	846	844
5647530	5705369	5763206	844	843	843	841	841	840	839	839	837	837
6225880	6283711	6341541	836	836	834	834	833	833	831	831	830	829
6804153	6861976	6919798	57828	828	827	826	826	824	824	823	822	822
7382349	7440164	7497979	821	820	819	818	818	817	816	815	815	814
7960468	8018275	8076082	813	812	811	811	810	809	809	807	807	806
8538510	8596310	8654109	806	804	804	803	802	802	801	800	799	798
9116475	9174267	9232059	798	797	796	795	795	794	793	792	792	790
9694363	9752147	9809931	790	789	789	787	787	786	786	784	784	783
0272174	0329951	0387727	783	781	781	780	779	778	778	777	776	775
0849908	0907678	0965446	775	774	773	772	772	770	770	770	768	768
1427566	1485328	1543088	767	766	765	765	764	763	762	762	760	760
2005147	2062901	2120654	759	759	758	757	756	755	755	754	753	752
2582651	2640397	2698142	57751	751	750	749	749	748	747	746	745	745
3160078	3217816	3275554	744	743	742	742	740	740	740	738	738	737
3737428	3795159	3852889	736	735	735	734	733	732	732	731	730	729
4314702	4372425	4430147	729	727	727	727	725	725	724	723	722	722
4891899	4949614	5007329	721	720	719	719	717	717	717	715	715	714
5469019	5526727	5584434	713	712	712	711	710	709	709	708	707	706
6046062	6103762	6161462	705	705	704	703	703	701	701	700	700	698
6623029	6680722	6738413	698	697	697	695	695	694	693	693	691	691
7199919	7257604	7315288	690	690	688	688	687	687	685	685	684	683
7776733	7834410	7892086	683	682	681	680	679	679	678	677	676	676
8353470	8411139	8468808	57675	674	673	673	672	671	670	669	669	668
8930130	8987792	9045453	667	667	665	665	664	664	662	662	661	660
9506714	9564368	9622022	660	659	658	657	656	656	655	654	654	652
0083221	0140868	0198514	652	651	651	649	649	648	647	647	646	645
0659652	0717291	0774929	644	643	643	642	641	641	639	639	638	638
1236006	1293638	1351268	636	636	635	634	634	632	632	632	630	630
1812284	1869908	1927531	629	628	627	627	626	625	624	624	623	622
2388486	2446102	2503717	621	621	619	619	618	618	617	616	615	614
2964611	3022219	3079826	614	613	612	611	611	610	609	608	607	607
3540659	3598260	3655860	606	605	605	604	603	602	601	601	600	599
4116631	4174224	4231816	598	598	596	597	595	594	594	593	592	592

Numbers 75400–76009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7540	8773713459	3771057	3828655	3886251	3943848	4001443	4059037
41	4289408	4346999	4404589	4462178	4519766	4577354	4634941
42	4865281	4922864	4980446	5038028	5095608	5153188	5210768
43	5441077	5498653	5556227	5613801	5671374	5728947	5786518
44	6016797	6074365	6131932	6189498	6247064	6304629	6362193
45	6592441	6650001	6707561	6765119	6822677	6880234	6937791
46	7168009	7225561	7283113	7340664	7398214	7455764	7513313
47	7743500	7801045	7858589	7916132	7973675	8031217	8088758
48	8318915	8376452	8433989	8491525	8549060	8606594	8664127
49	8894254	8951783	9009312	9066840	9124368	9181895	9239420
7550	8779469516	9527038	9584560	9642080	9699600	9757119	9814637
51	8780044703	0102217	0159731	0217244	0274756	0332267	0389778
52	0619813	0677320	0734826	0792331	0849836	0907339	0964842
53	1194847	1252346	1309845	1367342	1424839	1482335	1539831
54	1769805	1827297	1884787	1942277	1999767	2057255	2114743
55	2344687	2402171	2459654	2517136	2574618	2632099	2689579
56	2919493	2976969	3034444	3091919	3149393	3206867	3264339
57	3494222	3551691	3609159	3666626	3724093	3781558	3839023
58	4068876	4126337	4183797	4241257	4298716	4356174	4413631
59	4643454	4700907	4758360	4815812	4873263	4930714	4988163
7560	8785217955	5275401	5332846	5390291	5447734	5505177	5562619
61	5792381	5849819	5907257	5964694	6022130	6079565	6137000
62	6366730	6424161	6481591	6539020	6596449	6653877	6711304
63	6941004	6998427	7055850	7113271	7170692	7228112	7285532
64	7515202	7572617	7630032	7687446	7744860	7802272	7859684
65	8089324	8146732	8204139	8261545	8318951	8376356	8433760
66	8663370	8720770	8778170	8835569	8892967	8950364	9007761
67	9237340	9294733	9352125	9409516	9466906	9524296	9581685
68	9811234	9868619	9926004	9983387	0040770	0098153	0155534
69	8790385052	0442430	0499807	0557183	0614559	0671933	0729307
7570	8790958795	1016165	1073534	1130903	1188271	1245638	1303004
71	1532462	1589824	1647186	1704547	1761907	1819267	1876626
72	2106053	2163408	2220762	2278115	2335468	2392820	2450171
73	2679568	2736916	2794262	2851608	2908953	2966298	3023641
74	3253008	3310348	3367687	3425025	3482362	3539699	3597035
75	3826372	3883704	3941035	3998366	4055696	4113025	4170354
76	4399660	4456985	4514309	4571632	4628954	4686276	4743597
77	4972872	5030190	5087506	5144822	5202136	5259450	5316764
78	5546009	5603319	5660628	5717936	5775243	5832549	5889855
79	6119071	6176373	6233674	6290974	6348274	6405573	6462871
7580	8796692056	6749351	6806644	6863937	6921229	6978521	7035811
81	7264966	7322253	7379539	7436825	7494109	7551393	7608676
82	7837801	7895080	7952359	8009637	8066914	8124190	8181465
83	8410560	8467832	8525103	8582373	8639642	8696911	8754179
84	8983243	9040508	9097771	9155034	9212296	9269557	9326817
85	9555851	9613108	9670364	9727619	9784873	9842127	9899380
86	8800128384	0185633	0242881	0300129	0357376	0414622	0471867
87	0700841	0758082	0815323	0872563	0929802	0987041	1044279
88	1273222	1330456	1387689	1444922	1502154	1559385	1616615
89	1845528	1902755	1959980	2017205	2074430	2131653	2188876
7590	8802417759	2474978	2532196	2589413	2646630	2703846	2761061
91	2989914	3047126	3104336	3161546	3218755	3275964	3333171
92	3561994	3619198	3676401	3733603	3790805	3848006	3905206
93	4133999	4191195	4248391	4305585	4362780	4419973	4477165
94	4705928	4763117	4820305	4877492	4934679	4991864	5049049
95	5277782	5334963	5392144	5449324	5506502	5563681	5620858
96	5849561	5906734	5963907	6021080	6078251	6135422	6192592
97	6421264	6478430	6535596	6592760	6649924	6707088	6764250
98	6992892	7050051	7107209	7164366	7221522	7278678	7335833
99	7564445	7621596	7678747	7735896	7793045	7850193	7907341
7600	8135923	8193066	8250209	8307351	8364493	8421633	8478773

OF NUMBERS. Logarithms 877371345 9–8808650188.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4116631	4174224	4231816	57598	598	596	597	595	594	594	593	592	592
4692527	4750112	4807697	591	590	589	588	588	587	586	585	585	584
5268346	5325924	5383501	583	582	582	580	580	580	578	578	577	576
5844089	5901659	5959229	576	574	574	573	573	571	571	570	570	568
6419756	6477318	6534880	568	567	566	566	565	564	563	562	562	561
6995346	7052901	7110455	560	560	558	558	557	557	555	555	554	554
7570861	7628408	7685954	552	552	551	550	550	549	548	547	546	546
8146298	8203838	8261377	545	544	543	543	542	541	540	540	539	538
8721660	8779192	8836723	537	537	536	535	534	533	533	532	531	531
9296946	9354470	9411993	529	529	528	528	527	525	526	524	523	523
9872155	9929671	9987187	57522	522	520	520	519	518	518	516	516	516
0447288	0504797	0562305	514	514	513	512	511	511	510	509	508	508
1022345	1079846	1137347	507	506	505	505	503	503	503	501	501	500
1597326	1654819	1712313	499	499	497	497	496	496	495	493	494	492
2172230	2229716	2287202	492	490	490	490	488	488	487	486	486	485
2747059	2804537	2862015	484	483	482	482	481	480	480	478	478	478
3321811	3379282	3436753	476	475	475	474	474	472	472	471	471	469
3896488	3953951	4011414	469	468	467	467	465	465	465	463	463	462
4471088	4528544	4585999	461	460	460	459	458	457	457	456	455	455
5045613	5103061	5160508	453	453	452	451	451	449	450	448	447	447
5620061	5677502	5734941	57446	445	445	443	443	442	442	441	439	440
6194433	6251866	6309299	438	438	437	436	435	435	433	433	433	431
6768730	6826155	6883580	431	430	429	429	428	427	426	425	425	424
7342950	7400368	7457785	423	423	421	421	420	420	418	418	417	417
7917095	7974505	8031915	415	415	414	414	412	412	411	410	410	409
8491164	8548566	8605968	408	407	406	406	405	404	404	402	402	402
9065157	9122552	9179946	400	400	399	398	397	397	396	395	394	394
9639074	9696461	9753848	393	392	391	390	390	389	389	387	387	386
0212915	0270295	0327674	385	385	383	383	383	381	381	380	379	378
0786680	0844053	0901424	378	377	376	376	374	374	373	373	371	371
1360370	1417735	1475099	57370	369	369	368	367	366	366	365	364	363
1933984	1991341	2048697	362	362	361	360	360	359	358	357	356	356
2507522	2564871	2622220	355	354	353	353	352	351	351	349	349	348
3080984	3138326	3195667	348	346	346	345	345	343	343	342	341	341
3654371	3711705	3769039	340	339	338	337	337	336	336	334	334	333
4227681	4285008	4342335	333	331	331	330	329	329	327	327	327	325
4800917	4858236	4915555	325	324	323	322	322	321	320	319	319	317
5374076	5431388	5488699	318	316	316	314	314	314	312	312	311	310
5947160	6004464	6061768	310	309	308	307	306	306	305	304	304	303
6520169	6577465	6634761	302	301	300	300	299	298	298	296	296	295
7093101	7150390	7207679	57295	293	293	292	292	290	290	289	289	287
7665958	7723240	7780521	287	286	286	284	284	283	282	282	281	280
8238740	8296014	8353287	279	279	278	277	276	275	275	274	273	273
8811446	8868713	8925978	272	271	270	269	269	268	267	267	265	265
9384077	9441336	9498594	265	263	263	262	261	260	260	259	258	257
9956632	0013883	0071134	257	256	255	254	254	253	252	251	251	250
0529111	0586355	0643598	249	248	248	247	246	245	244	244	243	243
1101516	1158752	1215987	241	241	240	239	239	238	237	236	235	235
1673844	1731073	1788301	234	233	233	232	231	230	229	229	228	227
2246098	2303319	2360539	227	225	225	225	223	223	222	221	220	220
2818276	2875489	2932702	57219	218	217	217	216	215	215	213	213	212
3390378	3447584	3504790	212	210	210	209	209	207	207	206	206	204
3962405	4019604	4076802	204	203	202	202	201	200	199	199	198	197
4534357	4591548	4648739	196	196	194	195	193	192	192	191	191	189
5106234	5163417	5220600	189	188	187	187	185	185	185	183	183	182
5678035	5735211	5792386	181	181	180	178	179	177	177	176	175	175
6249761	6306929	6364097	173	173	173	171	171	170	169	168	168	167
6821412	6878573	6935733	166	166	164	164	164	162	162	161	160	159
7392987	7450141	7507293	159	158	157	156	156	155	154	154	152	152
7964487	8021633	8078778	151	151	149	149	148	148	146	146	145	145
8535912	8593051	8650188	143	143	142	142	140	140	139	139	137	137

Numbers 76000–76609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7600	8808135923	8193066	8250209	8307351	8364493	8421633	8478773
1	8707325	8764461	8821597	8878731	8935865	8992998	9050131
2	9278653	9335781	9392909	9450036	9507163	9564288	9621413
3	9849905	9907026	9964146	0021266	0078385	0135503	0192620
4	8810421082	0478196	0535308	0592420	0649532	0706642	0763752
5	0992184	1049290	1106395	1163500	1220604	1277707	1334809
6	1563211	1620309	1677407	1734504	1791600	1848696	1905791
7	2134163	2191254	2248344	2305433	2362522	2419610	2476698
8	2705039	2762123	2819206	2876288	2933369	2990450	3047529
9	3275841	3332917	3389992	3447067	3504141	3561214	3618286
7610	8813846568	3903636	3960704	4017771	4074837	4131903	4188968
11	4417219	4474280	4531341	4588400	4645459	4702517	4759574
12	4987796	5044850	5101903	5158955	5216006	5273056	5330106
13	5558298	5615344	5672389	5729434	5786478	5843521	5900563
14	6128725	6185763	6242801	6299838	6356875	6413910	6470945
15	6699077	6756108	6813138	6870168	6927197	6984225	7041252
16	7269354	7326377	7383400	7440422	7497444	7554464	7611484
17	7839556	7896572	7953587	8010602	8067616	8124629	8181641
18	8409683	8466692	8523700	8580707	8637713	8694719	8751724
19	8979736	9036737	9093737	9150737	9207736	9264734	9321731
7620	8819549713	9606707	9663700	9720692	9777684	9834674	9891664
21	8820119616	0176602	0233588	0290573	0347556	0404540	0461522
22	0689444	0746423	0803401	0860378	0917355	0974330	1031305
23	1259198	1316169	1373139	1430109	1487078	1544046	1601014
24	1828876	1885840	1942803	1999765	2056727	2113688	2170648
25	2398480	2455436	2512392	2569347	2626301	2683254	2740207
26	2968009	3024958	3081906	3138854	3195800	3252746	3309691
27	3537464	3594405	3651346	3708286	3765225	3822163	3879101
28	4106844	4163778	4220711	4277643	4334575	4391506	4448436
29	4676149	4733075	4790001	4846926	4903850	4960774	5017696
7630	8825245380	5302299	5359217	5416134	5473051	5529967	5586882
31	5814536	5871447	5928358	5985268	6042177	6099086	6155993
32	6383617	6440521	6497424	6554327	6611229	6668130	6725030
33	6952624	7009520	7066416	7123311	7180206	7237099	7293992
34	7521556	7578445	7635334	7692221	7749108	7805994	7862880
35	8090414	8147296	8204177	8261057	8317936	8374815	8431693
36	8659197	8716071	8772945	8829818	8886690	8943561	9000431
37	9227906	9284773	9341639	9398504	9455369	9512233	9569096
38	9796540	9853400	9910258	9967116	0023973	0080830	0137685
39	8830365100	0421952	0478803	0535654	0592503	0649352	0706200
7640	8830933586	0990430	1047274	1104117	1160959	1217801	1274641
41	1501997	1558834	1615670	1672506	1729340	1786174	1843008
42	2070334	2127163	2183992	2240820	2297647	2354474	2411300
43	2638596	2695418	2752239	2809060	2865880	2922699	2979518
44	3206784	3263599	3320413	3377226	3434038	3490850	3547661
45	3774897	3831705	3888511	3945317	4002122	4058926	4115730
46	4342937	4399737	4456536	4513334	4570132	4626929	4683725
47	4910902	4967694	5024486	5081277	5138067	5194857	5251645
48	5478793	5535578	5592362	5649145	5705928	5762710	5819492
49	6046609	6103387	6160164	6216940	6273715	6330490	6387264
7650	8836614352	6671122	6727891	6784660	6841428	6898195	6954961
51	7182020	7238782	7295544	7352306	7409066	7465826	7522585
52	7749614	7806369	7863123	7919877	7976630	8033383	8090134
53	8317133	8373881	8430628	8487375	8544120	8600865	8657610
54	8884579	8941319	8998059	9054798	9111536	9168274	9225011
55	9451950	9508683	9565416	9622147	9678878	9735608	9792338
56	8840019248	0075973	0132698	0189422	0246146	0302869	0359591
57	0586471	0643189	0699907	0756623	0813340	0870055	0926769
58	1153620	1210331	1267041	1323750	1380459	1437167	1493874
59	1720695	1777399	1834101	1890803	1947505	2004205	2060905
7660	2287696	2344392	2401088	2457782	2514476	2571169	2627861

OF NUMBERS.

Logarithms 8808135923-8842797934.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8535912	8593051	8650188	57143	143	142	142	140	140	139	139	137	137
9107262	9164393	9221523	136	136	134	134	133	133	131	131	130	130
9678537	9735660	9792783	128	128	127	127	125	125	124	123	123	122
0249737	0306853	0363968	121	120	120	119	118	117	117	116	115	114
0820861	0877970	0935077	114	112	112	112	110	110	109	109	107	107
1391911	1449011	1506111	106	105	105	104	103	102	102	100	100	100
1962885	2019978	2077071	098	098	097	096	096	095	094	093	093	092
2533784	2590870	2647955	091	090	089	089	088	088	086	086	085	084
3104608	3161687	3218764	084	083	082	081	081	079	079	079	077	077
3675358	3732428	3789498	076	075	075	074	073	072	072	070	070	070
4246032	4303095	4360158	57068	068	067	066	066	065	064	063	063	061
4816631	4873687	4930742	061	061	059	059	058	057	057	056	055	054
5387155	5444204	5501251	054	053	052	051	050	050	049	049	047	047
5957605	6014645	6071685	046	045	045	044	043	042	042	040	040	040
6527979	6585012	6642045	038	038	037	037	035	035	034	033	033	032
7098279	7155304	7212329	031	030	030	029	028	027	027	025	025	025
7668503	7725521	7782539	023	023	022	022	020	020	019	018	018	017
8238653	8295664	8352674	016	015	015	014	013	012	012	011	010	009
8808728	8865731	8922734	009	008	007	006	006	005	004	003	003	002
9378728	9435724	9492719	001	000	000	999	998	997	997	996	995	994
9948653	0005642	0062629	56994	993	992	992	990	990	989	989	987	987
0518504	0575485	0632465	986	986	985	983	984	982	982	981	980	979
1088280	1145253	1202226	979	978	977	977	975	975	975	973	973	972
1657981	1714947	1771912	971	970	970	969	968	968	967	966	965	964
2227607	2284565	2341523	964	963	962	962	961	960	959	958	958	957
2797158	2854110	2911060	956	956	955	954	953	953	951	952	950	949
3366635	3423579	3480522	949	948	948	946	946	945	944	944	943	942
3936038	3992974	4049909	941	941	940	939	938	938	937	936	935	935
4505365	4562294	4619222	934	933	932	932	931	930	929	929	928	927
5074618	5131539	5188460	926	926	925	924	924	922	922	921	921	920
5643797	5700710	5757623	56919	918	917	917	916	915	915	913	913	913
6212900	6269807	6326712	911	911	910	909	909	907	907	907	905	905
6781930	6838828	6895726	904	903	903	902	901	900	900	898	898	898
7350884	7407776	7464666	896	896	895	895	893	893	892	892	890	890
7919764	7976648	8033531	889	889	887	887	886	886	884	884	883	883
8488570	8545447	8602322	882	881	880	879	879	878	877	877	875	875
9057301	9114170	9171039	874	874	873	872	871	870	870	869	869	867
9625958	9682819	9739680	867	866	865	865	864	863	862	861	861	860
0194540	0251394	0308248	860	858	858	857	857	855	855	854	854	852
0763048	0819895	0876741	852	851	851	849	849	848	848	847	846	845
1331481	1388321	1445159	56844	844	843	842	842	840	840	840	838	838
1899840	1956672	2013503	837	836	836	834	834	834	832	832	831	831
2468125	2524949	2581773	829	829	828	827	827	826	825	824	824	823
3036335	3093152	3149968	822	821	821	820	819	819	817	817	816	816
3604471	3661281	3718089	815	814	813	812	812	811	810	810	808	808
4172533	4229335	4286136	808	806	806	805	804	804	803	802	801	801
4740520	4797315	4854109	800	799	798	798	797	796	795	795	794	793
5308433	5365220	5422007	792	792	791	790	790	788	788	787	787	786
5876272	5933052	5989831	785	784	783	783	782	782	780	780	779	778
6444037	6500809	6557581	778	777	776	775	775	774	773	772	772	771
7011727	7068492	7125256	56770	769	769	768	767	766	766	765	764	764
7579343	7636101	7692858	762	762	762	760	760	759	758	758	757	756
8146885	8203635	8260385	755	754	754	753	753	751	751	750	750	748
8714353	8771096	8827838	748	747	747	745	745	745	743	743	742	741
9281747	9338482	9395217	740	740	739	738	738	737	736	735	735	733
9849066	9905794	9962521	733	733	731	731	730	730	728	728	727	727
0416312	0473032	0529752	725	725	724	724	723	722	721	720	720	719
0983483	1040196	1096909	718	718	716	717	715	714	714	713	713	711
1550580	1607286	1663991	711	710	709	709	708	707	706	706	705	704
2117604	2174302	2231000	704	702	702	702	700	700	699	698	698	696
2684553	2741244	2797934	696	696	694	694	693	692	692	691	690	689

Numbers 76600–77209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7660	8842287696	2344392	2401088	2457782	2514476	2571169	2627861
61	2854623	2911312	2968000	3024687	3081374	3138059	3194744
62	3421476	3478158	3534838	3591518	3648197	3704875	3761553
63	3988256	4044929	4101603	4158275	4214946	4271617	4328288
64	4554961	4611627	4668293	4724958	4781622	4838286	4894948
65	5121592	5178251	5234909	5291567	5348224	5404880	5461535
66	5688149	5744801	5801452	5858102	5914751	5971400	6028048
67	6254633	6311277	6367920	6424563	6481205	6537847	6594487
68	6821042	6877679	6934315	6990950	7047585	7104219	7160852
69	7387378	7444007	7500636	7557264	7613891	7670518	7727144
7670	8847953639	8010262	8066883	8123504	8180124	8236743	8293361
71	8519827	8576442	8633056	8689669	8746282	8802894	8859505
72	9085942	9142549	9199156	9255761	9312367	9368971	9425575
73	9651982	9708582	9765181	9821780	9878378	9934975	9991571
74	8850217949	0274541	0331133	0387724	0444315	0500904	0557493
75	0783841	0840427	0897011	0953595	1010178	1066760	1123342
76	1349661	1406238	1462816	1519392	1575968	1632543	1689117
77	1915406	1971977	2028546	2085115	2141684	2198251	2254818
78	2481078	2537641	2594203	2650765	2707326	2763886	2820445
79	3046676	3103232	3159787	3216341	3272894	3329447	3385999
7680	8853612200	3668749	3725296	3781843	3838389	3894935	3951480
81	4177651	4234192	4290732	4347272	4403811	4460349	4516886
82	4743028	4799562	4856095	4912627	4969159	5025689	5082219
83	5308332	5364858	5421384	5477909	5534433	5590956	5647479
84	5873562	5930081	5986599	6043117	6099633	6156149	6212665
85	6438718	6495230	6551741	6608251	6664760	6721269	6777777
86	7003801	7060306	7116809	7173312	7229814	7286315	7342816
87	7568811	7625308	7681804	7738299	7794794	7851288	7907781
88	8133747	8190236	8246725	8303213	8359700	8416187	8472673
89	8698609	8755091	8811573	8868053	8924533	8981013	9037491
7690	8859263398	9319873	9376347	9432820	9489293	9545765	9602236
91	9828114	9884581	9941048	9997514	0053979	0110444	0166908
92	8860392756	0449216	0505675	0562134	0618592	0675049	0731506
93	0957324	1013777	1070229	1126681	1183131	1239581	1296030
94	1521820	1578265	1634710	1691154	1747597	1804040	1860482
95	2086242	2142680	2199117	2255554	2311990	2368425	2424860
96	2650590	2707021	2763451	2819881	2876309	2932737	2989164
97	3214866	3271289	3327712	3384134	3440555	3496976	3553396
98	3779068	3835484	3891899	3948314	4004728	4061141	4117554
99	4343196	4399605	4456013	4512421	4568827	4625233	4681638
7700	8864907252	4963653	5020054	5076454	5132853	5189252	5245650
1	5471234	5527628	5584022	5640414	5696806	5753198	5809588
2	6035143	6091530	6147916	6204301	6260686	6317070	6373453
3	6598979	6655358	6711737	6768115	6824492	6880869	6937245
4	7162741	7219113	7275485	7331856	7388226	7444595	7500964
5	7726431	7782795	7839160	7895523	7951886	8008248	8064609
6	8290047	8346404	8402761	8459117	8515473	8571827	8628181
7	8853590	8909940	8966290	9022639	9078987	9135334	9191681
8	9417060	9473403	9529745	9586087	9642427	9698767	9755107
9	9980457	0036792	0093127	0149462	0205795	0262128	0318460
7710	8870543781	0600109	0656437	0712763	0769090	0825415	0881740
11	1107031	1163352	1219673	1275992	1332311	1388629	1444947
12	1670209	1726523	1782836	1839148	1895460	1951770	2008081
13	2233314	2289620	2345926	2402231	2458535	2514839	2571141
14	2796345	2852644	2908943	2965241	3021538	3077834	3134129
15	3359304	3415596	3471887	3528177	3584467	3640756	3697044
16	3922190	3978474	4034758	4091041	4147324	4203605	4259886
17	4485002	4541280	4597556	4653832	4710107	4766382	4822655
18	5047742	5104012	5160282	5216550	5272818	5329085	5385351
19	5610409	5666672	5722934	5779195	5835456	5891715	5947974
7720	6173003	6229259	6285513	6341767	6398021	6454273	6510525

OF NUMBERS.

Logarithms 8842287696–8876679276.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2684553	2741244	2797934	56696	696	694	694	693	692	692	691	690	689
3251428	3308112	3364794	689	688	687	687	685	685	684	684	682	682
3818230	3874906	3931581	682	680	680	679	678	678	677	676	675	675
4384957	4441626	4498294	673	674	672	671	671	671	669	669	668	667
4951610	5008272	5064932	666	666	665	664	664	662	662	662	660	660
5518190	5574844	5631497	659	658	658	657	656	655	655	654	653	652
6084695	6141342	6197988	652	651	650	649	649	648	647	647	646	645
6651127	6707766	6764404	644	643	643	642	642	640	640	639	638	638
7217485	7274116	7330747	637	636	635	635	634	633	633	631	631	631
7783769	7840393	7897017	629	629	628	627	627	626	625	624	624	622
8349979	8406596	8463212	56623	621	621	620	619	618	618	617	616	615
8916115	8972725	9029334	615	614	613	613	612	611	610	610	609	608
9482178	9538780	9595381	607	607	605	606	604	604	603	602	601	601
0048166	0104761	0161355	600	599	599	598	597	596	595	595	594	594
0614081	0670669	0727256	592	592	591	591	589	589	588	588	587	585
1179923	1236503	1293082	586	584	584	583	582	582	581	580	579	579
1745690	1802263	1858835	577	578	576	576	575	574	573	573	572	571
2311384	2367949	2424514	571	569	569	569	567	567	566	565	565	564
2877004	2933562	2990119	563	562	562	561	560	559	559	558	557	557
3442551	3499101	3555651	556	555	554	553	553	552	552	550	550	549
4008024	4064567	4121109	56549	547	547	546	546	545	544	543	542	542
4573423	4629959	4686494	541	540	540	539	538	537	537	536	535	534
5138749	5195277	5251805	534	533	532	532	530	530	530	528	528	527
5704001	5760522	5817042	526	526	525	524	523	523	522	521	520	520
6269179	6325693	6382206	519	518	518	516	516	516	514	514	513	512
6834284	6890791	6947296	512	511	510	509	509	508	507	507	505	505
7399316	7455815	7512313	505	503	503	502	501	501	500	499	498	498
7964274	8020765	8077256	497	496	495	495	494	493	493	491	491	491
8529158	8585642	8642126	489	489	488	487	487	486	485	484	484	483
9093969	9150446	9206922	482	482	480	480	480	478	478	477	476	476
9658707	9715176	9771645	56475	474	473	473	472	471	471	469	469	469
0223371	0279833	0336295	467	467	466	465	465	464	463	462	462	461
0787961	0844417	0900871	460	459	459	458	457	457	455	456	454	453
1352479	1408927	1465373	453	452	452	450	450	449	449	448	446	447
1916923	1973363	2029803	445	445	444	443	443	442	441	440	440	439
2481293	2537726	2594159	438	437	437	436	435	435	433	433	433	431
3045591	3102016	3158441	431	430	430	428	428	427	427	425	425	425
3609815	3666233	3722651	423	423	422	421	421	420	419	418	418	417
4173965	4230376	4286787	416	415	415	414	413	413	411	411	411	409
4738043	4794446	4850849	409	408	408	406	406	405	405	403	403	403
5302047	5358443	5414839	56401	401	400	399	399	398	397	396	396	395
5865978	5922367	5978755	394	394	392	392	392	390	390	389	388	388
6429836	6486217	6542598	387	386	385	385	384	383	383	381	381	381
6993620	7049995	7106368	379	379	378	377	377	376	375	375	373	373
7557332	7613699	7670065	372	372	371	370	369	369	368	367	366	366
8120970	8177329	8233688	364	365	363	363	362	361	361	359	359	359
8684535	8740887	8797239	357	357	356	356	354	354	354	352	352	351
9248027	9304372	9360716	350	350	349	348	347	347	346	345	344	344
9811445	9867783	9924120	343	342	342	340	340	340	338	338	337	337
0374791	0431122	0487451	335	335	335	333	333	332	331	331	329	330
0938064	0994387	1050709	56328	328	326	327	325	325	324	323	322	322
1501263	1557579	1613894	321	321	319	319	318	318	316	316	315	315
2064390	2120699	2177006	314	313	312	212	310	311	309	309	307	308
2627443	2683745	2740045	306	306	305	304	304	302	302	302	300	300
3190424	3246718	3303011	299	299	298	297	296	295	295	294	293	293
3753332	3809618	3865904	292	291	290	290	289	288	288	286	286	286
4316166	4372446	4428725	284	284	283	283	281	281	280	280	279	277
4878928	4935200	4991472	278	276	276	275	275	273	273	272	272	270
5441617	5497882	5554146	270	270	268	268	267	266	266	265	264	263
6004233	6060490	6116747	263	262	261	261	259	259	259	257	257	256
6566776	6623026	6679276	256	254	254	254	252	252	251	250	250	249

Numbers 77200–77809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7720	8876173003	6229259	6285513	6341767	6398021	6454273	6510525
21	6735525	6791773	6848020	6904267	6960513	7016758	7073002
22	7297973	7354214	7410454	7466693	7522932	7579170	7635407
23	7860348	7916582	7972815	8029047	8085278	8141509	8197739
24	8422651	8478877	8535103	8591328	8647552	8703775	8759998
25	8984881	9041100	9097318	9153536	9209753	9265969	9322184
26	9547038	9603250	9659461	9715671	9771881	9828089	9884297
27	8880109122	0165327	0221531	0277734	0333936	0390137	0446338
28	0671134	0727331	0783528	0839723	0895918	0952113	1008306
29	1233073	1289263	1345452	1401640	1457828	1514015	1570201
7730	8881794939	1851122	1907304	1963485	2019665	2075845	2132024
31	2356733	2412908	2469083	2525257	2581430	2637602	2693774
32	2918454	2974622	3030789	3086956	3143122	3199287	3255451
33	3480102	3536263	3592423	3648582	3704741	3760899	3817056
34	4041677	4097831	4153984	4210136	4266287	4322438	4378588
35	4603180	4659327	4715472	4771617	4827761	4883905	4940047
36	5164611	5220750	5276888	5333026	5389163	5445299	5501434
37	5725969	5782100	5838231	5894362	5950491	6006620	6062748
38	6287254	6343378	6399502	6455625	6511748	6567869	6623990
39	6848467	6904584	6960700	7016816	7072931	7129046	7185159
7740	8887409607	7465717	7521826	7577935	7634043	7690150	7746256
41	7970675	8026777	8082879	8138981	8195081	8251181	8307280
42	8531670	8587765	8643860	8699954	8756048	8812140	8868232
43	9092593	9148681	9204769	9260855	9316941	9373027	9429112
44	9653443	9709524	9765604	9821684	9877763	9933841	9989918
45	8890214221	0270295	0326368	0382440	0438512	0494583	0550653
46	0774927	0830993	0887059	0943124	0999188	1055252	1111315
47	1335560	1391619	1447678	1503736	1559793	1615849	1671905
48	1896120	1952173	2008224	2064275	2120325	2176374	2232422
49	2456609	2512654	2568698	2624741	2680784	2736826	2792867
7750	8893017025	3073063	3129100	3185136	3241171	3297206	3353240
51	3577369	3633399	3689429	3745458	3801486	3857514	3913540
52	4137640	4193664	4249686	4305708	4361729	4417749	4473769
53	4697840	4753856	4809871	4865885	4921899	4977912	5033925
54	5257967	5313975	5369983	5425991	5481997	5538003	5594008
55	5818021	5874023	5930024	5986024	6042023	6098022	6154020
56	6378004	6433998	6489992	6545985	6601977	6657968	6713959
57	6937914	6993902	7049888	7105873	7161858	7217843	7273826
58	7497753	7553732	7609712	7665690	7721668	7777645	7833621
59	8057519	8113491	8169463	8225434	8281405	8337375	8393344
7760	8898617213	8673178	8729143	8785107	8841070	8897032	8952994
61	9176834	9232793	9288750	9344707	9400663	9456618	9512573
62	9736384	9792335	9848285	9904235	9960184	0016132	0072079
63	8900295862	0351805	0407749	0463691	0519632	0575573	0631514
64	0855267	0911204	0967140	1023075	1079009	1134943	1190876
65	1414601	1470530	1526459	1582387	1638314	1694240	1750166
66	1973862	2029784	2085706	2141627	2197547	2253466	2309384
67	2533052	2588967	2644881	2700794	2756707	2812619	2868531
68	3092169	3148077	3203984	3259890	3315796	3371701	3427605
69	3651214	3707115	3763015	3818914	3874813	3930710	3986607
7770	8904210188	4266081	4321974	4377866	4433757	4489648	4545538
71	4769090	4824976	4880861	4936746	4992630	5048513	5104396
72	5327919	5383798	5439677	5495554	5551431	5607307	5663183
73	5886677	5942549	5998420	6054290	6110160	6166029	6221897
74	6445363	6501228	6557092	6612955	6668817	6724679	6780540
75	7003977	7059834	7115691	7171547	7227402	7283257	7339111
76	7562519	7618369	7674219	7730068	7785916	7841763	7897610
77	8120990	8176833	8232675	8288517	8344358	8400198	8456037
78	8679388	8735224	8791059	8846894	8902727	8958560	9014393
79	9237715	9293544	9349372	9405199	9461026	9516851	9572677
7780	9795970	9851791	9907612	9963432	0019252	0075070	0130888

OF NUMBERS. Logarithms 8876173003-8910298338.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6566776	6623026	6679276	56256	254	254	254	252	252	251	250	250	249
7129246	7185489	7241731	248	247	247	246	245	244	244	243	242	242
7691643	7747879	7804114	241	240	239	239	238	237	236	236	235	234
8253968	8310196	8366424	234	233	232	231	231	230	229	228	228	227
8816220	8872441	8928661	226	226	225	224	223	223	222	221	220	220
9378399	9434612	9490826	219	218	218	217	216	215	215	213	214	212
9940505	9996711	0052917	212	211	210	210	208	208	208	206	206	205
0502538	0558738	0614936	205	204	203	202	201	201	200	200	198	198
1064499	1120691	1176882	197	197	195	195	195	193	193	192	191	191
1626387	1682572	1738756	190	189	188	188	187	186	186	185	184	183
2188202	2244380	2300557	56183	182	181	180	180	179	178	178	177	176
2749945	2806115	2862285	175	175	174	173	172	172	171	170	170	169
3311615	3367778	3423940	168	167	167	166	165	164	164	163	162	162
3873212	3929368	3985523	161	160	159	159	158	157	156	156	155	154
4434737	4490886	4547033	154	153	152	151	151	150	149	149	147	147
4996189	5052330	5108471	147	145	145	144	144	142	142	141	141	140
5557569	5613703	5669836	139	138	138	137	136	135	135	134	133	133
6118876	6175003	6231129	131	131	131	129	129	128	128	127	126	125
6680110	6736230	6792349	124	124	123	123	121	121	120	120	119	118
7241272	7297385	7353496	117	116	116	115	115	113	113	113	111	111
7802362	7858467	7914571	56110	109	109	108	107	106	106	105	104	104
8363379	8419477	8475574	102	102	102	100	100	099	099	098	097	096
8924323	8980414	9036504	095	095	094	094	092	092	091	091	090	089
9485196	9541279	9597361	088	088	086	086	086	085	084	083	082	082
0045995	0102071	0158146	081	080	080	079	078	077	077	076	075	075
0606722	0662791	0718859	074	073	072	072	071	070	069	069	068	068
1167377	1223439	1279500	066	066	065	064	064	063	062	062	061	060
1727960	1784014	1840068	059	059	058	057	056	056	055	054	054	052
2288470	2344517	2400563	053	051	051	050	049	048	048	047	046	046
2848908	2904948	2960987	045	044	043	043	042	041	041	040	039	038
3409273	3465306	3521338	56038	037	036	035	035	034	033	033	032	031
3969567	4025592	4081617	030	030	029	028	028	026	027	025	025	023
4529788	4585806	4641823	024	022	022	021	020	020	019	018	017	017
5089936	5145947	5201957	016	015	014	014	013	013	011	011	010	010
5650013	5706016	5762019	008	008	008	006	006	005	005	003	003	002
6210017	6266013	6322009	002	001	000	999	999	998	997	996	996	995
6769949	6825938	6881927	55994	994	993	992	991	991	990	989	989	987
7329809	7385791	7441772	988	986	985	985	985	983	983	982	981	981
7889596	7945571	8001545	979	980	978	978	977	976	975	975	974	974
8449312	8505280	8561246	972	972	971	971	970	969	968	968	966	967
9008955	9064916	9120875	55965	965	964	963	962	962	961	961	959	959
9568527	9624480	9680432	959	957	957	956	955	955	954	953	952	952
0128026	0183972	0239917	951	950	950	949	948	947	947	946	945	945
0687453	0743392	0799330	943	944	942	941	941	941	939	939	938	937
1246808	1302740	1358671	937	936	935	934	934	933	932	932	931	930
1806091	1862016	1917939	929	929	928	927	926	926	925	925	923	923
2365302	2421219	2477136	922	922	921	920	919	918	918	917	917	916
2924441	2980351	3036260	915	914	913	913	912	912	910	910	909	909
3483508	3539411	3595313	908	907	906	906	905	904	903	903	902	901
4042504	4098399	4154294	901	900	899	899	897	897	897	895	895	894
4601427	4657315	4713203	55893	893	892	891	891	890	889	888	888	887
5160278	5216159	5272040	886	885	885	884	883	883	882	881	881	879
5719057	5774931	5830805	879	879	877	877	876	876	874	874	874	872
6277765	6333632	6389498	872	871	870	870	869	868	868	867	866	865
6836400	6892260	6948119	865	864	863	862	862	861	860	860	859	858
7394964	7450816	7506668	857	857	856	855	855	854	853	852	852	851
7953456	8009301	8065146	850	850	849	848	847	847	846	845	845	844
8511876	8567714	8623551	843	842	842	841	840	839	839	838	837	837
9070224	9126055	9181885	836	835	835	833	833	833	831	831	830	830
9628501	9684325	9740148	829	828	827	827	825	826	824	824	823	822
0186706	0242522	0298338	821	821	820	820	818	818	818	816	816	815

Numbers 77800–78409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7780	8909795970	9851791	9907612	9963432	0019252	0075070	0130888
81	8910354153	0409968	0465781	0521594	0577406	0633218	0689029
82	0912265	0968072	1023878	1079684	1135489	1191294	1247097
83	1470304	1526105	1581904	1637702	1693500	1749298	1805094
84	2028273	2084065	2139858	2195649	2251440	2307230	2363019
85	2586169	2641955	2697740	2753524	2809308	2865090	2920873
86	3143994	3199772	3255550	3311327	3367104	3422879	3478654
87	3701747	3757518	3813289	3869059	3924828	3980597	4036364
88	4259428	4315193	4370956	4426719	4482481	4538242	4594003
89	4817038	4872795	4928552	4984307	5040062	5095817	5151570
7790	8915374577	5430327	5486076	5541824	5597572	5653319	5709065
91	5932043	5987786	6043528	6099270	6155010	6210750	6266489
92	6489439	6545174	6600909	6656643	6712377	6768109	6823842
93	7046762	7102491	7158219	7213946	7269672	7325397	7381122
94	7604015	7659736	7715456	7771176	7826896	7882614	7938332
95	8161195	8216909	8272623	8328336	8384048	8439759	8495469
96	8718304	8774011	8829718	8885423	8941128	8996832	9052536
97	9275342	9331042	9386741	9442440	9498137	9553834	9609531
98	9832309	9888001	9943693	9999384	0055075	0110765	0166454
99	8920389203	0444889	0500574	0556258	0611941	0667624	0723306
7800	8920946027	1001705	1057383	1113060	1168736	1224412	1280087
1	1502779	1558450	1614121	1669791	1725460	1781128	1836796
2	2059460	2115124	2170787	2226450	2282112	2337773	2393434
3	2616069	2671726	2727382	2783038	2838693	2894347	2950001
4	3172607	3228257	3283906	3339555	3395203	3450850	3506496
5	3729074	3784717	3840359	3896000	3951641	4007281	4062920
6	4285469	4341105	4396740	4452374	4508008	4563640	4619273
7	4841794	4897422	4953050	5008677	5064303	5119929	5175554
8	5398047	5453668	5509289	5564909	5620528	5676146	5731764
9	5954228	6009843	6065456	6121069	6176681	6232292	6287903
7810	8926510339	6565946	6621552	6677158	6732763	6788367	6843971
11	7066378	7121978	7177577	7233176	7288774	7344371	7399967
12	7622346	7677939	7733531	7789123	7844713	7900304	7955893
13	8178243	8233829	8289414	8344998	8400582	8456165	8511747
14	8734069	8789648	8845226	8900803	8956379	9011955	9067530
15	9289824	9345395	9400966	9456536	9512106	9567674	9623242
16	9845507	9901072	9956635	0012198	0067761	0123322	0178883
17	8930401120	0456677	0512234	0567789	0623345	0678899	0734453
18	0956661	1012211	1067761	1123310	1178858	1234405	1289952
19	1512131	1567674	1623217	1678759	1734300	1789840	1845379
7820	8932067531	2123067	2178602	2234137	2289670	2345204	2400736
21	2622859	2678388	2733916	2789444	2844970	2900496	2956022
22	3178116	3233638	3289159	3344680	3400199	3455718	3511236
23	3733302	3788817	3844331	3899845	3955357	4010869	4066380
24	4288418	4343925	4399432	4454939	4510444	4565949	4621453
25	4843462	4898963	4954463	5009962	5065460	5120958	5176455
26	5398436	5453929	5509422	5564914	5620405	5675896	5731386
27	5953338	6008825	6064310	6119795	6175279	6230763	6286246
28	6508170	6563649	6619128	6674606	6730083	6785559	6841035
29	7062931	7118403	7173874	7229345	7284815	7340284	7395753
7830	8937617621	7673086	7728550	7784014	7839477	7894939	7950401
31	8172240	8227698	8283155	8338612	8394067	8449523	8504977
32	8726788	8782239	8837689	8893139	8948587	9004036	9059483
33	9281265	9336709	9392152	9447595	9503037	9558478	9613918
34	9835672	9891109	9946545	0001980	0057415	0112849	0168282
35	8940390008	0445438	0500867	0556295	0611723	0667149	0722576
36	0944273	0999696	1055118	1110539	1165959	1221379	1276798
37	1498468	1553883	1609298	1664712	1720126	1775538	1830950
38	2052591	2108000	2163408	2218815	2274221	2329627	2385032
39	2606644	2662046	2717447	2772847	2828246	2883644	2939042
7840	3160627	3216021	3271415	3326808	3382200	3437592	3492982

OF NUMBERS. Logarithms 8909795970–8943659151.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0186706	0242522	0298338	55821	821	820	820	818	818	818	816	816	815
0744839	0800648	0856457	815	813	813	812	812	811	810	809	809	808
1302900	1358702	1414504	807	806	806	805	805	803	803	802	802	800
1860890	1916685	1972479	801	799	798	798	798	796	796	795	794	794
2418808	2474595	2530383	792	793	791	791	790	789	789	787	788	786
2976654	3032435	3088215	786	785	784	784	782	783	781	781	780	779
3534429	3590202	3645975	778	778	777	777	775	775	775	773	773	772
4092132	4147898	4203664	771	771	770	769	769	767	768	766	766	764
4649763	4705522	4761281	765	763	763	762	761	761	760	759	759	757
5207323	5263075	5318826	757	757	755	755	755	753	753	752	751	751
5764811	5820556	5876300	55750	749	748	748	747	746	746	745	744	743
6322228	6377965	6433702	743	742	742	740	740	739	739	737	737	737
6879573	6935303	6991033	735	735	734	734	732	733	731	730	730	729
7436846	7492570	7548293	729	728	727	726	725	725	724	724	723	722
7994049	8049765	8105480	721	720	720	720	718	718	717	716	715	715
8551179	8606888	8662597	714	714	713	712	711	710	710	709	709	707
9108238	9163940	9219642	707	707	705	705	704	704	702	702	702	700
9665226	9720921	9776615	700	699	699	697	697	697	695	695	694	694
0222142	0277830	0333517	692	692	691	691	690	689	688	688	687	686
0778987	0834668	0890348	686	685	684	683	683	682	681	681	680	679
1335761	1391434	1447107	55678	678	677	676	676	675	674	673	673	672
1892463	1948129	2003795	671	671	670	669	668	668	667	666	666	665
2449094	2504753	2560411	664	663	663	662	661	661	660	659	658	658
3005653	3061305	3116957	657	656	656	655	654	654	652	652	652	650
3562141	3617786	3673431	650	649	649	648	647	646	645	645	645	643
4118558	4174196	4229833	643	642	641	641	640	639	638	638	637	636
4674904	4730535	4786164	636	635	634	634	632	633	631	631	629	630
5231178	5286802	5342425	628	628	627	626	626	625	624	624	623	622
5787381	5842998	5898613	621	621	620	619	618	618	617	617	615	615
6343513	6399122	6454731	615	613	613	612	611	611	610	609	609	608
6899574	6955176	7010777	55607	606	606	605	604	604	603	602	601	601
7455563	7511158	7566753	600	599	599	598	597	596	596	595	595	593
8011481	8067069	8122657	593	592	592	590	591	589	588	588	588	586
8567329	8622909	8678490	586	585	584	584	583	582	582	580	581	579
9123105	9178678	9234251	579	578	577	576	576	575	575	573	573	573
9678810	9734376	9789942	571	571	570	570	568	568	568	566	566	565
0234443	0290003	0345562	565	563	563	563	561	561	560	560	559	558
0790006	0845558	0901110	557	557	555	556	554	554	553	552	552	551
1345498	1401043	1456587	550	550	549	548	547	547	546	545	544	544
1900918	1956456	2011994	543	543	542	541	540	539	539	538	538	537
2456268	2511799	2567329	55536	535	535	533	534	532	532	531	530	530
3011546	3067070	3122594	529	528	528	526	526	526	524	524	524	522
3566754	3622271	3677787	522	521	521	519	519	518	518	517	516	515
4121891	4177400	4232909	515	514	514	512	512	511	511	509	509	509
4676956	4732459	4787961	507	507	507	505	505	504	503	503	502	501
5231951	5287447	5342942	501	500	499	498	498	497	496	496	495	494
5786875	5842363	5897851	493	493	492	491	491	490	489	488	488	487
6341728	6397209	6452690	487	485	485	484	484	483	482	481	481	480
6896510	6951984	7007458	479	479	478	477	476	476	475	474	474	473
7451221	7506688	7562155	472	471	471	470	469	469	468	467	467	466
8005861	8061322	8116781	55465	464	464	463	462	462	460	461	459	459
8560431	8615884	8671336	458	457	457	455	456	454	454	453	452	452
9114930	9170376	9225821	451	450	450	448	449	447	447	446	445	444
9669358	9724796	9780235	444	443	443	442	441	440	440	438	439	437
0223715	0279147	0334578	437	436	435	435	434	433	433	432	431	430
0778001	0833426	0888850	430	429	428	428	426	427	425	425	424	423
1332217	1387634	1443051	423	422	421	420	420	419	419	417	417	417
1886362	1941772	1997182	415	415	414	414	412	412	412	410	410	409
2440436	2495840	2551242	409	408	407	406	406	405	404	404	402	402
2994440	3049836	3105232	402	401	400	399	398	398	398	396	396	395
3548372	3603762	3659151	394	394	393	392	392	390	390	390	389	388

Numbers 78400–79009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7840	8943160627	3216021	3271415	3326808	3382200	3437592	3492982
41	3714539	3769926	3825312	3880698	3936083	3991468	4046852
42	4268380	4323760	4379139	4434518	4489896	4545274	4600650
43	4822150	4877523	4932896	4988267	5043639	5099009	5154378
44	5375850	5431216	5486581	5541946	5597310	5652673	5708036
45	5929479	5984838	6040197	6095554	6150911	6206267	6261623
46	6483038	6538390	6593741	6649092	6704442	6759791	6815139
47	7036526	7091871	7147215	7202559	7257902	7313244	7368585
48	7589944	7645282	7700619	7755955	7811291	7866626	7921960
49	8143291	8198622	8253952	8309281	8364610	8419938	8475265
7850	8948696567	8751891	8807214	8862537	8917858	8973179	9028500
51	9249774	9305090	9360406	9415722	9471036	9526350	9581663
52	9802909	9858219	9913528	9968836	0024144	0079451	0134757
53	8950355975	0411277	0466579	0521880	0577181	0632481	0687780
54	0908969	0964265	1019560	1074854	1130148	1185440	1240732
55	1461894	1517182	1572470	1627757	1683044	1738330	1793615
56	2014748	2070029	2125310	2180590	2235870	2291148	2346426
57	2567531	2622806	2678080	2733353	2788625	2843897	2899168
58	3120245	3175512	3230779	3286045	3341310	3396575	3451839
59	3672888	3728148	3783408	3838667	3893925	3949183	4004440
7860	8954225460	4280714	4335966	4391218	4446470	4501720	4556970
61	4777963	4833209	4888455	4943700	4998944	5054188	5109430
62	5330395	5385634	5440873	5496111	5551348	5606585	5661820
63	5882757	5937989	5993221	6048452	6103682	6158911	6214140
64	6435048	6490274	6545498	6600722	6655945	6711168	6766389
65	6987270	7042488	7097705	7152922	7208138	7263354	7318569
66	7539421	7594632	7649843	7705052	7760262	7815470	7870678
67	8091502	8146706	8201909	8257112	8312314	8367516	8422717
68	8643512	8698710	8753906	8809102	8864297	8919492	8974685
69	9195453	9250643	9305833	9361022	9416210	9471397	9526584
7870	8959747324	9802507	9857689	9912871	9968052	0023233	0078412
71	8960299124	0354300	0409476	0464650	0519824	0574998	0630171
72	0850854	0906023	0961192	1016360	1071527	1126693	1181859
73	1402514	1457677	1512838	1567999	1623159	1678318	1733477
74	1954105	2009260	2064414	2119568	2174721	2229873	2285025
75	2505625	2560773	2615920	2671067	2726213	2781358	2836503
76	3057075	3112216	3167356	3222496	3277635	3332773	3387911
77	3608455	3663589	3718722	3773855	3828987	3884118	3939249
78	4159765	4214892	4270018	4325144	4380269	4435394	4490517
79	4711005	4766125	4821244	4876363	4931481	4986599	5041715
7880	8965262175	5317288	5372401	5427512	5482623	5537734	5592843
81	5813275	5868381	5923487	5978591	6033696	6088799	6143902
82	6364305	6419404	6474503	6529601	6584698	6639794	6694890
83	6915266	6970358	7025449	7080540	7135630	7190720	7245808
84	7466156	7521241	7576326	7631410	7686493	7741575	7796657
85	8016977	8072055	8127132	8182209	8237285	8292361	8347435
86	8567727	8622799	8677869	8732939	8788008	8843077	8898144
87	9118408	9173473	9228536	9283599	9338661	9393723	9448783
88	9669019	9724077	9779133	9834189	9889244	9944299	9999352
89	8970219561	0274611	0329660	0384709	0439758	0494805	0549852
7890	8970770032	0825075	0880118	0935160	0990201	1045242	1100282
91	1320434	1375470	1430506	1485541	1540575	1595609	1650641
92	1870766	1925795	1980824	2035852	2090879	2145906	2200932
93	2421028	2476050	2531072	2586093	2641113	2696133	2751152
94	2971221	3026236	3081251	3136265	3191278	3246291	3301303
95	3521343	3576352	3631360	3686367	3741373	3796379	3851384
96	4071397	4126398	4181399	4236399	4291398	4346397	4401395
97	4621380	4676375	4731368	4786362	4841354	4896346	4951337
98	5171294	5226282	5281268	5336255	5391240	5446225	5501209
99	5721138	5776119	5831099	5886078	5941056	5996034	6051011
7900	6270913	6325887	6380859	6435832	6490803	6545774	6600744

OF NUMBERS.

Logarithms 8943160627–8976765651.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3548372	3603762	3659151	55394	394	393	392	392	390	390	390	389	388
4102235	4157617	4212999	387	386	386	385	385	384	383	382	382	381
4656026	4711402	4766776	380	379	379	378	378	376	376	376	374	374
5209747	5265116	5320483	373	373	371	372	370	369	369	369	367	367
5763398	5818759	5874119	366	365	365	364	363	363	362	361	360	360
6316978	6372332	6427685	359	359	357	357	356	356	355	354	353	353
6870487	6925834	6981180	352	351	351	350	349	348	348	347	346	346
7423926	7479266	7534605	345	344	344	343	342	341	341	340	339	339
7977294	8032627	8087959	338	337	336	336	335	334	334	333	332	332
8530592	8585918	8641243	331	330	329	329	328	327	327	326	325	324
9083819	9139138	9194456	55324	323	323	321	321	321	319	319	318	318
9636976	9692288	9747599	316	316	316	314	314	313	313	312	311	310
0190062	0245367	0300671	310	309	308	308	307	306	305	305	304	304
0743078	0798376	0853673	302	302	301	301	300	299	298	298	297	296
1296024	1351315	1406604	296	295	294	294	292	292	292	291	289	290
1848899	1904183	1959466	288	288	287	287	286	285	284	284	283	282
2401704	2456980	2512256	281	281	280	280	278	278	278	276	276	275
2954438	3009708	3064977	275	274	273	272	272	271	270	270	269	268
3507102	3562365	3617627	267	267	266	265	265	264	263	263	262	261
4059696	4114951	4170206	260	260	259	258	258	257	256	255	255	254
4612219	4667468	4722716	55254	252	252	252	250	250	249	249	248	247
5164673	5219914	5275155	246	246	245	244	244	242	243	241	241	240
5717055	5772290	5827524	239	239	238	237	237	235	235	235	234	233
6269368	6324596	6379822	232	232	231	230	229	229	228	228	226	226
6821611	6876831	6932051	226	224	224	223	223	221	222	220	220	219
7373783	7428996	7484209	218	217	217	216	216	215	214	213	213	212
7925885	7981091	8036297	211	211	209	210	208	208	207	206	206	205
8477917	8533116	8588315	204	203	203	202	202	201	200	199	199	197
9029878	9085071	9140262	198	196	196	195	195	193	193	193	191	191
9581770	9636955	9692140	190	190	189	188	187	187	186	185	185	184
0133591	0188769	0243947	55183	182	182	181	181	179	179	178	178	177
0685343	0740514	0795684	176	176	174	174	174	173	172	171	170	170
1237024	1292188	1347352	169	169	168	167	166	166	165	164	164	162
1788635	1843792	1898949	163	161	161	160	159	159	158	157	157	156
2340176	2395326	2450476	155	154	154	153	152	152	151	150	150	149
2891647	2946790	3001933	148	147	147	146	145	145	144	143	143	142
3443048	3498184	3553320	141	140	140	139	138	138	137	136	136	135
3994379	4049508	4104637	134	133	133	132	131	131	130	129	129	128
4545640	4600762	4655884	127	126	126	125	125	123	123	122	122	121
5096831	5151946	5207061	120	119	119	118	118	116	116	115	115	114
5647952	5703061	5758168	55113	113	111	111	111	109	109	109	107	107
6199004	6254105	6309205	106	106	104	105	103	103	102	101	100	100
6749985	6805079	6860173	099	099	098	097	096	096	095	094	094	093
7300896	7355984	7411070	092	091	091	090	090	088	088	088	086	086
7851738	7906818	7961898	085	085	084	083	082	082	081	080	080	079
8402509	8457583	8512655	078	077	077	076	076	074	074	074	072	072
8953211	9008278	9063343	072	070	070	069	069	067	067	067	065	065
9503843	9558903	9613961	065	063	063	062	062	060	060	060	058	058
0054406	0109458	0164510	058	056	056	055	055	053	054	052	052	051
0604898	0659943	0714988	050	049	049	049	047	047	046	045	045	044
1155321	1210359	1265397	55043	043	042	041	041	040	039	038	038	037
1705674	1760705	1815736	036	036	035	034	034	032	033	031	031	030
2255957	2310981	2366005	029	029	028	027	027	026	025	024	024	023
2806170	2861188	2916204	022	022	021	020	020	019	018	018	016	017
3356314	3411324	3466334	015	015	014	013	013	012	011	010	010	009
3906388	3961392	4016394	009	008	007	006	006	005	004	004	002	003
4456392	4511389	4566385	001	001	000	999	999	998	997	997	996	995
5006327	5061317	5116306	54995	993	994	992	992	991	990	990	989	988
5556192	5611175	5666157	988	986	987	985	985	984	983	983	982	981
6105988	6160964	6215939	981	980	979	978	978	977	977	976	975	974
6655714	6710683	6765651	974	972	973	971	971	970	970	969	968	967

Numbers 79000–79609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7900	8976270913	6325887	6380859	6435832	6490803	6545774	6600744
1	6820618	6875585	6930551	6985516	7040481	7095444	7150408
2	7370253	7425213	7480172	7535131	7590088	7645045	7700001
3	7919819	7974772	8029724	8084676	8139626	8194576	8249526
4	8469316	8524262	8579207	8634151	8689095	8744038	8798980
5	9018743	9073682	9128620	9183557	9238494	9293430	9348365
6	9568100	9623032	9677963	9732894	9787824	9842753	9897681
7	8980117388	0172313	0227237	0282161	0337084	0392006.	0446927
8	0666606	0721524	0776442	0831358	0886274	0941190	0996104
9	1215755	1270666	1325577	1380487	1435396	1490304	1545211
7910	8981764835	1819739	1874643	1929545	1984447	2039349	2094249
11	2313845	2368742	2423639	2478535	2533430	2588324	2643218
12	2862786	2917676	2972566	3027455	3082343	3137230	3192117
13	3411657	3466541	3521423	3576305	3631186	3686067	3740947
14	3960459	4015336	4070211	4125086	4179961	4234834	4289707
15	4509192	4564061	4618930	4673798	4728666	4783532	4838398
16	5057855	5112718	5167580	5222441	5277301	5332161	5387020
17	5606449	5661305	5716160	5771014	5825868	5880720	5935573
18	6154974	6209823	6264671	6319518	6374365	6429211	6484056
19	6703430	6758271	6813112	6867953	6922792	6977631	7032470
7920	8987251816	7306651	7361485	7416318	7471151	7525983	7580814
21	7800133	7854961	7909788	7964615	8019440	8074265	8129090
22	8348381	8403202	8458022	8512842	8567660	8622479	8677296
23	8896559	8951373	9006187	9060999	9115811	9170623	9225433
24	9444669	9499476	9554282	9609088	9663893	9718697	9773501
25	9992709	0047509	0102309	0157107	0211906	0266703	0321500
26	8990540680	0595473	0650266	0705058	0759849	0814640	0869429
27	1088582	1143368	1198154	1252939	1307723	1362507	1417290
28	1636415	1691194	1745973	1800751	1855529	1910305	1965081
29	2184179	2238951	2293723	2348494	2403265	2458034	2512804
7930	8992731873	2786639	2841404	2896168	2950932	3005695	3060457
31	3279499	3334258	3389016	3443773	3498530	3553286	3608041
32	3827055	3881807	3936558	3991309	4046059	4100808	4155556
33	4374543	4429288	4484032	4538776	4593519	4648261	4703002
34	4921961	4976699	5031437	5086173	5140909	5195645	5250379
35	5469311	5524042	5578773	5633502	5688231	5742960	5797688
36	6016591	6071316	6126039	6180762	6235484	6290206	6344927
37	6563803	6618520	6673237	6727953	6782668	6837383	6892097
38	7110946	7165656	7220366	7275075	7329783	7384491	7439198
39	7658019	7712723	7767426	7822128	7876830	7931530	7986231
7940	8998205024	8259721	8314417	8369112	8423807	8478501	8533194
41	8751960	8806650	8861339	8916028	8970715	9025402	9080089
42	9298827	9353510	9408192	9462874	9517555	9572235	9626914
43	9845625	9900302	9954977	0009652	0064326	0118999	0173671
44	9000392355	0447024	0501692	0556360	0611027	0665694	0720359
45	0939015	0993678	1048339	1103000	1157660	1212320	1266979
46	1485607	1540263	1594917	1649571	1704225	1758877	1813529
47	2032130	2086779	2141427	2196074	2250720	2305366	2360011
48	2578584	2633226	2687867	2742507	2797147	2851786	2906424
49	3124970	3179605	3234239	3288872	3343505	3398137	3452768
7950	9003671287	3725914	3780542	3835168	3889794	3944419	3999044
51	4217535	4272156	4326776	4381396	4436015	4490633	4545250
52	4763714	4818328	4872942	4927554	4982166	5036778	5091389
53	5309825	5364432	5419038	5473644	5528250	5582854	5637458
54	5855866	5910467	5965067	6019666	6074264	6128862	6183459
55	6401840	6456433	6511026	6565618	6620210	6674801	6729391
56	6947745	7002331	7056917	7111503	7166087	7220671	7275254
57	7493581	7548160	7602740	7657318	7711896	7766473	7821049
58	8039348	8093921	8148493	8203065	8257636	8312206	8366776
59	8585047	8639613	8694179	8748743	8803307	8857871	8912433
60	9130677	9185237	9239795	9294353	9348910	9403467	9458023

OF NUMBERS. Logarithms 8976270913–9009621686.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6655714	6710683	6765651	54974	972	973	971	971	970	970	969	968	967
7205370	7260332	7315293	967	966	965	965	963	964	962	962	961	960
7754957	7809912	7864866	960	959	959	957	957	956	956	955	954	953
8304474	8359422	8414369	953	952	952	950	950	950	948	948	947	947
8853922	8908863	8963803	946	945	944	944	943	942	942	941	940	940
9403300	9458234	9513167	939	938	937	937	936	935	935	934	933	933
9952609	0007536	0062462	932	931	931	930	929	928	928	927	926	926
0501848	0556768	0611688	925	924	924	923	922	921	921	920	920	918
1051018	1105931	1160844	918	918	916	916	916	914	914	913	913	911
1600118	1655025	1709930	911	911	910	909	908	907	907	907	905	905
2149149	2204049	2258947	54904	904	902	902	902	900	900	900	898	898
2698111	2753003	2807895	897	897	896	895	894	894	893	892	892	891
3247003	3301889	3356773	890	890	889	888	887	887	886	886	884	884
3795826	3850704	3905582	884	882	882	881	881	880	879	878	878	877
4344579	4399451	4454322	877	875	875	875	873	873	872	872	871	870
4893264	4948128	5002992	869	869	868	868	866	866	866	864	864	863
5441878	5496736	5551593	863	862	861	860	860	859	858	858	857	856
5990424	6045275	6100125	856	855	854	854	852	853	851	851	850	849
6538900	6593744	6648587	849	848	847	847	846	845	844	844	843	843
7087307	7142144	7196980	841	841	841	839	839	839	837	837	836	836
7635645	7690475	7745304	54835	834	833	833	832	831	831	830	829	829
8183914	8238737	8293559	828	827	827	825	825	825	824	823	822	822
8732113	8786929	8841745	821	820	820	818	819	817	817	816	816	814
9280243	9335052	9389861	814	814	812	812	812	810	810	809	809	808
9828304	9883106	9937908	807	806	806	805	804	804	803	802	802	801
0376296	0431091	0485886	800	800	798	799	797	797	796	795	795	794
0924219	0979007	1033795	793	793	792	791	791	789	790	788	788	787
1472072	1526854	1581635	786	786	785	784	784	783	782	782	781	780
2019857	2074631	2129405	779	779	778	778	776	776	776	774	774	774
2567572	2622340	2677107	772	772	771	771	769	770	768	768	767	766
3115218	3169979	3224739	54766	765	764	764	763	762	761	761	760	760
3662796	3717550	3772303	759	758	757	757	756	755	755	754	753	752
4210304	4265051	4319797	752	751	751	750	749	748	748	747	746	746
4757743	4812483	4867223	745	744	744	743	742	741	741	740	740	738
5305113	5359847	5414579	738	738	736	736	736	734	734	734	732	732
5852415	5907141	5961867	731	731	729	729	729	728	727	726	726	724
6399647	6454366	6509085	725	723	723	722	722	721	720	719	719	718
6946810	7001523	7056235	717	717	716	715	715	714	713	713	712	711
7493905	7548610	7603315	710	710	709	708	708	707	707	705	705	704
8040930	8095629	8150327	704	703	702	702	700	701	699	699	698	697
8587887	8642579	8697270	54697	696	695	695	694	693	693	692	691	690
9134774	9189459	9244144	690	689	689	687	687	687	685	685	685	683
9681593	9736271	9790949	683	682	682	681	680	679	679	678	678	676
0228343	0283015	0337685	677	675	675	674	673	672	672	672	670	670
0775025	0829689	0884352	669	668	668	667	667	665	666	664	663	663
1321637	1376294	1430951	663	661	661	660	660	659	658	657	657	656
1868181	1922831	1977481	656	654	654	654	652	652	652	650	650	649
2414655	2469299	2523942	649	648	647	646	646	645	644	644	643	642
2961061	3015698	3070334	642	641	640	640	639	638	637	637	636	636
3507399	3562029	3616658	635	634	633	633	632	631	631	630	629	629
4053667	4108290	4162913	54627	628	626	626	625	625	623	623	623	622
4599867	4654484	4709099	621	620	620	619	618	617	617	617	615	615
5145999	5200608	5255217	614	614	612	612	612	611	610	609	609	608
5692061	5746664	5801265	607	606	606	606	604	604	603	603	601	601
6238055	6292651	6347246	601	600	599	598	598	597	596	596	595	594
6783980	6838569	6893157	593	593	592	592	591	590	589	589	588	588
7329837	7384419	7439000	586	586	586	584	584	583	583	582	581	581
7875625	7930200	7984774	579	580	578	578	577	576	576	575	574	574
8421345	8475913	8530480	573	572	572	571	570	570	569	568	567	567
8966995	9021557	9076117	566	566	564	564	564	562	562	562	560	560
9512578	9567132	9621686	560	558	558	557	557	556	555	554	554	553

Numbers 79600–80209. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
7960	9009130677	9185237	9239795	9294353	9348910	9403467	9458023
61	9676239	9730792	9785343	9839894	9894445	9948994	0003543
62	9010221732	0276278	0330823	0385367	0439911	0494453	0548996
63	0767157	0821696	0876234	0930771	0985308	1039844	1094379
64	1312514	1367045	1421577	1476107	1530637	1585166	1639694
65	1857801	1912326	1966851	2021374	2075897	2130420	2184941
66	2403021	2457539	2512056	2566573	2621089	2675605	2730120
67	2948172	3002683	3057194	3111704	3166213	3220721	3275229
68	3493254	3547759	3602262	3656766	3711268	3765770	3820271
69	4038268	4092766	4147263	4201759	4256255	4310750	4365244
7970	9014583214	4637705	4692195	4746684	4801173	4855661	4910149
71	5128091	5182575	5237059	5291541	5346023	5400504	5454985
72	5672900	5727377	5781854	5836330	5890805	5945279	5999753
73	6217641	6272111	6326581	6381050	6435518	6489986	6544453
74	6762313	6816777	6871240	6925702	6980163	7034624	7089084
75	7306917	7361374	7415830	7470285	7524740	7579194	7633647
76	7851453	7905903	7960352	8014800	8069248	8123695	8178142
77	8395921	8450364	8504806	8559247	8613688	8668129	8722568
78	8940320	8994756	9049191	9103626	9158060	9212494	9266927
79	9484651	9539080	9593509	9647937	9702364	9756791	9811217
7980	9020028914	0083336	0137758	0192179	0246600	0301019	0355438
81	0573108	0627524	0681939	0736353	0790767	0845180	0899592
82	1117234	1171643	1226052	1280459	1334866	1389272	1443678
83	1661293	1715695	1770096	1824497	1878897	1933296	1987695
84	2205283	2259678	2314073	2368467	2422860	2477252	2531644
85	2749205	2803593	2857981	2912368	2966754	3021140	3075525
86	3293059	3347440	3401821	3456201	3510581	3564960	3619338
87	3836844	3891219	3945593	3999967	4054340	4108712	4163083
88	4380562	4434930	4489297	4543664	4598030	4652395	4706760
89	4924212	4978573	5032933	5087293	5141652	5196011	5250369
7990	9025467793	5522148	5576501	5630854	5685207	5739558	5793909
91	6011307	6065654	6120001	6174347	6228693	6283038	6337382
92	6554752	6609093	6663433	6717773	6772111	6826449	6880787
93	7098130	7152464	7206797	7261130	7315462	7369793	7424124
94	7641439	7695766	7750093	7804419	7858744	7913069	7967392
95	8184681	8239001	8293321	8347640	8401958	8456276	8510593
96	8727854	8782168	8836481	8890793	8945105	8999416	9053726
97	9270960	9325267	9379573	9433879	9488183	9542488	9596791
98	9813998	9868298	9922597	9976896	0031194	0085491	0139788
99	9030356968	0411261	0465554	0519846	0574137	0628427	0682717
8000	9030899870	0954156	1008442	1062727	1117012	1171295	1225579
1	1442704	1496984	1551263	1605541	1659819	1714096	1768372
2	1985470	2039743	2094016	2148287	2202558	2256828	2311098
3	2528169	2582435	2636701	2690965	2745229	2799493	2853755
4	3070800	3125059	3179318	3233576	3287833	3342090	3396346
5	3613363	3667615	3721867	3776118	3830369	3884619	3938868
6	4155857	4210103	4264348	4318592	4372837	4427080	4481322
7	4698285	4752524	4806762	4861000	4915237	4969473	5023709
8	5240645	5294877	5349109	5403339	5457570	5511799	5566028
9	5782936	5837162	5891387	5945611	5999834	6054057	6108279
8010	9036325161	6379380	6433598	6487815	6542032	6596248	6650463
11	6867317	6921529	6975741	7029951	7084161	7138370	7192579
12	7409406	7463611	7517816	7572020	7626223	7680425	7734627
13	7951427	8005626	8059824	8114021	8168217	8222413	8276608
14	8493381	8547573	8601764	8655954	8710143	8764332	8818521
15	9035267	9089452	9143636	9197819	9252002	9306185	9360366
16	9577085	9631263	9685441	9739618	9793794	9847969	9902144
17	9040118836	0173007	0227178	0281348	0336517	0389686	0443854
18	0660519	0714684	0768848	0823011	0877173	0931335	0985497
19	1202135	1256293	1310450	1364606	1418762	1472917	1527072
8020	1743683	1797834	1851984	1906134	1960283	2014432	2068579

OF NUMBERS.

Logarithms 9009130677–9042231018.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9512578	9567132	9621686	54560	558	558	557	557	556	555	554	554	553
0058092	0112639	0167186	553	551	551	551	549	549	549	547	547	546
0603537	0658078	0712618	546	545	544	544	542	543	541	541	540	539
1148914	1203448	1257981	539	538	537	537	536	535	535	534	533	533
1694222	1748749	1803276	531	532	530	530	529	528	528	527	527	525
2239462	2293982	2348502	525	525	523	523	523	521	521	520	520	519
2784634	2839147	2893660	518	517	517	516	516	515	514	513	513	512
3329737	3384243	3438749	511	511	510	509	508	508	508	506	506	505
3874771	3929271	3983770	505	503	504	502	502	501	500	500	499	498
4419737	4474230	4528722	498	497	496	496	495	494	493	493	492	492
4964635	5019121	5073607	54491	490	489	489	488	488	486	486	486	484
5509465	5563944	5618422	484	484	482	482	481	481	480	479	478	478
6054226	6108698	6163170	477	477	476	475	474	474	473	472	472	471
6598919	6653384	6707849	470	470	469	468	468	467	466	465	465	464
7143543	7198002	7252460	464	463	462	461	461	460	459	459	458	457
7688099	7742551	7797003	457	456	455	455	454	453	452	452	452	450
8232587	8287032	8341477	450	449	448	448	447	447	445	445	445	444
8777007	8831445	8885883	443	442	441	441	441	439	439	438	438	437
9321359	9375790	9430221	436	435	435	434	434	433	432	431	431	430
9865642	9920066	9974490	429	429	428	427	427	426	425	424	424	424
0409857	0464275	0518692	54422	422	421	421	419	419	419	418	417	416
0954004	1008415	1062825	416	415	414	414	413	412	412	411	410	409
1498082	1552487	1606890	409	409	407	407	406	406	404	405	403	403
2042093	2096490	2150887	402	401	401	400	399	399	398	397	397	396
2586035	2640426	2694816	395	395	394	393	392	392	391	391	390	389
3129910	3184293	3238676	388	388	387	386	386	385	385	383	383	383
3673716	3728093	3782469	381	381	380	380	379	378	378	377	376	375
4217454	4271824	4326193	375	374	374	373	372	371	371	370	369	369
4761124	4815487	4869850	368	367	367	366	365	365	364	363	363	362
5304726	5359082	5413438	361	360	360	359	359	358	357	356	356	355
5848260	5902609	5956958	54355	353	353	353	351	351	351	349	349	349
6391726	6446069	6500411	347	347	346	346	345	344	344	343	342	341
6935124	6989460	7043795	341	340	340	338	338	338	337	336	335	335
7478454	7532783	7587111	334	333	333	332	331	331	330	329	328	328
8021715	8076038	8130360	327	327	326	325	325	323	323	323	322	321
8564910	8619225	8673540	320	320	319	318	318	317	317	315	315	314
9108036	9162344	9216653	314	313	312	312	311	310	310	308	309	307
9651094	9705396	9759697	307	306	306	304	305	303	303	302	301	301
0194084	0248379	0302674	300	299	299	298	297	297	296	295	295	294
0737006	0791295	0845583	293	293	292	291	290	290	289	289	288	287
1279861	1334143	1388424	54286	286	285	285	283	284	282	282	281	280
1822648	1876923	1931197	280	279	278	278	277	276	276	275	274	273
2365367	2419635	2473902	273	273	271	271	270	270	269	268	267	267
2908018	2962279	3016540	266	266	264	264	264	262	263	261	261	260
3450601	3504855	3559109	259	259	258	257	257	256	255	254	254	254
3993116	4047364	4101611	252	252	251	251	250	249	248	248	247	246
4535564	4589805	4644045	246	245	244	245	243	242	242	241	240	240
5077944	5132178	5186412	239	238	238	237	236	236	235	234	234	233
5620256	5674484	5728710	232	232	230	231	229	229	228	228	226	226
6162501	6216721	6270941	226	225	224	223	223	222	222	220	220	220
6704678	6758891	6813105	54219	218	217	217	216	215	215	213	214	212
7246787	7300994	7355200	212	212	210	210	209	209	208	207	206	206
7788828	7843029	7897228	205	205	204	203	202	202	201	201	199	199
8330802	8384996	8439189	199	198	197	196	196	195	194	194	193	192
8872708	8926895	8981081	192	191	190	189	189	189	187	187	186	186
9414547	9468727	9522906	185	184	183	183	183	181	181	180	179	179
9956318	0010491	0064664	178	178	177	176	175	175	174	173	173	172
0498021	0552188	0606354	171	171	170	169	169	168	167	167	166	165
1039657	1093817	1147976	165	164	163	162	162	162	160	160	159	159
1581226	1635379	1689531	158	157	156	156	155	155	154	153	152	152
2122726	2176873	2231018	151	150	150	149	149	147	147	147	145	145

Numbers 80200–80809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8020	9041743683	1797834	1851984	1906134	1960283	2014432	2068579
21	2285163	2339308	2393451	2447594	2501737	2555878	2610019
22	2826576	2880714	2934851	2988987	3043123	3097258	3151392
23	3367922	3422053	3476183	3530313	3584441	3638570	3692697
24	3909200	3963324	4017448	4071570	4125692	4179814	4233935
25	4450411	4504528	4558645	4612761	4666876	4720991	4775105
26	4991554	5045665	5099775	5153884	5207992	5262100	5316208
27	5532630	5586734	5640837	5694939	5749041	5803142	5857243
28	6073638	6127735	6181832	6235928	6290023	6344117	6398211
29	6614579	6668670	6722759	6776848	6830937	6885024	6939111
8030	9047155453	7209536	7263619	7317702	7371783	7425864	7479945
31	7696259	7750336	7804412	7858488	7912563	7966637	8020711
32	8236998	8291068	8345138	8399207	8453275	8507342	8561409
33	8777670	8831733	8885796	8939858	8993919	9047980	9102040
34	9318274	9372331	9426387	9480442	9534497	9588551	9642604
35	9858811	9912861	9966910	0020959	0075007	0129054	0183101
36	9050399281	0453324	0507367	0561409	0615450	0669490	0723530
37	0939683	0993720	1047756	1101791	1155825	1209859	1263893
38	1480019	1534048	1588078	1642106	1696134	1750161	1804187
39	2020287	2074310	2128332	2182354	2236375	2290395	2344415
8040	9052560487	2614504	2668520	2722535	2776549	2830563	2884576
41	3100621	3154631	3208640	3262648	3316656	3370663	3424669
42	3640688	3694691	3748693	3802695	3856695	3910696	3964695
43	4180687	4234683	4288679	4342674	4396668	4450662	4504654
44	4720619	4774609	4828598	4882586	4936573	4990560	5044546
45	5260484	5314467	5368449	5422431	5476412	5530392	5584371
46	5800282	5854258	5908234	5962209	6016183	6070156	6124129
47	6340013	6393983	6447951	6501919	6555887	6609854	6663820
48	6879677	6933640	6987602	7041563	7095524	7149484	7203443
49	7419274	7473230	7527185	7581140	7635094	7689047	7743000
8050	9057958804	8012753	8066702	8120650	8174597	8228543	8282489
51	8498266	8552209	8606151	8660092	8714033	8767973	8821912
52	9037662	9091598	9145533	9199468	9253402	9307335	9361267
53	9576991	9630920	9684849	9738776	9792704	9846630	9900556
54	9060116253	0170175	0224097	0278018	0331939	0385859	0439778
55	0655448	0709363	0763278	0817193	0871107	0925020	0978932
56	1194575	1248485	1302393	1356301	1410208	1464114	1518020
57	1733636	1787539	1841441	1895342	1949242	2003142	2057041
58	2272631	2326526	2380421	2434316	2488209	2542102	2595995
59	2811558	2865447	2919335	2973223	3027110	3080996	3134882
8060	9063350418	3404300	3458182	3512063	3565943	3619823	3673702
61	3889212	3943087	3996962	4050837	4104710	4158583	4212456
62	4427938	4481807	4535675	4589543	4643410	4697276	4751142
63	4966598	5020460	5074322	5128183	5182043	5235903	5289762
64	5505191	5559047	5612902	5666756	5720610	5774462	5828315
65	6043717	6097566	6151414	6205262	6259109	6312955	6366801
66	6582177	6636019	6689861	6743702	6797542	6851381	6905220
67	7120569	7174405	7228240	7282074	7335908	7389741	7443573
68	7658895	7712724	7766553	7820380	7874207	7928033	7981859
69	8197155	8250977	8304799	8358619	8412440	8466259	8520078
8070	9068735347	8789163	8842978	8896792	8950606	9004418	9058231
71	9273473	9327282	9381090	9434898	9488705	9542511	9596317
72	9811532	9865335	9919136	9972937	0026737	0080537	0134336
73	9070349525	0403320	0457115	0510910	0564703	0618496	0672288
74	0887451	0941240	0995028	1048816	1102602	1156389	1210174
75	1425310	1479092	1532874	1586655	1640435	1694215	1747994
76	1963103	2016878	2070653	2124428	2178201	2231974	2285746
77	2500829	2554598	2608366	2662134	2715901	2769667	2823433
78	3038488	3092251	3146012	3199773	3253534	3307293	3361052
79	3576081	3629837	3683592	3737346	3791100	3844853	3898605
8080	4113608	4167357	4221105	4274853	4328600	4382346	4436092

OF NUMBERS. Logarithms 9041743683-9074597325.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2122726	2176873	2231018	54151	150	150	149	149	147	147	147	145	145
2664160	2718299	2772438	145	143	143	143	141	141	141	139	139	138
3205525	3259658	3313791	138	137	136	136	135	134	133	133	133	131
3746824	3800950	3855075	131	130	130	128	129	127	127	126	125	125
4288055	4342174	4396293	124	124	122	122	122	121	120	119	119	118
4829218	4883331	4937443	117	117	116	115	115	114	113	113	112	111
5370314	5424420	5478525	111	110	109	108	108	108	106	106	105	105
5911343	5965442	6019540	104	103	102	102	101	101	100	099	098	098
6452304	6506396	6560488	097	097	096	095	094	094	093	092	092	091
6993198	7047283	7101368	091	089	089	089	087	087	087	085	085	085
7534024	7588103	7642181	54083	083	083	081	081	081	079	079	078	078
8074783	8128856	8182927	077	076	076	075	074	074	072	073	071	071
8615475	8669541	8723606	070	070	069	068	067	067	066	066	065	064
9156100	9210158	9264217	063	063	062	061	061	060	060	058	059	057
9696657	9750709	9804760	057	056	055	055	054	053	053	052	051	051
0237147	0291192	0345237	050	049	049	048	047	047	046	045	045	044
0777570	0831608	0885646	043	043	042	041	040	040	040	038	038	037
1317925	1371957	1425988	037	036	035	034	034	034	032	032	031	031
1858213	1912238	1966263	029	030	028	028	027	026	026	025	025	024
2398434	2452453	2506470	023	022	022	021	020	020	019	019	017	017
2938588	2992600	3046611	54017	016	015	014	014	013	012	012	011	010
3478675	3532680	3586684	010	009	008	008	007	006	006	005	004	004
4018694	4072693	4126690	003	002	002	000	001	999	999	999	997	997
4558647	4612638	4666629	53996	996	995	994	994	992	993	991	991	990
5098532	5152517	5206501	990	989	988	987	987	986	986	985	984	983
5638350	5692328	5746306	983	982	982	981	980	979	979	978	978	976
6178101	6232072	6286043	976	976	975	974	973	973	972	971	971	970
6717785	6771750	6825714	970	968	968	968	967	966	965	965	964	963
7257402	7311360	7365317	963	962	961	961	960	959	959	958	957	957
7796952	7850903	7904854	956	955	955	954	953	953	952	951	951	950
8336435	8390379	8444323	53949	949	948	947	946	946	946	944	944	943
8875850	8929788	8983726	943	942	941	941	940	939	938	938	938	936
9415199	9469131	9523061	936	935	935	934	933	932	932	932	930	930
9954481	0008406	0062330	929	929	927	928	926	926	925	925	924	923
0493696	0547614	0601531	922	922	921	921	920	919	918	918	917	917
1032844	1086755	1140666	915	915	915	914	913	912	912	911	911	909
1571925	1625830	1679733	910	908	908	907	906	906	905	905	903	903
2110939	2164837	2218734	903	902	901	900	900	899	898	898	897	897
2649887	2703778	2757668	895	895	895	893	893	893	892	891	890	890
3188767	3242651	3296535	889	888	888	887	886	886	885	884	884	883
3727581	3781458	3835335	53882	882	881	880	880	879	879	877	877	877
4266327	4320198	4374069	875	875	875	873	873	873	871	871	871	869
4805007	4858871	4912735	869	868	868	867	866	866	865	864	864	863
5343620	5397478	5451335	862	862	861	860	860	859	858	858	857	856
5882166	5936017	5989868	856	855	854	854	852	853	851	851	851	849
6420646	6474490	6528334	849	848	848	847	846	846	845	844	844	843
6959059	7012896	7066733	842	842	841	840	839	839	839	837	837	836
7497405	7551236	7605066	836	835	834	834	833	832	832	831	830	829
8035684	8089508	8143332	829	829	827	827	826	826	825	824	824	823
8573896	8627714	8681531	822	822	820	821	819	819	818	818	817	816
9112042	9165853	9219664	53816	815	814	814	812	813	811	811	811	809
9650122	9703926	9757729	809	808	808	807	806	806	805	804	803	803
0188134	0241932	0295729	803	801	801	800	800	799	798	798	797	796
0726080	0779871	0833661	795	795	795	793	793	792	792	791	790	790
1263959	1317744	1371527	789	788	788	786	787	785	785	785	783	783
1801772	1855550	1909326	782	782	781	780	780	779	778	778	776	777
2339518	2393289	2447059	775	775	775	773	773	772	772	771	770	770
2877197	2930962	2984725	769	768	768	767	766	766	764	765	763	763
3414810	3468568	3522325	763	761	761	761	759	759	758	758	757	756
3952357	4006108	4059858	756	755	754	754	753	752	752	751	750	750
4489837	4543581	4597325	749	748	748	747	746	746	745	744	744	743

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8080	9074113608	4167357	4221105	4274853	4328600	4382346	4436092
81	4651068	4704810	4758552	4812293	4866033	4919773	4973512
82	5188461	5242197	5295932	5349666	5403400	5457133	5510865
83	5725788	5779517	5833245	5886973	5940700	5994427	6048152
84	6263048	6316771	6370493	6424214	6477934	6531654	6585373
85	6800242	6853958	6907673	6961388	7015101	7068815	7122527
86	7337370	7391079	7444788	7498495	7552202	7605909	7659615
87	7874431	7928134	7981835	8035536	8089237	8142937	8196636
88	8411426	8465122	8518817	8572511	8626205	8679898	8733591
89	8948354	9002043	9055732	9109420	9163107	9216793	9270479
8090	9079485216	9538899	9592581	9646262	9699942	9753622	9807301
91	9080022012	0075688	0129363	0183037	0236711	0290385	0344057
92	0558741	0612410	0666079	0719747	0773414	0827081	0880747
93	1095404	1149067	1202729	1256390	1310051	1363711	1417370
94	1632001	1685657	1739312	1792967	1846621	1900274	1953927
95	2168531	2222180	2275829	2329477	2383124	2436771	2490417
96	2704995	2758638	2812280	2865921	2919562	2973202	3026842
97	3241393	3295029	3348664	3402299	3455933	3509567	3563200
98	3777724	3831354	3884983	3938611	3992238	4045865	4099491
99	4313990	4367613	4421235	4474856	4528477	4582097	4635717
8100	9084850189	4903805	4957421	5011036	5064650	5118264	5171876
1	5386322	5439931	5493540	5547149	5600756	5654363	5707970
2	5922388	5975992	6029594	6083196	6136797	6190397	6243997
3	6458389	6511985	6565581	6619176	6672771	6726365	6779958
4	6994324	7047913	7101502	7155091	7208679	7262266	7315852
5	7530192	7583775	7637358	7690939	7744521	7798101	7851681
6	8065994	8119571	8173147	8226722	8280296	8333870	8387444
7	8601730	8655300	8708869	8762438	8816006	8869573	8923140
8	9137400	9190964	9244526	9298088	9351650	9405210	9458771
9	9673004	9726561	9780117	9833672	9887227	9940781	9994335
8110	9090208542	0262092	0315642	0369191	0422739	0476286	0529833
11	0744014	0797558	0851100	0904643	0958184	1011725	1065265
12	1279420	1332957	1386493	1440029	1493564	1547098	1600632
13	1814760	1868290	1921820	1975349	2028877	2082405	2135932
14	2350034	2403557	2457081	2510603	2564125	2617646	2671166
15	2885242	2938759	2992275	3045791	3099306	3152821	3206335
16	3420384	3473894	3527404	3580913	3634422	3687930	3741437
17	3955460	4008964	4062467	4115970	4169472	4222973	4276474
18	4490470	4543967	4597464	4650960	4704455	4757950	4811444
19	5025414	5078905	5132395	5185884	5239373	5292861	5346349
8120	9095560292	5613777	5667260	5720743	5774225	5827707	5881188
21	6095105	6148583	6202060	6255536	6309011	6362486	6415961
22	6629852	6683323	6736793	6790263	6843732	6897200	6950668
23	7164532	7217997	7271461	7324924	7378386	7431848	7485309
24	7699147	7752605	7806062	7859519	7912975	7966430	8019885
25	8233697	8287148	8340598	8394048	8447498	8500946	8554394
26	8768180	8821625	8875069	8928512	8981955	9035397	9088838
27	9302598	9356036	9409473	9462910	9516346	9569782	9623217
28	9836949	9890381	9943812	9997242	0050672	0104101	0157529
29	9100371236	0424661	0478085	0531509	0584932	0638354	0691776
8130	9100905456	0958874	1012292	1065709	1119126	1172542	1225957
31	1439611	1493023	1546434	1599844	1653254	1706663	1760072
32	1973700	2027105	2080510	2133914	2187317	2240720	2294122
33	2507723	2561122	2614520	2667917	2721314	2774710	2828105
34	3041681	3095073	3148464	3201855	3255245	3308635	3362024
35	3575573	3628958	3682343	3735728	3789111	3842494	3895876
36	4109399	4162778	4216157	4269534	4322911	4376288	4429664
37	4643160	4696532	4749904	4803275	4856646	4910016	4963385
38	5176855	5230221	5283586	5336951	5390315	5443678	5497041
39	5710485	5763844	5817203	5870561	5923918	5977275	6030631
8140	6244049	6297402	6350754	6404105	6457456	6510806	6564156

OF NUMBERS. Logarithms 9074113608-9106724201.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4489837	4543581	4597325	53749	748	748	747	746	746	745	744	744	743
5027250	5080988	5134725	742	742	741	740	740	739	738	738	737	736
5564597	5618328	5672058	736	735	734	734	733	732	732	731	730	730
6101877	6155602	6209325	729	728	728	727	727	725	725	725	723	723
6639091	6692809	6746526	723	722	721	720	720	719	718	718	717	716
7176239	7229950	7283660	716	715	715	713	714	712	712	711	710	710
7713320	7767024	7820728	709	709	707	707	707	706	705	704	704	703
8250334	8304032	8357729	703	701	701	701	700	699	698	698	697	697
8787283	8840974	8894664	696	695	694	694	693	693	692	691	690	690
9324165	9377849	9431533	689	689	688	687	686	686	686	684	684	683
9860980	9914658	9968335	53683	682	681	680	680	679	679	678	677	677
0397729	0451400	0505071	676	675	674	674	674	672	672	671	671	670
0934412	0988077	1041741	669	669	668	667	667	666	665	665	664	663
1471029	1524687	1578344	663	662	661	661	660	659	659	658	657	657
2007579	2061230	2114881	656	655	655	654	653	653	652	651	651	650
2544063	2597707	2651352	649	649	648	647	647	646	646	644	645	643
3080480	3134119	3187756	643	642	641	641	640	640	638	639	637	637
3616832	3670463	3724094	636	635	635	634	634	633	632	631	631	630
4153117	4206742	4260366	630	629	628	627	627	626	626	625	624	624
4689336	4742954	4796572	623	622	621	621	620	620	619	618	618	617
5225489	5279100	5332711	53616	616	615	614	614	612	613	611	611	611
5761575	5815180	5868785	609	609	609	607	607	607	605	605	605	603
6297596	6351194	6404792	604	602	602	601	600	600	599	598	598	597
6833550	6887142	6940733	596	596	595	595	594	593	592	592	591	591
7369438	7423023	7476608	589	589	589	588	587	586	586	585	585	584
7905260	7958839	8012417	583	583	581	582	580	580	579	579	578	577
8441016	8494588	8548160	577	576	575	574	574	574	572	572	572	570
8976706	9030271	9083836	570	569	569	568	567	567	566	565	565	564
9512330	9565889	9619447	564	562	562	562	560	561	559	559	558	557
0047888	0101440	0154991	557	556	555	555	554	554	553	552	551	551
0583379	0636925	0690470	53550	550	549	548	547	547	546	546	545	544
1118805	1172344	1225882	544	542	543	541	541	540	540	539	538	538
1654165	1707697	1761229	537	536	536	535	534	534	533	532	532	531
2189458	2242984	2296509	530	530	529	528	528	527	526	526	525	525
2724686	2778205	2831724	523	524	522	522	521	520	520	519	519	518
3259848	3313360	3366872	517	516	516	515	515	514	513	512	512	512
3794944	3848450	3901955	510	510	509	509	508	507	507	506	505	505
4329974	4383473	4436972	504	503	503	502	501	501	500	499	499	498
4864938	4918430	4971923	497	497	496	495	495	494	494	492	493	491
5399836	5453322	5506808	491	490	489	489	488	488	487	486	486	484
5934668	5988148	6041627	53485	483	483	482	482	481	480	480	479	478
6469434	6522907	6576380	478	477	476	475	475	475	473	473	473	472
7004135	7057601	7111067	471	470	470	469	468	468	467	466	466	465
7538770	7592230	7645689	465	464	463	462	462	461	461	460	459	458
8073339	8126792	8180245	458	457	457	456	455	455	454	453	453	452
8607842	8661288	8714735	451	450	450	450	448	448	448	446	447	445
9142279	9195719	9249159	445	444	443	443	442	441	441	440	440	439
9676651	9730084	9783517	438	437	437	436	436	435	434	433	433	432
0210957	0264384	0317810	432	431	430	430	429	428	428	427	426	426
0745197	0798617	0852037	425	424	424	423	422	422	421	420	420	419
1279371	1332785	1386198	53418	418	417	417	416	415	414	414	413	413
1813480	1866887	1920294	412	411	410	410	409	409	408	407	407	406
2347523	2400924	2454324	405	405	404	403	403	402	401	401	400	399
2881500	2934894	2988288	399	398	397	397	396	395	395	394	394	393
3415412	3468800	3522186	392	391	391	390	390	389	388	388	386	387
3949258	4002639	4056019	385	385	385	383	383	382	382	381	380	380
4483039	4536413	4589787	379	379	377	377	377	376	375	374	374	373
5016753	5070121	5123489	372	372	371	371	370	369	368	368	368	366
5550403	5603764	5657125	366	365	365	364	363	363	362	361	361	360
6083987	6137341	6190695	359	359	358	357	357	356	356	354	354	354
6617505	6670853	6724201	353	352	351	351	350	350	349	348	348	346

Numbers 81400–82009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8140	9106244049	6297402	6350754	6404105	6457456	6510806	6564156
41	6777547	6830894	6884239	6937584	6990928	7044272	7097615
42	7310980	7364320	7417659	7470998	7524335	7577672	7631009
43	7844348	7897681	7951014	8004345	8057677	8111007	8164337
44	8377650	8430977	8484302	8537628	8590952	8644276	8697600
45	8910886	8964206	9017526	9070845	9124163	9177480	9230797
46	9444058	9497371	9550684	9603996	9657308	9710618	9763929
47	9977163	0030470	0083776	0137082	0190387	0243691	0296995
48	9110510203	0563504	0616803	0670103	0723401	0776699	0829996
49	1043178	1096472	1149765	1203058	1256350	1309641	1362932
8150	9111576087	1629375	1682661	1735947	1789233	1842518	1895802
51	2108931	2162212	2215492	2268772	2322051	2375329	2428606
52	2641710	2694984	2748258	2801531	2854803	2908075	2961346
53	3174423	3227691	3280958	3334224	3387490	3440755	3494020
54	3707071	3760332	3813593	3866853	3920112	3973371	4026629
55	4239654	4292908	4346162	4399416	4452669	4505921	4559172
56	4772171	4825419	4878667	4931914	4985160	5038405	5091650
57	5304623	5357865	5411106	5464346	5517586	5570825	5624063
58	5837010	5890245	5943479	5996713	6049946	6103179	6156411
59	6369331	6422560	6475788	6529015	6582242	6635468	6688693
8160	9116901588	6954810	7008031	7061252	7114472	7167691	7220910
61	7433779	7486994	7540209	7593423	7646637	7699850	7753062
62	7965904	8019113	8072322	8125529	8178736	8231943	8285149
63	8497965	8551167	8604369	8657570	8710771	8763971	8817170
64	9029960	9083156	9136352	9189546	9242740	9295934	9349126
65	9561891	9615080	9668269	9721457	9774645	9827831	9881018
66	9120093756	0146939	0200121	0253303	0306484	0359664	0412844
67	0625556	0678732	0731908	0785083	0838258	0891431	0944605
68	1157291	1210461	1263630	1316799	1369967	1423134	1476300
69	1688961	1742124	1795287	1848449	1901610	1954771	2007931
8170	9122220565	2273722	2326878	2380034	2433189	2486343	2539497
71	2752105	2805255	2858405	2911554	2964703	3017850	3070998
72	3283580	3336723	3389867	3443009	3496151	3549293	3602433
73	3814989	3868127	3921263	3974399	4027535	4080670	4133804
74	4346334	4399465	4452595	4505724	4558853	4611982	4665109
75	4877613	4930738	4983861	5036985	5090107	5143229	5196350
76	5408828	5461946	5515063	5568180	5621296	5674411	5727525
77	5939978	5993089	6046200	6099310	6152419	6205528	6258636
78	6471062	6524167	6577271	6630375	6683478	6736580	6789682
79	7002082	7055180	7108278	7161375	7214472	7267567	7320663
8180	9127533037	7586129	7639220	7692310	7745400	7798490	7851578
81	8063927	8117012	8170097	8223181	8276264	8329347	8382429
82	8594752	8647831	8700909	8753986	8807063	8860140	8913215
83	9125512	9178584	9231656	9284727	9337798	9390868	9443937
84	9656207	9709273	9762338	9815403	9868467	9921530	9974593
85	9130186837	0239897	0292956	0346014	0399072	0452128	0505185
86	0717403	0770456	0823508	0876560	0929611	0982662	1035711
87	1247904	1300950	1353996	1407042	1460086	1513130	1566173
88	1778340	1831380	1884419	1937458	1990496	2043534	2096570
89	2308711	2361745	2414778	2467810	2520841	2573872	2626903
8190	9132839018	2892045	2945071	2998097	3051122	3104147	3157170
91	3369259	3422280	3475300	3528319	3581338	3634356	3687373
92	3899436	3952450	4005464	4058477	4111489	4164501	4217511
93	4429549	4482556	4535563	4588570	4641575	4694580	4747585
94	4959596	5012597	5065598	5118598	5171597	5224596	5277594
95	5489579	5542574	5595568	5648561	5701554	5754546	5807538
96	6019497	6072486	6125473	6178460	6231446	6284432	6337417
97	6549351	6602333	6655314	6708294	6761274	6814253	6867232
98	7079140	7132115	7185090	7238064	7291037	7344010	7396982
99	7608864	7661833	7714801	7767769	7820736	7873702	7926668
8200	8138524	8191486	8244448	8297409	8350370	8403329	8456289

OF NUMBERS.

Logarithms 9106244049–9138615162.

Mantissæ.			Differences.									
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6617505	6670853	6724201	53353	352	351	351	350	350	349	348	348	346
7150957	7204299	7257640	347	345	345	344	344	343	342	342	341	340
7684345	7737680	7791014	340	339	339	337	337	337	336	335	334	334
8217666	8270995	8324323	333	333	331	332	330	330	329	329	328	327
8750922	8804244	8857566	327	325	326	324	324	324	322	322	322	320
9284113	9337429	9390743	320	320	319	318	317	317	316	316	314	315
9817238	9870547	9923855	313	313	312	312	310	311	309	309	308	308
0350298	0403600	0456902	307	306	306	305	304	304	303	302	302	301
0883292	0936588	0989884	301	299	300	298	298	297	296	296	296	294
1416221	1469511	1522799	294	293	293	292	291	291	289	290	288	288
1949085	2002368	2055650	53288	286	286	286	285	284	283	283	282	281
2481883	2535159	2588435	281	280	280	279	278	277	277	276	276	275
3014616	3067886	3121155	274	274	273	272	272	271	270	270	269	268
3547284	3600547	3653809	268	267	266	266	265	265	264	263	262	262
4079886	4133142	4186398	261	261	260	259	259	258	257	256	256	256
4612423	4665673	4718922	254	254	254	253	252	251	251	250	249	249
5144894	5198138	5251381	248	248	247	246	245	245	244	244	243	242
5677301	5730538	5783774	242	241	240	240	239	238	238	237	236	236
6209642	6262872	6316102	235	234	234	233	233	232	231	230	230	229
6741918	6795142	6848365	229	228	227	227	226	225	225	224	223	223
7274128	7327346	7380562	53222	221	221	220	219	219	218	218	216	217
7806273	7859484	7912695	215	215	214	214	213	212	211	211	211	209
8338354	8391558	8444762	209	209	207	207	207	206	205	204	204	203
8870369	8923567	8976764	202	202	201	201	200	199	199	198	197	196
9402318	9455510	9508701	196	196	194	194	194	192	192	192	191	190
9934203	9987388	0040572	189	189	188	188	186	187	185	185	184	184
0466023	0519201	0572379	183	182	182	181	180	180	179	178	178	177
0997777	1050949	1104120	176	176	175	175	173	174	172	172	171	171
1529466	1582632	1635797	170	169	169	168	167	166	166	166	165	164
2061091	2114250	2167408	163	163	162	161	161	160	160	159	158	157
2592650	2645802	2698954	53157	156	156	155	154	154	153	152	152	151
3124144	3177290	3230435	150	150	149	149	147	148	146	146	145	145
3655573	3708712	3761851	143	144	142	142	142	140	140	139	139	138
4186937	4240070	4293202	138	136	136	136	135	134	133	133	132	132
4718236	4771363	4824488	131	130	129	129	129	127	127	127	125	125
5249470	5302590	5355709	125	123	124	122	122	121	120	120	119	119
5780639	5833753	5886865	118	117	117	116	115	114	114	114	112	113
6311744	6364850	6417957	111	111	110	109	109	108	108	106	107	105
6842783	6895883	6948983	105	104	104	103	102	102	101	100	100	099
7373757	7426851	7479944	098	098	097	097	095	096	094	094	093	093
7904666	7957754	8010841	53092	091	090	090	090	088	088	088	087	086
8435511	8488592	8541672	085	085	084	083	083	082	082	081	080	080
8966291	9019365	9072439	079	078	077	077	077	075	076	074	074	073
9497005	9550073	9603140	072	072	071	071	070	069	068	068	067	067
0027655	0080717	0133777	066	065	065	064	063	063	062	062	060	060
0558240	0611295	0664349	060	059	058	058	056	057	055	055	054	054
1088760	1141809	1194857	053	052	052	051	051	049	049	049	048	047
1619216	1672258	1725299	046	046	046	044	044	043	043	042	041	041
2149607	2202642	2255677	040	039	039	038	038	036	037	035	035	034
2679932	2732961	2785990	034	033	032	031	031	031	029	029	029	028
3210194	3263216	3316238	53027	026	026	025	025	023	024	022	022	021
3740390	3793406	3846422	021	020	019	019	018	017	017	016	016	014
4270522	4323531	4376540	014	014	013	012	012	010	011	009	009	009
4800589	4853592	4906594	007	007	007	005	005	005	004	003	002	002
5330591	5383588	5436584	001	001	000	999	999	998	997	997	996	995
5860529	5913519	5966508	52995	994	993	993	992	992	991	990	989	989
6390402	6443385	6496368	989	987	987	986	986	985	985	983	983	983
6920210	6973187	7026164	982	981	980	980	979	979	978	977	977	976
7449954	7502924	7555895	975	975	974	973	973	972	972	970	971	969
7979633	8032597	8085561	969	968	968	967	966	966	965	964	964	963
8509247	8562205	8615162	962	962	961	961	959	960	958	958	957	957

Numbers 82000–82609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8200	9138138524	8191486	8244448	8297409	8350370	8403329	8456289
1	8668119	8721075	8774030	8826985	8879939	8932892	8985845
2	9197650	9250599	9303548	9356496	9409444	9462391	9515337
3	9727116	9780059	9833001	9885943	9938884	9991824	0044764
4	9140256517	0309454	0362390	0415325	0468259	0521193	0574127
5	0785854	0838784	0891714	0944642	0997571	1050498	1103425
6	1315126	1368050	1420973	1473895	1526817	1579738	1632659
7	1844334	1897251	1950168	2003084	2055999	2108914	2161828
8	2373478	2426388	2479299	2532208	2585117	2638025	2690933
9	2902557	2955461	3008365	3061268	3114170	3167072	3219973
8210	9143431571	3484469	3537366	3590263	3643159	3696054	3748949
11	3960521	4013413	4066304	4119194	4172083	4224972	4277860
12	4489407	4542292	4595176	4648060	4700943	4753826	4806707
13	5018228	5071107	5123985	5176862	5229739	5282615	5335490
14	5546985	5599857	5652729	5705600	5758470	5811339	5864208
15	6075678	6128543	6181408	6234273	6287137	6340000	6392862
16	6604306	6657165	6710024	6762882	6815739	6868596	6921452
17	7132870	7185723	7238575	7291426	7344277	7397128	7449977
18	7661369	7714216	7767061	7819907	7872751	7925595	7978438
19	8189804	8242644	8295484	8348323	8401161	8453998	8506835
8220	9148718175	8771009	8823842	8876674	8929506	8982337	9035167
21	9246482	9299309	9352136	9404962	9457787	9510611	9563435
22	9774724	9827545	9880365	9933185	9986003	0038822	0091639
23	9150302903	0355717	0408531	0461344	0514156	0566968	0619779
24	0831017	0883824	0936632	0989438	1042244	1095049	1147854
25	1359066	1411868	1464668	1517469	1570268	1623067	1675865
26	1887052	1939847	1992641	2045435	2098228	2151020	2203812
27	2414973	2467762	2520550	2573337	2626124	2678910	2731695
28	2942830	2995612	3048394	3101175	3153955	3206735	3259514
29	3470623	3523399	3576174	3628949	3681722	3734496	3787268
8230	9153998352	4051121	4103890	4156658	4209426	4262193	4314959
31	4526017	4578780	4631542	4684304	4737065	4789825	4842585
32	5053618	5106374	5159130	5211885	5264640	5317394	5370147
33	5581154	5633904	5686654	5739403	5792151	5844898	5897645
34	6108627	6161370	6214113	6266856	6319598	6372339	6425079
35	6636035	6688772	6741509	6794245	6846981	6899715	6952449
36	7163379	7216110	7268841	7321570	7374299	7427028	7479755
37	7690660	7743384	7796108	7848831	7901554	7954276	8006997
38	8217876	8270594	8323312	8376029	8428745	8481460	8534175
39	8745029	8797740	8850451	8903162	8955872	9008581	9061289
8240	9159272117	9324822	9377527	9430231	9482934	9535637	9588339
41	9799141	9851840	9904539	9957236	0009933	0062630	0115325
42	9160326102	0378794	0431486	0484178	0536868	0589558	0642247
43	0852998	0905685	0958370	1011055	1063739	1116423	1169106
44	1379831	1432511	1485190	1537868	1590546	1643223	1695900
45	1906600	1959273	2011946	2064618	2117289	2169960	2222630
46	2433305	2485972	2538638	2591304	2643969	2696633	2749297
47	2959946	3012606	3065266	3117925	3170584	3223242	3275900
48	3486523	3539177	3591831	3644483	3697136	3749787	3802438
49	4013036	4065684	4118331	4170978	4223623	4276269	4328913
8250	9164539485	4592127	4644768	4697408	4750047	4802686	4855325
51	5065871	5118506	5171141	5223774	5276408	5329040	5381672
52	5592193	5644822	5697450	5750077	5802704	5855330	5907956
53	6118451	6171073	6223695	6276316	6328936	6381556	6434175
54	6644645	6697261	6749877	6802491	6855105	6907719	6960331
55	7170776	7223386	7275994	7328603	7381210	7433817	7486424
56	7696843	7749446	7802049	7854650	7907252	7959852	8012452
57	8222846	8275443	8328039	8380634	8433229	8485824	8538417
58	8748785	8801376	8853966	8906555	8959143	9011731	9064318
59	9274661	9327245	9379829	9432411	9484994	9537575	9590156
8260	9800473	9853051	9905628	9958204	0010780	0063355	0115930

OF NUMBERS. Logarithms 913813852⁴–917027365⁰.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8509247	8562205	8615162	52962	962	961	961	959	960	958	958	957	957
9038797	9091749	9144699	956	955	955	954	953	953	952	952	950	951
9568282	9621227	9674172	949	949	948	948	947	946	945	945	945	944
0097703	0150642	0203580	943	942	942	941	940	940	939	939	938	937
0627060	0679992	0732923	937	936	935	934	934	934	933	932	931	931
1156351	1209277	1262202	930	930	928	929	927	927	926	926	925	924
1685579	1738498	1791416	924	923	922	922	921	921	920	919	918	918
2214741	2267654	2320566	917	917	916	915	915	914	913	913	912	912
2743840	2796746	2849652	910	911	909	909	908	908	907	906	906	905
3272874	3325773	3378673	904	904	903	902	902	901	901	899	900	898
3801843	3854736	3907629	52898	897	897	896	895	895	894	893	893	892
4330748	4383635	4436521	892	891	890	889	889	888	888	887	886	886
4859589	4912469	4965349	885	884	884	883	883	881	882	880	880	879
5388365	5441239	5494112	879	878	877	877	876	875	875	874	873	873
5917077	5969944	6022811	872	872	871	870	869	869	869	867	867	867
6445724	6498585	6551446	865	865	865	864	863	862	862	861	861	860
6974307	7027162	7080016	859	859	858	857	857	856	855	855	854	854
7502826	7555674	7608522	853	852	851	851	851	849	849	848	848	847
8031281	8084123	8136964	847	845	846	844	844	843	843	842	841	840
8559671	8612506	8665341	840	840	839	838	837	837	836	835	835	834
9087997	9140826	9193654	52834	833	832	832	831	830	830	829	828	828
9616258	9669081	9721903	827	827	826	825	824	824	823	823	822	821
0144456	0197272	0250088	821	820	820	818	819	817	817	816	816	815
0672589	0725399	0778208	814	814	813	812	812	811	810	810	809	809
1200658	1253461	1306264	807	808	806	806	805	805	804	803	803	802
1728663	1781460	1834256	802	800	801	799	799	798	798	797	796	796
2256603	2309394	2362184	795	794	794	793	792	792	791	791	790	789
2784480	2837264	2890047	789	788	787	787	786	785	785	784	783	783
3312292	3365070	3417847	782	782	781	780	780	779	778	778	777	776
3840040	3892811	3945582	776	775	775	773	774	772	772	771	771	770
4367724	4420489	4473253	52769	769	768	768	767	766	765	765	764	764
4895344	4948103	5000860	763	762	762	761	760	760	759	759	757	758
5422900	5475652	5528403	756	756	755	755	754	753	753	752	751	751
5950392	6003137	6055882	750	750	749	748	747	747	747	745	745	745
6477819	6530558	6583297	743	743	743	742	741	740	740	739	739	738
7005183	7057916	7110648	737	737	736	736	734	734	734	733	732	731
7532482	7585209	7637935	731	731	729	729	729	727	727	727	726	725
8059718	8112438	8165157	724	724	723	723	722	721	721	720	719	719
8586890	8639603	8692316	718	718	717	716	715	715	715	713	713	713
9113997	9166704	9219411	711	711	711	710	709	708	708	707	707	706
9641041	9693742	9746442	52705	705	704	703	703	702	702	701	700	699
0168020	0220715	0273409	699	699	697	697	697	695	695	695	694	693
0694936	0747624	0800312	692	692	692	690	690	689	689	688	688	686
1221788	1274470	1327151	687	685	685	684	684	683	682	682	681	680
1748576	1801251	1853926	680	679	678	678	677	677	676	675	675	674
2275300	2327969	2380637	673	673	672	671	671	670	670	669	668	668
2801960	2854623	2907284	667	666	666	665	664	664	663	663	661	662
3328556	3381212	3433868	660	660	659	659	658	658	656	656	656	655
3855089	3907738	3960388	654	654	652	653	651	651	651	649	650	648
4381557	4434201	4486843	648	647	647	645	646	644	644	644	642	642
4907962	4960599	5013235	52642	641	640	639	639	639	637	637	636	636
5434303	5486934	5539564	635	635	633	634	632	632	631	631	630	629
5960580	6013205	6065828	629	628	627	627	626	626	624	625	623	623
6486794	6539412	6592029	622	622	621	620	620	619	619	618	617	616
7012944	7065555	7118166	616	616	614	614	614	612	613	611	611	610
7539029	7591635	7644239	610	608	609	607	607	607	605	606	604	604
8065052	8117650	8170249	603	603	601	602	600	600	600	598	599	597
8591010	8643603	8696194	597	596	595	595	595	593	593	593	591	591
9116905	9169491	9222076	591	590	589	588	588	587	587	586	585	585
9642736	9695316	9747895	584	584	582	583	581	581	580	580	579	578
0168504	0221077	0273650	578	577	576	576	575	575	574	573	573	572

Numbers 82600–83209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8260	9169800473	9853051	9905628	9958204	$\overline{0}$010780	$\overline{0}$063355	$\overline{0}$115930
61	9170326222	0378793	0431364	0483934	0536503	0589072	0641640
62	0851906	0904471	0957036	1009599	1062163	1114725	1167287
63	1377528	1430086	1482644	1535202	1587758	1640314	1692870
64	1903085	1955637	2008189	2060740	2113290	2165840	2218389
65	2428579	2481125	2533670	2586215	2638759	2691302	2743845
66	2954009	3006549	3059088	3111626	3164164	3216701	3269237
67	3479376	3531909	3584442	3636974	3689505	3742036	3794566
68	4004680	4057206	4109733	4162258	4214783	4267307	4319831
69	4529919	4582440	4634960	4687479	4739997	4792515	4845033
8270	9175055096	5107610	5160123	5212636	5265148	5317660	5370171
71	5580208	5632716	5685223	5737730	5790236	5842741	5895245
72	6105257	6157759	6210260	6262760	6315259	6367758	6420257
73	6630243	6682738	6735233	6787727	6840220	6892712	6945204
74	7155166	7207654	7260142	7312630	7365117	7417603	7470089
75	7680024	7732507	7784989	7837470	7889950	7942430	7994909
76	8204820	8257296	8309771	8362246	8414720	8467194	8519667
77	8729552	8782022	8834491	8886959	8939427	8991894	9044361
78	9254221	9306684	9359147	9411609	9464070	9516531	9568991
79	9778826	9831283	9883739	9936195	9988650	$\overline{0}$041105	$\overline{0}$093559
8280	9180303368	0355819	0408269	0460718	0513167	0565615	0618063
81	0827846	0880291	0932735	0985178	1037620	1090062	1142503
82	1352262	1404700	1457137	1509574	1562010	1614446	1666880
83	1876614	1929045	1981476	2033907	2086337	2138766	2191194
84	2400902	2453328	2505752	2558176	2610600	2663023	2715445
85	2925128	2977547	3029965	3082383	3134800	3187216	3239632
86	3449290	3501702	3554114	3606526	3658937	3711347	3763757
87	3973388	4025795	4078201	4130606	4183010	4235414	4287817
88	4497424	4549824	4602224	4654622	4707021	4759418	4811815
89	5021396	5073790	5126183	5178576	5230968	5283359	5335749
8290	9185545306	5597693	5650080	5702466	5754851	5807236	5859621
91	6069151	6121533	6173913	6226293	6278672	6331051	6383429
92	6592934	6645309	6697683	6750057	6802430	6854802	6907174
93	7116654	7169022	7221390	7273757	7326124	7378490	7430855
94	7640310	7692672	7745034	7797395	7849755	7902115	7954474
95	8163904	8216260	8268615	8320969	8373323	8425677	8478029
96	8687434	8739783	8792132	8844481	8896828	8949175	9001522
97	9210901	9263244	9315587	9367929	9420270	9472611	9524951
98	9734305	9786642	9838978	9891314	9943649	9995983	$\overline{0}$048317
99	9190257646	0309977	0362306	0414636	0466965	0519293	0571620
8300	9190780924	0833248	0885572	0937895	0990217	1042539	1094860
1	1304139	1356457	1408774	1461091	1513407	1565722	1618037
2	1827290	1879602	1931913	1984224	2036534	2088843	2141151
3	2350379	2402685	2454989	2507294	2559597	2611900	2664202
4	2873405	2925704	2978003	3030301	3082598	3134894	3187190
5	3396368	3448661	3500953	3553244	3605535	3657826	3710115
6	3919268	3971554	4023840	4076125	4128410	4180694	4232977
7	4442105	4494385	4546664	4598943	4651222	4703500	4755777
8	4964879	5017153	5069426	5121699	5173971	5226242	5278513
9	5487590	5539857	5592124	5644391	5696656	5748922	5801186
8310	9196010238	6062499	6114760	6167020	6219279	6271538	6323797
11	6532823	6585078	6637333	6689586	6741840	6794092	6846344
12	7055345	7107594	7159842	7212090	7264337	7316583	7368829
13	7577805	7630048	7682289	7734531	7786771	7839011	7891251
14	8100202	8152438	8204673	8256908	8309143	8361376	8413610
15	8622536	8674765	8726995	8779223	8831452	8883679	8935906
16	9144807	9197030	9249253	9301476	9353697	9405919	9458139
17	9667015	9719232	9771449	9823665	9875881	9928095	9980310
18	9200189160	0241371	0293582	0345792	0398001	0450209	0502417
19	0711243	0763448	0815652	0867856	0920058	0972261	1024462
8320	1233263	1285461	1337659	1389857	1442053	1494249	1546445

OF NUMBERS. Logarithms 9169800473–9201703027.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0168504	0221077	0273650	52578	577	576	576	575	575	574	573	573	572
0694208	0746775	0799341	571	571	570	569	569	568	568	567	566	565
1219848	1272408	1324968	565	565	563	564	562	562	561	560	560	560
1745425	1797979	1850532	558	558	558	556	556	556	555	554	553	553
2270938	2323485	2376033	552	552	551	550	550	549	549	547	548	546
2796387	2848928	2901469	546	545	545	544	543	543	542	541	541	540
3321773	3374308	3426842	540	539	538	538	537	536	536	535	534	534
3847095	3899624	3952152	533	533	532	531	531	530	529	529	528	528
4372354	4424876	4477398	526	527	525	525	524	524	523	522	522	521
4897549	4950065	5002581	521	520	519	518	518	518	516	516	516	515
5422681	5475191	5527700	52514	513	513	512	512	511	510	510	509	508
5947749	6000253	6052755	508	507	507	506	505	504	504	504	502	502
6472754	6525251	6577748	502	501	500	499	499	499	497	497	497	495
6997696	7050186	7102676	495	495	494	493	492	492	492	490	490	490
7522573	7575058	7627541	488	488	488	487	486	486	484	485	483	483
8047388	8099866	8152343	483	482	481	480	480	479	479	478	477	477
8572139	8624611	8677082	476	475	475	474	474	473	472	472	471	470
9096827	9149292	9201757	470	469	468	468	467	467	466	465	465	464
9621451	9673910	9726368	463	463	462	461	461	460	460	459	458	458
0146012	0198465	0250917	457	456	456	455	455	454	453	453	452	451
0670510	0722956	0775401	52451	450	449	449	448	448	447	446	445	445
1194944	1247384	1299823	445	444	443	442	442	441	441	440	439	439
1719315	1771748	1824181	438	437	437	436	436	434	435	433	433	433
2243622	2296050	2348476	431	431	431	430	429	428	428	428	426	426
2767867	2820288	2872708	426	424	424	424	423	422	422	421	420	420
3292048	3344462	3396876	419	418	418	417	416	416	416	414	414	414
3816165	3868574	3920981	412	412	412	411	410	410	408	409	407	407
4340220	4392622	4445023	407	406	405	404	404	403	403	402	401	401
4864211	4916607	4969002	400	400	398	399	397	397	396	396	395	394
5388139	5440529	5492917	394	393	393	392	391	390	390	390	388	389
5912004	5964387	6016770	52387	387	386	385	385	385	383	383	383	381
6435806	6488183	6540559	382	380	380	379	379	378	377	377	376	375
6959545	7011915	7064285	375	374	374	373	372	372	371	370	370	369
7483220	7535584	7587947	368	368	367	367	366	365	365	364	363	363
8006832	8059190	8111547	362	362	361	360	360	359	358	358	357	357
8530381	8582733	8635084	356	355	354	354	354	352	352	352	351	350
9053867	9106213	9158557	349	349	349	347	347	347	345	346	344	344
9577290	9629629	9681967	343	343	342	341	341	340	339	339	338	338
0100650	0152983	0205315	337	336	336	335	334	334	333	333	332	331
0623947	0676273	0728599	331	329	330	329	328	327	327	326	326	325
1147181	1199501	1251820	52324	324	323	322	322	321	321	320	319	319
1670351	1722665	1774978	318	317	317	316	315	315	314	314	313	312
2193459	2245767	2298073	312	311	311	310	309	308	308	308	306	306
2716504	2768805	2821105	306	304	305	303	303	302	302	301	300	300
3239486	3291780	3344074	299	299	298	297	296	296	296	294	294	294
3762404	3814693	3866981	293	292	291	291	291	289	289	289	288	287
4285260	4337542	4389824	286	286	285	285	284	283	283	282	282	281
4808053	4860329	4912604	280	279	279	279	278	277	276	276	275	275
5330783	5383053	5435321	274	273	273	272	271	271	270	270	268	269
5853450	5905713	5957976	267	267	267	265	266	264	264	263	263	262
6376054	6428311	6480567	52261	261	260	259	259	259	257	257	256	256
6898595	6950846	7003096	255	255	253	254	252	252	251	251	250	249
7421074	7473318	7525562	249	248	248	247	246	246	245	244	244	243
7943489	7995727	8047965	243	241	242	240	240	240	238	238	238	237
8465842	8518074	8570305	236	235	235	235	233	234	232	232	231	231
8988132	9040357	9092582	229	230	228	229	227	227	226	225	225	225
9510359	9562578	9614797	223	223	223	221	222	220	220	219	219	218
0032523	0084736	0136949	217	217	216	216	214	215	213	213	213	211
0554625	0606831	0659038	211	211	210	209	208	208	208	206	207	205
1076664	1128864	1181064	205	204	204	202	203	201	202	200	200	199
1598640	1650834	1703027	198	198	198	196	196	196	195	194	193	193

Numbers 83200–83809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8320	9201233263	1285461	1337659	1389857	1442053	1494249	1546445
21	1755220	1807412	1859604	1911795	1963985	2016175	2068364
22	2277115	2329301	2381486	2433671	2485855	2538038	2590221
23	2798946	2851126	2903305	2955484	3007661	3059839	3112015
24	3320715	3372889	3425062	3477234	3529405	3581576	3633747
25	3842422	3894589	3946756	3998921	4051087	4103251	4155416
26	4364066	4416226	4468387	4520546	4572705	4624864	4677022
27	4885647	4937801	4989955	5042109	5094261	5146414	5198565
28	5407165	5459313	5511461	5563608	5615755	5667901	5720046
29	5928621	5980763	6032904	6085045	6137186	6189325	6241464
8330	9206450014	6502150	6554285	6606420	6658554	6710687	6762820
31	6971345	7023474	7075603	7127732	7179859	7231987	7284113
32	7492613	7544736	7596859	7648981	7701102	7753223	7805344
33	8013818	8065935	8118052	8170168	8222283	8274398	8326512
34	8534961	8587072	8639182	8691292	8743401	8795509	8847617
35	9056042	9108146	9160250	9212354	9264456	9316558	9368660
36	9577060	9629158	9681256	9733353	9785449	9837545	9889640
37	9210098015	0150107	0202199	0254289	0306380	0358469	0410558
38	0618908	0670994	0723079	0775164	0827248	0879331	0931414
39	1139738	1191818	1243897	1295975	1348053	1400130	1452207
8340	9211660506	1712580	1764652	1816725	1868796	1920867	1972937
41	2181212	2233279	2285346	2337411	2389477	2441541	2493605
42	2701855	2753916	2805976	2858036	2910095	2962153	3014211
43	3222436	3274490	3326544	3378598	3430651	3482703	3534754
44	3742954	3795003	3847050	3899098	3951144	4003190	4055235
45	4263410	4315452	4367494	4419535	4471575	4523615	4575654
46	4783804	4835840	4887875	4939910	4991944	5043977	5096010
47	5304135	5356165	5408194	5460222	5512250	5564277	5616304
48	5824404	5876427	5928450	5980472	6032494	6084515	6136535
49	6344611	6396628	6448644	6500660	6552676	6604690	6656705
8350	9216864755	6916766	6968776	7020786	7072795	7124804	7176812
51	7384837	7436842	7488846	7540849	7592852	7644854	7696856
52	7904857	7956855	8008853	8060850	8112847	8164843	8216839
53	8424814	8476806	8528798	8580789	8632780	8684769	8736759
54	8944709	8996695	9048681	9100666	9152650	9204634	9256617
55	9464542	9516522	9568501	9620480	9672458	9724435	9776412
56	9984313	0036287	0088260	0140232	0192204	0244175	0296146
57	9220504022	0555989	0607956	0659922	0711888	0763853	0815817
58	1023668	1075629	1127590	1179550	1231509	1283468	1335426
59	1543252	1595207	1647162	1699115	1751069	1803021	1854973
8360	9222062774	2114723	2166671	2218619	2270566	2322512	2374458
61	2582234	2634177	2686119	2738060	2790001	2841941	2893880
62	3101632	3153569	3205504	3257439	3309374	3361308	3413241
63	3620968	3672898	3724828	3776756	3828685	3880612	3932539
64	4140241	4192165	4244089	4296011	4347934	4399855	4451776
65	4659453	4711371	4763288	4815204	4867120	4919035	4970950
66	5178602	5230514	5282425	5334335	5386245	5438154	5490062
67	5697690	5749595	5801500	5853404	5905307	5957210	6009113
68	6216715	6268614	6320513	6372411	6424308	6476205	6528101
69	6735679	6787572	6839464	6891356	6943247	6995137	7047027
8370	9227254580	7306467	7358353	7410238	7462123	7514007	7565891
71	7773419	7825300	7877180	7929059	7980938	8032816	8084693
72	8292197	8344071	8395945	8447818	8499690	8551562	8603433
73	8810912	8862780	8914648	8966515	9018381	9070247	9122112
74	9329566	9381427	9433289	9485150	9537010	9588869	9640728
75	9848157	9900013	9951868	0003722	0055576	0107430	0159282
76	9230366687	0418536	0470385	0522234	0574081	0625928	0677775
77	0885154	0936998	0988841	1040683	1092524	1144365	1196205
78	1403560	1455397	1507234	1559070	1610905	1662740	1714574
79	1921904	1973735	2025566	2077395	2129224	2181053	2232881
8380	2440186	2492011	2543835	2595658	2647482	2699304	2751126

OF NUMBERS. Logarithms 9201233263-9232906587.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1598640	1650834	1703027	52198	198	198	196	196	196	195	194	193	193
2120553	2172741	2224928	192	192	191	190	190	189	189	188	187	187
2642403	2694585	2746766	186	185	185	184	183	183	182	182	181	180
3164191	3216367	3268541	180	179	179	177	178	176	176	176	174	174
3685916	3738086	3790254	174	173	172	171	171	171	169	170	168	168
4207579	4259742	4311904	167	167	165	166	164	165	163	163	162	162
4729179	4781335	4833491	160	161	159	159	159	158	157	156	156	156
5250716	5302866	5355016	154	154	154	152	153	151	151	150	150	149
5772191	5824335	5876478	148	148	147	147	146	145	145	144	143	143
6293603	6345740	6397878	142	141	141	141	139	139	139	137	138	136
6814952	6867084	6919214	52136	135	135	134	133	133	132	132	130	131
7336239	7388364	7440489	129	129	129	127	128	126	126	125	125	124
7857463	7909582	7961701	123	123	122	121	121	121	119	119	119	117
8378625	8430738	8482850	117	117	116	115	115	114	113	113	112	111
8899724	8951831	9003936	111	110	110	109	108	108	107	107	105	106
9420761	9472861	9524961	104	104	104	102	102	102	101	100	100	099
9941735	9993829	0045922	098	098	097	096	096	095	095	094	093	093
0462647	0514734	0566821	092	092	090	091	089	089	089	087	087	087
0983496	1035577	1087658	086	085	085	084	083	083	082	081	081	080
1504283	1556358	1608432	080	079	078	078	077	077	076	075	074	074
2025007	2077076	2129144	52074	072	073	071	071	070	070	069	068	068
2545669	2597731	2649794	067	067	065	066	064	064	064	062	063	061
3066268	3118325	3170381	061	060	060	059	058	058	057	057	056	055
3586805	3638856	3690905	054	054	054	053	052	051	051	051	049	049
4107280	4159324	4211367	049	047	048	046	046	045	045	044	043	043
4627692	4679730	4731767	042	042	041	040	040	039	038	038	037	037
5148042	5200074	5252105	036	035	035	034	033	033	032	032	031	030
5668330	5720355	5772380	030	029	028	028	027	027	026	025	025	024
6188555	6240574	6292593	023	023	022	022	021	020	020	019	019	018
6708718	6760731	6812743	017	016	016	016	014	015	013	013	012	012
7228819	7280825	7332831	52011	010	010	009	009	008	007	006	006	006
7748857	7800858	7852857	005	004	003	003	002	002	001	001	999	999
8268833	8320828	8372821	51998	998	997	997	996	996	994	995	993	993
8788747	8840735	8892723	992	992	991	991	989	990	988	988	988	986
9308599	9360581	9412562	986	986	985	984	984	983	982	982	981	980
9828388	9880364	9932339	980	979	979	978	977	977	976	976	975	974
0348116	0400085	0452054	974	973	972	972	971	971	970	969	969	968
0867781	0919744	0971706	967	967	966	966	965	964	964	963	962	962
1387384	1439340	1491297	961	961	960	959	959	958	958	956	957	955
1906924	1958875	2010825	955	955	953	954	952	952	951	951	950	949
2426403	2478347	2530291	51949	948	948	947	946	946	945	944	944	943
2945819	2997758	3049695	943	942	941	941	940	939	939	939	937	937
3465174	3517106	3569037	937	935	935	935	934	933	933	932	931	931
3984466	4036392	4088317	930	930	928	929	927	927	927	926	925	924
4503696	4555616	4607535	924	924	922	923	921	921	920	920	919	918
5022864	5074778	5126690	918	917	916	916	915	915	914	914	912	912
5541970	5593877	5645784	912	911	910	910	909	908	908	907	907	906
6061014	6112915	6164815	905	905	904	903	903	903	901	901	900	900
6579996	6631891	6683785	899	899	898	897	897	896	895	895	894	894
7098916	7150805	7202693	893	892	892	891	890	890	889	889	888	887
7617774	7669656	7721538	51887	886	885	885	884	884	883	882	882	881
8136570	8188446	8240322	881	880	879	879	878	877	877	876	876	875
8655304	8707174	8759043	874	874	873	872	872	871	871	870	869	869
9173976	9225840	9277703	868	868	867	866	866	865	864	864	863	863
9692586	9744444	9796301	861	862	861	860	859	859	858	858	857	856
0211134	0262986	0314837	856	855	854	854	854	852	852	852	851	850
0729621	0781466	0833310	849	849	849	847	847	847	846	845	844	844
1248045	1299884	1351722	844	843	842	841	841	840	840	839	838	838
1766408	1818240	1870073	837	837	836	835	835	834	834	832	833	831
2284708	2336535	2388361	831	831	829	829	829	828	827	827	826	825
2802947	2854767	2906587	825	824	823	824	822	822	821	820	820	820

Numbers 83800–84409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8380	9232440186	2492011	2543835	2595658	2647482	2699304	2751126
81	2958407	3010225	3062043	3113861	3165677	3217493	3269309
82	3476565	3528377	3580189	3632000	3683811	3735621	3787430
83	3994662	4046468	4098273	4150079	4201883	4253687	4305490
84	4512696	4564496	4616296	4668095	4719893	4771691	4823488
85	5030669	5082463	5134257	5186049	5237841	5289633	5341424
86	5548581	5600368	5652156	5703942	5755728	5807513	5859298
87	6066430	6118212	6169993	6221773	6273553	6325332	6377110
88	6584218	6635993	6687768	6739542	6791316	6843089	6894861
89	7101944	7153713	7205482	7257250	7309017	7360784	7412550
8390	9237619608	7671371	7723134	7774896	7826657	7878417	7930177
91	8137211	8188968	8240724	8292480	8344235	8395989	8447743
92	8654752	8706503	8758253	8810002	8861751	8913499	8965247
93	9172231	9223976	9275720	9327463	9379206	9430948	9482689
94	9689649	9741387	9793125	9844862	9896599	9948334	0000070
95	9240207005	0258737	0310469	0362200	0413930	0465660	0517389
96	0724299	0776025	0827751	0879475	0931200	0982923	1034646
97	1241532	1293252	1344971	1396690	1448408	1500125	1551842
98	1758703	1810417	1862130	1913842	1965554	2017266	2068976
99	2275813	2327520	2379227	2430933	2482639	2534344	2586049
8400	9242792861	2844562	2896263	2947963	2999663	3051362	3103060
1	3309847	3361542	3413237	3464931	3516624	3568317	3620009
2	3826772	3878461	3930150	3981838	4033525	4085211	4136897
3	4343635	4395318	4447001	4498682	4550364	4602044	4653724
4	4860437	4912114	4963790	5015466	5067141	5118815	5170489
5	5377178	5428848	5480518	5532188	5583857	5635525	5687192
6	5893857	5945521	5997185	6048848	6100511	6152173	6203835
7	6410474	6462133	6513790	6565447	6617104	6668760	6720415
8	6927030	6978682	7030334	7081985	7133635	7185285	7236934
9	7443525	7495171	7546816	7598461	7650105	7701749	7753392
8410	9247959958	8011598	8063237	8114876	8166514	8218152	8269788
11	8476330	8527964	8579597	8631229	8682861	8734493	8786123
12	8992640	9044268	9095895	9147521	9199147	9250772	9302397
13	9508889	9560511	9612132	9663752	9715372	9766991	9818609
14	9250025077	0076692	0128307	0179921	0231535	0283148	0334760
15	0541203	0592812	0644421	0696029	0747636	0799243	0850849
16	1057268	1108871	1160474	1212076	1263677	1315278	1366878
17	1573272	1624869	1676465	1728061	1779656	1831251	1882845
18	2089214	2140805	2192395	2243985	2295574	2347162	2398750
19	2605095	2656680	2708264	2759848	2811430	2863013	2914594
8420	9253120915	3172494	3224072	3275649	3327226	3378802	3430377
21	3636674	3688246	3739818	3791389	3842960	3894530	3946099
22	4152371	4203937	4255503	4307068	4358633	4410197	4461760
23	4668007	4719567	4771127	4822686	4874244	4925802	4977359
24	5183582	5235136	5286689	5338242	5389795	5441346	5492897
25	5699095	5750643	5802191	5853738	5905284	5956829	6008374
26	6214548	6266090	6317631	6369172	6420712	6472251	6523790
27	6729939	6781475	6833010	6884545	6936079	6987612	7039145
28	7245269	7296799	7348328	7399856	7451384	7502912	7554438
29	7760538	7812062	7863585	7915107	7966629	8018150	8069670
8430	9258275746	8327264	8378780	8430297	8481812	8533327	8584842
31	8790893	8842404	8893915	8945425	8996935	9048443	9099952
32	9305979	9357484	9408988	9460492	9511996	9563499	9615001
33	9821003	9872502	9924001	9975499	0026996	0078493	0129989
34	9260335967	0387460	0438952	0490444	0541935	0593426	0644916
35	0850869	0902356	0953842	1005328	1056813	1108298	1159781
36	1365711	1417191	1468672	1520151	1571630	1623109	1674586
37	1880491	1931966	1983440	2034913	2086386	2137858	2189330
38	2395210	2446679	2498147	2549614	2601081	2652547	2704013
39	2909869	2961331	3012793	3064254	3115715	3167175	3218635
8440	3424466	3475923	3527378	3578834	3630288	3681742	3733195

OF NUMBERS. Logarithms 9232440186–9263887552.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2802947	2854767	2906587	51825	824	823	824	822	822	821	820	820	820
3321124	3372938	3424752	818	818	818	816	816	816	815	814	814	813
3839239	3891047	3942855	812	812	811	811	810	809	809	808	808	807
4357292	4409094	4460896	806	805	806	804	804	803	802	802	802	800
4875284	4927080	4978875	800	800	799	798	798	797	796	796	795	794
5393214	5445003	5496792	794	794	792	792	792	791	790	789	789	789
5911082	5962865	6014648	787	788	786	786	785	785	784	783	783	782
6428888	6480665	6532442	782	781	780	780	779	778	778	777	777	776
6946633	6998404	7050174	775	775	774	774	773	772	772	771	770	770
7464315	7516080	7567845	769	769	768	767	767	766	765	765	765	763
7981937	8033695	8085453	51763	763	762	761	760	760	760	758	758	758
8499496	8551249	8603001	757	756	756	755	754	754	753	753	752	751
9016994	9068740	9120486	751	750	749	749	748	748	747	746	746	745
9534430	9586170	9637910	745	744	743	743	742	741	741	740	740	739
0051804	0103538	0155272	738	738	737	737	735	736	734	734	734	733
0569117	0620845	0672572	732	732	731	730	730	729	728	728	727	727
1086369	1138090	1189811	726	726	724	725	723	723	723	721	721	721
1603558	1655274	1706989	720	719	719	718	717	717	716	716	715	714
2120686	2172396	2224104	714	713	712	712	712	710	710	710	708	709
2637753	2689456	2741159	707	707	706	706	705	705	704	703	703	702
3154758	3206455	3258151	51701	701	700	700	699	698	698	697	696	696
3671701	3723392	3775082	695	695	694	693	693	692	692	691	690	690
4188583	4240268	4291952	689	689	688	687	686	686	686	685	684	683
4705403	4757082	4808760	683	683	681	682	680	680	679	679	678	677
5222162	5273835	5325506	677	676	676	675	674	674	673	673	671	672
5738859	5790526	5842192	670	670	670	669	668	667	667	667	666	665
6255495	6307156	6358815	664	664	663	663	662	662	660	661	659	659
6772070	6823724	6875377	659	657	657	657	656	655	655	654	653	653
7288583	7340231	7391878	652	652	651	650	650	649	649	648	647	647
7805034	7856676	7908317	646	645	645	644	644	643	642	642	641	641
8321425	8373060	8424695	51640	639	639	638	638	636	637	635	635	635
8837753	8889383	8941012	634	633	632	632	632	630	630	630	629	628
9354021	9405644	9457267	628	627	626	626	625	625	624	623	623	622
9870227	9921844	9973461	622	621	620	620	619	618	618	617	617	616
0386372	0437983	0489593	615	615	614	614	613	612	612	611	610	610
0902455	0954060	1005664	609	609	608	607	607	606	606	605	604	604
1418477	1470076	1521674	603	603	602	601	601	600	599	599	598	598
1934438	1986031	2037623	597	596	596	595	595	594	593	593	592	591
2450337	2501924	2553510	591	590	590	589	588	588	587	587	586	585
2966175	3017756	3069336	585	584	584	582	583	581	581	581	580	579
3481952	3533527	3585100	51579	578	577	577	576	575	575	575	573	574
3997668	4049236	4100804	572	572	571	571	570	569	569	568	568	567
4513323	4564885	4616446	566	566	565	565	564	563	563	562	561	561
5028916	5080472	5132027	560	560	559	558	558	557	557	556	555	555
5544448	5595998	5647547	554	553	553	553	551	551	551	550	549	548
6059919	6111462	6163005	548	548	547	546	545	545	545	543	543	543
6575328	6626866	6678403	542	541	541	540	539	539	538	538	537	536
7090677	7142208	7193739	536	535	535	534	533	533	532	531	531	530
7605964	7657489	7709014	530	529	528	528	528	526	526	525	525	524
8121190	8172710	8224228	524	523	522	522	521	520	520	520	518	518
8636355	8687869	8739381	51518	516	517	515	515	515	513	514	512	512
9151459	9202966	9254473	511	511	510	510	508	509	507	507	507	506
9666502	9718003	9769504	505	504	504	504	503	502	501	501	501	499
0181484	0232979	0284473	499	499	498	497	497	496	495	495	494	494
0696405	0747894	0799382	493	492	492	491	491	490	489	489	488	487
1211265	1262747	1314229	487	486	486	485	485	483	484	482	482	482
1726063	1777540	1829016	480	481	479	479	479	477	477	477	476	475
2240801	2292271	2343741	475	474	473	473	472	472	471	470	470	469
2755478	2806942	2858406	469	468	467	467	466	466	465	464	464	463
3270093	3321552	3373009	462	462	461	461	460	460	458	459	457	457
3784648	3836100	3887552	457	455	456	454	454	453	453	452	452	451

Numbers 84400–85009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8440	9263424466	3475923	3527378	3578834	3630288	3681742	3733195
41	3939003	3990453	4041903	4093352	4144800	4196248	4247695
42	4453478	4504922	4556366	4607809	4659251	4710693	4762134
43	4967893	5019331	5070768	5122205	5173641	5225077	5276512
44	5482246	5533678	5585110	5636541	5687971	5739400	5790829
45	5996539	6047965	6099390	6150815	6202239	6253663	6305085
46	6510771	6562191	6613610	6665029	6716447	6767864	6819281
47	7024942	7076356	7127769	7179181	7230593	7282004	7333415
48	7539052	7590460	7641867	7693273	7744679	7796084	7847489
49	8053101	8104503	8155904	8207304	8258704	8310103	8361501
8450	9268567089	8618485	8669880	8721274	8772668	8824061	8875453
51	9081017	9132406	9183795	9235183	9286571	9337958	9389344
52	9594884	9646267	9697650	9749032	9800413	9851794	9903175
53	9270108690	0160067	0211444	0262820	0314195	0365570	0416944
54	0622435	0673806	0725177	0776547	0827916	0879285	0930653
55	1136119	1187484	1238849	1290213	1341576	1392939	1444301
56	1649743	1701102	1752460	1803818	1855175	1906532	1957888
57	2163306	2214659	2266011	2317363	2368714	2420065	2471415
58	2676808	2728155	2779501	2830847	2882192	2933536	2984880
59	3190250	3241590	3292931	3344270	3395609	3446948	3498285
8460	9273703630	3754965	3806299	3857633	3908966	3960298	4011630
61	4216951	4268279	4319607	4370935	4422262	4473588	4524913
62	4730210	4781533	4832855	4884176	4935497	4986817	5038137
63	5243409	5294725	5346041	5397357	5448671	5499985	5551299
64	5756547	5807857	5859167	5910477	5961785	6013093	6064401
65	6269624	6320929	6372233	6423536	6474838	6526140	6577442
66	6782641	6833940	6885237	6936535	6987831	7039127	7090422
67	7295598	7346890	7398182	7449473	7500763	7552053	7603342
68	7808493	7859780	7911065	7962350	8013635	8064919	8116202
69	8321329	8372609	8423888	8475167	8526446	8577724	8629001
8470	9278834103	8885377	8936651	8987924	9039196	9090468	9141739
71	9346817	9398085	9449353	9500620	9551886	9603152	9654417
72	9859471	9910733	9961994	0013255	0064515	0115775	0167034
73	9280372064	0423320	0474575	0525830	0577084	0628338	0679591
74	0884597	0935847	0987096	1038345	1089593	1140840	1192087
75	1397069	1448313	1499556	1550799	1602041	1653282	1704523
76	1909480	1960718	2011955	2063192	2114428	2165664	2216898
77	2421832	2473063	2524295	2575525	2626755	2677985	2729213
78	2934122	2985348	3036573	3087798	3139022	3190245	3241468
79	3446353	3497572	3548791	3600010	3651228	3702445	3753662
8480	9283958523	4009736	4060949	4112162	4163374	4214585	4265796
81	4470632	4521840	4573047	4624253	4675459	4726664	4777869
82	4982681	5033883	5085084	5136284	5187484	5238683	5289882
83	5494670	5545866	5597061	5648255	5699449	5750642	5801834
84	6006598	6057788	6108977	6160165	6211353	6262540	6313727
85	6518467	6569650	6620833	6672015	6723197	6774378	6825558
86	7030274	7081452	7132629	7183805	7234981	7286156	7337330
87	7542022	7593193	7644364	7695534	7746704	7797873	7849041
88	8053709	8104874	8156039	8207203	8258367	8309530	8360692
89	8565336	8616495	8667654	8718812	8769970	8821127	8872283
8490	9289076902	9128056	9179209	9230361	9281512	9332663	9383813
91	9588409	9639556	9690703	9741849	9792994	9844139	9895284
92	9290099855	0150996	0202137	0253277	0304417	0355555	0406694
93	0611241	0662376	0713511	0764645	0815778	0866911	0918043
94	1122567	1173696	1224824	1275953	1327080	1378207	1429333
95	1633832	1684955	1736078	1787200	1838321	1889442	1940562
96	2145037	2196155	2247271	2298387	2349503	2400617	2451732
97	2656183	2707294	2758404	2809514	2860624	2911733	2962841
98	3167268	3218373	3269477	3320581	3371685	3422787	3473890
99	3678292	3729392	3780490	3831588	3882686	3933782	3984878
8500	4189257	4240350	4291443	4342535	4393626	4444717	4495807

OF NUMBERS. Logarithms 9263424466-9294649074.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3784648	3836100	3887552	51457	455	456	454	454	453	453	452	452	451
4299142	4350588	4402033	450	450	449	448	448	447	447	446	445	445
4813575	4865015	4916454	444	444	443	442	442	441	441	440	439	439
5327947	5379381	5430814	438	437	437	436	436	435	435	434	433	432
5842258	5893685	5945113	432	432	431	430	429	429	429	427	428	426
6356508	6407929	6459350	426	425	425	424	424	422	423	421	421	421
6870697	6922113	6973527	420	419	419	418	417	417	416	416	414	415
7384825	7436235	7487644	414	413	412	412	411	411	410	410	409	408
7898893	7950296	8001699	408	407	406	406	405	405	404	403	403	402
8412899	8464297	8515693	402	401	400	400	399	398	398	398	396	396
8926845	8978236	9029627	51396	395	394	394	393	392	392	391	391	390
9440730	9492115	9543500	389	389	388	388	387	386	386	385	385	384
9954554	0005933	0057312	383	383	382	381	381	381	379	379	379	378
0468318	0519691	0571063	377	377	376	375	375	374	374	373	372	372
0982020	1033387	1084754	371	371	370	369	369	368	367	367	367	365
1495662	1547023	1598383	365	365	364	363	363	362	361	361	360	360
2009243	2060598	2111952	359	358	358	357	357	356	355	355	354	354
2522764	2574113	2625461	353	352	352	351	351	350	349	349	348	347
3036224	3087566	3138908	347	346	346	345	344	344	344	342	342	342
3549623	3600959	3652295	340	341	339	339	339	337	338	336	336	335
4062961	4114291	4165621	51335	334	334	333	332	332	331	330	330	330
4576238	4627563	4678887	328	328	328	327	326	325	325	325	324	323
5089455	5140774	5192092	323	322	321	321	320	320	318	319	318	317
5602612	5653924	5705236	316	316	316	314	314	314	313	312	312	311
6115708	6167014	6218319	310	310	310	308	308	308	307	306	305	305
6628743	6680043	6731342	305	304	303	302	302	302	301	300	299	299
7141717	7193011	7244305	299	297	298	296	296	295	295	294	294	293
7654631	7705919	7757207	292	292	291	290	290	289	289	288	288	286
8167484	8218766	8270048	287	285	285	285	284	283	282	282	282	281
8680277	8731553	8782829	280	279	279	279	278	277	276	276	276	274
9193010	9244279	9295549	51274	274	273	272	272	271	271	269	270	268
9705681	9756945	9808208	268	268	267	266	266	265	264	264	263	263
0218292	0269550	0320807	262	261	261	260	260	259	258	258	257	257
0730843	0782095	0833346	256	255	255	254	254	253	252	252	251	251
1243333	1294579	1345824	250	249	249	248	247	247	246	246	245	245
1755763	1807003	1858242	244	243	243	242	241	241	240	240	239	238
2268133	2319366	2370599	238	237	237	236	236	234	235	233	233	233
2780441	2831669	2882896	231	232	230	230	230	228	228	228	227	226
3292690	3343911	3395132	226	225	225	224	223	223	222	221	221	221
3804878	3856093	3907308	219	219	219	218	217	217	216	215	215	215
4317006	4368215	4419424	51213	213	213	212	211	211	210	209	209	208
4829073	4880276	4931479	208	207	206	206	205	205	204	203	203	202
5341080	5392277	5443474	202	201	200	200	199	199	198	197	197	196
5853026	5904218	5955408	196	195	194	194	193	192	192	192	190	190
6364912	6416098	6467282	190	189	188	188	187	187	185	186	184	185
6876738	6927918	6979096	183	183	182	182	181	180	180	180	178	178
7388504	7439677	7490850	178	177	176	176	175	174	174	173	173	172
7900209	7951376	8002543	171	171	170	170	169	168	168	167	167	166
8411854	8463015	8514176	165	165	164	164	163	162	162	161	161	160
8923439	8974594	9025748	159	159	158	158	157	156	156	155	154	154
9434963	9486112	9537261	51154	153	152	151	151	150	150	149	149	148
9946427	9997571	0048713	147	147	146	145	145	145	143	144	142	142
0457831	0508968	0560105	141	141	140	140	138	139	137	137	137	136
0969175	1020306	1071437	135	135	134	133	133	132	132	131	131	130
1480459	1531584	1582708	129	128	129	127	127	126	126	125	124	124
1991682	2042801	2093920	123	123	122	121	121	120	120	119	119	117
2502845	2553958	2605071	118	116	116	116	114	115	113	113	113	112
3013948	3065055	3116162	111	110	110	110	109	108	107	107	107	106
3524991	3576092	3627193	105	104	104	104	102	103	101	101	101	099
4035974	4087069	4138163	100	098	098	098	096	096	096	095	094	094
4546897	4597986	4649074	093	093	092	091	091	090	090	089	088	088

Numbers 85000–85609. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8500	9294189257	4240350	4291443	4342535	4393626	4444717	4495807
1	4700162	4751249	4802335	4853421	4904507	4955592	5006676
2	5211006	5262087	5313168	5364248	5415327	5466406	5517484
3	5721791	5772866	5823940	5875014	5926088	5977160	6028233
4	6232515	6283584	6334653	6385721	6436788	6487855	6538921
5	6743179	6794243	6845305	6896367	6947428	6998489	7049549
6	7253784	7304841	7355897	7406953	7458009	7509063	7560118
7	7764328	7815379	7866430	7917480	7968529	8019578	8070626
8	8274812	8325857	8376902	8427946	8478989	8530032	8581074
9	8785237	8836276	8887314	8938352	8989389	9040426	9091462
8510	9299295601	9346634	9397667	9448698	9499730	9550760	9601791
11	9805905	9856932	9907959	9958985	0010010	0061035	0112059
12	9300316150	0367171	0418191	0469211	0520230	0571249	0622267
13	0826334	0877349	0928364	0979378	1030391	1081404	1132416
14	1336458	1387468	1438476	1489484	1540491	1591498	1642504
15	1846523	1897526	1948529	1999531	2050532	2101533	2152533
16	2356528	2407525	2458521	2509517	2560513	2611508	2662502
17	2866472	2917464	2968454	3019444	3070434	3121422	3172411
18	3376357	3427343	3478327	3529311	3580295	3631277	3682260
19	3886182	3937162	3988140	4039118	4090096	4141073	4192049
8520	9304395948	4446921	4497894	4548866	4599837	4650808	4701778
21	4905653	4956620	5007587	5058553	5109518	5160483	5211448
22	5415299	5466260	5517221	5568181	5619140	5670099	5721057
23	5924884	5975840	6026794	6077749	6128702	6179655	6230607
24	6434410	6485360	6536308	6587257	6638204	6689151	6740097
25	6943877	6994820	7045763	7096705	7147646	7198587	7249528
26	7453283	7504220	7555157	7606093	7657029	7707964	7758898
27	7962630	8013561	8064492	8115422	8166352	8217281	8268209
28	8471917	8522842	8573767	8624691	8675615	8726538	8777460
29	8981144	9032064	9082982	9133901	9184818	9235735	9286652
8530	9309490312	9541225	9592138	9643050	9693962	9744873	9795784
31	9999420	0050327	0101234	0152140	0203046	0253951	0304856
32	9310508468	0559369	0610270	0661171	0712070	0762970	0813868
33	1017456	1068352	1119247	1170141	1221035	1271928	1322821
34	1526385	1577275	1628164	1679052	1729940	1780827	1831714
35	2035255	2086138	2137021	2187904	2238786	2289667	2340547
36	2544064	2594942	2645819	2696695	2747571	2798447	2849321
37	3052814	3103686	3154557	3205428	3256298	3307167	3358036
38	3561505	3612370	3663236	3714100	3764964	3815828	3866690
39	4070136	4120995	4171855	4222713	4273571	4324429	4375286
8540	9314578707	4629561	4680414	4731267	4782119	4832970	4883821
41	5087219	5138067	5188914	5239761	5290607	5341452	5392297
42	5595671	5646513	5697354	5748195	5799035	5849875	5900714
43	6104064	6154900	6205735	6256570	6307404	6358238	6409071
44	6612397	6663227	6714056	6764885	6815713	6866541	6917368
45	7120671	7171495	7222318	7273141	7323963	7374785	7425606
46	7628885	7679703	7730521	7781337	7832154	7882970	7933785
47	8137040	8187852	8238663	8289474	8340285	8391095	8441904
48	8645135	8695941	8746747	8797552	8848356	8899160	8949964
49	9153171	9203971	9254771	9305570	9356369	9407166	9457964
8550	9319661147	9711942	9762735	9813529	9864321	9915113	9965905
51	9320169064	0219853	0270641	0321428	0372215	0423001	0473786
52	0676922	0727705	0778486	0829268	0880048	0930829	0981608
53	1184720	1235497	1286273	1337048	1387823	1438597	1489371
54	1692459	1743230	1794000	1844769	1895538	1946306	1997074
55	2200139	2250903	2301668	2352431	2403194	2453956	2504718
56	2707759	2758518	2809276	2860033	2910790	2961547	3012303
57	3215320	3266073	3316825	3367577	3418328	3469078	3519828
58	3722821	3773568	3824315	3875060	3925806	3976550	4027294
59	4230264	4281005	4331745	4382485	4433224	4483963	4534701
8560	4737647	4788382	4839116	4889850	4940583	4991316	5042048

OF NUMBERS. Logarithms 9294189257-9325194241.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4546897	4597986	4649074	51093	093	092	091	091	090	090	089	088	088
5057759	5108842	5159925	087	086	086	086	085	084	083	083	083	081
5568562	5619639	5670715	081	081	080	079	079	078	078	077	076	076
6079304	6130375	6181445	075	074	074	074	072	073	071	071	070	070
6589986	6641051	6692116	069	069	068	067	067	066	065	065	065	063
7100609	7151668	7202726	064	062	062	061	061	060	060	059	058	058
7611171	7662224	7713276	057	056	056	056	054	055	053	053	052	052
8121673	8172720	8223767	051	051	050	049	049	048	047	047	047	045
8632116	8683157	8734197	045	045	044	043	043	042	042	041	040	040
9142498	9193533	9244567	039	038	038	037	037	036	036	035	034	034
9652820	9703849	9754877	51033	033	031	032	030	031	029	029	028	028
0163082	0214105	0265128	027	027	026	025	025	024	023	023	023	022
0673285	0724302	0775318	021	020	020	019	019	018	018	017	016	016
1183427	1234438	1285449	015	015	014	013	013	012	011	011	011	009
1693510	1744515	1795519	010	008	008	007	007	006	006	005	004	004
2203533	2254532	2305530	003	003	002	001	001	000	000	999	998	998
2713495	2764488	2815481	50997	996	996	996	995	994	993	993	993	991
3223398	3274385	3325372	992	990	990	990	988	989	987	987	987	985
3733241	3784222	3835203	986	984	984	984	982	983	981	981	981	979
4243024	4293999	4344974	980	978	978	978	977	976	975	975	975	974
4752748	4803717	4854685	50973	973	972	971	971	970	970	969	968	968
5262411	5313374	5364337	967	967	966	965	965	965	963	963	963	962
5772015	5822972	5873929	961	961	960	959	959	958	958	957	957	955
6281559	6332510	6383461	956	954	955	953	953	952	952	951	951	949
6791043	6841988	6892933	950	948	949	947	947	946	946	945	945	944
7300467	7351407	7402345	943	943	942	941	941	941	939	940	938	938
7809832	7860765	7911698	937	937	936	936	935	934	934	933	933	932
8319137	8370064	8420991	931	931	930	930	929	928	928	927	927	926
8828382	8879303	8930224	925	925	924	924	923	922	922	921	921	920
9337568	9388483	9439398	920	918	919	917	917	917	916	915	915	914
9846693	9897603	9948511	50913	913	912	912	911	911	909	910	908	909
0355760	0406663	0457566	907	907	906	906	905	905	904	903	903	902
0864766	0915663	0966560	901	901	901	899	900	898	898	897	897	896
1373713	1424604	1475495	896	895	894	894	893	893	892	891	891	890
1882600	1933485	1984370	890	889	888	888	887	887	886	885	885	885
2391428	2442307	2493186	883	883	883	882	881	880	881	879	879	878
2900195	2951069	3001942	878	877	876	876	876	874	874	874	873	872
3408904	3459771	3510638	872	871	871	870	869	869	868	867	867	867
3917553	3968414	4019275	865	866	864	864	864	862	863	861	861	861
4426142	4476997	4527852	859	860	858	858	858	857	856	855	855	855
4934671	4985521	5036370	50854	853	853	852	851	851	850	850	849	849
5443141	5493985	5544828	848	847	847	846	845	845	844	844	843	843
5951552	6002390	6053227	842	841	841	840	840	839	838	838	837	837
6459903	6510735	6561566	836	835	835	834	834	833	832	832	831	831
6968195	7019021	7069846	830	829	829	828	828	827	827	826	825	825
7476427	7527247	7578066	824	823	823	822	822	821	821	820	819	819
7984599	8035413	8086227	818	818	816	817	816	815	814	814	814	813
8492713	8543521	8594328	812	811	811	811	810	809	809	808	807	807
9000766	9051568	9102370	806	806	805	804	804	804	802	802	802	801
9508761	9559557	9610352	800	800	799	799	797	798	797	796	795	795
0016695	0067486	0118275	50795	793	794	792	792	792	790	791	789	789
0524571	0575355	0626139	789	788	787	787	786	785	785	784	784	783
1032387	1083165	1133943	783	781	782	780	781	779	779	778	778	777
1540144	1590916	1641688	777	776	775	775	774	774	773	772	772	771
2047841	2098608	2149373	771	770	769	769	768	768	767	767	765	766
2555479	2606240	2657000	764	765	763	763	762	762	761	761	760	759
3063058	3113812	3164566	759	758	757	757	757	756	755	754	754	754
3570577	3621326	3672074	753	752	752	751	750	750	749	749	748	747
4078037	4128780	4179522	747	747	745	746	744	744	743	743	742	742
4585438	4636175	4686911	741	740	740	739	739	738	737	737	736	736
5092780	5143510	5194241	735	734	734	733	733	732	732	730	731	730

Numbers 85600–86209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8560	9324737647	4788382	4839116	4889850	4940583	4991316	5042048
61	5244971	5295700	5346428	5397156	5447883	5498610	5549336
62	5752235	5802958	5853681	5904403	5955124	6005845	6056565
63	6259440	6310157	6360874	6411590	6462306	6513021	6563735
64	6766586	6817298	6868008	6918718	6969428	7020137	7070845
65	7273673	7324379	7375083	7425788	7476491	7527194	7577897
66	7780701	7831400	7882099	7932797	7983495	8034192	8084889
67	8287669	8338363	8389056	8439748	8490440	8541131	8591822
68	8794578	8845266	8895953	8946639	8997325	9048011	9098695
69	9301428	9352110	9402791	9453472	9504152	9554831	9605510
8570	9329808219	9858895	9909570	9960245	$\overline{0}010919$	$\overline{0}061593$	$\overline{0}112265$
71	9330314951	0365621	0416290	0466959	0517627	0568295	0618962
72	0821624	0872288	0922951	0973614	1024276	1074938	1125599
73	1328237	1378895	1429553	1480210	1530866	1581522	1632177
74	1834792	1885444	1936096	1986747	2037397	2088047	2138696
75	2341287	2391933	2442579	2493224	2543869	2594513	2645156
76	2847723	2898364	2949004	2999643	3050281	3100920	3151557
77	3354101	3404735	3455369	3506002	3556635	3607267	3657899
78	3860419	3911048	3961676	4012303	4062930	4113556	4164182
79	4366678	4417301	4467923	4518545	4569165	4619786	4670405
8580	9334872878	4923495	4974111	5024727	5075342	5125956	5176570
81	53[illegible]19	5429631	5480241	5530851	5581460	5632068	5682676
82	5885102	5935707	5986311	6036915	6087518	6138121	6188723
83	6391125	6441724	6492323	6542921	6593518	6644115	6694711
84	6897090	6947683	6998275	7048867	7099459	7150050	7200640
85	7402995	7453582	7504169	7554755	7605341	7655926	7706510
86	7908841	7959423	8010004	8060584	8111164	8161743	8212321
87	8414629	8465205	8515779	8566354	8616928	8667501	8718073
88	8920358	8970927	9021496	9072065	9122633	9173200	9223767
89	9426027	9476591	9527154	9577717	9628279	9678840	9729401
8590	9339931638	9982196	$\overline{0}032753$	$\overline{0}083310$	$\overline{0}133866$	$\overline{0}184422$	$\overline{0}234977$
91	9340437190	0487742	0538294	0588844	0639395	0689944	0740493
92	0942684	0993230	1043775	1094320	1144864	1195408	1245951
93	1448118	1498658	1549198	1599737	1650275	1700813	1751350
94	1953493	2004028	2054562	2105095	2155627	2206159	2256691
95	2458810	2509339	2559867	2610394	2660920	2711447	2761972
96	2964068	3014591	3065113	3115634	3166155	3216675	3267195
97	3469267	3519784	3570300	3620816	3671331	3721845	3772359
98	3974408	4024919	4075429	4125938	4176448	4226956	4277464
99	4479489	4529994	4580499	4631003	4681506	4732008	4782510
8600	93449845 12	5035012	5085510	5136008	5186505	5237002	5287498
1	5489477	5539970	5590462	5640954	5691446	5741937	5792427
2	5994382	6044870	6095356	6145842	6196328	6246813	6297297
3	6499229	6549710	6600191	6650672	6701151	6751630	6802109
4	7004017	7054493	7104968	7155442	7205916	7256389	7306862
5	7508747	7559216	7609685	7660154	7710622	7761089	7811556
6	8013417	8063881	8114345	8164807	8215269	8265731	8316192
7	8518030	8568488	8618945	8669402	8719858	8770314	8820769
8	9022583	9073035	9123487	9173938	9224388	9274838	9325287
9	9527078	9577524	9627970	9678415	9728860	9779304	9829747
8610	9350031515	0081955	0132395	0182834	0233273	0283711	0334148
11	0535892	0586327	0636761	0687194	0737627	0788059	0838491
12	1040212	1090640	1141068	1191496	1241923	1292349	1342775
13	1544472	1594895	1645317	1695739	1746160	1796581	1847000
14	2048674	2099091	2149508	2199923	2250339	2300753	2351167
15	2552818	2603229	2653640	2704050	2754459	2804868	2855276
16	3056903	3107308	3157713	3208117	3258521	3308923	3359326
17	3560929	3611329	3661728	3712126	3762524	3812921	3863317
18	4064898	4115291	4165684	4216077	4266468	4316860	4367250
19	4568807	4619195	4669582	4719969	4770355	4820740	4871125
8620	5072658	5123040	5173421	5223802	5274182	5324562	5374941

OF NUMBERS. Logarithms 9324737647–9355526074.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5092780	5143510	5194241	50735	734	734	733	733	732	732	730	731	730
5600062	5650787	5701511	729	728	728	727	727	726	726	725	724	724
6107285	6158004	6208722	723	723	722	721	721	720	720	719	718	718
6614449	6665162	6715874	717	717	716	716	715	714	714	713	712	712
7121553	7172260	7222967	712	710	710	710	709	708	708	707	707	706
7628599	7679300	7730001	706	704	705	703	703	703	702	701	701	700
8135585	8186280	8236975	699	699	698	698	697	697	696	695	695	694
8642512	8693201	8743890	694	693	692	692	691	691	690	689	689	688
9149379	9200063	9250746	688	687	686	686	686	684	684	684	683	682
9656188	9706866	9757543	682	681	681	680	679	679	678	678	677	676
$\overline{0162938}$	$\overline{0213609}$	$\overline{0264281}$	50676	675	675	674	674	672	673	671	672	670
0669628	0720294	0770959	670	669	669	668	668	667	666	666	665	665
1176259	1226919	1277579	664	663	663	662	662	661	660	660	660	658
1682832	1733486	1784139	658	658	657	656	656	655	655	654	653	653
2189345	2239993	2290640	652	652	651	650	650	649	649	648	647	647
2695799	2746441	2797083	646	646	645	645	644	643	643	642	642	640
3202194	3252830	3303466	641	640	639	638	639	637	637	636	636	635
3708530	3759160	3809790	634	634	633	633	632	632	631	630	630	629
4214807	4265431	4316055	629	628	627	627	626	626	625	624	624	623
4721025	4771643	4822261	623	622	622	620	621	619	620	618	618	617
5227184	5277796	5328408	50617	616	616	615	614	614	614	612	612	611
5733283	5783890	5834496	612	610	610	609	608	608	607	607	606	606
6239324	6289925	6340526	605	604	604	603	603	602	601	601	601	599
6745306	6795901	6846496	599	599	598	597	597	596	595	595	595	594
7251230	7301819	7352407	593	592	592	592	591	590	590	589	588	588
7757094	7807677	7858259	587	587	586	586	585	584	584	583	582	582
8262899	8313476	8364053	582	581	580	580	579	578	578	577	577	576
8768645	8819217	8869787	576	574	575	574	573	572	572	572	570	571
9274333	9324898	9375463	569	569	569	568	567	567	566	565	565	564
9779961	9830521	9881080	564	563	563	562	561	561	560	560	559	558
$\overline{0285531}$	$\overline{0336085}$	$\overline{0386638}$	50558	557	557	556	556	555	554	554	553	552
0791042	0841590	0892137	552	552	550	551	549	549	549	548	547	547
1296494	1347036	1397577	546	545	545	544	544	543	543	542	541	541
1801887	1852423	1902959	540	540	539	538	538	537	537	536	536	534
2307221	2357752	2408281	535	534	533	532	532	532	530	531	529	529
2812497	2863021	2913545	529	528	527	526	527	525	525	524	524	523
3317714	3368232	3418750	523	522	521	521	520	520	519	518	518	517
3822872	3873384	3923896	517	516	516	515	514	514	513	512	512	512
4327971	4378478	4428984	511	510	509	510	508	508	507	507	506	505
4833012	4883513	4934013	505	505	504	503	502	502	502	501	500	499
5337994	5388489	5438983	50500	498	498	497	497	496	496	495	494	494
5842917	5893406	5943894	493	492	492	492	491	490	490	489	488	488
6347781	6398264	6448747	488	486	486	486	485	484	484	483	483	482
6852587	6903064	6953541	481	481	481	479	479	479	478	477	477	476
7357334	7407805	7458276	476	475	474	474	473	473	472	471	471	471
7862022	7912488	7962953	469	469	469	468	467	467	466	466	465	464
8366652	8417112	8467571	464	464	462	462	462	461	460	460	459	459
8871223	8921677	8972131	458	457	457	456	456	455	454	454	454	452
9375736	9426184	9476631	452	452	451	450	450	449	449	448	447	447
9880190	9930632	9981074	446	446	445	445	444	443	443	442	442	441
0384585	0435021	0485457	50440	440	439	439	438	437	437	436	436	435
0888922	0939352	0989782	435	434	433	433	432	432	431	430	430	430
1393200	1443625	1494049	428	428	428	427	426	426	425	425	424	423
1897420	1947839	1998257	423	422	422	421	421	419	420	419	418	417
2401581	2451994	2502406	417	417	415	416	414	414	414	413	412	412
2905684	2956091	3006497	411	411	410	409	409	408	408	407	406	406
3409728	3460129	3510529	405	405	404	404	402	403	402	401	400	400
3913713	3964109	4014503	400	399	398	398	397	396	396	396	394	395
4417640	4468030	4518419	393	393	393	391	392	390	390	390	389	388
4921509	4971893	5022276	388	387	387	386	385	385	384	384	383	382
5425319	5475697	5526074	382	381	381	380	380	379	378	378	377	377

Numbers 86200–86809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8620	9355072658	5123040	5173421	5223802	5274182	5324562	5374941
21	5576451	5626827	5677202	5727577	5777952	5828325	5878698
22	6080185	6130555	6180925	6231294	6281663	6332030	6382398
23	6583861	6634225	6684589	6734952	6785315	6835677	6886038
24	7087478	7137837	7188195	7238552	7288909	7339265	7389621
25	7591037	7641390	7691742	7742094	7792445	7842795	7893145
26	8094538	8144885	8195231	8245577	8295922	8346267	8396610
27	8597980	8648321	8698662	8749002	8799341	8849680	8900018
28	9101364	9151699	9202034	9252368	9302702	9353034	9403367
29	9604690	9655019	9705348	9755676	9806004	9856331	9906657
8630	9360107957	0158281	0208604	0258926	0309248	0359569	0409890
31	0611166	0661484	0711801	0762117	0812433	0862749	0913063
32	1114317	1164629	1214940	1265251	1315561	1365870	1416179
33	1617409	1667715	1718021	1768325	1818630	1868933	1919237
34	2120443	2170743	2221043	2271342	2321641	2371938	2422236
35	2623419	2673713	2724007	2774300	2824593	2874885	2925177
36	3126337	3176625	3226913	3277201	3327487	3377774	3428059
37	3629196	3679479	3729761	3780042	3830323	3880604	3930884
38	4131997	4182274	4232550	4282826	4333101	4383376	4433650
39	4634740	4685011	4735282	4785552	4835821	4886090	4936358
8640	9365137425	5187690	5237955	5288219	5338482	5388745	5439008
41	5640051	5690311	5740570	5790828	5841086	5891343	5941599
42	6142620	6192873	6243126	6293379	6343631	6393882	6444133
43	6645130	6695378	6745625	6795872	6846118	6896363	6946608
44	7147582	7197824	7248066	7298306	7348547	7398786	7449025
45	7649976	7700212	7750448	7800683	7850917	7901151	7951385
46	8152312	8202542	8252772	8303001	8353230	8403458	8453686
47	8654590	8704814	8755038	8805262	8855485	8905707	8955929
48	9156809	9207028	9257246	9307464	9357681	9407898	9458113
49	9658971	9709184	9759396	9809608	9859819	9910030	9960240
8650	9370161075	0211282	0261488	0311694	0361900	0412105	0462309
51	0663120	0713322	0763522	0813723	0863922	0914121	0964320
52	1165108	1215303	1265498	1315693	1365886	1416080	1466272
53	1667037	1717227	1767416	1817605	1867793	1917980	1968167
54	2168909	2219093	2269276	2319459	2369641	2419823	2470004
55	2670722	2720900	2771078	2821255	2871431	2921607	2971782
56	3172478	3222650	3272822	3322993	3373164	3423334	3473503
57	3674175	3724342	3774508	3824673	3874838	3925002	3975166
58	4175815	4225976	4276136	4326295	4376454	4426613	4476771
59	4677396	4727551	4777706	4827860	4878013	4928166	4978318
8660	9375178920	5229069	5279218	5329366	5379513	5429660	5479807
61	5680386	5730529	5780672	5830814	5880956	5931097	5981238
62	6181794	6231932	6282069	6332205	6382341	6432476	6482611
63	6683144	6733276	6783407	6833538	6883668	6933797	6983926
64	7184436	7234562	7284688	7334813	7384937	7435061	7485184
65	7685670	7735791	7785910	7836030	7886148	7936266	7986383
66	8186847	8236961	8287075	8337189	8387301	8437414	8487525
67	8687966	8738074	8788182	8838290	8888397	8938503	8988609
68	9189026	9239129	9289232	9339333	9389435	9439535	9489635
69	9690030	9740127	9790223	9840319	9890415	9940509	9990604
8670	9380190975	0241066	0291157	0341247	0391337	0441426	0491514
71	0691862	0741948	0792033	0842117	0892201	0942284	0992367
72	1192692	1242772	1292851	1342930	1393008	1443085	1493162
73	1693464	1743538	1793611	1843684	1893757	1943828	1993899
74	2194178	2244246	2294314	2344381	2394448	2444514	2494579
75	2694835	2744897	2794959	2845020	2895081	2945141	2995201
76	3195433	3245490	3295546	3345602	3395657	3445711	3495765
77	3695975	3746025	3796076	3846126	3896175	3946223	3996271
78	4196458	4246503	4296548	4346592	4396635	4446678	4496720
79	4696884	4746923	4796962	4847000	4897038	4947075	4997111
8680	5197252	5247285	5297318	5347351	5397383	5447414	5497445

OF NUMBERS. Logarithms 9355072658–9385647534.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5425319	5475697	5526074	50382	381	381	380	380	379	378	378	377	377
5929071	5979443	6029814	376	375	375	375	373	373	373	372	371	371
6432764	6483131	6533496	370	370	369	369	367	368	366	367	365	365
6936399	6986760	7037119	364	364	363	363	362	361	361	361	359	359
7439976	7490330	7540684	359	358	357	357	356	356	355	354	354	353
7943494	7993843	8044191	353	352	352	351	350	350	349	349	348	347
8446954	8497297	8547639	347	346	346	345	345	343	344	343	342	341
8950355	9000692	9051029	341	341	340	339	339	338	337	337	337	335
9453698	9504029	9554360	335	335	334	334	332	333	331	331	331	330
9956983	0007308	0057633	329	329	328	328	327	326	326	325	325	324
0460210	0510529	0560848	50324	323	322	322	321	321	320	319	319	318
0963378	1013691	1064004	318	317	316	316	316	314	315	313	313	313
1466488	1516795	1567102	312	311	311	310	309	309	309	307	307	307
1969539	2019841	2070142	306	306	304	305	303	304	302	302	301	301
2472532	2522829	2573124	300	300	299	299	297	298	296	297	295	295
2975467	3025758	3076047	294	294	293	293	292	292	290	291	289	290
3478344	3528629	3578913	288	288	288	286	287	285	285	285	284	283
3981163	4031442	4081720	283	282	281	281	281	280	279	279	278	277
4483923	4534196	4584468	277	276	276	275	275	274	273	273	272	272
4986625	5036892	5087159	271	271	270	269	269	268	267	267	267	266
5489269	5539531	5589791	50265	265	264	263	263	263	261	262	260	260
5991855	6042111	6092366	260	259	258	258	257	256	256	256	255	254
6494383	6544633	6594882	253	253	253	252	251	251	250	250	249	248
6996853	7047096	7097340	248	247	247	246	245	245	245	243	244	242
7499264	7549502	7599739	242	242	240	241	239	239	239	238	237	237
8001617	8051849	8102081	236	236	235	234	234	234	232	232	232	231
8503913	8554139	8604365	230	230	229	229	228	228	227	226	226	225
9006150	9056370	9106590	224	224	224	223	222	222	221	220	220	219
9508329	9558543	9608758	219	218	218	217	217	215	216	214	215	213
0010450	0060659	0110867	213	212	212	211	211	210	210	209	208	208
0512513	0562716	0612918	50207	206	206	206	205	204	204	203	202	202
1014518	1064715	1114912	202	200	201	199	199	199	198	197	197	196
1516464	1566656	1616847	195	195	195	193	194	192	192	192	191	190
2018353	2068539	2118724	190	189	189	188	188	187	187	186	186	185
2520184	2570364	2620543	184	183	183	182	182	181	180	180	179	179
3021957	3072131	3122305	178	178	177	176	176	175	175	174	174	173
3523672	3573840	3624008	172	172	171	171	170	169	169	168	168	167
4025329	4075491	4125653	167	166	165	165	164	164	163	162	162	162
4526928	4577085	4627241	161	160	159	159	159	158	157	157	156	155
5028469	5078620	5128770	155	155	154	153	153	152	151	151	150	150
5529952	5580097	5630242	50149	149	148	147	147	147	145	145	145	144
6031378	6081517	6131656	143	143	142	142	141	141	140	139	139	138
6532745	6582879	6633012	138	137	136	136	135	135	134	134	133	132
7034055	7084182	7134310	132	131	131	130	129	129	129	127	128	126
7535306	7585428	7635550	126	126	125	124	124	123	122	122	122	120
8036500	8086616	8136732	121	119	120	118	118	117	117	116	116	115
8537636	8587747	8637856	114	114	114	112	113	111	111	111	109	110
9038714	9088819	9138923	108	108	108	107	106	106	105	105	104	103
9539735	9589833	9639932	103	103	101	102	100	100	100	098	099	098
0040697	0090790	0140883	097	096	096	096	094	095	093	093	093	092
0541602	0591690	0641776	50091	091	090	090	089	088	088	088	086	086
1042449	1092531	1142612	086	085	084	084	083	083	082	082	081	080
1543238	1593314	1643389	080	079	079	078	077	077	076	076	075	075
2043970	2094040	2144109	074	073	073	073	071	071	071	070	069	069
2544644	2594708	2644772	068	068	067	067	066	065	065	064	064	063
3045260	3095318	3145376	062	062	061	061	060	060	059	058	058	057
3545818	3595871	3645923	057	056	056	055	054	054	053	053	052	052
4046319	4096366	4146412	050	051	050	049	048	048	048	047	046	046
4546762	4596803	4646844	045	045	044	043	043	042	042	041	041	040
5047147	5097183	5147218	039	039	038	038	037	036	036	036	035	034
5547475	5597505	5647534	033	033	033	032	031	031	030	030	029	028

Numbers 86800–87409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8680	9385197252	5247285	5297318	5347351	5397383	5447414	5497445
81	5697562	5747590	5797617	5847644	5897670	5947696	5997721
82	6197815	6247837	6297859	6347880	6397900	6447920	6497939
83	6698010	6748027	6798042	6848058	6898072	6948086	6998100
84	7198148	7248158	7298168	7348178	7398187	7448195	7498203
85	7698228	7748233	7798237	7848241	7898244	7948246	7998248
86	8198250	8248249	8298248	8348246	8398243	8448240	8498236
87	8698215	8748208	8798201	8848193	8898185	8948176	8998166
88	9198122	9248110	9298097	9348083	9398069	9448055	9498039
89	9697972	9747954	9797935	9847916	9897896	9947876	9997854
8690	9390197764	0247741	0297716	0347691	0397665	0447639	0497612
91	0697499	0747470	0797439	0847408	0897377	0947345	0997312
92	1197176	1247141	1297105	1347068	1397031	1446994	1496955
93	1696796	1746755	1796713	1846671	1896628	1946585	1996541
94	2196359	2246312	2296264	2346216	2396167	2446118	2496068
95	2695863	2745811	2795757	2845704	2895649	2945594	2995539
96	3195311	3245252	3295193	3345134	3395074	3445013	3494952
97	3694701	3744637	3794572	3844507	3894441	3944374	3994307
98	4194033	4243963	4293893	4343822	4393750	4443678	4493605
99	4693308	4743233	4793157	4843080	4893002	4942924	4992846
8700	9395192526	5242445	5292363	5342280	5392197	5442114	5492029
1	5691687	5741599	5791512	5841423	5891335	5941245	5991155
2	6190790	6240697	6290603	6340509	6390415	6440320	6490224
3	6689835	6739737	6789637	6839538	6889437	6939337	6989235
4	7188824	7238719	7288614	7338509	7388403	7438296	7488189
5	7687755	7737644	7787534	7837423	7887311	7937199	7987086
6	8186628	8236512	8286396	8336279	8386162	8436044	8485925
7	8685445	8735323	8785201	8835078	8884955	8934831	8984707
8	9184204	9234076	9283949	9333820	9383691	9433562	9483432
9	9682906	9732773	9782639	9832505	9882370	9932235	9982099
8710	9400181550	0231411	0281272	0331132	0380992	0430851	0480709
11	0680137	0729993	0779848	0829702	0879556	0929410	0979262
12	1178667	1228517	1278367	1328215	1378063	1427911	1477758
13	1677140	1726984	1776828	1826671	1876513	1926355	1976197
14	2175556	2225394	2275232	2325070	2374906	2424742	2474578
15	2673914	2723747	2773579	2823411	2873242	2923072	2972902
16	3172216	3222043	3271869	3321695	3371520	3421345	3471169
17	3670460	3720281	3770102	3819922	3869741	3919560	3969379
18	4168647	4218462	4268277	4318092	4367906	4417719	4467532
19	4666777	4716586	4766396	4816204	4866013	4915820	4965627
8720	9405164849	5214653	5264457	5314260	5364062	5413864	5463666
21	5662865	5712663	5762461	5812258	5862055	5911851	5961647
22	6160823	6210616	6260408	6310200	6359991	6409781	6459571
23	6658725	6708512	6758298	6808084	6857869	6907654	6957438
24	7156569	7206350	7256131	7305911	7355691	7405470	7455248
25	7654356	7704132	7753907	7803681	7853455	7903229	7953001
26	8152087	8201856	8251626	8301394	8351163	8400930	8450697
27	8649760	8699524	8749287	8799050	8848813	8898575	8948336
28	9147376	9197134	9246892	9296650	9346406	9396162	9445918
29	9644935	9694688	9744440	9794192	9843943	9893693	9943443
8730	9410142437	0192184	0241931	0291677	0341422	0391167	0440911
31	0639882	0689624	0739364	0789105	0838844	0888583	0938322
32	1137270	1187006	1236741	1286476	1336210	1385943	1435676
33	1634602	1684332	1734061	1783790	1833518	1883246	1932973
34	2131876	2181600	2231324	2281047	2330770	2380492	2430213
35	2629093	2678812	2728530	2778247	2827964	2877681	2927396
36	3126254	3175967	3225679	3275391	3325102	3374812	3424523
37	3623357	3673064	3722771	3772477	3822183	3871888	3921592
38	4120404	4170105	4219806	4269507	4319206	4368906	4418604
39	4617393	4667089	4716785	4766479	4816173	4865867	4915560
8740	5114326	5164017	5213706	5263395	5313084	5362771	5412459

OF NUMBERS. Logarithms 9385197252–9415561517.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5547475	5597505	5647534	50033	033	033	032	031	031	030	030	029	028
6047745	6097769	6147792	028	027	027	026	026	025	024	024	023	023
6547958	6597976	6647993	022	022	021	020	020	019	019	018	017	017
7048113	7098125	7148137	017	015	016	014	014	014	013	012	012	011
7548210	7598216	7648222	010	010	010	009	008	008	007	006	006	006
8048250	8098250	8148251	005	004	004	003	002	002	002	000	001	999
8548232	8598227	8648221	49999	999	998	997	997	996	996	995	994	994
9048156	9098146	9148134	993	993	992	992	991	990	990	990	988	988
9548023	9598007	9647990	988	987	986	986	986	984	984	984	983	982
0047833	0097810	0147788	982	981	981	980	980	978	979	977	978	976
0547585	0597557	0647528	49977	975	975	974	974	973	973	972	971	971
1047279	1097246	1147211	971	969	969	969	968	967	967	967	965	965
1546916	1596877	1646837	965	964	963	963	963	961	961	961	960	959
2046496	2096451	2146405	959	958	958	957	957	956	955	955	954	954
2546018	2595967	2645915	953	952	952	951	951	950	950	949	948	948
3045483	3095426	3145369	948	946	947	945	945	945	944	943	943	942
3544890	3594827	3644764	941	941	941	940	939	939	938	937	937	937
4044240	4094171	4144103	936	935	935	934	933	933	933	931	932	930
4543532	4593458	4643384	930	930	929	928	928	927	927	926	926	924
5042767	5092687	5142607	925	924	923	922	922	922	921	920	920	919
5541944	5591859	5641773	49919	918	917	917	917	915	915	915	914	914
6041065	6090974	6140882	912	913	911	912	910	910	910	909	908	908
6540128	6590031	6639933	907	906	906	906	905	904	904	903	902	902
7039133	7089030	7138927	902	900	901	899	900	898	898	897	897	897
7538081	7587973	7637864	895	895	895	894	893	893	892	892	891	891
8036972	8086858	8136743	889	890	889	888	888	887	886	886	885	885
8535806	8585686	8635566	884	884	883	883	882	881	881	880	880	879
9034582	9084456	9134330	878	878	877	877	876	876	875	874	874	874
9533301	9583170	9633038	872	873	871	871	871	870	869	869	868	868
0031963	0081826	0131688	867	866	866	865	865	864	864	863	862	862
0530567	0580425	0630281	49861	861	860	860	859	858	858	858	856	856
1029114	1078966	1128817	856	855	854	854	854	852	852	852	851	850
1527604	1577450	1627296	850	850	848	848	848	847	846	846	846	844
2026037	2075877	2125717	844	844	843	842	842	842	840	840	840	839
2524413	2574247	2624081	838	838	838	836	836	836	835	834	834	833
3022731	3072560	3122388	833	832	832	831	830	830	829	829	828	828
3520993	3570816	3620638	827	826	826	825	825	824	824	823	822	822
4019197	4069014	4118831	821	821	820	819	819	819	818	817	817	816
4517344	4567155	4616966	815	815	815	814	813	813	812	811	811	811
5015434	5065239	5115045	809	810	808	809	807	807	807	805	806	804
5513466	5563266	5613066	49804	804	803	802	802	802	800	800	800	799
6011442	6061236	6111030	798	798	797	797	796	796	795	794	794	793
6509360	6559149	6608937	793	792	792	791	790	790	789	789	788	788
7007222	7057005	7106787	787	786	786	785	785	784	784	783	782	782
7505026	7554803	7604580	781	781	780	780	779	778	778	777	777	776
8002773	8052545	8102316	776	775	774	774	774	772	772	772	771	771
8500464	8550230	8599995	769	770	768	769	767	767	767	766	765	765
8998097	9047857	9097617	764	763	763	763	762	761	761	760	760	759
9495673	9545428	9595182	758	758	758	756	756	756	755	755	754	753
9993192	0042941	0092689	753	752	752	751	750	750	749	749	748	748
0490655	0540398	0590140	49747	747	746	745	745	744	744	743	742	742
0988060	1037797	1087534	742	740	741	739	739	739	738	737	737	736
1485408	1535140	1584871	736	735	735	734	733	733	732	732	731	731
1982700	2032426	2082151	730	729	729	728	728	727	727	726	725	725
2479934	2529654	2579374	724	724	723	723	722	721	721	720	720	719
2977111	3026826	3076540	719	718	717	717	717	715	715	715	714	714
3474232	3523941	3573649	713	712	712	711	710	711	709	709	708	708
3971296	4020999	4070702	707	707	706	706	705	704	704	703	703	702
4468303	4518000	4567697	701	701	701	699	700	698	699	697	697	696
4965252	5014944	5064636	696	696	694	694	694	693	692	692	692	690
5462146	5511832	5561517	691	689	689	689	687	688	687	686	685	685

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8740	9415114326	5164017	5213706	5263395	5313084	5362771	5412459
41	5611202	5660887	5710571	5760254	5809937	5859619	5909301
42	6108022	6157700	6207379	6257056	6306733	6356410	6406086
43	6604784	6654457	6704130	6753802	6803473	6853144	6902814
44	7101489	7151157	7200824	7250490	7300156	7349821	7399485
45	7598138	7647800	7697461	7747122	7796782	7846441	7896100
46	8094730	8144386	8194042	8243697	8293351	8343005	8392658
47	8591265	8640916	8690565	8740215	8789863	8839512	8889159
48	9087744	9137388	9187033	9236676	9286319	9335962	9385603
49	9584165	9633804	9683443	9733081	9782718	9832355	9881991
8750	9420080530	0130164	0179796	0229429	0279060	0328691	0378322
51	0576838	0626466	0676093	0725720	0775346	0824971	0874596
52	1073090	1122712	1172333	1221954	1271575	1321194	1370814
53	1569285	1618901	1668517	1718132	1767747	1817361	1866974
54	2065423	2115033	2164644	2214253	2263862	2313471	2363078
55	2561504	2611109	2660714	2710318	2759921	2809524	2859126
56	3057529	3107128	3156727	3206325	3255923	3305520	3355117
57	3553497	3603091	3652684	3702276	3751868	3801460	3851051
58	4049409	4098997	4148584	4198171	4247757	4297343	4346928
59	4545263	4594846	4644428	4694009	4743590	4793170	4842749
8760	9425041062	5090638	5140215	5189790	5239365	5288940	5338513
61	5536803	5586374	5635945	5685515	5735084	5784653	5834221
62	6032488	6082054	6131619	6181183	6230747	6280310	6329872
63	6528117	6577677	6627236	6676794	6726353	6775910	6825467
64	7023689	7073243	7122796	7172349	7221902	7271454	7321005
65	7519204	7568753	7618301	7667848	7717395	7766941	7816486
66	8014663	8064206	8113748	8163290	8212831	8262371	8311911
67	8510066	8559603	8609139	8658675	8708211	8757746	8807280
68	9005411	9054943	9104474	9154004	9203534	9253063	9302592
69	9500701	9550227	9599752	9649277	9698801	9748324	9797847
8770	9429995934	$\overline{0045454}$	$\overline{0094973}$	$\overline{0144493}$	$\overline{0194011}$	$\overline{0243529}$	$\overline{0293046}$
71	9430491110	0540625	0590139	0639652	0689165	0738677	0788189
72	0986230	1035739	1085247	1134755	1184262	1233769	1283275
73	1481294	1530797	1580300	1629802	1679303	1728804	1778305
74	1976301	2025798	2075295	2124792	2174288	2223783	2273278
75	2471251	2520743	2570235	2619726	2669216	2718706	2768195
76	2966146	3015632	3065118	3114603	3164088	3213572	3263055
77	3460984	3510464	3559944	3609424	3658903	3708381	3757859
78	3955765	4005240	4054715	4104189	4153662	4203135	4252607
79	4450490	4499960	4549429	4598897	4648365	4697832	4747298
8780	9434945159	4994623	5044086	5093549	5143011	5192472	5241933
81	5439772	5489230	5538687	5588144	5637601	5687057	5736512
82	5934328	5983780	6033232	6082684	6132134	6181585	6231034
83	6428828	6478274	6527721	6577166	6626612	6676056	6725500
84	6923271	6972712	7022153	7071593	7121033	7170472	7219910
85	7417658	7467094	7516529	7565964	7615397	7664831	7714264
86	7911989	7961419	8010849	8060278	8109706	8159134	8208561
87	8406264	8455688	8505112	8554535	8603958	8653380	8702802
88	8900482	8949901	8999319	9048737	9098154	9147571	9196987
89	9394645	9444058	9493470	9542882	9592294	9641705	9691115
8790	9439888751	9938158	9987565	$\overline{0036972}$	$\overline{0086377}$	$\overline{0135783}$	$\overline{0185187}$
91	9440382801	0432202	0481604	0531005	0580405	0629804	0679203
92	0876794	0926190	0975586	1024981	1074376	1123770	1173163
93	1370732	1420122	1469512	1518902	1568291	1617679	1667067
94	1864613	1913998	1963382	2012766	2062150	2111532	2160915
95	2358438	2407817	2457196	2506575	2555952	2605329	2654706
96	2852207	2901581	2950954	3000327	3049699	3099070	3148441
97	3345920	3395288	3444656	3494023	3543389	3592755	3642120
98	3839576	3888939	3938301	3987662	4037023	4086384	4135743
99	4333177	4382534	4431890	4481246	4530602	4579956	4629310
8800	4826722	4876073	4925424	4974774	5024124	5073473	5122821

OF NUMBERS.

Logarithms 9415114326–9445270864.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5462146	5511832	5561517	49691	689	689	689	687	688	687	686	685	685
5958982	6008662	6058342	685	684	683	683	682	682	681	680	680	680
6455761	6505436	6555110	678	679	677	677	677	676	675	675	674	674
6952484	7002153	7051821	673	673	672	671	671	670	670	669	668	668
7449149	7498813	7548476	668	667	666	666	665	664	664	664	663	662
7945758	7995416	8045073	662	661	661	660	659	659	658	658	657	657
8442311	8491963	8541614	656	656	655	654	654	653	653	652	651	651
8938806	8988453	9038098	651	649	650	648	649	647	647	647	645	646
9435245	9484886	9534526	644	645	643	643	643	641	642	641	640	639
9931627	9981262	0030896	639	639	638	637	637	636	636	635	634	634
0427952	0477581	0527210	49634	632	633	631	631	631	630	629	629	628
0924220	0973844	1023467	628	627	627	626	625	625	624	624	623	623
1420432	1470050	1519668	622	621	621	621	619	620	618	618	618	617
1916587	1966200	2015812	616	616	615	615	614	613	613	613	612	611
2412686	2462292	2511899	610	611	609	609	609	607	608	606	607	605
2908727	2958329	3007929	605	605	604	603	603	602	602	601	602	600
3404713	3454308	3503903	599	599	598	598	597	597	596	595	595	594
3900641	3950231	3999820	594	593	592	592	592	591	590	590	589	589
4396513	4446097	4495680	588	587	587	586	586	585	585	584	583	583
4892328	4941907	4991484	583	582	581	581	580	579	579	579	577	578
5388087	5437660	5487232	49576	577	575	575	575	573	574	573	572	571
5883789	5933356	5982922	571	571	570	569	569	568	568	567	566	566
6379434	6428996	6478557	566	565	564	564	563	562	562	562	561	560
6875023	6924579	6974134	560	559	558	559	557	557	556	556	555	555
7370556	7420106	7469655	554	553	553	553	552	551	551	550	549	549
7866031	7915576	7965120	549	548	547	547	546	545	545	545	544	543
8361451	8410990	8460528	543	542	542	541	540	540	540	539	538	538
8856814	8906347	8955879	537	536	536	536	535	534	534	533	532	532
9352120	9401647	9451174	532	531	530	530	529	529	528	527	527	527
9847370	9896892	9946413	526	525	525	524	523	523	523	522	521	521
0342563	0392079	0441595	49520	519	520	518	518	517	517	516	516	515
0837700	0887211	0936721	515	514	513	513	512	512	511	511	510	509
1332780	1382285	1431790	509	508	508	507	507	506	505	505	505	504
1827804	1877304	1926803	503	503	502	501	501	501	499	500	499	498
2322772	2372266	2421759	497	497	497	496	495	495	494	494	493	492
2817683	2867171	2916659	492	492	491	490	490	489	488	488	488	487
3312538	3362020	3411502	486	486	485	485	484	483	483	482	482	482
3807337	3856813	3906289	480	480	480	479	478	478	478	476	476	476
4302079	4351550	4401020	475	475	474	473	473	472	472	471	470	470
4796764	4846230	4895695	470	469	468	468	467	466	466	466	465	464
5291394	5340854	5390313	49464	463	463	462	461	461	461	460	459	459
5785967	5835421	5884875	458	457	457	457	456	455	455	454	454	453
6280483	6329932	6379380	452	452	452	450	451	449	449	449	448	448
6774944	6824387	6873829	446	447	445	446	444	444	444	443	442	442
7269348	7318785	7368222	441	441	440	440	439	438	438	437	437	436
7763696	7813128	7862559	436	435	435	433	434	433	432	432	431	430
8257988	8307414	8356839	430	430	429	428	428	427	427	426	425	425
8752223	8801643	8851063	424	424	423	423	422	422	421	420	420	419
9246402	9295817	9345231	419	418	418	417	417	416	415	415	414	414
9740525	9789934	9839343	413	412	412	412	411	410	410	409	409	408
0234592	0283995	0333398	49407	407	407	405	406	404	405	403	403	403
0728602	0778000	0827397	401	402	401	400	399	399	399	398	397	397
1222556	1271949	1321340	396	396	395	395	394	393	393	393	391	392
1716454	1765841	1815227	390	390	390	389	388	388	387	387	386	386
2210296	2259677	2309058	385	384	384	384	382	383	381	381	381	380
2704082	2753458	2802833	379	379	379	377	377	377	376	376	375	374
3197812	3247182	3296551	374	373	373	372	371	371	371	370	369	369
3691485	3740850	3790213	368	368	367	366	366	365	365	365	363	363
4185103	4234461	4283819	363	362	361	361	361	359	360	358	358	358
4678664	4728017	4777370	357	356	356	356	354	354	354	353	353	352
5172169	5221517	5270864	351	351	350	350	349	348	348	348	347	346

Numbers 88000–88609. LOGARITHMS

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8800	9444826722	4876073	4925424	4974774	5024124	5073473	5122821
1	5320210	5369556	5418901	5468246	5517590	5566933	5616276
2	5813642	5862982	5912322	5961661	6011000	6060337	6109675
3	6307019	6356353	6405687	6455021	6504353	6553686	6603017
4	6800339	6849668	6898996	6948324	6997651	7046978	7096304
5	7293603	7342926	7392249	7441571	7490893	7540214	7589535
6	7786811	7836129	7885446	7934763	7984079	8033394	8082709
7	8279963	8329276	8378587	8427898	8477209	8526519	8575828
8	8773060	8822366	8871672	8920978	8970282	9019587	9068890
9	9266100	9315401	9364701	9414001	9463300	9512599	9561897
8810	9449759084	9808379	9857674	9906968	9956262	0005555	0054848
11	9450252012	0301302	0350591	0399880	0449168	0498456	0547743
12	0744885	0794169	0843453	0892736	0942018	0991300	1040581
13	1237701	1286980	1336258	1385535	1434812	1484088	1533364
14	1730462	1779735	1829007	1878279	1927550	1976821	2026091
15	2223166	2272434	2321701	2370967	2420233	2469498	2518762
16	2715815	2765077	2814338	2863599	2912859	2962118	3011377
17	3208408	3257664	3306920	3356175	3405429	3454683	3503937
18	3700945	3750196	3799446	3848695	3897944	3947192	3996440
19	4193426	4242671	4291916	4341159	4390403	4439646	4488888
8820	9454685851	4735091	4784330	4833568	4882806	4932043	4981280
21	5178221	5227455	5276688	5325921	5375153	5424385	5473616
22	5670534	5719763	5768990	5818218	5867444	5916670	5965896
23	6162792	6212015	6261237	6310459	6359680	6408900	6458120
24	6654994	6704211	6753428	6802644	6851860	6901074	6950289
25	7147141	7196352	7245563	7294774	7343983	7393193	7442402
26	7639231	7688437	7737643	7786847	7836052	7885255	7934459
27	8131266	8180466	8229666	8278865	8328064	8377262	8426460
28	8623245	8672440	8721634	8770828	8820021	8869214	8918406
29	9115168	9164357	9213546	9262734	9311922	9361109	9410295
8830	9459607036	9656219	9705403	9754585	9803767	9852949	9902130
31	9460098848	0148026	0197203	0246380	0295557	0344733	0393908
32	0590604	0639776	0688948	0738120	0787291	0836461	0885631
33	1082304	1131471	1180638	1229804	1278969	1328134	1377298
34	1573949	1623111	1672272	1721432	1770592	1819751	1868909
35	2065538	2114694	2163850	2213004	2262159	2311312	2360465
36	2557072	2606222	2655372	2704521	2753670	2802818	2851965
37	3048550	3097695	3146839	3195982	3245126	3294268	3343410
38	3539972	3589111	3638250	3687388	3736526	3785663	3834799
39	4031339	4080473	4129606	4178738	4227870	4277002	4326132
8840	9464522650	4571778	4620906	4670033	4719159	4768285	4817410
41	5013906	5063028	5112150	5161272	5210392	5259513	5308632
42	5505106	5554223	5603339	5652455	5701570	5750685	5799799
43	5996250	6045362	6094472	6143583	6192692	6241802	6290910
44	6487339	6536445	6585550	6634655	6683759	6732863	6781966
45	6978372	7027473	7076572	7125672	7174770	7223868	7272966
46	7469350	7518445	7567539	7616633	7665726	7714818	7763910
47	7960273	8009362	8058451	8107539	8156626	8205713	8254800
48	8451140	8500223	8549306	8598389	8647471	8696552	8745633
49	8941951	8991029	9040107	9089184	9138260	9187336	9236411
8850	9469432707	9481780	9530852	9579923	9628994	9678064	9727134
51	9923407	9972474	0021541	0070607	0119672	0168737	0217801
52	9470414053	0463114	0512175	0561235	0610295	0659354	0708413
53	0904642	0953698	1002753	1051808	1100863	1149916	1198969
54	1395176	1444227	1493277	1542326	1591375	1640423	1689470
55	1885655	1934700	1983744	2032788	2081831	2130874	2179916
56	2376079	2425118	2474157	2523195	2572233	2621270	2670306
57	2866447	2915481	2964514	3013546	3062579	3111610	3160641
58	3356759	3405788	3454815	3503843	3552869	3601895	3650921
59	3847017	3896040	3945062	3994083	4043104	4092125	4141145
8860	4337219	4386236	4435253	4484269	4533284	4582299	4631314

OF NUMBERS. Logarithms 9444826722–9474778353.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
5172169	5221517	5270864	49351	351	350	350	349	348	348	348	347	346
5665618	5714960	5764302	346	345	345	344	343	343	342	342	342	340
6159012	6208348	6257683	340	340	339	339	337	338	337	336	335	336
6652349	6701679	6751009	334	334	334	332	333	331	332	330	330	330
7145630	7194955	7244279	329	328	328	327	327	326	326	325	324	324
7638855	7688174	7737493	323	323	322	322	321	321	320	319	319	318
8132024	8181337	8230651	318	317	317	316	315	315	315	313	314	312
8625137	8674445	8723753	313	311	311	311	310	309	309	308	308	307
9118194	9167496	9216798	306	306	306	304	305	303	304	302	302	302
9611195	9660492	9709788	301	300	300	299	299	298	298	297	296	296
0104140	0153431	0202722	49295	295	294	294	293	293	292	291	291	290
0597029	0646315	0695600	290	289	289	288	288	287	286	286	285	285
1089862	1139142	1188422	284	284	283	282	282	281	281	280	280	279
1582639	1631914	1681188	279	278	277	277	276	276	275	275	274	274
2075361	2124630	2173898	273	272	272	271	271	270	270	269	268	268
2568026	2617290	2666553	268	267	266	266	265	264	264	264	263	262
3060636	3109894	3159151	262	261	261	260	259	259	259	258	257	257
3553190	3602442	3651694	256	256	255	254	254	254	253	252	252	251
4045688	4094934	4144180	251	250	249	249	248	248	248	246	246	246
4538130	4587371	4636611	245	245	243	244	243	242	242	241	240	240
5030516	5079751	5128986	49240	239	238	238	237	237	236	235	235	235
5522846	5572076	5621306	234	233	233	232	232	231	230	230	230	228
6015121	6064345	6113569	229	227	228	226	226	226	225	224	224	223
6507340	6556558	6605777	223	222	222	221	220	220	220	218	219	217
6999503	7048716	7097928	217	217	216	216	214	215	214	213	212	213
7491610	7540817	7590025	211	211	211	209	210	209	208	208	207	208
7983661	8032863	8082065	206	206	204	205	203	204	202	202	202	201
8475657	8524854	8574050	200	200	199	199	198	198	197	197	196	195
8967597	9016788	9065978	195	194	194	193	193	192	191	191	190	190
9459481	9508667	9557852	189	189	188	188	187	186	186	186	185	184
9951310	0000490	0049669	49183	184	182	182	182	181	180	180	179	179
0443083	0492257	0541431	178	177	177	177	176	175	175	174	174	173
0934800	0983969	1033137	172	172	172	171	170	170	169	169	168	167
1426462	1475625	1524787	167	167	166	165	165	164	164	163	162	162
1918068	1967225	2016382	162	161	160	160	159	158	159	157	157	156
2409618	2458770	2507921	156	156	154	155	153	153	153	152	151	151
2901112	2950259	2999405	150	150	149	149	148	147	147	147	146	145
3392551	3441692	3490833	145	144	143	144	142	142	141	141	141	139
3883935	3933070	3982205	139	139	138	138	137	136	136	135	135	134
4375263	4424392	4473522	134	133	132	132	132	130	131	129	130	128
4866535	4915659	4964783	49128	128	127	126	126	125	125	124	124	123
5357752	5406870	5455988	122	122	122	120	121	119	120	118	118	118
5848913	5898026	5947138	117	116	116	115	115	114	114	113	112	112
6340018	6389126	6438233	112	110	111	109	110	108	108	108	107	106
6831068	6880170	6929272	106	105	105	104	104	103	102	102	102	100
7322063	7371159	7420255	101	099	100	098	098	098	097	096	096	095
7813002	7862093	7911183	095	094	094	093	092	092	092	091	090	090
8303885	8352971	8402055	089	089	088	087	087	087	085	086	084	085
8794713	8843793	8892872	083	083	083	082	081	081	080	080	079	079
9285486	9334560	9383634	078	078	077	076	076	075	075	074	074	073
9776203	9825272	9874340	49073	072	071	071	070	070	069	069	068	067
0266865	0315928	0364991	067	067	066	065	065	064	064	063	063	062
0757471	0806529	0855586	061	061	060	060	059	059	058	058	057	056
1248022	1297074	1346125	056	055	055	055	053	053	053	052	051	051
1738517	1787564	1836610	051	050	049	049	048	047	047	047	046	045
2228957	2277998	2327039	045	044	044	043	043	042	041	041	041	040
2719342	2768378	2817412	039	039	038	038	037	036	036	036	034	035
3209671	3258701	3307731	034	033	032	033	031	031	030	030	030	028
3699945	3748970	3797994	029	027	028	026	026	026	024	025	024	023
4190164	4239183	4288201	023	022	021	021	021	020	019	019	018	018
4680327	4729341	4778353	017	017	016	015	015	015	013	014	012	013

Numbers 88600–89209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8860	9474337219	4386236	4435253	4484269	4533284	4582299	4631314
61	4827366	4876377	4925388	4974399	5023409	5072418	5121427
62	5317457	5366463	5415469	5464474	5513478	5562482	5611485
63	5807493	5856494	5905494	5954493	6003492	6052490	6101488
64	6297474	6346469	6395463	6444457	6493451	6542444	6591436
65	6787399	6836389	6885378	6934366	6983354	7032341	7081328
66	7277270	7326254	7375237	7424220	7473202	7522184	7571165
67	7767085	7816063	7865041	7914018	7962995	8011971	8060947
68	8256844	8305817	8354790	8403762	8452733	8501704	8550674
69	8746549	8795516	8844483	8893450	8942415	8991381	9040345
8870	9479236198	9285160	9334122	9383082	9432043	9481002	9529961
71	9725792	9774749	9823705	9872660	9921615	9970569	0019522
72	9480215331	0264282	0313233	0362182	0411132	0460080	0509028
73	0704815	0753761	0802705	0851650	0900593	0949536	0998479
74	1194244	1243184	1292123	1341062	1390000	1438937	1487875
75	1683617	1732552	1781485	1830419	1879351	1928283	1977215
76	2172936	2221864	2270793	2319720	2368647	2417574	2466500
77	2662199	2711122	2760045	2808967	2857889	2906810	2955730
78	3151407	3200325	3249242	3298159	3347075	3395990	3444905
79	3640560	3689472	3738384	3787295	3836206	3885116	3934025
8880	9484129658	4178565	4227471	4276376	4325282	4374186	4423090
81	4618701	4667602	4716503	4765403	4814302	4863201	4912100
82	5107688	5156584	5205479	5254374	5303268	5352162	5401055
83	5596621	5645511	5694401	5743290	5792179	5841067	5889954
84	6085499	6134384	6183268	6232151	6281034	6329917	6378799
85	6574321	6623201	6672079	6720957	6769835	6818712	6867589
86	7063089	7111963	7160836	7209709	7258581	7307452	7356323
87	7551802	7600670	7649538	7698405	7747271	7796137	7845003
88	8040459	8089322	8138184	8187046	8235907	8284768	8333628
89	8529062	8577919	8626776	8675632	8724488	8773343	8822197
8890	9489017610	9066461	9115313	9164163	9213013	9261863	9310712
91	9506102	9554949	9603794	9652640	9701484	9750328	9799172
92	9994540	0043381	0092221	0141061	0189900	0238739	0287577
93	9490482923	0531758	0580593	0629427	0678261	0727094	0775927
94	0971251	1020081	1068910	1117739	1166567	1215395	1264222
95	1459524	1508348	1557172	1605995	1654818	1703640	1752462
96	1947742	1996561	2045379	2094197	2143014	2191831	2240647
97	2435906	2484719	2533532	2582344	2631156	2679967	2728777
98	2924014	2972822	3021629	3070436	3119242	3168048	3216853
99	3412068	3460870	3509672	3558473	3607274	3656074	3704874
8900	9493900066	3948863	3997660	4046455	4095251	4144045	4192839
1	4388010	4436802	4485593	4534383	4583173	4631962	4680750
2	4875899	4924685	4973471	5022256	5071040	5119823	5168607
3	5363734	5412514	5461294	5510073	5558852	5607630	5656408
4	5851513	5900288	5949063	5997836	6046610	6095382	6144155
5	6339238	6388007	6436776	6485545	6534313	6583080	6631847
6	6826908	6875672	6924435	6973198	7021961	7070722	7119484
7	7314523	7363282	7412040	7460797	7509554	7558310	7607066
8	7802084	7850837	7899589	7948341	7997092	8045843	8094594
9	8289589	8338337	8387084	8435830	8484576	8533322	8582067
8910	9498777040	8825782	8874524	8923265	8972005	9020745	9069485
11	9264437	9313173	9361909	9410645	9459380	9508114	9556848
12	9751778	9800509	9849240	9897970	9946700	9995429	0044157
13	9500239065	0287791	0336516	0385241	0433965	0482688	0531411
14	0726298	0775018	0823737	0872457	0921175	0969893	1018611
15	1213475	1262190	1310904	1359618	1408331	1457043	1505755
16	1700598	1749307	1798016	1846724	1895432	1944139	1992846
17	2187666	2236370	2285074	2333776	2382478	2431180	2479881
18	2674680	2723379	2772077	2820774	2869470	2918166	2966862
19	3161639	3210332	3259025	3307716	3356408	3405098	3453789
8920	3648544	3697231	3745918	3794604	3843290	3891976	3940660

OF NUMBERS. Logarithms 9474337219–9504086711.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4680327	4729341	4778353	49017	017	016	015	015	015	013	014	012	013
5170435	5219443	5268450	011	011	011	010	009	009	008	008	007	007
5660488	5709490	5758492	006	006	005	004	004	003	003	002	002	001
6150485	6199482	6248478	001	000	999	999	998	998	997	997	996	996
6640428	6689419	6738409	48995	994	994	994	993	992	992	991	990	990
7130314	7179300	7228285	990	989	988	988	987	987	986	986	985	985
7620146	7669126	7718106	984	983	983	982	982	981	981	980	980	979
8109922	8158897	8207871	978	978	977	977	976	976	975	975	974	973
8599643	8648612	8697581	973	973	972	971	971	970	969	969	969	968
9089309	9138273	9187236	967	967	967	965	966	964	964	964	963	962
9578920	9627878	9676836	48962	962	960	961	959	959	959	958	958	956
0068476	0117428	0166380	957	956	955	955	954	953	954	952	952	951
0557976	0606923	0655869	951	951	949	950	948	948	948	947	946	946
1047421	1096362	1145303	946	944	945	943	943	943	942	941	941	941
1536811	1585747	1634682	940	939	939	938	937	938	936	936	935	935
2026146	2075076	2124006	935	933	934	932	932	932	931	930	930	930
2515426	2564351	2613275	928	929	927	927	927	926	926	925	924	924
3004650	3053570	3102489	923	923	922	922	921	920	920	920	919	918
3493820	3542734	3591647	918	917	917	916	915	915	915	914	913	913
3982934	4031843	4080750	912	912	911	911	910	909	909	909	907	908
4471994	4520896	4569799	48907	906	905	906	904	904	904	902	903	902
4960998	5009895	5058792	901	901	900	899	899	899	898	897	897	896
5449947	5498839	5547730	896	895	895	894	894	893	892	892	891	891
5938841	5987728	6036613	890	890	889	889	888	887	887	887	885	886
6427680	6476561	6525442	885	884	883	883	883	882	881	881	881	879
6916465	6965340	7014215	880	878	878	878	877	877	876	875	875	874
7405194	7454064	7502933	874	873	873	872	871	871	871	870	869	869
7893868	7942732	7991596	868	868	867	866	866	866	865	864	864	863
8382487	8431346	8480204	863	862	862	861	861	860	859	859	858	858
8871051	8919905	8968757	857	857	856	856	855	854	854	854	852	853
9359560	9408408	9457256	48851	852	850	850	850	849	848	848	848	846
9848015	9896857	9945699	847	845	846	844	844	844	843	842	842	841
0336414	0385251	0434087	841	840	840	839	839	838	837	837	836	836
0824759	0873590	0922421	835	835	834	834	833	833	832	831	831	830
1313048	1361874	1410699	830	829	829	828	828	827	826	826	825	825
1801283	1850103	1898923	824	824	823	823	822	822	821	820	820	819
2289462	2338277	2387092	819	818	818	817	817	816	815	815	815	814
2777587	2826397	2875206	813	813	812	812	811	810	810	810	809	808
3265657	3314461	3363265	808	807	807	806	806	805	804	804	804	803
3753673	3802471	3851269	802	802	801	801	800	800	799	798	798	797
4241633	4290426	4339218	48797	797	795	796	794	794	794	793	792	792
4729538	4778326	4827113	792	791	790	790	789	788	788	788	787	786
5217389	5266171	5314953	786	786	785	784	783	784	782	782	782	781
5705185	5753962	5802738	780	780	779	779	778	778	777	777	776	775
6192926	6241697	6290468	775	775	773	774	772	773	771	771	771	770
6680613	6729378	6778143	769	769	769	768	767	767	766	765	765	765
7168244	7217004	7265764	764	763	763	763	761	762	760	760	760	759
7655821	7704576	7753330	759	758	757	757	756	756	755	755	754	754
8143343	8192093	8240841	753	752	752	751	751	751	749	750	748	748
8630811	8679555	8728298	748	747	746	746	746	745	744	744	743	742
9118224	9166962	9215700	48742	742	741	740	740	740	739	738	738	737
9605582	9654314	9703047	736	736	736	735	734	734	734	732	733	731
0092885	0141612	0190339	731	731	730	730	729	728	728	727	727	726
0580134	0628855	0677577	726	725	725	724	723	723	723	721	722	721
1067328	1116044	1164760	720	719	720	718	718	718	717	716	716	715
1554467	1603178	1651888	715	714	714	713	712	712	712	711	710	710
2041552	2090257	2138962	709	709	708	708	707	707	706	705	705	704
2528582	2577282	2625981	704	704	702	702	702	701	701	700	699	699
3015557	3064252	3112946	699	698	697	696	696	696	695	695	694	693
3502478	3551167	3599856	693	693	691	692	690	691	689	689	689	688
3989344	4038028	4086711	687	687	686	686	686	684	684	684	683	683

Numbers 89200–89809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8920	9503648544	3697231	3745918	3794604	3843290	3891976	3940660
21	4135394	4184076	4232757	4281438	4330118	4378798	4427477
22	4622189	4670866	4719542	4768217	4816892	4865566	4914240
23	5108930	5157601	5206271	5254941	5303611	5352280	5400948
24	5595616	5644282	5692947	5741611	5790275	5838939	5887602
25	6082248	6130908	6179568	6228227	6276885	6325543	6374201
26	6568825	6617480	6666134	6714788	6763441	6812093	6860745
27	7055348	7103997	7152646	7201294	7249942	7298589	7347235
28	7541816	7590460	7639103	7687746	7736388	7785030	7833671
29	8028230	8076868	8125506	8174143	8222780	8271416	8320052
8930	9508514589	8563222	8611854	8660486	8709117	8757748	8806378
31	9000894	9049521	9098148	9146774	9195400	9244026	9292650
32	9487144	9535766	9584388	9633008	9681629	9730249	9778868
33	9973340	0021956	0070573	0119188	0167803	0216417	0265031
34	9510459481	0508093	0556703	0605313	0653923	0702532	0751140
35	0945568	0994174	1042779	1091384	1139988	1188592	1237195
36	1431601	1480201	1528801	1577400	1625999	1674597	1723195
37	1917579	1966174	2014768	2063362	2111955	2160548	2209140
38	2403503	2452093	2500681	2549270	2597858	2646445	2695031
39	2889373	2937957	2986540	3035123	3083705	3132287	3180868
8940	9513375188	3423766	3472344	3520922	3569499	3618075	3666651
41	3860949	3909522	3958094	4006666	4055238	4103809	4152379
42	4346655	4395223	4443790	4492357	4540923	4589488	4638053
43	4832308	4880870	4929431	4977993	5026553	5075113	5123673
44	5317905	5366462	5415018	5463574	5512129	5560684	5609238
45	5803449	5852000	5900551	5949102	5997651	6046200	6094749
46	6288938	6337484	6386030	6434575	6483119	6531663	6580206
47	6774373	6822914	6871454	6919993	6968532	7017071	7065608
48	7259754	7308289	7356824	7405358	7453891	7502424	7550957
49	7745081	7793610	7842140	7890668	7939196	7987724	8036251
8950	9518230353	8278877	8327401	8375924	8424447	8472969	8521491
51	8715571	8764090	8812608	8861126	8909643	8958160	9006676
52	9200735	9249249	9297761	9346274	9394786	9443297	9491808
53	9685845	9734353	9782860	9831367	9879874	9928379	9976885
54	9520170900	0219403	0267905	0316407	0364908	0413408	0461908
55	0655902	0704399	0752896	0801392	0849887	0898382	0946877
56	1140849	1189341	1237832	1286323	1334813	1383302	1431791
57	1625742	1674228	1722714	1771200	1819684	1868168	1916652
58	2110581	2159062	2207542	2256022	2304502	2352980	2401458
59	2595366	2643841	2692316	2740791	2789265	2837738	2886211
8960	9523080097	3128567	3177036	3225505	3273974	3322442	3370909
61	3564773	3613238	3661702	3710166	3758629	3807091	3855553
62	4049396	4097855	4146314	4194772	4243230	4291687	4340143
63	4533964	4582418	4630871	4679324	4727776	4776228	4824679
64	5018479	5066927	5115375	5163822	5212269	5260716	5309161
65	5502939	5551382	5599825	5648267	5696708	5745149	5793589
66	5987345	6035783	6084220	6132657	6181093	6229528	6277963
67	6471698	6520130	6568562	6616993	6665423	6713853	6762283
68	6955996	7004423	7052849	7101275	7149700	7198125	7246549
69	7440240	7488662	7537083	7585503	7633923	7682342	7730761
8970	9527924430	7972847	8021262	8069677	8118091	8166505	8214919
71	8408567	8456977	8505388	8553797	8602206	8650615	8699023
72	8892649	8941054	8989459	9037863	9086267	9134670	9183073
73	9376678	9425077	9473477	9521876	9570274	9618671	9667069
74	9860652	9909046	9957440	0005834	0054227	0102619	0151011
75	9530344573	0392962	0441350	0489738	0538126	0586513	0634899
76	0828439	0876823	0925206	0973589	1021971	1070352	1118733
77	1312252	1360630	1409008	1457385	1505762	1554138	1602514
78	1796011	1844384	1892756	1941128	1989499	2037870	2086240
79	2279716	2328083	2376450	2424817	2473182	2521548	2569913
8980	2763367	2811729	2860090	2908451	2956812	3005172	3053531

OF NUMBERS.

Logarithms 9503648544–9533198607.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3989344	4038028	4086711	48687	687	686	686	686	684	684	684	683	683
4476156	4524834	4573512	682	681	681	680	680	679	679	678	678	677
4962913	5011586	5060258	677	676	675	675	674	674	673	673	672	672
5449616	5498283	5546950	671	670	670	670	669	668	668	667	667	666
5936264	5984926	6033587	666	665	664	664	664	663	662	662	661	661
6422858	6471514	6520170	660	660	659	658	658	658	657	656	656	655
6909397	6958048	7006698	655	654	654	653	652	652	652	651	650	650
7395881	7444527	7493172	649	649	648	648	647	646	646	646	645	644
7882311	7930951	7979591	644	643	643	642	642	641	640	640	640	639
8368687	8417321	8465955	638	638	637	637	636	636	635	634	634	634
8855008	8903637	8952266	48633	632	632	631	631	630	630	629	629	628
9341275	9389898	9438521	627	627	626	626	626	624	625	623	623	623
9827487	9876105	9924723	622	622	620	621	620	619	619	618	618	617
0313645	0362257	0410870	616	617	615	615	614	614	614	612	613	611
0799748	0848355	0896962	612	610	610	610	609	608	608	607	607	606
1285797	1334399	1383000	606	605	605	604	604	603	602	602	601	601
1771792	1820388	1868984	600	600	599	599	598	598	597	596	596	595
2257732	2306323	2354913	595	594	594	593	593	592	592	591	590	590
2743618	2792203	2840788	590	588	589	588	587	586	587	585	585	585
3229449	3278029	3326609	584	583	583	582	582	581	581	580	580	579
3715226	3763801	3812375	48578	578	578	577	576	576	575	575	574	574
4200949	4249518	4298087	573	572	572	572	571	570	570	569	569	568
4686618	4735181	4783745	568	567	567	566	565	565	565	563	564	563
5172232	5220790	5269348	562	561	562	560	560	560	559	558	558	557
5657792	5706345	5754897	557	556	556	555	555	554	554	553	552	552
6143297	6191845	6240392	551	551	551	549	549	549	548	548	547	546
6628749	6677291	6725832	546	546	545	544	544	543	543	542	541	541
7114146	7162682	7211219	541	540	539	539	539	537	538	536	537	535
7599489	7648020	7696551	535	535	534	533	533	533	532	531	531	530
8084777	8133303	8181828	529	530	528	528	528	527	526	526	525	525
8570012	8618532	8667052	48524	524	523	523	522	522	521	520	520	519
9055192	9103707	9152221	519	518	518	517	517	516	516	515	514	514
9540318	9588827	9637336	514	512	513	512	511	511	510	509	509	509
0025389	0073894	0122397	508	507	507	507	505	506	504	505	503	503
0510407	0558906	0607404	503	502	502	501	500	500	499	499	498	498
0995371	1043864	1092357	497	497	496	495	495	495	494	493	493	492
1480280	1528768	1577255	492	491	491	490	489	489	489	488	487	487
1965135	2013618	2062100	486	486	486	484	484	484	483	483	482	481
2449936	2498413	2546890	481	480	480	480	478	478	478	477	477	476
2934683	2983155	3031626	475	475	475	474	473	473	472	472	471	471
3419376	3467842	3516308	48470	469	469	469	468	467	467	466	466	465
3904015	3952476	4000936	465	464	464	463	462	462	462	461	460	460
4388599	4437055	4485510	459	459	458	458	457	456	456	456	455	454
4873130	4921580	4970030	454	453	453	452	452	451	451	450	450	449
5357607	5406051	5454495	448	448	447	447	447	445	446	444	444	444
5842029	5890468	5938907	443	443	442	441	441	440	440	439	439	438
6326398	6374831	6423265	438	437	437	436	435	435	435	433	434	433
6810712	6859141	6907568	432	432	431	430	430	430	429	429	427	428
7294973	7343396	7391818	427	426	426	425	425	424	424	423	422	422
7779179	7827597	7876014	422	421	420	420	419	419	418	418	417	416
8263332	8311744	8360156	48417	415	415	414	414	414	413	412	412	411
8747430	8795837	8844243	410	411	409	409	409	408	407	407	406	406
9231475	9279876	9328277	405	405	404	404	403	403	402	401	401	401
9715465	9763861	9812257	399	400	399	398	397	398	396	396	396	395
0199402	0247793	0296183	394	394	394	393	392	392	391	391	390	390
0683285	0731670	0780055	389	388	388	388	387	386	386	385	385	384
1167114	1215494	1263873	384	383	383	382	381	381	381	380	379	379
1650889	1699263	1747637	378	378	377	377	376	376	375	374	374	374
2134610	2182979	2231348	373	372	372	371	371	370	370	369	369	368
2618277	2666641	2715004	367	367	367	365	366	365	364	364	363	363
3101890	3150249	3198607	362	361	361	361	360	359	359	359	358	357

Numbers 89800–90409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
8980	9532763367	2811729	2860090	2908451	2956812	3005172	3053531
81	3246964	3295321	3343677	3392033	3440388	3488742	3537096
82	3730507	3778859	3827209	3875560	3923910	3972259	4020607
83	4213997	4262343	4310688	4359033	4407378	4455721	4504065
84	4697433	4745773	4794113	4842453	4890792	4939130	4987468
85	5180814	5229150	5277484	5325819	5374152	5422485	5470818
86	5664143	5712472	5760802	5809131	5857459	5905786	5954114
87	6147417	6195741	6244065	6292389	6340712	6389034	6437356
88	6630637	6678957	6727275	6775593	6823911	6872228	6920544
89	7113804	7162118	7210431	7258744	7307056	7355368	7403679
8990	9537596917	7645226	7693533	7741841	7790148	7838454	7886759
91	8079977	8128280	8176582	8224884	8273185	8321486	8369786
92	8562982	8611280	8659577	8707873	8756169	8804465	8852760
93	9045934	9094226	9142518	9190809	9239100	9287390	9335679
94	9528832	9577119	9625406	9673691	9721977	9770261	9818545
95	9540011677	0059958	0108239	0156520	0204800	0253079	0301358
96	0494468	0542744	0591019	0639294	0687569	0735843	0784116
97	0977205	1025476	1073746	1122015	1170285	1218553	1266821
98	1459888	1508154	1556419	1604683	1652947	1701210	1749473
99	1942518	1990778	2039038	2087297	2135555	2183813	2232070
9000	9542425094	2473349	2521603	2569857	2618110	2666362	2714614
1	2907617	2955866	3004115	3052363	3100611	3148858	3197105
2	3390086	3438330	3486573	3534816	3583059	3631300	3679542
3	3872501	3920740	3968978	4017216	4065453	4113689	4161925
4	4354863	4403097	4451329	4499561	4547793	4596024	4644255
5	4837172	4885399	4933627	4981854	5030080	5078306	5126531
6	5319426	5367649	5415871	5464092	5512313	5560534	5608753
7	5801627	5849845	5898061	5946277	5994493	6042708	6090922
8	6283775	6331987	6380198	6428409	6476619	6524829	6573038
9	6765869	6814076	6862282	6910487	6958692	7006896	7055100
9010	9547247910	7296111	7344311	7392512	7440711	7488910	7537108
11	7729897	7778093	7826288	7874483	7922677	7970870	8019063
12	8211831	8260021	8308211	8356400	8404589	8452777	8500965
13	8693711	8741896	8790080	8838264	8886448	8934631	8982813
14	9175537	9223717	9271896	9320075	9368253	9416431	9464608
15	9657311	9705485	9753659	9801832	9850005	9898177	9946349
16	9550139030	0187199	0235368	0283536	0331703	0379870	0428037
17	0620697	0668860	0717024	0765186	0813348	0861510	0909671
18	1102310	1150468	1198626	1246783	1294940	1343096	1391252
19	1583869	1632022	1680175	1728327	1776478	1824629	1872779
9020	9552065375	2113523	2161670	2209817	2257963	2306108	2354253
21	2546828	2594971	2643112	2691254	2739394	2787535	2835674
22	3028228	3076365	3124501	3172637	3220772	3268907	3317042
23	3509574	3557705	3605836	3653967	3702097	3750227	3798356
24	3990866	4038993	4087119	4135244	4183369	4231493	4279616
25	4472106	4520227	4568347	4616467	4664587	4712705	4760824
26	4953292	5001408	5049523	5097637	5145751	5193865	5241978
27	5434425	5482535	5530645	5578754	5626863	5674971	5723079
28	5915504	5963609	6011714	6059818	6107921	6156024	6204126
29	6396530	6444630	6492729	6540828	6588926	6637023	6685120
9030	9556877503	6925597	6973691	7021785	7069877	7117970	7166061
31	7358423	7406512	7454600	7502688	7550776	7598863	7646949
32	7839289	7887373	7935456	7983539	8031621	8079702	8127783
33	8320102	8368181	8416259	8464336	8512413	8560489	8608565
34	8800862	8848935	8897008	8945080	8993151	9041222	9089293
35	9281569	9329637	9377704	9425771	9473837	9521902	9569967
36	9762222	9810285	9858347	9906408	9954469	0002529	0050589
37	9560242823	0290880	0338936	0386993	0435048	0483103	0531157
38	0723370	0771422	0819473	0867524	0915574	0963624	1011673
39	1203864	1251910	1299956	1348002	1396047	1444091	1492135
9040	1684305	1732346	1780387	1828427	1876466	1924505	1972544

OF NUMBERS. Logarithms 9532763367-9562116656.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3101890	3150249	3198607	48362	361	361	361	360	359	359	359	358	357
3585450	3633803	3682155	357	356	356	355	354	354	354	353	352	352
4068956	4117303	4165650	352	350	351	350	349	348	349	347	347	347
4552407	4600750	4649091	346	345	345	345	343	344	342	343	341	342
5035806	5084142	5132479	340	340	340	339	338	338	338	336	337	335
5519150	5567481	5615812	336	334	335	333	333	333	332	331	331	331
6002440	6050766	6099092	329	330	329	328	327	328	326	326	326	325
6485677	6533998	6582318	324	324	324	323	322	322	321	321	320	319
6968860	7017175	7065490	320	318	318	318	317	316	316	315	315	314
7451989	7500299	7548608	314	313	313	312	312	311	310	310	309	309
7935064	7983369	8031673	48309	307	308	307	306	305	305	305	304	304
8418086	8466385	8514684	303	302	302	301	301	300	300	299	299	298
8901054	8949348	8997641	298	297	296	296	296	295	294	294	293	293
9383969	9432257	9480545	292	292	291	291	290	289	290	288	288	287
9866829	9915112	9963395	287	287	285	286	284	284	284	283	283	282
0349636	0397914	0446191	281	281	281	280	279	279	278	278	277	277
0832389	0880662	0928933	276	275	275	275	274	273	273	273	271	272
1315089	1363356	1411622	271	270	269	270	268	268	268	267	267	266
1797735	1845996	1894258	266	265	264	264	263	263	262	261	262	260
2280327	2328583	2376839	260	260	259	258	258	257	257	256	256	255
2762866	2811117	2859367	48255	254	254	253	252	252	252	251	250	250
3245351	3293597	3341842	249	249	248	248	247	247	246	246	245	244
3727782	3776023	3824262	244	243	243	243	241	242	240	241	239	239
4210160	4258395	4306630	239	238	238	237	236	236	235	235	235	233
4692485	4740714	4788943	234	232	232	232	231	231	230	229	229	229
5174755	5222980	5271203	227	228	227	226	226	225	224	225	223	223
5656973	5705191	5753410	223	222	221	221	221	219	220	218	219	217
6139136	6187350	6235563	218	216	216	216	215	214	214	214	213	212
6621247	6669455	6717662	212	211	211	210	210	209	209	208	207	207
7103303	7151506	7199708	207	206	205	205	204	204	203	203	202	202
7585306	7633504	7681701	48201	200	201	199	199	198	198	198	197	196
8067256	8115448	8163640	196	195	195	194	193	193	193	192	192	190
8549152	8597339	8645525	191	190	189	189	188	188	187	187	186	186
9030995	9079176	9127357	185	184	184	184	183	182	182	181	181	180
9512784	9560960	9609136	180	179	179	178	178	177	176	176	176	175
9994520	0042691	0090861	174	174	173	173	172	172	171	171	170	169
0476202	0524368	0572533	169	169	168	167	167	167	165	166	165	164
0957831	1005991	1054151	163	164	162	162	162	161	160	160	160	159
1439407	1487562	1535716	158	158	157	157	156	156	155	155	154	153
1920929	1969078	2017227	153	153	152	151	151	150	150	149	149	148
2402398	2450542	2498685	48148	147	147	146	145	145	145	144	143	143
2883813	2931952	2980090	143	141	142	140	141	139	139	139	138	138
3365175	3413309	3461441	137	136	136	135	135	135	133	134	132	133
3846484	3894612	3942740	131	131	131	130	130	129	128	128	128	126
4327740	4375862	4423984	127	126	125	125	124	123	124	122	122	122
4808942	4857059	4905176	121	120	120	120	118	119	118	117	117	116
5290090	5338202	5386314	116	115	114	114	114	113	112	112	112	111
5771186	5819292	5867399	110	110	109	109	108	108	107	106	107	105
6252228	6300329	6348430	105	105	104	103	103	102	102	101	101	100
6733217	6781313	6829408	100	099	099	098	097	097	097	096	095	095
7214152	7262243	7310333	48094	094	094	092	093	091	091	091	090	090
7695035	7743120	7791205	089	088	088	088	087	086	086	085	085	084
8175864	8223944	8272023	084	083	083	082	081	081	081	080	079	079
8656640	8704715	8752789	079	078	077	077	076	076	075	075	074	073
9137363	9185432	9233501	073	073	072	071	071	071	070	069	069	068
9618032	9666096	9714160	068	067	067	066	065	065	065	064	064	062
0098648	0146707	0194765	063	062	061	061	060	060	059	059	058	058
0579211	0627265	0675318	057	056	057	055	055	054	054	054	053	052
1059721	1107769	1155817	052	051	051	050	050	049	048	048	048	047
1540178	1588221	1636263	046	046	046	045	044	044	043	043	042	042
2020582	2068619	2116656	041	041	040	039	039	039	038	037	037	036

Numbers 90400–91009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9040	9561684305	1732346	1780387	1828427	1876466	1924505	1972544
41	2164692	2212728	2260764	2308798	2356833	2404866	2452900
42	2645027	2693058	2741088	2789117	2837146	2885174	2933202
43	3125308	3173334	3221358	3269382	3317406	3365429	3413452
44	3605537	3653557	3701576	3749595	3797613	3845631	3893648
45	4085712	4133727	4181741	4229754	4277767	4325780	4373792
46	4565834	4613843	4661852	4709860	4757868	4805875	4853882
47	5045903	5093907	5141911	5189914	5237916	5285918	5333919
48	5525919	5573918	5621916	5669914	5717911	5765907	5813903
49	6005882	6053876	6101868	6149861	6197852	6245844	6293834
9050	9566485792	6533780	6581768	6629755	6677741	6725727	6773713
51	6965649	7013632	7061614	7109596	7157577	7205558	7253538
52	7445453	7493430	7541407	7589384	7637360	7685335	7733310
53	7925204	7973176	8021148	8069119	8117089	8165059	8213029
54	8404902	8452868	8500835	8548801	8596766	8644731	8692695
55	8884547	8932508	8980469	9028430	9076390	9124349	9172308
56	9364138	9412095	9460050	9508006	9555960	9603915	9651868
57	9843677	9891628	9939579	9987529	0035478	0083427	0131375
58	9570323163	0371109	0419054	0466999	0514943	0562887	0610830
59	0802597	0850537	0898477	0946416	0994355	1042293	1090231
9060	9571281977	1329912	1377846	1425781	1473714	1521647	1569579
61	1761304	1809234	1857163	1905092	1953020	2000948	2048875
62	2240578	2288503	2336427	2384350	2432273	2480195	2528118
63	2719800	2767719	2815638	2863556	2911474	2959391	3007307
64	3198969	3246883	3294796	3342709	3390621	3438533	3486444
65	3678084	3725993	3773901	3821809	3869716	3917622	3965528
66	4157147	4205051	4252953	4300856	4348758	4396659	4444560
67	4636157	4684055	4731953	4779850	4827747	4875643	4923538
68	5115115	5163007	5210900	5258791	5306683	5354573	5402464
69	5594019	5641907	5689794	5737680	5785566	5833451	5881336
9070	9576072871	6120753	6168635	6216516	6264396	6312277	6360156
71	6551669	6599546	6647423	6695299	6743174	6791049	6838923
72	7030415	7078287	7126158	7174029	7221899	7269769	7317638
73	7509109	7556975	7604841	7652706	7700571	7748436	7796299
74	7987749	8035610	8083471	8131331	8179191	8227050	8274908
75	8466337	8514193	8562048	8609903	8657757	8705611	8753464
76	8944872	8992723	9040573	9088422	9136271	9184120	9231968
77	9423354	9471200	9519045	9566889	9614733	9662576	9710419
78	9901784	9949624	9997464	0045303	0093141	0140979	0188817
79	9580380161	0427996	0475830	0523664	0571497	0619330	0667162
9080	9580858485	0906315	0954144	1001972	1049800	1097628	1145454
81	1336757	1384581	1432405	1480228	1528051	1575873	1623694
82	1814976	1862795	1910613	1958431	2006248	2054065	2101882
83	2293142	2340956	2388769	2436581	2484394	2532205	2580016
84	2771255	2819064	2866872	2914679	2962486	3010293	3058098
85	3249316	3297120	3344922	3392724	3440526	3488327	3536128
86	3727325	3775123	3822920	3870717	3918513	3966309	4014105
87	4205281	4253073	4300865	4348657	4396448	4444239	4492029
88	4683184	4730971	4778758	4826544	4874330	4922116	4969900
89	5161034	5208816	5256598	5304379	5352160	5399940	5447719
9090	9585638832	5686609	5734386	5782161	5829937	5877712	5925486
91	6116578	6164349	6212120	6259891	6307661	6355431	6403200
92	6594271	6642037	6689803	6737568	6785333	6833097	6880861
93	7071911	7119672	7167433	7215193	7262952	7310711	7358470
94	7549499	7597255	7645010	7692765	7740519	7788273	7836026
95	8027034	8074785	8122535	8170284	8218033	8265782	8313530
96	8504517	8552262	8600007	8647751	8695495	8743239	8790981
97	8981947	9029687	9077427	9125166	9172905	9220643	9268380
98	9459325	9507060	9554794	9602528	9650261	9697994	9745726
99	9936650	9984380	0032109	0079838	0127566	0175293	0223020
9100	9590413923	0461648	0509371	0557095	0604818	0652540	0700262

OF NUMBERS. Logarithms 9561684305–9590843424.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
2020582	2068619	2116656	48041	041	040	039	039	039	038	037	037	036
2500932	2548964	2596996	036	036	034	035	033	034	032	032	032	031
2981230	3029256	3077283	031	030	029	029	028	028	028	026	027	025
3461474	3509495	3557516	026	024	024	024	023	023	022	021	021	021
3941665	3989681	4037697	020	019	019	018	018	017	017	016	016	015
4421803	4469814	4517824	015	014	013	013	013	012	011	011	010	010
4901888	4949894	4997899	009	009	008	008	007	007	006	006	005	004
5381920	5429920	5477920	004	004	003	002	002	001	001	000	000	999
5861899	5909894	5957888	47999	998	998	997	996	996	996	995	994	994
6341825	6389814	6437803	994	992	993	991	992	990	991	989	989	989
6821697	6869682	6917666	47988	988	987	986	986	986	984	985	984	983
7301517	7349496	7397475	983	982	982	981	981	980	979	979	979	978
7781284	7829258	7877231	977	977	977	976	975	975	974	974	973	973
8260998	8308966	8356934	972	972	971	970	970	970	969	968	968	968
8740659	8788622	8836584	966	967	966	965	965	964	964	963	962	963
9220266	9268224	9316182	961	961	961	960	959	959	958	958	958	956
9699821	9747774	9795726	957	955	956	954	955	953	953	953	952	951
0179323	0227270	0275217	951	951	950	949	949	948	948	947	947	946
0658772	0706714	0754656	946	945	945	944	944	943	942	942	942	941
1138168	1186105	1234041	940	940	939	939	938	938	937	937	936	936
1617511	1665443	1713374	47935	934	935	933	933	932	932	932	931	930
2096802	2144728	2192653	930	929	929	928	928	927	927	926	925	925
2576039	2623960	2671880	925	924	923	923	922	923	921	921	920	920
3055224	3103139	3151054	919	919	918	918	917	916	917	915	915	915
3534355	3582265	3630175	914	913	913	912	912	911	911	910	910	909
4013434	4061339	4109243	909	908	908	907	906	906	906	905	904	904
4492460	4540360	4588259	904	902	903	902	901	901	900	900	899	898
4971433	5019327	5067221	898	898	897	897	896	895	895	894	894	894
5450353	5498242	5546131	892	893	891	892	890	891	889	889	889	888
5929221	5977104	6024988	888	887	886	886	885	885	885	883	884	883
6408035	6455914	6503792	47882	882	881	880	881	879	879	879	878	877
6886797	6934670	6982543	877	877	876	875	875	874	874	873	873	872
7365506	7413374	7461242	872	871	871	870	870	869	868	868	868	867
7844163	7892025	7939888	866	866	865	865	865	863	864	862	863	861
8322766	8370624	8418481	861	861	860	860	859	858	858	858	857	856
8801317	8849169	8897021	856	855	855	854	854	853	853	852	852	851
9279815	9327662	9375509	851	850	849	849	849	848	847	847	847	845
9758261	9806102	9853943	846	845	844	844	843	843	842	841	841	841
0236653	0284490	0332326	840	840	839	838	838	838	836	837	836	835
0714993	0762825	0810655	835	834	834	833	833	832	831	832	830	830
1193281	1241107	1288932	47830	829	828	828	828	826	827	826	825	825
1671516	1719336	1767156	824	824	823	823	822	821	822	820	820	820
2149698	2197513	2245328	819	818	818	817	817	817	816	815	815	814
2627827	2675637	2723446	814	813	812	813	811	811	811	810	809	809
3105904	3153708	3201513	809	808	807	807	807	805	806	804	805	803
3583928	3631727	3679526	804	802	802	802	801	801	800	799	799	799
4061899	4109694	4157487	798	797	797	796	796	796	794	795	793	794
4539818	4587607	4635396	792	792	792	791	791	790	789	789	789	788
5017685	5065468	5113252	787	787	786	786	786	784	785	783	784	782
5495498	5543277	5591055	782	782	781	781	780	779	779	779	778	777
5973260	6021033	6068805	47777	777	775	776	775	774	774	773	772	773
6450968	6498736	6546504	771	771	771	770	770	769	768	768	768	767
6928624	6976387	7024149	766	766	765	765	764	764	763	763	762	762
7406228	7453985	7501742	761	761	760	759	759	759	758	757	757	757
7883779	7931531	7979283	756	755	755	754	754	753	753	752	752	751
8361277	8409024	8456771	751	750	749	749	749	748	747	747	747	746
8838724	8886465	8934206	745	745	744	744	744	742	743	741	741	741
9316117	9363854	9411590	740	740	739	739	738	737	737	737	736	735
9793458	9841189	9888920	735	734	734	733	733	732	732	731	731	730
0270747	0318473	0366198	730	729	729	728	727	727	727	726	725	725
0747983	0795704	0843424	725	723	724	723	722	722	721	721	720	720

Numbers 91000–91609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9100	9590413923	0461648	0509371	0557095	0604818	0652540	0700262
1	0891144	0938863	0986581	1034300	1082017	1129734	1177451
2	1368312	1416026	1463739	1511452	1559164	1606876	1654587
3	1845427	1893136	1940844	1988552	2036259	2083965	2131672
4	2322491	2370194	2417897	2465599	2513301	2561002	2608703
5	2799501	2847200	2894897	2942594	2990291	3037987	3085683
6	3276460	3324153	3371845	3419537	3467228	3514919	3562610
7	3753366	3801053	3848741	3896427	3944114	3991799	4039484
8	4230219	4277902	4325584	4373265	4420946	4468627	4516308
9	4707021	4754698	4802375	4850051	4897727	4945402	4993076
9110	9595183770	5231442	5279113	5326784	5374455	5422125	5469794
11	5660466	5708133	5755799	5803465	5851130	5898795	5946459
12	6137111	6184772	6232433	6280094	6327754	6375413	6423072
13	6613703	6661359	6709015	6756670	6804325	6851979	6899633
14	7090242	7137894	7185544	7233194	7280844	7328493	7376141
15	7566730	7614376	7662021	7709666	7757310	7804954	7852597
16	8043165	8090806	8138446	8186085	8233725	8281363	8329001
17	8519548	8567183	8614818	8662453	8710087	8757720	8805353
18	8995879	9043509	9091139	9138768	9186396	9234024	9281652
19	9472157	9519782	9567407	9615030	9662654	9710277	9757899
9120	9599948383	9996003	0043622	0091241	0138859	0186477	0234094
21	9600424557	0472172	0519786	0567399	0615012	0662625	0710237
22	0900679	0948288	0995897	1043505	1091113	1138720	1186327
23	1376749	1424353	1471956	1519559	1567162	1614764	1662365
24	1852766	1900365	1947963	1995561	2043158	2090755	2138351
25	2328731	2376325	2423918	2471511	2519103	2566694	2614285
26	2804644	2852233	2899821	2947408	2994995	3042581	3090167
27	3280505	3328089	3375671	3423253	3470835	3518416	3565997
28	3756314	3803892	3851470	3899047	3946623	3994199	4041774
29	4232071	4279644	4327216	4374788	4422359	4469930	4517500
9130	9604707775	4755343	4802910	4850477	4898043	4945608	4993173
31	5183428	5230990	5278552	5326113	5373674	5421235	5468794
32	5659028	5706585	5754142	5801698	5849254	5896809	5944363
33	6134576	6182128	6229680	6277231	6324781	6372331	6419880
34	6610073	6657619	6705166	6752711	6800257	6847801	6895345
35	7085517	7133058	7180599	7228140	7275680	7323219	7370758
36	7560909	7608445	7655981	7703517	7751051	7798586	7846119
37	8036249	8083780	8131311	8178841	8226371	8273900	8321428
38	8511537	8559063	8606589	8654113	8701638	8749162	8796685
39	8986773	9034294	9081814	9129334	9176853	9224372	9271890
9140	9609461957	9509473	9556988	9604502	9652016	9699530	9747043
41	9937089	9984600	0032110	0079619	0127128	0174636	0222144
42	9610412170	0459675	0507179	0554683	0602187	0649690	0697193
43	0887198	0934698	0982197	1029696	1077194	1124692	1172190
44	1362174	1409669	1457163	1504657	1552150	1599642	1647135
45	1837098	1884588	1932077	1979565	2027053	2074541	2122028
46	2311970	2359455	2406939	2454422	2501905	2549387	2596869
47	2786791	2834270	2881749	2929227	2976704	3024182	3071658
48	3261559	3309033	3356507	3403980	3451452	3498924	3546396
49	3736276	3783745	3831213	3878681	3926148	3973615	4021081
9150	9614210941	4258404	4305867	4353330	4400792	4448254	4495715
51	4685554	4733012	4780470	4827927	4875384	4922840	4970296
52	5160114	5207568	5255020	5302473	5349924	5397376	5444826
53	5634624	5682072	5729519	5776966	5824413	5871859	5919304
54	6109081	6156524	6203966	6251408	6298849	6346290	6393730
55	6583486	6630924	6678361	6725798	6773234	6820670	6868105
56	7057840	7105273	7152705	7200136	7247567	7294997	7342427
57	7532142	7579569	7626996	7674422	7721848	7769273	7816698
58	8006392	8053814	8101236	8148657	8196077	8243498	8290917
59	8480590	8528007	8575424	8622840	8670255	8717670	8765084
9160	8954737	9002148	9049560	9096971	9144381	9191791	9239200

OF NUMBERS. Logarithms 9590413923–9619381424.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
0747983	0795704	0843424	47725	723	724	723	722	722	721	721	720	720
1225167	1272882	1320597	719	718	719	717	717	717	716	715	715	715
1702298	1750008	1797718	714	713	713	712	712	711	711	710	710	709
2179377	2227082	2274787	709	708	708	707	706	707	705	705	705	704
2656404	2704103	2751803	703	703	702	702	701	701	701	699	700	698
3133378	3181072	3228766	699	697	697	697	696	696	695	694	694	694
3610299	3657989	3705678	693	692	692	691	691	691	689	690	689	688
4087169	4134853	4182536	687	688	686	687	685	685	685	684	683	683
4563987	4611665	4659343	683	682	681	681	681	681	679	678	678	678
5040751	5088424	5136097	677	677	676	676	675	674	675	673	673	673
5517463	5565131	5612799	47672	671	671	671	670	669	669	668	668	667
5994123	6041786	6089449	667	666	666	665	665	664	664	663	663	662
6470731	6518389	6566046	661	661	661	660	659	659	659	658	657	657
6947286	6994939	7042591	656	656	655	655	654	654	653	653	652	651
7423789	7471437	7519084	652	650	650	650	649	648	648	648	647	646
7900240	7947882	7995524	646	645	645	644	644	643	643	642	642	641
8376639	8424276	8471912	641	640	639	640	638	638	638	637	636	636
8852985	8900617	8948248	635	635	635	634	633	633	632	632	631	631
9329279	9376906	9424532	630	630	629	628	628	628	627	627	626	625
9805521	9853142	9900763	625	625	623	624	623	622	622	621	621	620
0281711	0329327	0376942	47620	619	619	618	618	617	617	616	615	615
0757848	0805459	0853069	615	614	613	613	613	612	611	611	610	610
1233933	1281539	1329144	609	609	608	608	607	607	606	606	605	605
1709966	1757567	1805167	604	603	603	603	602	601	601	601	600	599
2185947	2233542	2281137	599	598	598	597	597	596	596	595	595	594
2661876	2709466	2757055	594	593	593	592	591	591	591	590	589	589
3137752	3185337	3232922	589	588	587	587	586	586	585	585	585	583
3613577	3661157	3708736	584	582	582	582	581	581	580	580	579	578
4089349	4136924	4184497	578	578	577	576	576	575	575	575	573	574
4565069	4612639	4660207	573	572	572	571	571	570	569	570	568	568
5040738	5088301	5135865	47568	567	567	566	565	565	565	563	564	563
5516354	5563912	5611470	562	562	561	561	561	559	560	558	558	558
5991917	6039471	6087024	557	557	556	556	555	554	554	554	553	552
6467429	6514978	6562525	552	552	551	550	550	549	549	549	547	548
6942889	6990432	7037975	546	547	545	546	544	544	544	543	543	542
7418297	7465835	7513372	541	541	541	540	539	539	539	538	537	537
7893653	7941185	7988717	536	536	536	534	535	533	534	532	532	532
8368956	8416484	8464011	531	531	530	530	529	528	528	528	527	526
8844208	8891730	8939252	526	526	524	525	524	523	523	522	522	521
9319408	9366925	9414441	521	520	520	519	519	518	518	517	516	516
9794555	9842067	9889579	47516	515	514	514	514	513	512	512	512	510
0269651	0317158	0364664	511	510	509	509	508	508	507	507	506	506
0744695	0792196	0839697	505	504	504	504	503	503	502	501	501	501
1219686	1267183	1314679	500	499	499	498	498	498	496	497	496	495
1694626	1742117	1789608	495	494	494	493	492	493	491	491	491	490
2169514	2217000	2264486	490	489	488	488	488	487	486	486	486	484
2644350	2691831	2739311	485	484	483	483	482	482	481	481	480	480
3119134	3166610	3214085	479	479	478	477	478	476	476	476	475	474
3593866	3641337	3688807	474	474	473	472	472	472	470	471	470	469
4068547	4116012	4163477	469	468	468	467	467	466	466	465	465	464
4543175	4590635	4638095	47463	463	463	462	462	461	460	460	460	459
5017752	5065206	5112661	458	458	457	457	456	456	456	454	455	453
5492276	5539726	5587175	454	452	453	451	452	450	450	450	449	449
5966749	6014194	6061638	448	447	447	447	446	445	445	445	444	443
6441170	6488609	6536048	443	442	442	441	441	440	440	439	439	438
6915539	6962973	7010407	438	437	437	436	436	435	434	434	434	433
7389857	7437286	7484714	433	432	431	431	430	430	430	429	428	428
7864122	7911546	7958969	427	427	426	426	425	425	424	424	423	423
8338336	8385755	8433173	422	422	421	420	421	419	419	419	418	417
8812498	8859912	8907324	417	417	416	415	415	414	414	414	412	413
9286608	9334017	9381424	411	412	411	410	410	409	408	409	407	407

Numbers 91600–92209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9160	9618954737	9002148	9049560	9096971	9144381	9191791	9239200
61	9428831	9476238	9523644	9571050	9618455	9665859	9713263
62	9902874	9950276	9997677	0045077	0092477	0139876	0187275
63	9620376866	0424262	0471658	0519053	0566448	0613842	0661236
64	0850805	0898196	0945587	0992977	1040367	1087756	1135144
65	1324693	1372079	1419464	1466849	1514234	1561617	1609001
66	1798529	1845910	1893290	1940670	1988049	2035428	2082806
67	2272314	2319689	2367064	2414439	2461813	2509186	2556559
68	2746046	2793417	2840787	2888156	2935525	2982893	3030261
69	3219727	3267093	3314457	3361822	3409185	3456548	3503911
9170	9623693357	3740717	3788076	3835435	3882794	3930152	3977510
71	4166934	4214289	4261644	4308998	4356351	4403704	4451056
72	4640461	4687810	4735160	4782508	4829857	4877204	4924551
73	5113935	5161280	5208624	5255967	5303310	5350653	5397995
74	5587358	5634697	5682036	5729375	5776713	5824050	5871387
75	6060729	6108064	6155397	6202731	6250063	6297396	6344727
76	6534049	6581378	6628707	6676035	6723362	6770689	6818016
77	7007317	7054641	7101964	7149287	7196610	7243932	7291253
78	7480534	7527852	7575171	7622488	7669806	7717123	7764439
79	7953699	8001012	8048325	8095638	8142950	8190262	8237573
9180	9628426812	8474120	8521429	8568736	8616043	8663349	8710655
81	8899874	8947177	8994480	9041782	9089084	9136386	9183686
82	9372884	9420183	9467480	9514777	9562074	9609370	9656666
83	9845843	9893136	9940429	9987721	0035012	0082303	0129594
84	9630318751	0366038	0413326	0460613	0507899	0555185	0602470
85	0791606	0838889	0886171	0933453	0980734	1028015	1075295
86	1264411	1311688	1358966	1406242	1453518	1500794	1548069
87	1737164	1784436	1831708	1878980	1926251	1973521	2020791
88	2209865	2257133	2304399	2351666	2398931	2446197	2493461
89	2682515	2729777	2777039	2824300	2871561	2918821	2966081
9190	9633155114	3202371	3249627	3296883	3344139	3391394	3438648
91	3627661	3674913	3722164	3769415	3816666	3863915	3911165
92	4100157	4147404	4194650	4241896	4289141	4336385	4383630
93	4572601	4619843	4667084	4714324	4761565	4808804	4856043
94	5044994	5092231	5139467	5186702	5233937	5281171	5328405
95	5517336	5564567	5611798	5659028	5706258	5753487	5800716
96	5989626	6036852	6084078	6131303	6178528	6225752	6272975
97	6461865	6509086	6556306	6603526	6650746	6697965	6745184
98	6934052	6981268	7028484	7075699	7122913	7170127	7217340
99	7406189	7453399	7500610	7547819	7595029	7642237	7689446
9200	9637878273	7925479	7972684	8019889	8067093	8114297	8161500
1	8350307	8397508	8444708	8491907	8539106	8586305	8633503
2	8822289	8869485	8916680	8963874	9011068	9058261	9105454
3	9294220	9341411	9388600	9435790	9482978	9530167	9577354
4	9766100	9813285	9860470	9907654	9954837	0002021	0049203
5	9640237928	0285108	0332288	0379467	0426645	0473823	0521001
6	0709706	0756880	0804055	0851229	0898402	0945575	0992747
7	1181432	1228601	1275771	1322939	1370108	1417275	1464442
8	1653106	1700271	1747435	1794599	1841762	1888924	1936086
9	2124730	2171889	2219048	2266207	2313365	2360522	2407679
9210	9642596302	2643456	2690610	2737764	2784917	2832069	2879221
11	3067823	3114972	3162121	3209269	3256417	3303564	3350711
12	3539293	3586437	3633581	3680724	3727867	3775009	3822150
13	4010712	4057851	4104989	4152127	4199265	4246402	4293538
14	4482079	4529213	4576347	4623479	4670612	4717744	4764875
15	4953396	5000524	5047653	5094780	5141908	5189035	5236161
16	5424661	5471785	5518908	5566030	5613153	5660274	5707395
17	5895875	5942993	5990112	6037229	6084346	6131463	6178579
18	6367038	6414151	6461264	6508377	6555489	6602600	6649711
19	6838150	6885258	6932366	6979473	7026580	7073687	7120792
9220	7309211	7356314	7403417	7450519	7497621	7544722	7591822

OF NUMBERS. Logarithms 9618954737-9647733122.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9286608	9334017	9381424	47411	412	411	410	410	409	408	409	407	407
9760667	9808070	9855472	407	406	406	405	404	404	404	403	402	402
0234674	0282072	0329469	402	401	400	400	399	399	399	398	397	397
0708629	0756021	0803414	396	396	395	395	394	394	393	392	393	391
1182532	1229920	1277307	391	391	390	390	389	388	388	388	387	386
1656384	1703766	1751148	386	385	385	385	383	384	383	382	382	381
2130184	2177561	2224937	381	380	380	379	379	378	378	377	376	377
2603932	2651304	2698675	375	375	375	374	373	373	373	372	371	371
3077628	3124995	3172362	371	370	369	369	368	368	367	367	367	365
3551273	3598635	3645996	366	364	365	363	363	363	362	362	361	361
4024867	4072223	4119579	47360	359	359	359	358	358	357	356	356	355
4498408	4545759	4593110	355	355	354	353	353	352	352	351	351	351
4971898	5019244	5066590	349	350	348	349	347	347	347	346	346	345
5445337	5492678	5540018	345	344	343	343	343	342	342	341	340	340
5918723	5966059	6013394	339	339	339	338	337	337	336	336	335	335
6392058	6439389	6486719	335	333	334	332	333	331	331	331	330	330
6865342	6912668	6959993	329	329	328	327	327	327	326	326	325	324
7338574	7385894	7433214	324	323	323	323	322	321	321	320	320	320
7811754	7859070	7906384	318	319	317	318	317	316	315	316	314	315
8284883	8332193	8379503	313	313	313	312	312	311	310	310	310	309
8757961	8805266	8852570	47308	309	307	307	306	306	306	305	304	304
9230987	9278286	9325586	303	303	302	302	302	300	301	299	300	298
9703961	9751256	9798550	299	297	297	297	296	296	295	295	294	293
0176884	0224173	0271462	293	293	292	291	291	291	290	289	289	289
0649755	0697039	0744323	287	288	287	286	286	285	285	284	284	283
1122575	1169854	1217133	283	282	282	281	281	280	280	279	279	278
1595343	1642617	1689891	277	278	276	276	276	275	274	274	274	273
2068060	2115329	2162597	272	272	272	271	270	270	269	269	268	268
2540726	2587989	2635253	268	266	267	265	266	264	265	263	264	262
3013340	3060598	3107856	262	262	261	261	260	260	259	258	258	258
3485902	3533156	3580409	47257	256	256	256	255	254	254	254	253	252
3958413	4005662	4052910	252	251	251	251	249	250	248	249	248	247
4430873	4478116	4525359	247	246	246	245	244	245	243	243	243	242
4903282	4950520	4997757	242	241	240	241	239	239	239	238	237	237
5375639	5422872	5470104	237	236	235	235	234	234	234	233	232	232
5847944	5895172	5942399	231	231	230	230	229	229	228	228	227	227
6320199	6367421	6414643	226	226	225	225	224	223	224	222	222	222
6792402	6839619	6886836	221	220	220	220	219	219	218	217	217	216
7264553	7311765	7358977	216	216	215	214	214	213	213	212	212	212
7736653	7783861	7831067	210	211	209	210	208	209	207	208	206	206
8208702	8255904	8303106	47206	205	205	204	204	203	202	202	202	201
8680700	8727897	8775093	201	200	199	199	199	198	197	197	196	196
9152646	9199838	9247029	196	195	194	194	193	193	192	192	191	191
9624541	9671728	9718914	191	189	190	188	189	187	187	187	186	186
0096385	0143567	0190748	185	185	184	183	184	182	182	182	181	180
0568178	0615354	0662530	180	180	179	178	178	178	177	176	176	176
1039919	1087090	1134261	174	175	174	173	173	172	172	171	171	171
1511609	1558775	1605941	169	170	168	169	167	167	167	166	166	165
1983248	2030409	2077570	165	164	164	163	162	162	162	161	161	160
2454836	2501992	2549147	159	159	159	158	157	157	157	156	155	155
2926372	2973523	3020673	47154	154	154	153	152	152	151	151	150	150
3397857	3445003	3492148	149	149	148	148	147	147	146	146	145	145
3869291	3916432	3963572	144	144	143	143	142	141	141	141	140	140
4340674	4387810	4434945	139	138	138	138	137	136	136	136	135	134
4812006	4859136	4906266	134	134	132	133	132	131	131	130	130	130
5283287	5330412	5377537	128	129	127	128	127	126	126	125	125	124
5754516	5801636	5848756	124	123	122	123	121	121	121	120	120	119
6225694	6272809	6319924	118	119	117	117	117	116	115	115	115	114
6696822	6743931	6791041	113	113	113	112	111	111	111	109	110	109
7167898	7215002	7262107	108	108	107	107	107	105	106	104	105	104
7638923	7686022	7733122	103	103	102	102	101	100	101	099	100	098

Numbers 92200–92809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9220	9647309211	7356314	7403417	7450519	7497621	7544722	7591822
21	7780220	7827318	7874416	7921513	7968610	8015706	8062802
22	8251179	8298272	8345364	8392456	8439548	8486639	8533729
23	8722086	8769174	8816262	8863349	8910435	8957521	9004606
24	9192943	9240026	9287108	9334190	9381271	9428352	9475432
25	9663748	9710826	9757903	9804980	9852056	9899132	9946207
26	9650134503	0181575	0228647	0275719	0322790	0369861	0416931
27	0605206	0652274	0699341	0746407	0793473	0840539	0887604
28	1075858	1122921	1169983	1217044	1264105	1311166	1358225
29	1546460	1593517	1640574	1687630	1734686	1781741	1828796
9230	9652017010	2064062	2111114	2158165	2205216	2252266	2299316
31	2487510	2534557	2581603	2628650	2675695	2722740	2769785
32	2957958	3005000	3052042	3099083	3146123	3193163	3240203
33	3428356	3475393	3522429	3569465	3616500	3663535	3710570
34	3898702	3945734	3992765	4039796	4086827	4133856	4180886
35	4368998	4416025	4463051	4510077	4557102	4604126	4651151
36	4839242	4886264	4933285	4980306	5027326	5074346	5121365
37	5309436	5356453	5403469	5450484	5497499	5544514	5591528
38	5779579	5826591	5873602	5920612	5967622	6014631	6061640
39	6249671	6296677	6343683	6390689	6437694	6484698	6531702
9240	9656719712	6766714	6813714	6860715	6907714	6954714	7001712
41	7189702	7236699	7283694	7330690	7377684	7424678	7471672
42	7659642	7706633	7753624	7800614	7847603	7894592	7941581
43	8129530	8176516	8223502	8270487	8317472	8364456	8411439
44	8599368	8646349	8693330	8740309	8787289	8834268	8881246
45	9069155	9116131	9163106	9210081	9257055	9304029	9351003
46	9538891	9585862	9632832	9679802	9726771	9773740	9820708
47	9660008576	0055542	0102507	0149472	0196436	0243400	0290363
48	0478211	0525171	0572132	0619091	0666050	0713009	0759967
49	0947794	0994750	1041705	1088660	1135614	1182567	1229520
9250	9661417327	1464278	1511228	1558177	1605126	1652075	1699023
51	1886810	1933755	1980700	2027644	2074588	2121532	2168475
52	2356241	2403181	2450121	2497061	2543999	2590938	2637875
53	2825622	2872557	2919492	2966426	3013360	3060293	3107226
54	3294952	3341882	3388812	3435741	3482669	3529598	3576525
55	3764231	3811156	3858081	3905005	3951928	3998852	4045774
56	4233459	4280380	4327299	4374218	4421137	4468055	4514972
57	4702637	4749552	4796467	4843381	4890294	4937207	4984120
58	5171764	5218674	5265584	5312493	5359401	5406309	5453216
59	5640841	5687746	5734650	5781554	5828457	5875360	5922263
9260	9666109867	6156767	6203666	6250565	6297463	6344361	6391258
61	6578842	6625737	6672631	6719525	6766418	6813311	6860203
62	7047767	7094656	7141545	7188434	7235322	7282210	7329097
63	7516641	7563525	7610409	7657293	7704176	7751058	7797941
64	7985464	8032343	8079222	8126101	8172979	8219857	8266734
65	8454237	8501111	8547985	8594858	8641731	8688604	8735476
66	8922959	8969828	9016697	9063565	9110433	9157301	9204168
67	9391630	9438495	9485358	9532222	9579085	9625947	9672809
68	9860251	9907110	9953969	0000828	0047685	0094543	0141399
69	9670328822	0375676	0422530	0469383	0516236	0563088	0609940
9270	9670797341	0844191	0891039	0937888	0984735	1031582	1078429
71	1265811	1312655	1359499	1406342	1453184	1500026	1546868
72	1734230	1781069	1827907	1874745	1921583	1968420	2015257
73	2202598	2249432	2296265	2343098	2389931	2436763	2483595
74	2670916	2717745	2764573	2811401	2858229	2905056	2951882
75	3139183	3186007	3232830	3279653	3326476	3373298	3420119
76	3607400	3654219	3701037	3747855	3794672	3841489	3888306
77	4075566	4122380	4169193	4216006	4262818	4309630	4356442
78	4543682	4590491	4637299	4684107	4730914	4777721	4824527
79	5011747	5058551	5105354	5152157	5198959	5245761	5292562
9280	5479762	5526561	5573359	5620157	5666954	5713751	5760547

OF NUMBERS.

Logarithms 964730921I–9675900933.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7638923	7686022	7733122	47103	103	102	102	101	100	101	099	100	098
8109897	8156991	8204085	098	098	097	097	096	096	095	094	094	094
8580819	8627909	8674998	093	092	092	092	091	090	090	090	089	088
9051691	9098776	9145860	088	088	087	086	086	085	085	085	084	083
9522512	9569591	9616670	083	082	082	081	081	080	080	079	079	078
9993282	0040356	0087430	078	077	077	076	076	075	075	074	074	073
0464000	0511070	0558138	072	072	072	071	071	070	069	070	068	068
0934668	0981732	1028796	068	067	066	066	066	065	064	064	064	062
1405285	1452344	1499402	063	062	061	061	061	059	060	059	058	058
1875850	1922904	1969958	057	057	056	056	055	055	054	054	054	052
2346365	2393414	2440462	46052	052	051	051	050	050	049	049	048	048
2816829	2863873	2910916	047	046	047	045	045	045	044	044	043	042
3287242	3334280	3381318	042	042	041	040	040	040	039	038	038	038
3757604	3804637	3851670	037	036	036	035	035	035	034	033	033	032
4227914	4274943	4321970	032	031	031	031	029	030	028	029	027	028
4698174	4745198	4792220	027	026	026	025	024	025	023	024	022	022
5168383	5215402	5262419	022	021	021	020	020	019	018	019	017	017
5638542	5685555	5732567	017	016	015	015	015	014	014	013	012	012
6108649	6155657	6202664	012	011	010	010	009	009	009	008	007	007
6578705	6625708	6672710	006	006	006	005	004	004	003	003	002	002
7048711	7095708	7142706	47002	000	001	999	999	998	999	997	998	996
7518665	7565658	7612650	46997	995	996	994	994	994	993	993	992	992
7988569	8035557	8082544	991	991	990	989	989	989	988	988	987	986
8458422	8505405	8552387	986	986	985	985	984	983	983	983	982	981
8928224	8975202	9022179	981	981	979	980	979	978	978	978	977	976
9397976	9444948	9491920	976	975	975	974	974	974	973	972	972	971
9867676	9914643	9961610	971	970	970	969	969	968	968	967	967	966
0337326	0384288	0431250	966	965	965	964	964	963	963	962	962	961
0806925	0853882	0900838	960	961	959	959	959	658	958	957	956	956
1276473	1323425	1370376	956	955	955	954	953	953	953	952	951	951
1745970	1792917	1839864	46951	950	949	949	949	948	947	947	947	946
2215417	2262359	2309300	945	945	944	944	944	943	942	942	941	941
2684813	2731750	2778686	940	940	940	938	539	937	938	937	936	936
3154158	3201090	3248021	935	935	934	934	933	933	932	932	931	931
3623452	3670379	3717305	930	930	929	928	929	927	927	927	926	926
4092696	4139618	4186539	925	925	924	923	924	922	922	922	921	920
4561889	4608806	4655722	921	919	919	919	918	917	917	917	916	915
5031032	5077943	5124854	915	915	914	913	913	913	912	911	911	910
5500123	5547030	5593936	910	910	909	908	908	907	907	907	906	905
5969164	6016066	6062967	905	904	904	903	903	903	901	902	901	900
6438155	6485051	6531947	46900	899	899	898	898	897	897	896	896	895
6907095	6953986	7000876	895	894	894	893	893	892	892	891	890	891
7375984	7422870	7469755	889	889	889	888	888	887	887	886	885	886
7844822	7891703	7938584	884	884	884	883	882	883	881	881	881	880
8313610	8360486	8407362	879	879	879	878	878	877	876	876	876	875
8782347	8829218	8876089	874	874	873	873	873	872	871	871	871	870
9251034	9297900	9344765	869	869	868	868	868	867	866	866	865	865
9719670	9766531	9813391	865	863	864	863	862	862	861	861	860	860
0188256	0235112	0281967	859	859	859	857	858	856	857	856	855	855
0656791	0703642	0750492	854	854	853	853	852	852	851	851	850	849
1125275	1172121	1218966	46850	848	849	847	847	847	846	846	845	845
1593709	1640550	1687390	844	844	843	842	842	842	841	841	840	840
2062093	2108928	2155763	839	838	838	838	837	837	836	835	835	835
2530426	2577256	2624086	834	833	833	833	832	832	831	830	830	830
2998708	3045533	3092358	829	828	828	828	827	826	826	825	825	825
3466940	3513760	3560580	824	823	823	823	822	821	821	820	820	820
3935121	3981937	4028752	819	818	818	817	817	817	815	816	815	814
4403252	4450063	4496873	814	813	813	812	812	812	810	811	810	809
4871333	4918138	4964943	809	808	808	807	807	806	806	805	805	804
5339363	5386163	5432963	804	803	803	802	802	801	801	800	800	799
5807343	5854138	5900933	799	798	798	797	797	796	796	795	795	794

Numbers 92800–93409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9280	9675479762	5526561	5573359	5620157	5666954	5713751	5760547
81	5947727	5994520	6041314	6088106	6134898	6181690	6228481
82	6415641	6462429	6509218	6556005	6602792	6649579	6696365
83	6883505	6930288	6977071	7023854	7070636	7117417	7164199
84	7351318	7398096	7444874	7491652	7538429	7585206	7631982
85	7819081	7865854	7912627	7959400	8006172	8052943	8099714
86	8286793	8333562	8380330	8427097	8473864	8520631	8567397
87	8754455	8801219	8847982	8894744	8941506	8988268	9035029
88	9222067	9268826	9315584	9362341	9409098	9455854	9502610
89	9689629	9736382	9783135	9829887	9876639	9923391	9970142
9290	9680157140	0203888	0250636	0297383	0344130	0390877	0437622
91	062460I	0671344	0718087	0764829	0811571	0858312	0905053
92	1092011	1138750	1185487	1232225	1278961	1325698	1372433
93	1559371	1606105	1652838	1699570	1746302	1793033	1839763
94	2026681	2073410	2120137	2166865	2213591	2260318	2307043
95	2493941	2540664	2587387	2634109	2680831	2727552	2774273
96	2961150	3007869	3054586	3101303	3148020	3194736	3241452
97	3428310	3475023	3521735	3568448	3615159	3661870	3708581
98	3895418	3942127	3988834	4035541	4082248	4128954	4175660
99	4362477	4409180	4455883	4502585	4549287	4595988	4642688
9300	9684829486	4876184	4922881	4969578	5016275	5062971	5109666
1	5296444	5343137	5389829	5436521	5483213	5529904	5576595
2	5763352	5810040	5856727	5903414	5950101	5996787	6043472
3	6230210	6276893	6323575	6370257	6416939	6463620	6510300
4	6697017	6743695	6790373	6837050	6883726	6930402	6977078
5	7163775	7210448	7257120	7303792	7350464	7397135	7443805
6	7630482	7677150	7723817	7770484	7817151	7863817	7910482
7	8097139	8143802	8190465	8237126	8283788	8330449	8377109
8	8563746	8610404	8657062	8703718	8750375	8797031	8843686
9	9030303	9076956	9123608	9170260	9216912	9263563	9310213
9310	9684968I0	9543458	9590105	9636752	9683398	9730044	9776690
11	9963266	0009909	0056552	0103194	0149835	0196476	0243116
12	9690429673	0476311	0522948	0569585	0616222	0662858	0709493
13	0896030	0942662	0989295	1035927	1082558	1129189	1175819
14	1362336	1408964	1455591	1502218	1548845	1595470	1642096
15	1828592	1875215	1921838	1968459	2015081	2061701	2108322
16	2294799	2341417	2388034	2434651	2481267	2527883	2574498
17	2760955	2807568	2854180	2900792	2947403	2994014	3040625
18	3227061	3273669	3320276	3366883	3413490	3460095	3506701
19	3693117	3739720	3786323	3832924	3879526	3926127	3972727
9320	9694159124	4205721	4252319	4298916	4345512	4392108	4438703
21	4625080	4671673	4718265	4764857	4811448	4858039	4904629
22	5090986	5137574	5184161	5230748	5277334	5323920	5370506
23	5556842	5603425	5650007	5696589	5743171	5789752	5836332
24	6022648	6069226	6115804	6162381	6208957	6255533	6302108
25	6488405	6534978	6581550	6628122	6674693	6721264	6767835
26	6954111	7000679	7047246	7093813	7140380	7186946	7233511
27	7419768	7466331	7512893	7559455	7606016	7652577	7699138
28	7885374	7931932	7978489	8025046	8071603	8118159	8164714
29	8350931	8397484	8444036	8490588	8537139	8583690	8630241
9330	9698816437	8862985	8909533	8956080	9002626	9049172	9095718
31	9281894	9328437	9374980	9421522	9468063	9514604	9561144
32	9747301	9793839	9840377	9886914	9933450	9979986	0026521
33	9700212658	0259191	0305724	0352256	0398787	0445318	0491849
34	0677965	0724493	0771021	0817548	0864074	0910600	0957126
35	1143223	1189746	1236268	1282790	1329312	1375833	1422353
36	1608430	1654948	1701466	1747983	1794499	1841015	1887531
37	2073588	2120101	2166614	2213126	2259637	2306148	2352659
38	2538696	2585204	2631712	2678219	2724725	2771231	2817737
39	3003754	3050257	3096760	3143262	3189763	3236264	3282765
9340	3468762	3515260	3561758	3608255	3654752	3701248	3747743

OF NUMBERS.

Logarithms 9675479762–9703887227.

Mantissæ.			Differences.									
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5807343	5854138	5900933	46799	798	798	797	797	796	796	795	795	794
6275272	6322062	6368852	793	794	792	792	792	791	791	790	790	789
6743151	6789936	6836720	788	789	787	787	787	786	786	785	784	785
7210979	7257759	7304539	783	783	783	782	781	782	780	780	780	779
7678757	7725532	7772307	778	778	778	777	777	776	775	775	775	774
8146485	8193255	8240024	773	773	773	772	771	771	771	770	769	769
8614162	8660927	8707692	769	768	767	767	767	766	765	765	765	763
9081789	9128549	9175308	764	763	762	762	762	761	760	760	759	759
9549366	9596121	9642875	759	758	757	757	756	756	756	755	754	754
0016892	0063642	0110391	753	753	752	752	752	751	750	750	749	749
0484368	0531113	0577857	46748	748	747	747	747	745	746	745	744	744
0951793	0998533	1045272	743	743	742	742	741	741	740	740	739	739
1419169	1465903	1512638	739	737	738	736	737	735	736	734	735	733
1886494	1933223	1979953	734	733	732	732	731	730	731	729	730	728
2353768	2400493	2447217	729	727	728	726	727	725	725	725	724	724
2820993	2867713	2914432	723	723	722	722	721	721	720	720	719	718
3288167	3334882	3381596	719	717	717	717	716	716	715	715	714	714
3755291	3802001	3848710	713	712	713	711	711	711	710	710	709	708
4222365	4269069	4315774	709	707	707	707	706	706	705	704	705	703
4689388	4736088	4782787	703	703	702	702	701	700	700	700	699	699
5156362	5203056	5249750	46698	697	697	697	696	695	696	694	694	694
5623285	5669974	5716663	693	692	692	692	691	691	690	689	689	689
6090157	6136842	6183526	688	687	687	687	686	685	685	685	684	684
6556980	6603660	6650339	683	682	682	682	681	680	680	680	679	678
7023753	7070427	7117101	678	678	677	676	676	676	675	674	674	674
7490475	7537145	7583813	673	672	672	672	671	670	670	670	668	669
7957147	8003812	8050476	668	667	667	667	666	665	665	665	664	663
8423769	8470429	8517088	663	663	661	662	661	660	660	660	659	658
8890341	8936996	8983650	658	658	656	657	656	655	655	655	654	653
9356863	9403512	9450161	653	652	652	652	651	650	650	649	649	649
9823335	9869979	9916623	46648	647	647	646	646	646	645	644	644	643
0289756	0336396	0383035	643	643	642	641	641	640	640	640	639	638
0756128	0802762	0849396	638	637	637	637	636	635	635	634	634	634
1222449	1269079	1315708	632	633	632	631	631	630	630	630	629	628
1688721	1735345	1781969	628	627	627	627	625	626	625	624	624	623
2154942	2201561	2248180	623	623	621	622	620	621	620	619	619	619
2621113	2667728	2714342	618	617	617	616	616	615	615	615	614	613
3087235	3133844	3180453	613	612	612	611	611	611	610	609	609	608
3553306	3599910	3646514	608	607	607	607	605	606	605	604	604	603
4019327	4065926	4112525	603	603	601	602	601	600	600	599	599	599
4485298	4531893	4578486	46597	598	597	596	596	595	595	595	593	594
4951219	4997809	5044398	593	592	592	591	591	590	590	590	589	588
5417091	5463675	5510259	588	587	587	586	586	586	585	584	584	583
5882912	5929491	5976070	583	582	582	582	581	580	580	579	579	578
6348683	6395258	6441831	578	578	577	576	576	575	575	575	573	574
6814405	6860974	6907543	573	572	572	571	571	571	570	569	569	568
7280076	7326640	7373204	568	567	567	567	566	565	565	564	564	564
7745697	7792257	7838816	563	562	562	561	561	561	559	560	559	558
8211269	8257823	8304377	558	557	557	557	556	555	555	554	554	554
8676791	8723340	8769889	553	552	552	551	551	551	550	549	549	548
9142262	9188807	9235351	46548	548	547	546	546	546	544	545	544	543
9607684	9654224	9700763	543	543	542	541	541	540	540	540	539	538
0073056	0119591	0166125	538	538	537	536	536	535	535	535	534	533
0538379	0584908	0631437	533	533	532	531	531	531	530	529	529	528
1003651	1050175	1096699	528	528	527	526	526	526	525	524	524	524
1468873	1515393	1561912	523	522	522	522	521	520	520	520	519	518
1934046	1980561	2027075	518	518	517	516	516	516	515	515	514	513
2399169	2445678	2492187	513	513	512	511	511	511	510	509	509	509
2864242	2910746	2957250	508	508	507	506	506	506	505	504	504	504
3329265	3375765	3422264	503	503	502	501	501	501	500	500	499	498
3794238	3840733	3887227	498	498	497	497	496	495	495	495	494	494

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9340	9703468762	3515260	3561758	3608255	3654752	3701248	3747743
41	3933721	3980214	4026707	4073199	4119690	4166181	4212672
42	4398630	4445118	4491605	4538092	4584579	4631065	4677551
43	4863488	4909972	4956454	5002936	5049418	5095899	5142380
44	5328298	5374776	5421254	5467731	5514207	5560684	5607159
45	5793057	5839530	5886003	5932475	5978947	6025418	6071889
46	6257767	6304235	6350703	6397170	6443637	6490103	6536569
47	6722427	6768890	6815353	6861815	6908277	6954738	7001199
48	7187037	7233495	7279953	7326411	7372867	7419324	7465780
49	7651598	7698051	7744504	7790956	7837408	7883859	7930310
9350	9708116109	8162557	8209005	8255452	8301899	8348346	8394791
51	8580570	8627013	8673456	8719899	8766341	8812782	8859223
52	9044982	9091420	9137858	9184293	9230732	9277169	9323605
53	9509343	9555777	9602210	9648642	9695074	9741506	9787937
54	9973656	0020084	0066512	0112940	0159367	0205793	0252219
55	9710437918	0484342	0530765	0577187	0623610	0670031	0716452
56	0902131	0948550	0994968	1041386	1087803	1134219	1180635
57	1366295	1412708	1459121	1505534	1551946	1598358	1644769
58	1830409	1876817	1923225	1969633	2016040	2062447	2108853
59	2294473	2340876	2387280	2433682	2480085	2526486	2572887
9360	9712758487	2804886	2851284	2897682	2944079	2990476	3036872
61	3222452	3268846	3315239	3361632	3408025	3454416	3500808
62	3686368	3732757	3779145	3825533	3871920	3918307	3964693
63	4150234	4196618	4243001	4289384	4335766	4382148	4428530
64	4614050	4660429	4706808	4753186	4799563	4845940	4892316
65	5077817	5124191	5170565	5216938	5263310	5309682	5356053
66	5541534	5587903	5634272	5680640	5727008	5773375	5819741
67	6005202	6051566	6097930	6144293	6190656	6237018	6283379
68	6468821	6515180	6561538	6607896	6654254	6700611	6746968
69	6932389	6978744	7025097	7071451	7117803	7164155	7210507
9370	9717395909	7442258	7488607	7534955	7581303	7627650	7673997
71	7859379	7905723	7952067	7998410	8044753	8091095	8137437
72	8322799	8369139	8415477	8461816	8508154	8554491	8600828
73	8786170	8832505	8878839	8925172	8971505	9017837	9064169
74	9249492	9295821	9342150	9388479	9434807	9481134	9527461
75	9712764	9759088	9805412	9851736	9898059	9944382	9990704
76	9720175987	0222306	0268625	0314944	0361262	0407580	0453897
77	0639160	0685475	0731789	0778102	0824416	0870728	0917040
78	1102284	1148594	1194903	1241212	1287520	1333827	1380135
79	1565359	1611663	1657968	1704271	1750575	1796877	1843180
9380	9722028384	2074684	2120983	2167282	2213580	2259878	2306175
81	2491360	2537654	2583949	2630243	2676536	2722829	2769121
82	2954286	3000576	3046865	3093154	3139443	3185731	3232018
83	3417163	3463448	3509733	3556017	3602300	3648583	3694866
84	3879991	3926271	3972551	4018830	4065108	4111386	4157664
85	4342770	4389045	4435319	4481594	4527867	4574140	4620413
86	4805499	4851769	4898039	4944308	4990577	5036845	5083113
87	5268179	5314444	5360709	5406973	5453237	5499500	5545763
88	5730809	5777070	5823329	5869589	5915848	5962106	6008364
89	6193391	6239646	6285901	6332155	6378409	6424663	6470916
9390	9726655923	6702173	6748423	6794673	6840922	6887170	6933418
91	7118405	7164651	7210896	7257141	7303385	7349628	7395872
92	7580839	7627080	7673320	7719560	7765799	7812037	7858276
93	8043223	8089459	8135694	8181929	8228163	8274397	8320630
94	8505558	8551789	8598020	8644249	8690479	8736708	8782936
95	8967844	9014070	9060296	9106521	9152745	9198969	9245192
96	9430081	9476302	9522522	9568742	9614962	9661181	9707399
97	9892269	9938485	9984700	0030915	0077130	0123344	0169557
98	9730354407	0400618	0446829	0493039	0539248	0585458	0631666
99	0816496	0862702	0908908	0955113	1001318	1047522	1093726
9400	1278536	1324737	1370938	1417138	1463338	1509538	1555736

OF NUMBERS.

Logarithms 9703468762–9731694330.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3794238	3840733	3887227	46498	498	497	497	496	495	495	495	494	494
4259162	4305652	4352141	493	493	492	491	491	491	490	490	489	489
4724036	4770521	4817005	488	487	487	487	486	486	485	485	484	483
5188860	5235340	5281819	484	482	482	482	481	481	480	480	479	479
5653635	5700109	5746583	478	478	477	476	477	475	476	474	474	474
6118359	6164829	6211298	473	473	472	472	471	471	470	470	469	469
6583034	6629499	6675963	468	468	467	467	466	466	465	465	464	464
7047659	7094119	7140578	463	463	462	462	461	461	460	460	459	459
7512235	7558690	7605144	458	458	458	456	457	456	455	455	454	454
7976761	8023210	8069660	453	453	452	452	451	451	451	449	450	449
8441237	8487682	8534126	46448	448	447	447	447	445	446	445	444	444
8905663	8952103	8998543	443	443	443	442	441	441	440	440	440	439
9370040	9416475	9462909	438	438	437	437	437	436	435	435	434	434
9834367	9880797	9927227	434	433	432	432	432	431	430	430	430	429
0298645	0345070	0391494	428	428	428	427	426	426	426	425	424	424
0762873	0809293	0855712	424	423	422	423	421	421	421	420	419	419
1227051	1273466	1319881	419	418	418	417	416	416	416	415	415	414
1691180	1737590	1783999	413	413	413	412	412	411	411	410	409	410
2155259	2201664	2248069	408	408	408	407	407	406	406	405	405	404
2619288	2665688	2712088	403	404	402	403	401	401	401	400	400	399
3083268	3129663	3176058	46399	398	398	397	397	396	396	395	395	394
3547198	3593589	3639979	394	393	393	393	391	392	390	391	390	389
4011079	4057465	4103849	389	388	388	387	387	386	386	386	384	385
4474911	4521291	4567671	384	383	383	382	382	382	381	380	380	379
4938692	4985068	5031443	379	379	378	377	377	376	376	376	375	374
5402424	5448795	5495165	374	374	373	372	372	371	371	371	370	369
5866107	5912473	5958838	369	369	368	368	367	366	366	366	365	364
6329740	6376101	6422461	364	364	363	363	362	361	361	361	360	360
6793324	6839680	6886035	359	358	358	358	357	357	356	356	355	354
7256858	7303209	7349559	355	353	354	352	352	552	351	351	350	350
7720343	7766689	7813034	46349	349	348	348	347	347	346	346	345	345
8183778	8230119	8276459	344	344	343	343	342	342	341	341	340	340
8647164	8693500	8739835	340	338	339	338	337	337	336	336	335	335
9110501	9156831	9203162	335	334	333	333	332	332	332	330	331	330
9573788	9620114	9666439	329	329	329	328	327	327	327	326	325	325
0037025	0083346	0129667	324	324	324	323	323	322	321	321	321	320
0500213	0546529	0592845	319	319	319	318	318	317	316	316	316	315
0963352	1009663	1055974	315	314	313	314	312	312	312	311	311	310
1426441	1472748	1519053	310	309	309	308	307	308	306	307	305	306
1889481	1935783	1982083	304	305	303	304	302	303	301	302	300	301
2352472	2398768	2445064	46300	299	299	298	298	297	297	296	296	296
2815413	2861705	2907996	294	295	294	293	293	292	292	292	291	290
3278305	3324592	3370878	290	289	289	289	288	287	287	287	286	285
3741148	3787429	3833711	285	285	284	283	283	283	282	281	282	280
4203941	4250218	4296494	280	280	279	278	278	278	277	277	276	276
4666685	4712957	4759228	275	274	275	273	273	273	272	272	271	271
5129380	5175647	5221913	270	270	269	269	268	268	267	267	266	266
5592025	5638287	5684548	265	265	264	264	263	263	262	262	261	261
6054621	6100878	6147135	261	259	260	259	258	258	257	257	257	256
6517168	6563420	6609672	255	255	254	254	254	253	252	252	252	251
6979666	7025913	7072159	46250	250	250	249	248	248	248	247	246	246
7442114	7488356	7534598	246	245	245	244	243	244	242	242	242	241
7904513	7950750	7996987	241	240	240	239	238	239	237	237	237	236
8366863	8413095	8459327	236	235	235	234	234	233	233	232	232	231
8829164	8875391	8921618	231	231	229	230	229	228	228	227	227	226
9291415	9337638	9383860	226	226	225	224	224	223	223	223	222	221
9753617	9799835	9846052	221	220	220	220	219	218	218	218	217	217
0215771	0261983	0308195	216	215	215	215	214	213	214	212	212	212
0677874	0724082	0770289	211	211	210	209	210	208	208	208	207	207
1139929	1186132	1232334	206	206	205	205	204	204	203	203	202	202
1601935	1648133	1694330	201	201	200	200	200	198	199	198	197	197

Numbers 94000–94609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9400	9731278536	1324737	1370938	1417138	1463338	1509538	1555736
1	1740527	1786723	1832919	1879114	1925309	1971504	2017698
2	2202469	2248660	2294851	2341041	2387231	2433421	2479610
3	2664361	2710548	2756734	2802919	2849104	2895289	2941473
4	3126205	3172386	3218567	3264748	3310928	3357108	3403287
5	3587999	3634176	3680352	3726528	3772703	3818878	3865052
6	4049744	4095916	4142087	4188258	4234428	4280598	4326768
7	4511440	4557607	4603774	4649940	4696105	4742270	4788434
8	4973087	5019249	5065411	5111572	5157732	5203892	5250052
9	5434685	5480842	5526999	5573155	5619311	5665466	5711621
9410	9735896234	5942386	5988538	6034689	6080840	6126990	6173140
11	6357734	6403881	6450028	6496175	6542320	6588466	6634611
12	6819185	6865327	6911469	6957611	7003752	7049892	7096032
13	7280587	7326724	7372861	7418998	7465134	7511269	7557404
14	7741940	7788072	7834204	7880336	7926467	7972598	8018728
15	8203244	8249371	8295498	8341625	8387751	8433877	8480002
16	8664498	8710621	8756743	8802865	8848987	8895107	8941228
17	9125704	9171822	9217939	9264056	9310173	9356289	9402404
18	9586861	9632974	9679087	9725199	9771310	9817421	9863532
19	9740047969	0094077	0140185	0186292	0232398	0278505	0324610
9420	9740509028	0555131	0601234	0647336	0693438	0739539	0785640
21	0970038	1016136	1062234	1108331	1154428	1200525	1246620
22	1430999	1477092	1523185	1569278	1615370	1661461	1707552
23	1891911	1938000	1984088	2030175	2076262	2122349	2168435
24	2352774	2398858	2444941	2491024	2537106	2583188	2629269
25	2813589	2859668	2905746	2951824	2997901	3043978	3090054
26	3274354	3320428	3366501	3412574	3458647	3504719	3550790
27	3735071	3781140	3827208	3873276	3919344	3965411	4011477
28	4195739	4241803	4287866	4333929	4379992	4426054	4472116
29	4656357	4702417	4748475	4794534	4840591	4886648	4932705
9430	9745116927	5162982	5209036	5255089	5301142	5347194	5393246
31	5577449	5623498	5669547	5715595	5761643	5807691	5853738
32	6037921	6083965	6130009	6176053	6222096	6268139	6314181
33	6498344	6544384	6590423	6636462	6682500	6728538	6774575
34	6958719	7004754	7050788	7096822	7142855	7188888	7234920
35	7419045	7465075	7511104	7557133	7603162	7649190	7695217
36	7879322	7925347	7971372	8017396	8063419	8109442	8155465
37	8339550	8385571	8431590	8477609	8523628	8569646	8615664
38	8799730	8845745	8891760	8937774	8983788	9029802	9075814
39	9259861	9305871	9351881	9397891	9443900	9489908	9535916
9440	9749719943	9765949	9811954	9857958	9903962	9949966	9995969
41	9750179976	0225977	0271977	0317977	0363976	0409975	0455973
42	0639961	0685957	0731952	0777947	0823941	0869935	0915928
43	1099897	1145888	1191878	1237868	1283858	1329847	1375835
44	1559784	1605770	1651756	1697741	1743725	1789709	1835693
45	2019623	2065604	2111584	2157565	2203544	2249524	2295502
46	2479412	2525389	2571365	2617340	2663315	2709289	2755263
47	2939154	2985125	3031096	3077066	3123036	3169006	3214975
48	3398846	3444813	3490779	3536744	3582709	3628674	3674638
49	3858490	3904452	3950413	3996374	4042334	4088294	4134253
9450	9754318085	4364042	4409998	4455954	4501910	4547864	4593819
51	4777632	4823584	4869535	4915486	4961437	5007387	5053336
52	5237130	5283077	5329023	5374970	5420915	5466860	5512805
53	5696579	5742521	5788463	5834404	5880345	5926285	5972225
54	6155980	6201917	6247854	6293790	6339726	6385662	6431597
55	6615332	6661264	6707196	6753128	6799059	6844990	6890920
56	7074635	7120563	7166490	7212417	7258343	7304269	7350194
57	7533890	7579813	7625736	7671657	7717579	7763500	7809420
58	7993097	8039015	8084932	8130849	8176766	8222682	8268597
59	8452255	8498168	8544080	8589993	8635904	8681815	8727726
9460	8911364	8957272	9003180	9049087	9094994	9140900	9186806

OF NUMBERS.

Logarithms 973127853⁶–975932452¹.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1601935	1648133	1694330	46201	201	200	200	200	198	199	198	197	197
2063891	2110084	2156277	196	196	195	195	195	194	193	193	193	192
2525798	2571987	2618174	191	191	190	190	190	189	188	189	187	187
2987657	3033840	3080022	187	186	185	185	185	184	184	183	182	183
3449466	3495644	3541822	181	181	181	180	180	179	179	178	178	177
3911226	3957399	4003572	177	176	176	175	175	174	174	173	173	172
4372937	4419105	4465273	172	171	171	170	170	170	169	168	168	167
4834598	4880762	4926925	167	167	166	165	165	164	164	164	163	162
5296211	5342370	5388528	162	162	161	160	160	160	159	159	158	157
5757775	5803928	5850082	157	157	156	156	155	155	154	153	154	152
6219289	6265438	6311586	46152	152	151	151	150	150	149	149	148	148
6680755	6726899	6773042	147	147	147	145	146	145	144	144	143	143
7142171	7188310	7234449	142	142	142	141	140	140	139	139	139	138
7603539	7649673	7695807	137	137	137	136	135	135	135	134	134	133
8064858	8110987	8157115	132	132	132	131	131	130	130	129	128	129
8526127	8572251	8618375	127	127	127	126	126	125	125	124	124	123
8987348	9033467	9079586	123	122	122	122	120	121	120	119	119	118
9448519	9494634	9540748	118	117	117	117	116	115	115	115	114	113
9909642	9955751	0001860	113	113	112	111	111	111	110	109	109	109
0370715	0416820	0462924	108	108	107	106	107	105	105	105	104	104
0831740	0877840	0923939	46103	103	102	102	101	101	100	100	099	099
1292716	1338811	1384905	098	098	097	097	097	095	096	095	094	094
1753643	1799733	1845822	093	093	093	092	091	091	091	090	089	089
2214521	2260606	2306690	089	088	087	087	087	086	086	085	084	084
2675350	2721430	2767510	084	083	083	082	082	081	081	080	080	079
3136130	3182205	3228280	079	078	078	077	077	076	076	075	075	074
3596861	3642931	3689001	074	073	073	073	072	071	071	070	070	070
4057543	4103609	4149674	069	068	068	068	067	066	066	066	065	065
4518177	4564238	4610298	064	063	063	063	062	062	061	061	060	059
4978762	5024817	5070873	060	058	059	057	057	057	057	055	056	054
5439297	5485348	5531399	46055	054	053	053	052	052	051	051	051	050
5899784	5945830	5991876	049	049	048	048	048	047	046	046	046	045
6360222	6406264	6452304	044	044	044	043	043	042	041	042	040	040
6820612	6866648	6912684	040	039	039	038	038	037	037	036	036	035
7280952	7326984	7373015	035	034	034	033	033	032	032	032	031	030
7741244	7787271	7833297	030	029	029	029	028	027	027	027	026	025
8201487	8247509	8293530	025	025	024	023	023	023	022	022	021	020
8661681	8707698	8753714	021	019	019	019	018	018	017	017	016	016
9121827	9167839	9213850	015	015	014	014	014	012	013	012	011	011
9581923	9627930	9673937	010	010	010	009	008	008	007	007	007	006
0041971	0087974	0133975	46006	005	004	004	004	003	002	003	001	001
0501971	0547968	0593965	001	000	000	999	999	998	998	997	997	996
0961921	1007914	1053905	45996	995	995	994	994	993	993	993	991	992
1421823	1467811	1513798	991	990	990	990	989	988	988	988	987	986
1881676	1927659	1973641	986	986	985	984	984	984	983	983	982	982
2341481	2387458	2433436	981	980	981	979	980	978	979	977	978	976
2801236	2847209	2893182	977	976	975	975	974	974	973	973	973	972
3260943	3306911	3352879	971	971	970	970	970	969	968	968	968	967
3720602	3766565	3812528	967	966	965	965	965	964	964	963	963	962
4180212	4226170	4272128	962	961	961	960	960	959	959	958	958	957
4639773	4685726	4731679	45957	956	956	956	954	955	954	953	953	953
5099285	5145234	5191182	952	951	951	951	950	949	949	949	948	948
5558749	5604693	5650636	947	946	947	945	945	945	944	944	943	943
6018165	6064103	6110042	942	942	941	941	940	940	940	938	939	938
6477531	6523465	6569399	937	937	936	936	936	935	934	934	934	933
6936849	6982779	7028707	932	932	932	931	931	930	929	930	928	928
7396119	7442043	7487967	928	927	927	926	926	925	925	924	924	923
7855340	7901259	7947178	923	923	921	922	921	920	920	919	919	919
8314512	8360427	8406341	918	917	917	917	916	915	915	915	914	914
8773636	8819546	8865455	913	912	913	911	911	911	910	910	909	909
9232712	9278617	9324521	908	908	907	907	906	906	906	905	904	904

Numbers 94600–95209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9460	9758911364	8957272	9003180	9049087	9094994	9140900	9186806
61	9370425	9416328	9462231	9508134	9554036	9599937	9645838
62	9829437	9875336	9921234	9967131	0013028	0058925	0104821
63	9760288401	0334295	0380188	0426081	0471973	0517865	0563756
64	0747316	0793205	0839093	0884981	0930869	0976756	1022642
65	1206183	1252067	1297951	1343834	1389716	1435598	1481480
66	1665001	1710880	1756759	1802637	1848515	1894392	1940269
67	2123771	2169645	2215519	2261393	2307266	2353138	2399010
68	2582493	2628362	2674231	2720100	2765968	2811835	2857702
69	3041166	3087030	3132894	3178758	3224621	3270484	3316346
9470	9763499790	3545650	3591509	3637368	3683226	3729084	3774941
71	3958366	4004221	4050076	4095930	4141783	4187636	4233489
72	4416894	4462744	4508594	4554443	4600291	4646139	4691987
73	4875373	4921218	4967063	5012907	5058751	5104595	5150437
74	5333804	5379644	5425484	5471324	5517163	5563001	5608839
75	5792186	5838022	5883857	5929692	5975526	6021360	6067193
76	6250521	6296351	6342182	6388011	6433841	6479669	6525498
77	6708806	6754632	6800458	6846283	6892107	6937931	6983754
78	7167044	7212865	7258685	7304505	7350325	7396144	7441963
79	7625233	7671049	7716865	7762680	7808495	7854309	7900123
9480	9768083373	8129185	8174996	8220806	8266616	8312426	8358235
81	8541466	8587272	8633078	8678884	8724689	8770494	8816298
82	8999510	9045312	9091113	9136914	9182714	9228514	9274313
83	9457506	9503303	9549099	9594895	9640690	9686485	9732280
84	9915453	9961245	0007037	0052828	0098619	0144409	0190198
85	9770373352	0419140	0464926	0510713	0556498	0602284	0648069
86	0831203	0876986	0922768	0968549	1014330	1060111	1105891
87	1289006	1334783	1380561	1426337	1472113	1517889	1563664
88	1746760	1792533	1838305	1884077	1929848	1975619	2021390
89	2204466	2250234	2296002	2341769	2387535	2433301	2479067
9490	9772662124	2707887	2753650	2799412	2845174	2890935	2936696
91	3119734	3165492	3211250	3257007	3302764	3348521	3394277
92	3577295	3623049	3668802	3714554	3760307	3806058	3851809
93	4034809	4080557	4126306	4172053	4217801	4263547	4309294
94	4492274	4538018	4583761	4629504	4675246	4720988	4766730
95	4949691	4995430	5041168	5086906	5132644	5178381	5224118
96	5407059	5452794	5498527	5544261	5589993	5635726	5681458
97	5864380	5910109	5955838	6001567	6047295	6093022	6138749
98	6321652	6367377	6413101	6458825	6504548	6550271	6595993
99	6778877	6824597	6870316	6916035	6961753	7007471	7053188
9500	9777236053	7281768	7327482	7373196	7418910	7464623	7510335
1	7693181	7738891	7784601	7830310	7876019	7921727	7967435
2	8150261	8195966	8241671	8287375	8333079	8378783	8424486
3	8607293	8652993	8698693	8744393	8790092	8835791	8881489
4	9064276	9109972	9155667	9201362	9247056	9292750	9338444
5	9521212	9566903	9612593	9658283	9703973	9749662	9795350
6	9978100	0023786	0069471	0115156	0160841	0206525	0252209
7	9780434939	0480620	0526301	0571982	0617661	0663341	0709020
8	0891731	0937407	0983083	1028759	1074434	1120108	1165782
9	1348474	1394146	1439817	1485488	1531158	1576828	1622497
9510	9781805169	1850836	1896503	1942169	1987834	2033499	2079164
11	2261817	2307479	2353140	2398802	2444462	2490122	2535782
12	2718416	2764073	2809730	2855387	2901042	2946698	2992353
13	3174967	3220620	3266272	3311924	3357575	3403225	3448875
14	3631471	3677119	3722766	3768412	3814059	3859705	3905350
15	4087926	4133569	4179212	4224853	4270495	4316136	4361776
16	4544334	4589972	4635609	4681247	4726883	4772519	4818155
17	5000693	5046326	5091959	5137592	5183223	5228855	5274486
18	5457005	5502633	5548261	5593889	5639516	5685142	5730769
19	5913268	5958892	6004515	6050138	6095760	6141382	6187003
9520	6369484	6415103	6460721	6506339	6551957	6597574	6643190

OF NUMBERS.

Logarithms 9758911364-9786780037.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
9232712	9278617	9324521	45908	908	907	907	906	906	906	905	904	904
9691739	9737639	9783538	903	903	903	902	901	901	901	900	899	899
0150717	0196612	0242507	899	898	897	897	897	896	896	895	895	894
0609647	0655537	0701427	894	893	893	892	892	891	891	890	890	889
1068528	1114414	1160299	889	888	888	888	887	886	886	886	885	884
1527361	1573242	1619122	884	884	883	882	882	882	881	881	880	879
1986145	2032021	2077896	879	879	878	878	877	877	876	876	875	875
2444881	2490752	2536623	874	874	874	873	872	872	871	871	871	870
2903569	2949435	2995300	869	869	869	868	867	867	867	866	865	866
3362208	3408069	3453930	864	864	864	863	863	862	862	861	861	860
3820798	3866655	3912511	45860	859	859	858	858	857	857	857	856	855
4279341	4325192	4371043	855	855	854	853	853	853	852	851	851	851
4737834	4783681	4829527	850	850	849	848	848	848	847	847	846	846
5196280	5242122	5287963	845	845	844	844	844	842	843	842	841	841
5654677	5700514	5746350	840	840	840	839	838	838	838	837	836	836
6113025	6158858	6204689	836	835	835	834	834	833	832	833	831	832
6571326	6617153	6662980	830	831	829	830	828	829	828	827	827	826
7029577	7075400	7121222	826	826	825	824	824	823	823	823	822	822
7487781	7533599	7579416	821	820	820	820	819	819	818	818	817	817
7945936	7991749	8037561	816	816	815	815	814	814	813	813	812	812
8404043	8449851	8495659	45812	811	810	810	810	809	808	808	808	807
8862102	8907905	8953708	806	806	806	805	805	804	804	803	803	802
9320112	9365910	9411708	802	801	801	800	800	799	799	798	798	798
9778074	9823867	9869660	797	796	796	795	795	795	794	793	793	793
0235988	0281776	0327565	792	792	791	791	790	789	790	788	789	787
0693853	0739637	0785420	788	786	787	785	786	785	784	784	783	783
1151670	1197449	1243228	783	782	781	781	781	780	779	779	779	778
1609439	1655213	1700987	777	778	776	776	776	775	775	774	774	773
2067160	2112929	2158698	773	772	772	771	771	771	770	769	769	768
2524832	2570597	2616361	768	768	767	766	766	766	765	765	764	763
2982456	3028216	3073975	45763	763	762	762	761	761	760	760	759	759
3440032	3485787	3531541	758	758	757	757	757	756	755	755	754	754
3897560	3943310	3989060	754	753	752	753	751	751	751	750	750	749
4355039	4400785	4446529	748	749	747	748	746	747	745	746	744	745
4812471	4858211	4903951	744	743	743	742	742	742	741	740	740	740
5269854	5315590	5361325	739	738	738	738	737	737	736	736	735	734
5727189	5772920	5818650	735	733	734	732	733	732	731	731	730	730
6184476	6230202	6275927	729	729	729	728	727	727	727	726	725	725
6641715	6687436	6733156	725	724	724	723	723	722	722	721	720	721
7098905	7144622	7190337	720	719	719	718	718	717	717	717	715	716
7556048	7601759	7647470	45715	714	714	714	713	712	713	711	711	711
8013142	8058849	8104555	710	710	709	709	708	708	707	707	706	706
8470188	8515890	8561592	705	705	704	704	704	703	702	702	702	701
8927186	8972883	9018580	700	700	700	699	699	698	697	697	697	696
9384136	9429829	9475521	696	695	695	694	694	694	692	693	692	691
9841038	9886726	9932413	691	690	690	690	689	688	688	688	687	687
0297892	0343575	0389257	686	685	685	685	684	684	683	683	682	682
0754698	0800376	0846054	681	681	681	679	680	679	678	678	678	677
1211456	1257129	1302802	676	676	676	675	674	674	674	673	673	672
1668166	1713834	1759502	672	671	671	670	670	669	669	668	668	667
2124828	2170491	2216154	45667	667	666	665	665	665	664	663	663	663
2581441	2627100	2672758	662	661	662	660	660	660	659	659	658	658
3038007	3083661	3129314	657	657	657	655	656	655	654	654	653	653
3494525	3540174	3585823	653	652	652	651	650	650	650	649	649	648
3950995	3996639	4042283	648	647	646	647	646	645	645	644	644	643
4407416	4453056	4498695	643	643	641	642	641	640	640	640	639	639
4863790	4909425	4955059	638	637	638	636	636	636	635	635	634	634
5320116	5365746	5411376	633	633	633	631	632	631	630	630	630	629
5776394	5822019	5867644	628	628	628	627	626	627	625	625	625	624
6232624	6278245	6323864	624	623	623	622	622	621	621	621	619	620
6688806	6734422	6780037	619	618	618	618	617	616	616	616	615	615

Numbers 95200–95809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9520	9786369484	6415103	6460721	6506339	6551957	6597574	6643190
21	6825652	6871266	6916879	6962493	7008105	7053717	7099329
22	7281771	7327381	7372990	7418598	7464206	7509813	7555420
23	7737843	7783448	7829052	7874656	7920259	7965861	8011463
24	8193867	8239467	8285066	8330665	8376264	8421861	8467459
25	8649843	8695438	8741033	8786627	8832221	8877814	8923406
26	9105772	9151362	9196952	9242541	9288130	9333718	9379306
27	9561652	9607238	9652823	9698407	9743991	9789574	9835157
28	9790017485	0063065	0108646	0154225	0199804	0245383	0290961
29	0473269	0518845	0564421	0609996	0655570	0701144	0746717
9530	9790929006	0974577	1020148	1065718	1111288	1156857	1202426
31	1384695	1430262	1475828	1521393	1566958	1612522	1658086
32	1840337	1885898	1931459	1977020	2022580	2068139	2113699
33	2295930	2341487	2387043	2432599	2478154	2523709	2569263
34	2751476	2797028	2842579	2888130	2933681	2979231	3024780
35	3206974	3252521	3298068	3343614	3389160	3434705	3480250
36	3662424	3707966	3753508	3799050	3844591	3890131	3935671
37	4117826	4163364	4208901	4254438	4299974	4345510	4391045
38	4573181	4618714	4664246	4709778	4755309	4800840	4846371
39	5028488	5074016	5119544	5165071	5210597	5256123	5301649
9540	9795483747	5529270	5574793	5620315	5665837	5711359	5756880
41	5938958	5984477	6029995	6075513	6121030	6166546	6212062
42	6394122	6439636	6485149	6530662	6576174	6621686	6667198
43	6849238	6894747	6940256	6985764	7031271	7076778	7122285
44	7304307	7349811	7395315	7440818	7486321	7531823	7577325
45	7759327	7804827	7850326	7895824	7941322	7986820	8032317
46	8214300	8259795	8305289	8350783	8396276	8441769	8487261
47	8669226	8714716	8760205	8805694	8851182	8896670	8942158
48	9124103	9169588	9215073	9260557	9306041	9351524	9397007
49	9578933	9624414	9669894	9715373	9760852	9806331	9851809
9550	9800033716	0079191	0124667	0170141	0215615	0261089	0306562
51	0488451	0533922	0579392	0624862	0670331	0715800	0761269
52	0943138	0988604	1034070	1079535	1124999	1170464	1215927
53	1397777	1443239	1488700	1534160	1579620	1625079	1670538
54	1852369	1897826	1943282	1988738	2034193	2079648	2125102
55	2306914	2352366	2397817	2443268	2488718	2534168	2579618
56	2761411	2806858	2852304	2897751	2943196	2988641	3034086
57	3215860	3261302	3306744	3352186	3397626	3443067	3488507
58	3670262	3715699	3761136	3806573	3852009	3897445	3942880
59	4124616	4170049	4215481	4260913	4306344	4351775	4397206
9560	9804578923	4624351	4669778	4715206	4760632	4806058	4851484
61	5033182	5078605	5124028	5169450	5214872	5260294	5305715
62	5487394	5532812	5578230	5623648	5669065	5714482	5759898
63	5941558	5986972	6032385	6077798	6123210	6168622	6214033
64	6395674	6441083	6486492	6531900	6577308	6622715	6668122
65	6849744	6895148	6940552	6985955	7031358	7076760	7122162
66	7303765	7349165	7394564	7439963	7485361	7530758	7576156
67	7757740	7803134	7848529	7893923	7939316	7984709	8030101
68	8211666	8257057	8302446	8347835	8393224	8438612	8484000
69	8665546	8710931	8756316	8801700	8847084	8892468	8937851
9570	9809119378	9164758	9210138	9255518	9300897	9346276	9391654
71	9573162	9618538	9663914	9709288	9754663	9800037	9845410
72	9810026899	0072271	0117641	0163011	0208381	0253750	0299119
73	0480589	0525955	0571321	0616687	0662052	0707416	0752780
74	0934231	0979593	1024954	1070315	1115675	1161035	1206394
75	1387826	1433183	1478540	1523896	1569251	1614606	1659961
76	1841374	1886726	1932078	1977429	2022780	2068130	2113480
77	2294874	2340222	2385569	2430915	2476261	2521607	2566952
78	2748327	2793670	2839012	2884354	2929695	2975036	3020376
79	3201733	3247071	3292408	3337745	3383082	3428418	3473753
9580	3655091	3700424	3745757	3791089	3836421	3881752	3927083

OF NUMBERS. Logarithms 9786369484-9814063073.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
6688806	6734422	6780037	45619	618	618	618	617	616	616	616	615	615
7144940	7190551	7236162	614	613	614	612	612	612	611	611	611	609
7601027	7646633	7692238	610	609	608	608	607	607	607	606	605	605
8057065	8102666	8148267	605	604	604	603	602	602	602	601	601	600
8513056	8558652	8604248	600	599	599	599	597	598	597	596	596	595
8968998	9014590	9060181	595	595	594	594	593	592	592	592	591	591
9424893	9470480	9516066	590	590	589	589	588	588	587	587	586	586
9880740	9926322	9971904	586	585	584	584	583	583	583	582	582	581
0336539	0382116	0427693	580	581	579	579	579	578	578	577	577	576
0792290	0837863	0883435	576	576	575	574	574	573	573	573	572	571
1247994	1293561	1339129	45571	571	570	570	569	569	568	567	568	566
1703649	1749212	1794775	567	566	565	565	564	564	563	563	563	562
2159257	2204815	2250373	561	561	561	560	559	560	558	558	558	557
2614817	2660371	2705923	557	556	556	555	555	554	554	554	552	553
3070329	3115878	3161426	552	551	551	551	550	549	549	549	548	548
3525794	3571338	3616881	547	547	546	546	545	545	544	544	543	543
3981211	4026750	4072288	542	542	542	541	540	540	540	539	538	538
4436580	4482114	4527648	538	537	537	536	536	535	535	534	534	533
4891901	4937430	4982959	533	532	532	531	531	531	530	529	529	529
5347174	5392699	5438223	528	528	527	526	526	526	525	525	524	524
5802400	5847920	5893439	45523	523	522	522	522	521	520	520	519	519
6257578	6303093	6348608	519	518	518	517	516	516	516	515	515	514
6712708	6758219	6803729	514	513	513	512	512	512	510	511	510	509
7167791	7213297	7258802	509	509	508	507	507	507	506	506	505	505
7622826	7668327	7713827	504	504	503	503	502	502	501	501	500	500
8077813	8123310	8168805	500	499	498	498	498	497	496	497	495	495
8532753	8578244	8623735	495	494	494	493	493	492	492	491	491	491
8987645	9033132	9078618	490	489	489	488	488	488	487	487	486	485
9442489	9487971	9533453	485	485	484	484	483	483	482	482	482	480
9897286	9942763	9988240	481	480	479	479	479	478	477	477	477	476
0352035	0397507	0442979	45475	476	474	474	474	473	473	472	472	472
0806737	0852204	0897671	471	470	470	469	469	469	468	467	467	467
1261391	1306853	1352316	466	466	465	464	465	463	464	462	463	461
1715997	1761455	1806912	462	461	460	460	459	459	459	458	457	457
2170556	2216009	2261462	457	456	456	455	455	454	454	453	453	452
2625067	2670515	2715963	452	451	451	450	450	450	449	448	448	448
3079530	3124974	3170417	447	446	447	445	445	445	444	444	443	443
3533946	3579385	3624824	442	442	442	440	441	440	439	439	439	438
3988315	4033749	4079183	437	437	437	436	436	435	435	434	434	433
4442636	4488065	4533494	433	432	432	431	431	431	430	429	429	429
4896909	4942334	4987758	45428	427	428	426	426	426	425	425	424	424
5351135	5396555	5441975	423	423	422	422	422	421	420	420	420	419
5805313	5850729	5896143	418	418	418	417	417	416	415	416	414	415
6259444	6304855	6350265	414	413	413	412	412	411	411	411	410	409
6713528	6758934	6804339	409	409	408	408	407	407	406	406	405	405
7167564	7212965	7258365	404	404	403	403	402	402	402	401	400	400
7621552	7666949	7712344	400	399	399	398	397	398	396	397	395	396
8075493	8120885	8166276	394	395	394	393	393	392	392	392	391	390
8529387	8574774	8620160	391	389	389	389	388	388	387	387	386	386
8983233	9028615	9073997	385	385	384	384	384	383	382	382	382	381
9437032	9482409	9527786	45380	380	380	379	379	378	378	377	377	376
9890783	9936156	9981528	376	376	374	375	374	373	373	373	372	371
0344487	0389855	0435222	372	370	370	370	369	369	368	368	367	367
0798144	0843507	0888869	366	366	366	365	364	364	364	363	362	362
1251753	1297111	1342469	362	361	361	360	360	359	359	358	358	357
1705315	1750668	1796021	357	357	356	355	355	355	354	353	353	353
2158829	2204178	2249526	352	352	351	351	350	350	349	349	348	348
2612296	2657640	2702984	348	347	346	346	346	345	344	344	344	343
3065716	3111055	3156394	343	342	342	341	341	340	340	339	339	339
3519088	3564423	3609757	338	337	337	337	336	335	335	335	334	334
3972413	4017743	4063073	333	333	332	332	331	331	330	330	330	329

Numbers 95800–96409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9580	9813655091	3700424	3745757	3791089	3836421	3881752	3927083
81	4108402	4153730	4199058	4244386	4289713	4335039	4380365
82	4561665	4606989	4652312	4697635	4742957	4788279	4833601
83	5014881	5060201	5105519	5150837	5196155	5241472	5286789
84	5468050	5513365	5558679	5603992	5649305	5694617	5739929
85	5921172	5966482	6011791	6057099	6102408	6147715	6193022
86	6374247	6419551	6464856	6510160	6555463	6600766	6646069
87	6827274	6872574	6917873	6963173	7008471	7053770	7099067
88	7280254	7325549	7370844	7416138	7461432	7506726	7552019
89	7733186	7778477	7823767	7869057	7914346	7959635	8004923
9590	9818186072	8231358	8276643	8321928	8367213	8412497	8457780
91	8638910	8684191	8729472	8774752	8820032	8865311	8910590
92	9091701	9136977	9182253	9227529	9272804	9318079	9363353
93	9544445	9589716	9634988	9680259	9725529	9770799	9816068
94	9997141	0042408	0087675	0132941	0178207	0223472	0268737
95	9820449791	0495053	0540315	0585576	0630837	0676098	0721358
96	0902393	0947651	0992908	1038164	1083421	1128676	1173932
97	1354948	1400201	1445453	1490705	1535957	1581208	1626458
98	1807456	1852704	1897952	1943199	1988446	2033692	2078938
99	2259917	2305160	2350403	2395646	2440888	2486129	2531371
9600	9822712330	2757569	2802807	2848045	2893283	2938520	2983756
1	3164697	3209931	3255165	3300398	3345630	3390863	3436094
2	3617016	3662246	3707475	3752703	3797931	3843158	3888385
3	4069289	4114513	4159737	4204961	4250184	4295407	4340629
4	4521514	4566734	4611953	4657172	4702391	4747609	4792826
5	4973692	5018907	5064122	5109336	5154550	5199763	5244976
6	5425823	5471034	5516244	5561453	5606662	5651871	5697079
7	5877907	5923113	5968318	6013523	6058727	6103931	6149135
8	6329944	6375145	6420346	6465546	6510746	6555945	6601144
9	6781934	6827130	6872326	6917522	6962717	7007911	7053105
9610	9827233877	7279068	7324260	7369450	7414641	7459830	7505020
11	7685773	7730960	7776146	7821332	7866518	7911703	7956887
12	8137621	8182804	8227985	8273167	8318348	8363528	8408708
13	8589423	8634601	8679778	8724954	8770131	8815306	8860482
14	9041178	9086351	9131523	9176695	9221867	9267038	9312208
15	9492886	9538054	9583222	9628389	9673556	9718722	9763888
16	9944547	9989710	0034873	0080036	0125198	0170359	0215521
17	9830396160	0441319	0486478	0531635	0576793	0621950	0667106
18	0847727	0892881	0938035	0983188	1028341	1073493	1118645
19	1299247	1344397	1389546	1434694	1479842	1524990	1570137
9620	9831750720	1795865	1841009	1886153	1931296	1976439	2021582
21	2202146	2247287	2292426	2337565	2382704	2427842	2472980
22	2653526	2698661	2743796	2788930	2834064	2879198	2924331
23	3104858	3149989	3195119	3240248	3285378	3330506	3375635
24	3556143	3601269	3646395	3691520	3736644	3781768	3826892
25	4007382	4052503	4097624	4142744	4187864	4232983	4278102
26	4458573	4503690	4548806	4593922	4639037	4684152	4729266
27	4909718	4954830	4999941	5045052	5090163	5135273	5180383
28	5360816	5405923	5451030	5496136	5541242	5586347	5631452
29	5811867	5856970	5902072	5947173	5992274	6037375	6082475
9630	9836262871	6307969	6353066	6398163	6443260	6488356	6533451
31	6713829	6758922	6804014	6849107	6894198	6939290	6984381
32	7164739	7209828	7254916	7300003	7345090	7390177	7435263
33	7615603	7660687	7705770	7750853	7795935	7841017	7886099
34	8066420	8111499	8156578	8201656	8246733	8291811	8336887
35	8517190	8562264	8607338	8652412	8697485	8742557	8787630
36	8967913	9012983	9058052	9103121	9148190	9193257	9238325
37	9418590	9463655	9508720	9553784	9598847	9643911	9688973
38	9869220	9914280	9959340	0004399	0049458	0094517	0139575
39	9840319803	0364858	0409914	0454969	0500023	0545077	0590130
9640	0770339	0815390	0860441	0905491	0950540	0995590	1040638

OF NUMBERS. Logarithms 9813655091–9841175782.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
3972413	4017743	4063073	45333	333	332	332	331	331	330	330	330	329
4425691	4471016	4516341	328	328	328	327	326	326	326	325	325	324
4878922	4924242	4969562	324	323	323	322	322	322	321	320	320	319
5332105	5377420	5422736	320	318	318	318	317	317	316	315	316	314
5785241	5830552	5875862	315	314	313	313	312	312	312	311	310	310
6238329	6283635	6328941	310	309	308	309	307	307	307	306	306	306
6691371	6736672	6781973	304	305	304	303	303	303	302	301	301	301
7144365	7189661	7234958	300	299	300	298	299	297	298	296	297	296
7597311	7642604	7687895	295	295	294	294	294	293	292	293	291	291
8050211	8095498	8140785	291	290	290	289	289	288	288	287	287	287
8503063	8548346	8593628	45286	285	285	285	284	283	283	283	282	282
8955869	9001146	9046424	281	281	280	280	279	279	279	277	278	277
9408627	9453900	9499172	276	276	276	275	275	274	274	273	272	273
9861337	9906606	9951874	271	272	271	270	270	269	269	269	268	267
0314001	0359265	0404528	267	267	266	266	265	265	264	264	563	263
0766617	0811876	0857135	262	262	261	261	261	260	259	259	259	258
1219186	1264441	1309695	258	257	256	257	255	256	254	255	254	253
1671709	1716958	1762207	253	252	252	252	251	250	251	249	249	249
2124183	2169428	2214673	248	248	247	247	246	246	245	245	245	244
2576611	2621851	2667091	243	243	243	242	241	242	240	240	240	239
3028992	3074227	3119462	45239	238	238	238	237	236	236	235	235	235
3481325	3526556	3571787	234	234	233	232	233	231	231	231	231	229
3933612	3978838	4024064	230	229	228	228	227	227	227	226	226	225
4385851	4431073	4476293	224	224	224	223	223	222	222	222	220	221
4838043	4883260	4928476	220	219	219	219	218	217	217	217	216	216
5290189	5335401	5380612	215	215	214	214	213	213	213	212	211	211
5742287	5787494	5832701	211	210	209	209	209	208	208	207	207	206
6194338	6239540	6284742	206	205	205	204	204	204	203	202	202	202
6646342	6691540	6736737	201	201	200	200	199	199	198	198	197	197
7098299	7143492	7188685	196	196	196	195	194	194	194	193	193	192
7550209	7595397	7640585	45191	192	190	191	189	190	189	188	188	188
8002072	8047255	8092439	187	186	186	186	185	184	185	183	184	182
8453888	8499067	8544245	183	181	182	181	180	180	180	179	178	178
8905656	8950831	8996005	178	177	176	177	175	176	174	175	174	173
9357378	9402548	9447717	173	172	172	172	171	170	170	170	169	169
9809053	9854218	9899383	168	168	167	167	166	166	165	165	165	164
0260681	0305841	0351001	163	163	163	162	161	162	160	160	160	159
0712262	0757418	0802573	159	159	157	158	157	156	156	156	155	154
1163796	1208947	1254097	154	154	153	153	152	152	151	151	150	150
1615283	1660430	1705575	150	149	148	148	148	147	146	147	145	145
2066724	2111865	2157006	45145	144	144	143	143	143	142	141	141	140
2518117	2563254	2608390	141	139	139	139	138	138	137	137	136	136
2969463	3014595	3059727	135	135	134	134	134	133	132	132	132	131
3420763	3465890	3511017	131	130	129	130	128	129	128	127	127	126
3872015	3917138	3962260	126	126	125	124	124	124	123	123	122	122
4323221	4368339	4413456	121	121	120	120	119	119	119	118	117	117
4774380	4819493	4864606	117	116	116	115	115	114	114	113	113	112
5225492	5270600	5315708	112	111	111	111	110	110	109	108	108	108
5676557	5721661	5766764	107	107	106	106	105	105	105	104	103	103
6127575	6172674	6217773	103	102	101	101	101	100	100	099	099	098
6578546	6623641	6668735	45098	097	097	097	096	095	095	095	094	094
7029471	7074561	7119650	093	092	093	091	092	091	090	090	089	089
7480349	7525434	7570519	089	088	087	087	087	086	086	085	085	084
7931180	7976260	8021340	084	083	683	082	082	082	081	080	080	080
8381964	8427040	8472115	079	079	078	077	078	076	077	076	075	075
8832701	8877772	8922843	074	074	074	073	072	073	071	071	071	070
9283392	9328458	9373524	070	069	069	069	067	068	067	066	066	066
9734036	9779097	9824159	065	065	064	063	064	062	063	061	062	061
0184633	0229690	0274747	060	060	059	059	059	058	058	057	057	056
0635183	0680236	0725287	055	056	055	054	054	053	053	053	051	052
1085687	1130734	1175782	051	051	050	049	050	048	049	047	048	047

Numbers 96400—97009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9640	9840770339	0815390	0860441	0905491	0950540	0995590	1040638
41	1220829	1265875	1310921	1355966	1401011	1446056	1491100
42	1671271	1716313	1761354	1806395	1851436	1896475	1941515
43	2121668	2166705	2211741	2256777	2301813	2346848	2391883
44	2572017	2617049	2662081	2707113	2752144	2797174	2842204
45	3022320	3067348	3112375	3157402	3202428	3247454	3292479
46	3472576	3517599	3562621	3607644	3652665	3697686	3742707
47	3922785	3967804	4012822	4057839	4102856	4147872	4192888
48	4372948	4417962	4462975	4507988	4553000	4598012	4643023
49	4823064	4868073	4913082	4958090	5003097	5048105	5093111
9650	9845273133	5318138	5363142	5408145	5453148	5498151	5543153
51	5723156	5768156	5813155	5858154	5903152	5948150	5993148
52	6173132	6218127	6263122	6308116	6353110	6398103	6443096
53	6623062	6668052	6713042	6758032	6803021	6848009	6892997
54	7072945	7117931	7162916	7207901	7252885	7297869	7342852
55	7522781	7567762	7612743	7657723	7702703	7747682	7792661
56	7972571	8017547	8062523	8107499	8152474	8197448	8242422
57	8422314	8467286	8512257	8557228	8602198	8647168	8692138
58	8872011	8916978	8961944	9006911	9051876	9096841	9141806
59	9321661	9366623	9411585	9456547	9501508	9546468	9591428
9660	9849771264	9816222	9861179	9906136	9951093	9996048	$\overline{0041004}$
61	9850220821	0265774	0310727	0355679	0400631	0445582	0490533
62	0670332	0715280	0760228	0805176	0850123	0895069	0940015
63	1119795	1164739	1209683	1254625	1299568	1344510	1389451
64	1569213	1614152	1659091	1704029	1748967	1793904	1838841
65	2018584	2063518	2108452	2153386	2198319	2243252	2288184
66	2467908	2512838	2557767	2602696	2647625	2692553	2737480
67	2917186	2962111	3007036	3051960	3096884	3141807	3186730
68	3366417	3411338	3456258	3501178	3546097	3591016	3635934
69	3815602	3860518	3905434	3950349	3995263	4040177	4085091
9670	9854264741	4309652	4354563	4399473	4444383	4489293	4534202
71	4713833	4758740	4803646	4848551	4893457	4938362	4983266
72	5162879	5207781	5252682	5297583	5342484	5387384	5432284
73	5611878	5656775	5701672	5746568	5791464	5836360	5881255
74	6060831	6105723	6150616	6195507	6240399	6285290	6330180
75	6509737	6554625	6599513	6644400	6689286	6734173	6779058
76	6958597	7003480	7048363	7093246	7138128	7183009	7227891
77	7407411	7452289	7497168	7542046	7586923	7631800	7676676
78	7856178	7901052	7945926	7990799	8035672	8080544	8125416
79	8304899	8349768	8394637	8439506	8484374	8529242	8574109
7180	9858753573	8798438	8843302	8888166	8933030	8977893	9022756
81	9202201	9247062	9291921	9336781	9381640	9426498	$\underline{9471356}$
82	9650783	9695639	9740494	9785349	9830203	9875057	9919910
83	9860099319	0144170	0189020	0233870	0278720	0323569	0368418
84	0547808	0592654	0637500	0682345	0727190	0772035	0816879
85	0996251	1041092	1085934	1130774	1175615	1220455	1265294
86	1444647	1489484	1534321	1579157	1623993	1668828	1713663
87	1892997	1937830	1982662	2027493	2072325	2117155	2161985
88	2341301	2386129	2430957	2475784	2520610	2565436	2610262
89	2789559	2834382	2879205	2924027	2968849	3013671	3058491
9690	9863237771	3282589	3327407	3372225	3417042	3461859	3506675
91	3685936	3730750	3775563	3820376	3865189	3910001	3954813
92	4134055	4178864	4223673	4268481	4313289	4358097	4402904
93	4582127	4626932	4671736	4716540	4761344	4806146	4850949
94	5030154	5074954	5119754	5164553	5209352	5254150	5298948
95	5478134	5522930	5567725	5612519	5657313	5702107	5746900
96	5926068	5970859	6015649	6060439	6105229	6150018	6194806
97	6373956	6418742	6463528	6508313	6553098	6597883	6642667
98	6821798	6866580	6911361	6956141	7000922	7045701	7090481
99	7269593	7314370	7359147	7403923	7448699	7493474	7538248
9700	7717343	7762115	7806887	7851658	7896429	7941200	7985970

OF NUMBERS. Logarithms 9840770339–9868120278.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1085687	1130734	1175782	45051	051	050	049	050	048	049	047	048	047
1536144	1581187	1626229	046	046	045	045	045	044	044	043	042	042
1986554	2031592	2076630	042	041	041	041	039	040	039	038	038	038
2436917	2481951	2526984	037	036	036	036	035	035	034	034	033	033
2887234	2932263	2977292	032	032	032	031	030	030	030	029	029	028
3337504	3382528	3427552	028	027	027	026	026	025	025	524	024	024
3787727	3832747	3877766	023	022	023	021	021	021	020	020	019	019
4237904	4282919	4327934	019	018	017	017	016	016	016	015	015	014
4688034	4733045	4778055	014	013	013	012	012	011	011	011	010	009
5138118	5183123	5228129	009	009	008	007	008	006	007	005	006	004
5588154	5633155	5678156	45005	004	003	003	003	002	001	001	001	000
6038144	6083141	6128137	000	999	999	998	998	998	996	997	996	995
6488088	6533080	6578071	44995	995	994	994	993	993	992	992	991	991
6937985	6982972	7027959	990	990	990	989	988	988	988	987	987	986
7387835	7432818	7477800	986	985	985	984	984	983	983	983	982	981
7837639	7882617	7927594	981	981	980	980	979	979	978	978	977	977
8287396	8332369	8377342	976	976	976	975	974	974	974	973	973	972
8737107	8782075	8827043	972	971	971	970	970	970	969	968	968	968
9186771	9231734	9276698	967	966	967	965	965	965	965	963	964	963
9636388	9681347	9726306	962	962	962	961	960	960	960	959	959	958
0085959	0130913	0175867	44958	957	957	957	955	956	955	954	954	954
0535483	0580433	0625383	953	953	952	952	951	951	950	950	950	949
0984961	1029906	1074851	948	948	948	947	946	946	946	945	945	944
1434392	1479333	1524273	944	944	942	943	942	941	941	941	940	940
1883777	1928713	1973649	939	939	938	938	937	937	936	036	936	935
2333116	2378047	2422978	934	934	934	933	933	932	932	931	931	930
2782407	2827334	2872260	930	929	929	929	928	927	927	927	926	926
3231653	3276575	3321496	925	925	924	924	923	923	923	922	921	921
3680852	3725769	3770686	921	920	920	919	919	918	918	917	917	916
4130004	4174917	4219829	916	916	915	914	914	914	913	913	912	912
4579110	4624018	4668926	44911	911	910	910	910	909	908	908	908	907
5028170	5073073	5117976	907	906	905	906	905	904	904	903	903	903
5477183	5522082	5566980	902	901	901	901	900	900	899	899	898	898
5926150	5971044	6015937	897	897	896	896	896	895	895	894	893	894
6375070	6419959	6464848	892	893	891	892	891	890	890	889	889	889
6823944	6868829	6913713	888	888	887	886	887	885	886	885	884	884
7272771	7317651	7362531	883	883	883	882	881	882	880	880	880	880
7721552	7766428	7811303	878	879	878	877	877	876	876	876	875	875
8170287	8215158	8260029	874	874	873	873	872	872	871	871	871	870
8618976	8663842	8708708	869	869	869	868	868	867	867	866	866	865
9067618	9112479	9157341	44865	864	864	864	863	863	862	861	862	860
9516213	9561070	9605927	861	859	860	859	858	858	857	857	857	856
9964763	0009615	0054467	856	855	855	854	854	853	853	852	852	852
0413266	0458114	0502961	851	850	850	850	849	849	848	848	847	847
0861723	0906566	0951408	846	846	845	845	845	844	844	843	842	843
1310133	1354971	1399810	841	842	840	841	840	839	839	838	839	837
1758497	1803331	1848164	837	837	836	836	835	835	834	834	833	833
2206815	2251644	2296473	833	832	831	832	830	830	830	829	829	828
2655087	2699911	2744735	828	828	827	826	826	826	825	824	824	824
3103312	3148132	3192951	823	823	822	822	822	820	821	820	819	820
3551491	3596306	3641121	44818	818	818	817	817	816	816	815	815	815
3999624	4044435	4089245	814	813	813	813	812	812	811	811	810	810
4447710	4492517	4537322	809	809	808	808	808	807	806	807	805	805
4895751	4940552	4985353	805	804	804	804	802	803	802	801	801	801
5343745	5388542	5433338	800	800	799	799	798	798	797	797	796	796
5791693	5836485	5881277	796	795	794	794	794	793	793	792	792	791
6239595	6284382	6329169	791	790	790	790	789	788	789	787	787	787
6687450	6732233	6777016	786	786	785	785	785	784	783	783	783	782
7135260	7180038	7224816	782	781	780	781	779	780	779	778	778	777
7583023	7627796	7672570	777	777	776	776	775	774	775	773	774	773
8030740	8075509	8120278	772	772	771	771	771	770	770	769	769	768

Numbers 97000–97609. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9700	9867717343	7762115	7806887	7851658	7896429	7941200	7985970
1	8165046	8209814	8254581	8299348	8344114	8388880	8433646
2	8612703	8657466	8702229	8746991	8791753	8836514	8881275
3	9060314	9105072	9149830	9194588	9239345	9284102	9328858
4	9507879	9552633	9597386	9642139	9686892	9731644	9776395
5	9955397	0000147	0044895	0089644	0134392	0179139	0223886
6	9870402870	0447615	0492359	0537103	0581846	0626589	0671331
7	0850296	0895036	0939776	0984515	1029254	1073992	1118730
8	1297677	1342412	1387147	1431882	1476616	1521349	1566083
9	1745011	1789742	1834472	1879202	1923932	1968661	2013389
9710	9872192299	2237025	2281751	2326477	2371201	2415926	2460650
11	2639541	2684263	2728984	2773705	2818425	2863145	2907864
12	3086737	3131454	3176171	3220887	3265603	3310318	3355033
13	3533887	3578600	3623312	3668023	3712734	3757445	3802155
14	3980991	4025699	4070407	4115114	4159820	4204526	4249232
15	4428049	4472753	4517455	4562158	4606860	4651561	4696262
16	4875061	4919760	4964458	5009156	5053853	5098550	5143246
17	5322027	5366721	5411415	5456108	5500801	5545493	5590185
18	5768947	5813637	5858326	5903014	5947702	5992390	6037077
19	6215821	6260506	6305191	6349874	6394558	6439241	6483924
9720	9876662649	6707330	6752009	6796689	6841368	6886046	6930724
21	7109431	7154107	7198782	7243457	7288131	7332805	7377478
22	7556167	7600838	7645509	7690179	7734849	7779518	7824187
23	8002858	8047524	8092190	8136856	8181521	8226185	8270850
24	8449502	8494164	8538825	8583486	8628147	8672807	8717466
25	8896100	8940757	8985414	9030071	9074726	9119382	9164037
26	9342652	9387305	9431957	9476609	9521260	9565911	9610562
27	9789159	9833807	9878455	9923102	9967748	0012395	0057041
28	9880235619	0280263	0324906	0369548	0414191	0458832	0503474
29	0682034	0726673	0771311	0815949	0860587	0905224	0949861
9730	9881128403	1173037	1217671	1262304	1306937	1351570	1396202
31	1574726	1619355	1663985	1708613	1753242	1797870	1842497
32	2021003	2065628	2110252	2154877	2199501	2244124	2288747
33	2467234	2511854	2556474	2601094	2645713	2690332	2734950
34	2913419	2958035	3002651	3047266	3091880	3136495	3181108
35	3359559	3404170	3448781	3493391	3538002	3582611	3627220
36	3805652	3850259	3894865	3939471	3984077	4028682	4073286
37	4251700	4296302	4340904	4385505	4430106	4474707	4519307
38	4697702	4742300	4786897	4831494	4876090	4920686	4965281
39	5143658	5188251	5232844	5277436	5322028	5366619	5411210
9740	9885589569	5634157	5678745	5723333	5767920	5812507	5857093
41	6035433	6080017	6124601	6169184	6213767	6258349	6302930
42	6481252	6525832	6570411	6614989	6659567	6704145	6748722
43	6927025	6971600	7016175	7060749	7105322	7149895	7194467
44	7372753	7417323	7461893	7506462	7551031	7595599	7640167
45	7818435	7863000	7907565	7952130	7996694	8041258	8085822
46	8264070	8308632	8353192	8397752	8442312	8486871	8531430
47	8709661	8754217	8798773	8843329	8887884	8932439	8976993
48	9155205	9199757	9244309	9288860	9333410	9377960	9422510
49	9600704	9645251	9689798	9734345	9778891	9823436	9867981
9750	9890046157	0090700	0135242	0179784	0224325	0268866	0313407
51	0491564	0536103	0580640	0625178	0669715	0714251	0758787
52	0936926	0981460	1025993	1070526	1115058	1159590	1204121
53	1382242	1426771	1471300	1515828	1560356	1604883	1649410
54	1827513	1872037	1916561	1961085	2005608	2050131	2094653
55	2272737	2317257	2361777	2406296	2450814	2495333	2539850
56	2717916	2762432	2806947	2851461	2895975	2940489	2985002
57	3163050	3207561	3252071	3296581	3341091	3385600	3430108
58	3608138	3652644	3697150	3741655	3786160	3830665	3875169
59	4053180	4097682	4142183	4186684	4231184	4275684	4320183
9760	4498177	4542674	4587171	4631667	4676163	4720658	4765153

OF NUMBERS. Logarithms 9867717343–9894898635.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
8030740	8075509	8120278	44772	772	771	771	771	770	770	769	769	768
8478411	8523175	8567939	768	767	767	766	766	766	765	764	764	764
8926035	8970795	9015555	763	763	762	762	761	761	760	760	760	759
9373614	9418369	9463124	758	758	758	757	757	756	756	755	755	755
9821146	9865897	9910647	754	753	753	753	752	751	751	751	750	750
0268633	0313379	0358125	750	748	749	748	747	747	747	746	746	745
0716073	0760815	0805556	745	744	744	743	743	742	742	742	741	740
1163467	1208204	1252941	740	740	739	739	738	738	737	737	737	736
1610815	1655548	1700280	735	735	735	734	733	734	732	733	732	731
2058117	2102845	2147572	731	730	730	730	729	728	728	728	727	727
2505373	2550096	2594819	44726	726	726	724	725	724	723	723	723	722
2952583	2997302	3042020	722	721	721	720	720	719	719	719	718	717
3399747	3444461	3489174	717	717	716	716	715	715	714	714	713	713
3846865	3891574	3936283	713	712	711	711	711	710	710	709	709	708
4293937	4338641	4383346	708	708	707	706	706	706	705	704	705	703
4740963	4785663	4830362	704	702	703	702	701	701	701	700	699	699
5187942	5232638	5277333	699	698	698	697	697	696	696	696	695	694
5634876	5679567	5724257	694	694	693	693	692	692	691	691	690	690
6081764	6126450	6171136	690	689	688	688	688	687	687	686	686	685
6528606	6573287	6617969	685	685	683	684	683	683	682	681	682	680
6975402	7020079	7064755	44681	679	680	679	678	678	678	677	676	676
7422151	7466824	7511496	676	675	675	674	674	673	673	673	672	671
7868855	7913523	7958191	671	671	670	670	669	669	668	668	668	667
8315513	8360177	8404839	666	666	666	665	664	665	663	664	662	663
8762125	8806784	8851442	662	661	661	661	660	659	659	659	658	658
9208691	9253346	9297999	657	657	657	655	656	655	654	655	653	653
9655212	9699861	9744510	653	652	652	651	651	651	650	649	649	649
0101686	0146331	0190975	648	648	647	646	647	646	645	645	644	644
0548114	0592755	0637395	644	643	642	643	641	642	640	641	640	639
0994497	1039133	1083768	639	638	638	638	637	637	636	636	635	635
1440834	1485465	1530095	44634	634	633	633	633	632	632	631	630	631
1887124	1931751	1976377	629	630	628	629	628	627	627	627	626	626
2333369	2377991	2422613	625	624	625	624	623	623	622	622	622	621
2779568	2824186	2868803	620	620	620	619	619	618	618	618	617	616
3225722	3270334	3314947	616	616	615	614	615	613	614	612	613	612
3671829	3716437	3761045	611	611	610	611	609	609	609	608	608	607
4117891	4162494	4207097	607	606	606	606	605	604	605	603	603	603
4563906	4608505	4653104	602	602	601	601	601	600	599	599	599	598
5009876	5054471	5099065	598	597	597	596	596	595	595	595	594	593
5455800	5500390	5544980	593	593	592	592	591	591	590	590	590	589
5901679	5946264	5990849	44588	588	588	587	587	586	586	585	585	584
6347511	6392092	6436673	584	584	583	583	582	581	581	581	581	579
6793298	6837875	6882450	580	579	578	578	578	577	576	577	575	575
7239039	7283611	7328182	575	575	574	573	573	572	572	572	571	571
7684735	7729302	7773868	570	570	569	569	568	568	568	567	566	567
8130384	8174947	8219509	565	565	565	564	564	564	562	563	562	561
8575988	8620546	8665104	562	560	560	560	559	559	558	558	558	557
9021547	9066100	9110653	556	556	556	555	555	554	554	553	553	552
9467059	9511608	9556156	552	552	551	550	550	550	549	549	548	548
9912526	9957070	0001614	547	547	547	546	545	545	545	544	544	543
0357947	0402487	0447026	44543	542	542	541	541	541	540	540	539	538
0803322	0847857	0892392	539	537	538	537	536	536	535	535	535	534
1248652	1293183	1337713	534	533	533	532	532	531	531	531	530	529
1693936	1738462	1782988	529	529	528	528	527	527	526	526	526	525
2139175	2183696	2228217	524	524	524	523	523	522	522	521	521	520
2584367	2628884	2673401	520	520	519	518	519	517	517	517	517	515
3029515	3074027	3118539	516	515	514	514	514	513	513	512	512	511
3474616	3519124	3563631	511	510	510	510	509	508	508	508	507	507
3919672	3964175	4008678	506	506	505	505	505	504	503	503	503	502
4364682	4409181	4453679	502	501	501	500	500	499	499	499	498	498
4809647	4854141	4898635	497	497	496	496	495	495	494	494	494	493

Numbers 97600–98209. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9760	9894498177	4542674	4587171	4631667	4676163	4720658	4765153
61	4943128	4987620	5032112	5076604	5121095	5165586	5210076
62	5388033	5432521	5477009	5521496	5565983	5610469	5654955
63	5832893	5877377	5921860	5966342	6010824	6055306	6099787
64	6277707	6322186	6366665	6411143	6455620	6500098	6544574
65	6722476	6766951	6811425	6855898	6900371	6944844	6989316
66	7167199	7211669	7256139	7300608	7345076	7389544	7434012
67	7611877	7656342	7700807	7745272	7789735	7834199	7878662
68	8056509	8100970	8145430	8189890	8234349	8278808	8323267
69	8501096	8545552	8590008	8634463	8678918	8723372	8767826
9770	9898945637	8990089	9034540	9078991	9123441	9167891	9212340
71	9390133	9434580	9479027	9523473	9567918	9612364	9656808
72	9834583	9879026	9923468	9967909	0012350	0056791	0101231
73	9900278988	0323426	0367863	0412300	0456737	0501173	0545609
74	0723347	0767780	0812213	0856646	0901078	0945509	0989941
75	1167661	1212090	1256518	1300946	1345373	1389801	1434227
76	1611929	1656353	1700777	1745201	1789624	1834046	1878468
77	2056152	2100572	2144991	2189410	2233828	2278246	2322664
78	2500329	2544745	2589159	2633574	2677988	2722401	2766814
79	2944461	2988872	3033282	3077692	3122101	3166510	3210919
9780	9903388548	3432954	3477360	3521765	3566170	3610574	3654978
81	3832589	3876991	3921392	3965793	4010193	4054593	4098992
82	4276585	4320982	4365379	4409775	4454170	4498566	4542961
83	4720535	4764928	4809320	4853712	4898103	4942493	4986884
84	5164440	5208828	5253216	5297603	5341990	5386376	5430762
85	5608300	5652683	5697066	5741449	5785831	5830213	5874594
86	6052114	6096493	6140872	6185250	6229627	6274004	6318381
87	6495883	6540258	6584632	6629005	6673378	6717751	6762123
88	6939607	6983977	7028346	7072715	7117084	7161452	7205819
89	7383285	7427650	7472015	7516380	7560744	7605107	7649470
9790	9907826918	7871279	7915639	7959999	8004359	8048718	8093076
91	8270506	8314862	8359218	8403573	8447928	8492283	8536637
92	8714048	8758400	8802751	8847102	8891452	8935802	8980152
93	9157545	9201892	9246239	9290585	9334931	9379277	9423622
94	9600997	9645340	9689682	9734024	9778365	9822706	9867046
95	9910044403	0088741	0133079	0177416	0221753	0266090	0310425
96	0487765	0532098	0576431	0620764	0665096	0709428	0753760
97	0931080	0975410	1019738	1064066	1108394	1152722	1197048
98	1374351	1418676	1463000	1507324	1551647	1595970	1640292
99	1817577	1861897	1906216	1950536	1994854	2039172	2083490
9800	9912260757	2305072	2349388	2393702	2438016	2482330	2526643
1	2703892	2748203	2792514	2836824	2881133	2925443	2969751
2	3146982	3191288	3235594	3279900	3324205	3368510	3412814
3	3590026	3634328	3678630	3722931	3767232	3811532	3855831
4	4033026	4077323	4121620	4165917	4210213	4254509	4298804
5	4475980	4520273	4564565	4608858	4653149	4697440	4741731
6	4918889	4963178	5007465	5051753	5096040	5140327	5184613
7	5361753	5406037	5450320	5494603	5538886	5583168	5627450
8	5804572	5848851	5893130	5937409	5981687	6025964	6070241
9	6247345	6291620	6335895	6380169	6424442	6468715	6512988
9810	9916690074	6734344	6778614	6822884	6867153	6911421	6955689
11	7132757	7177023	7221288	7265553	7309818	7354082	7398345
12	7575395	7619657	7663918	7708178	7752438	7796698	7840957
13	8017988	8062245	8106502	8150758	8195013	8239268	8283523
14	8460536	8504789	8549041	8593292	8637543	8681794	8726044
15	8903039	8947287	8991535	9035781	9080028	9124274	9168519
16	9345497	9389740	9433983	9478226	9522468	9566709	9610950
17	9787910	9832149	9876387	9920625	9964862	0009099	0053336
18	9920230278	0274512	0318746	0362979	0407212	0451445	0495677
19	0672600	0716830	0761059	0805288	0849517	0893745	0937972
9820	1114878	1159103	1203328	1247552	1291776	1336000	1380223

OF NUMBERS. Logarithms 9894498177–9921512889.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4809647	4854141	4898635	44497	497	496	496	495	495	494	494	494	493
5254566	5299056	5343545	492	492	492	491	491	490	490	490	489	488
5699440	5743925	5788409	488	488	487	487	486	486	485	485	484	484
6144268	6188748	6233228	484	483	482	482	482	481	481	480	480	479
6589050	6633526	6678001	479	479	478	477	478	476	476	476	475	475
7033787	7078258	7122729	475	474	473	473	473	472	471	471	471	470
7478479	7522945	7567411	470	470	469	468	468	468	467	466	466	466
7923124	7967587	8012048	465	465	465	463	464	463	462	463	461	461
8367725	8412182	8456639	461	460	460	459	459	459	458	457	457	457
8812280	8856733	8901185	456	456	455	455	454	454	454	453	452	452
9256789	9301237	9345685	44452	451	451	450	450	449	449	448	448	448
9701253	9745697	9790140	447	447	446	445	446	444	445	444	443	443
0145671	0190110	0234549	443	442	441	441	441	440	440	439	439	439
0590044	0634479	0678913	438	437	437	437	436	436	435	435	434	434
1034371	1078802	1123231	433	433	433	432	431	432	430	431	429	430
1478653	1523079	1567504	429	428	428	427	428	426	426	426	425	425
1922890	1967311	2011732	424	424	424	423	422	422	422	421	421	420
2367081	2411497	2455914	420	419	419	418	418	418	417	416	417	415
2811226	2855639	2900050	416	414	415	414	413	413	412	413	411	411
3255327	3299734	3344141	411	410	410	409	409	409	408	407	407	407
3699381	3743784	3788187	44406	406	405	405	404	404	403	403	403	402
4143391	4187789	4232187	402	401	401	400	400	399	399	398	398	398
4587355	4631749	4676142	397	397	396	395	396	395	394	394	393	393
5031274	5075663	5120052	393	392	392	391	390	391	390	389	389	388
5475147	5519532	5563916	388	388	387	387	386	386	385	385	384	384
5918975	5963355	6007735	383	383	383	382	382	381	381	380	380	379
6362757	6407133	6451508	379	379	378	377	377	377	376	376	375	375
6806494	6850866	6895236	375	374	373	373	373	372	371	372	370	371
7250186	7294553	7338919	370	369	369	369	368	367	367	367	366	366
7693833	7738195	7782557	365	365	365	364	363	363	363	362	362	361
8137434	8181792	8226149	44361	360	360	360	359	358	358	358	357	357
8580990	8625343	8669696	356	356	355	355	355	354	353	353	353	352
9024501	9068849	9113197	352	351	351	350	350	350	349	348	348	348
9467966	9512310	9556654	347	347	346	346	346	345	344	344	344	343
9911386	9955726	0000065	343	342	342	341	341	340	340	340	339	338
0354761	0399096	0443430	338	338	337	337	337	335	336	335	334	335
0798090	0842421	0886751	333	333	333	332	332	332	330	331	330	329
1241375	1285701	1330026	330	328	328	328	328	326	327	326	325	325
1684614	1728935	1773256	325	324	324	323	323	322	322	321	321	321
2127808	2172124	2216441	320	319	320	318	318	318	318	316	317	316
2570956	2615269	2659580	44315	316	314	314	314	313	313	313	311	312
3014060	3058367	3102675	311	311	310	309	310	308	309	307	308	307
3457118	3501421	3545724	306	306	306	305	305	304	304	303	303	302
3900131	3944430	3988728	302	302	301	301	300	299	300	299	298	298
4343099	4387393	4431687	297	297	297	296	296	295	295	294	294	293
4786021	4830311	4874600	293	292	293	291	291	291	290	290	289	289
5228899	5273184	5317469	289	287	288	287	287	286	286	285	285	284
5671731	5716012	5760292	284	283	283	283	282	282	281	281	280	280
6114518	6158794	6203070	279	279	279	278	277	277	277	276	276	275
6557260	6601532	6645803	275	275	274	273	273	273	272	272	271	271
6999957	7044224	7088491	44270	270	270	269	268	268	268	267	267	266
7442609	7486871	7531134	266	265	265	265	264	263	264	262	263	261
7885215	7929473	7973731	262	261	260	260	260	259	258	258	258	257
8327777	8372030	8416284	257	257	256	255	255	255	254	253	254	252
8770293	8814542	8858791	253	252	251	251	251	250	249	249	249	248
9212765	9257009	9301253	248	248	246	247	246	245	246	244	244	244
9655191	9699431	9743671	243	243	243	242	241	241	241	240	240	239
0097572	0141808	0186043	239	238	238	237	237	237	236	236	235	235
0539908	0584139	0628370	234	234	233	233	233	232	231	231	231	230
0982199	1026426	1070652	230	229	229	229	228	227	227	227	226	226
1424445	1468668	1512889	225	225	224	224	224	223	222	223	221	221

Numbers 98200–98809. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9820	9921114878	1159103	1203328	1247552	1291776	1336000	1380223
21	1557110	1601331	1645552	1689771	1733991	1778210	1822428
22	1999298	2043514	2087730	2131945	2176160	2220375	2264589
23	2441440	2485652	2529864	2574074	2618285	2662495	2706704
24	2883538	2927745	2971952	3016158	3060364	3104570	3148775
25	3325590	3369793	3413996	3458197	3502399	3546600	3590800
26	3767598	3811796	3855994	3900191	3944388	3988585	4032781
27	4209561	4253754	4297948	4342141	4386333	4430525	4474716
28	4651478	4695667	4739856	4784045	4828233	4872420	4916607
29	5093351	5137535	5181720	5225904	5270087	5314270	5358453
9830	9925535178	5579359	5623538	5667718	5711897	5756075	5800253
31	5976961	6021137	6065312	6109487	6153662	6197836	6242009
32	6418699	6462870	6507041	6551211	6595381	6639551	6683720
33	6860392	6904558	6948725	6992891	7037056	7081221	7125385
34	7302039	7346201	7390363	7434525	7478686	7522846	7567006
35	7743642	7787800	7831957	7876114	7920271	7964427	8008582
36	8185200	8229354	8273506	8317659	8361811	8405962	8450113
37	8626714	8670863	8715011	8759159	8803307	8847454	8891600
38	9068182	9112327	9156471	9200614	9244757	9288900	9333042
39	9509606	9553746	9597885	9642024	9686163	9730301	9774438
9840	9929950984	9995120	$\overline{0}039255$	$\overline{0}083389$	$\overline{0}127523$	$\overline{0}171657$	$\overline{0}215790$
41	9930392318	0436449	0480579	0524709	0568839	0612968	0657097
42	0833607	0877733	0921859	0965985	1010110	1054235	1098359
43	1274851	1318973	1363094	1407216	1451336	1495456	1539576
44	1716050	1760168	1804285	1848401	1892517	1936633	1980748
45	2157205	2201318	2245430	2289542	2333654	2377765	2421876
46	2598314	2642423	2686531	2730639	2774746	2818852	2862959
47	3039379	3083483	3127587	3171690	3215793	3259895	3303997
48	3480399	3524499	3568598	3612697	3656795	3700892	3744990
49	3921374	3965470	4009564	4053658	4097752	4141845	4185938
9850	9934362305	4406396	4450486	4494575	4538665	4582753	4626842
51	4803191	4847277	4891362	4935448	4979532	5023617	5067701
52	5244032	5288113	5332194	5376275	5420356	5464435	5508515
53	5684828	5728905	5772982	5817058	5861134	5905209	5949284
54	6125579	6169652	6213724	6257796	6301867	6345938	6390009
55	6566286	6610354	6654422	6698489	6742556	6786623	6830689
56	7006948	7051012	7095075	7139138	7183201	7227262	7271324
57	7447566	7491625	7535684	7579742	7623800	7667857	7711914
58	7888138	7932193	7976247	8020301	8064355	8108408	8152460
59	8328666	8372716	8416766	8460816	8504865	8548913	8592961
9860	9938769149	8813195	8857241	8901286	8945330	8989374	9033418
61	9209588	9253629	9297670	9341711	9385751	9429791	9473830
62	9649982	9694019	9738055	9782091	9826127	9870162	9914197
63	9940090331	0134364	0178396	0222427	0266458	0310489	0354519
64	0530636	0574664	0618691	0662719	0706745	0750771	0794797
65	0970896	1014919	1058943	1102965	1146987	1191009	1235030
66	1411111	1455130	1499149	1543167	1587185	1631202	1675219
67	1851282	1895297	1939311	1983325	2027338	2071351	2115363
68	2291408	2335418	2379428	2423437	2467446	2511455	2555462
69	2731490	2775495	2819501	2863506	2907510	2951514	2995517
9870	9943171527	3215528	3259529	3303529	3347529	3391528	3435527
71	3611519	3655516	3699512	3743508	3787504	3831499	3875493
72	4051467	4095459	4139451	4183443	4227434	4271424	4315414
73	4491370	4535358	4579345	4623332	4667319	4711305	4755291
74	4931229	4975212	5019195	5063178	5107160	5151141	5195123
75	5371043	5415022	5459000	5502979	5546956	5590933	5634910
76	5810813	5854787	5898761	5942735	5986708	6030681	6074653
77	6250538	6294508	6338478	6382447	6426415	6470384	6514351
78	6690218	6734184	6778149	6822114	6866078	6910042	6954005
79	7129854	7173815	7217776	7261736	7305696	7349656	7393615
9880	7569446	7613403	7657359	7701315	7745270	7789225	7833179

OF NUMBERS. Logarithms 9921114878–9947965040.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
1424445	1468668	1512889	44225	225	224	224	224	223	222	223	221	221
1866646	1910864	1955081	221	221	219	220	219	218	218	218	217	217
2308802	2353016	2397228	216	216	215	215	215	214	213	214	212	212
2750913	2795122	2839330	212	212	210	211	210	209	209	209	208	208
3192979	3237184	3281387	207	207	206	206	206	205	204	205	203	203
3635000	3679200	3723399	203	203	201	202	201	200	200	200	199	199
4076976	4121172	4165366	198	198	197	197	197	196	195	196	194	195
4518908	4563098	4607288	193	194	193	192	192	191	192	190	190	190
4960794	5004980	5049165	189	189	189	188	187	187	187	186	185	186
5402635	5446816	5490998	184	185	184	183	183	183	182	181	182	180
5844431	5888608	5932785	44181	179	180	179	178	178	178	177	177	176
6286182	6330355	6374527	176	175	175	175	174	173	173	173	172	172
6727888	6772057	6816224	171	171	170	170	170	169	168	169	167	168
7169549	7213713	7257876	166	167	166	165	165	164	164	164	163	163
7611166	7655325	7699484	162	162	162	161	160	160	160	159	159	158
8052737	8096892	8141046	158	157	157	157	156	155	155	155	154	154
8494264	8538415	8582565	154	152	153	152	151	151	151	151	150	149
8935746	8979892	9024037	149	148	148	148	147	146	146	146	145	145
9377183	9421325	9465465	145	144	143	143	143	142	141	142	140	141
9818575	9862712	9906848	140	139	139	139	138	137	137	137	136	136
0259923	0304055	0348187	44136	135	134	134	134	133	133	132	132	131
0701225	0745353	0789480	131	130	130	130	129	129	128	128	127	127
1142483	1186606	1230729	126	126	126	125	125	124	124	123	123	122
1583695	1627814	1671932	122	121	122	120	120	120	119	119	118	118
2024863	2068977	2113091	118	117	116	116	116	115	115	114	114	114
2465986	2510096	2554205	113	112	112	112	111	111	110	110	109	109
2907064	2951170	2995275	109	108	108	107	106	107	105	106	105	104
3348098	3392199	3436299	104	104	103	103	102	102	101	101	100	100
3789087	3833183	3877279	100	099	099	098	097	098	097	096	096	095
4230031	4274122	4318214	096	094	094	094	093	093	093	091	092	091
4670930	4715017	4759104	44091	090	089	090	088	089	088	087	087	087
5111784	5155867	5199950	086	085	086	084	085	084	083	083	083	082
5552594	5596672	5640750	081	081	081	081	079	080	079	078	078	078
5993359	6037433	6081506	077	077	076	076	075	075	075	074	073	073
6434079	6478148	6522217	073	072	072	071	071	071	070	069	069	069
6874754	6918819	6962884	068	068	067	067	067	066	065	065	065	064
7315385	7359446	7403506	064	063	063	063	061	062	061	061	060	060
7755971	7800027	7844083	059	059	058	058	057	057	057	056	056	055
8196512	8240564	8284615	055	054	054	054	053	052	052	052	051	051
8637009	8681056	8725103	050	050	050	049	048	048	048	047	047	046
9077461	9121504	9165546	44046	046	045	044	044	044	043	043	042	042
9517868	9561907	9605945	041	041	041	040	040	039	038	039	038	037
9958231	0002265	0046298	037	036	036	036	035	035	034	034	033	033
0398549	0442579	0486607	033	032	031	031	031	030	030	030	028	029
0838823	0882847	0926872	028	027	028	026	026	026	026	024	025	024
1279051	1323072	1367092	023	024	022	022	022	021	021	021	020	019
1719235	1763251	1807267	019	019	018	018	017	017	016	016	016	015
2159375	2203387	2247398	015	014	014	013	013	012	012	012	011	010
2599470	2643477	2687484	010	010	009	009	009	007	008	007	007	006
3039520	3083523	3127525	005	006	005	004	004	003	003	003	002	002
3479526	3523524	3567522	44001	001	000	000	999	999	999	998	998	997
3919487	3963481	4007474	43997	996	996	996	995	994	994	994	993	993
4359404	4403393	4447382	992	992	992	991	990	990	990	989	989	988
4799276	4843261	4887245	988	987	987	987	986	986	985	985	984	984
5239103	5283084	5327064	983	983	983	982	981	982	980	981	980	979
5678886	5722862	5766838	979	978	979	977	977	977	976	976	976	975
6118625	6162596	6206567	974	974	974	973	973	972	972	971	971	971
6558319	6602286	6646252	970	970	969	968	969	967	968	967	966	966
6997968	7041931	7085893	966	965	965	964	964	963	963	963	962	961
7437573	7481531	7525489	961	961	960	960	960	959	958	958	958	957
7877133	7921087	7965040	957	956	956	955	955	954	954	954	953	953

Numbers 98800–99409. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9880	9947569446	7613403	7657359	7701315	7745270	7789225	7833179
81	8008993	8052945	8096897	8140848	8184799	8228750	8272700
82	8448496	8492443	8536391	8580338	8624284	8668230	8712176
83	8887954	8931897	8975840	9019782	9063724	9107666	9151607
84	9327367	9371306	9415245	9459183	9503120	9547057	9590994
85	9766736	9810671	9854605	9898539	9942472	9986404	0030337
86	9950206061	0249991	0293921	0337850	0381779	0425707	0469635
87	0645342	0689267	0733192	0777117	0821041	0864965	0908888
88	1084577	1128499	1172419	1216340	1260259	1304179	1348098
89	1523769	1567686	1611602	1655518	1699433	1743348	1787262
9890	9951962916	2006828	2050740	2094651	2138562	2182473	2226383
91	2402019	2445926	2489834	2533741	2577647	2621553	2665459
92	2841077	2884980	2928883	2972786	3016688	3060589	3104491
93	3280091	3323990	3367888	3411786	3455684	3499581	3543477
94	3719060	3762955	3806849	3850742	3894636	3938528	3982421
95	4157985	4201875	4245765	4289654	4333543	4377431	4421319
96	4596866	4640752	4684637	4728522	4772406	4816290	4860174
97	5035703	5079584	5123465	5167345	5211225	5255104	5298983
98	5474495	5518372	5562248	5606124	5649999	5693874	5737749
99	5913243	5957115	6000987	6044858	6088729	6132600	6176470
9900	9956351946	6395814	6439681	6483548	6527415	6571281	6615147
1	6790605	6834469	6878332	6922194	6966056	7009918	7053779
2	7229220	7273079	7316938	7360796	7404653	7448511	7492368
3	7667790	7711645	7755499	7799353	7843206	7887059	7930912
4	8106317	8150167	8194017	8237866	8281715	8325563	8369411
5	8544799	8588645	8632490	8676335	8720179	8764023	8807867
6	8983236	9027078	9070919	9114759	9158599	9202439	9246278
7	9421630	9465467	9509303	9553139	9596975	9640810	9684645
8	9859979	9903812	9947644	9991475	0035306	0079137	0122967
9	9960298284	0342112	0385940	0429767	0473594	0517420	0561246
9910	9960736545	0780368	0824192	0868014	0911837	0955659	0999480
11	1174761	1218581	1262399	1306218	1350036	1393853	1437670
12	1612934	1656748	1700563	1744377	1788190	1832003	1875816
13	2051062	2094872	2138682	2182492	2226301	2270109	2313917
14	2489146	2532952	2576757	2620562	2664367	2708171	2751975
15	2927185	2970987	3014788	3058589	3102389	3146189	3189988
16	3365181	3408978	3452775	3496571	3540367	3584162	3627957
17	3803132	3846925	3890717	3934509	3978301	4022091	4065882
18	4241040	4284828	4328616	4372403	4416190	4459977	4503763
19	4678903	4722686	4766470	4810253	4854035	4897818	4941599
9920	9965116722	5160501	5204280	5248059	5291837	5335614	5379392
21	5554496	5598271	5642046	5685820	5729594	5773367	5817140
22	5992227	6035998	6079768	6123538	6167307	6211076	6254844
23	6429914	6473680	6517446	6561211	6604976	6648740	6692504
24	6867556	6911318	6955079	6998840	7042601	7086361	7130120
25	7305154	7348912	7392669	7436425	7480181	7523937	7567692
26	7742709	7786462	7830214	7873966	7917718	7961469	8005220
27	8180219	8223967	8267716	8311463	8355211	8398957	8442704
28	8617685	8661429	8705173	8748916	8792659	8836401	8880143
29	9055107	9098847	9142586	9186325	9230063	9273801	9317539
9930	9969492485	9536220	9579955	9623690	9667424	9711157	9754891
31	9929819	9973550	0017280	0061011	0104740	0148469	0192198
32	9970367109	0410835	0454562	0498287	0542012	0585737	0629462
33	0804355	0848077	0891799	0935520	0979241	1022961	1066681
34	1241557	1285274	1328992	1372709	1416425	1460141	1503857
35	1678714	1722428	1766141	1809853	1853565	1897277	1940988
36	2115828	2159537	2203246	2246954	2290662	2334369	2378076
37	2552898	2596603	2640307	2684011	2727714	2771417	2815119
38	2989924	3033624	3077324	3121023	3164722	3208421	3252119
39	3426906	3470602	3514297	3557992	3601686	3645380	3689074
9940	3863844	3907535	3951226	3994917	4038606	4082296	4125986

OF NUMBERS.

Logarithms 9947569446–9974257951.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
7877133	7921087	7965040	43957	956	956	955	955	954	954	954	953	953
8316649	8360599	8404547	952	952	951	951	951	950	949	950	948	949
8756121	8800066	8844010	947	948	947	946	946	946	945	945	944	944
9195548	9239488	9283428	943	943	942	942	942	941	941	940	940	939
9634930	9678866	9722802	939	939	938	937	937	937	936	936	936	934
0074268	0118200	0162131	935	934	934	933	932	933	931	932	931	930
0513562	0557489	0601416	930	930	929	929	928	928	927	927	927	926
0952811	0996734	1040656	925	925	925	924	924	923	923	923	922	921
1392016	1435934	1479852	922	920	921	919	920	919	918	918	918	917
1831177	1875090	1919003	917	916	916	915	915	914	915	913	913	913
2270292	2314202	2358110	43912	912	911	911	911	910	909	910	908	909
2709364	2753269	2797173	907	908	907	906	906	906	905	905	904	904
3148391	3192292	3236191	903	903	903	902	901	902	900	901	899	900
3587374	3631270	3675165	899	898	898	898	897	896	897	896	895	895
4026313	4070204	4114095	895	894	893	894	892	893	892	891	891	890
4465207	4509094	4552980	890	890	889	889	888	888	888	887	886	886
4904056	4947939	4991821	886	885	885	884	884	884	882	883	882	882
5342862	5386740	5430618	881	881	880	880	879	879	879	878	878	877
5781623	5825497	5869370	877	876	876	875	875	875	874	874	873	873
6220340	6264209	6308078	872	872	871	871	871	870	870	869	869	868
6659012	6702877	6746741	43868	867	867	867	866	866	865	865	864	864
7097640	7141501	7185360	864	863	862	862	8[illegible]	861	861	861	859	860
7536224	7580080	7623935	859	859	858	857	85[illegible]	857	856	856	855	855
7974764	8018615	8062466	855	854	854	853	853	853	852	851	851	851
8413259	8457106	8500953	850	850	849	849	848	848	848	847	847	846
8851710	8895552	8939395	846	845	845	844	844	844	843	842	843	841
9290117	9333955	9377793	842	841	840	840	840	839	839	838	838	837
9728479	9772313	9816146	837	836	836	836	835	835	834	834	833	833
0166797	0210627	0254456	833	832	831	831	831	830	830	830	829	828
0605071	0648896	0692721	828	828	827	827	826	826	825	825	825	824
1043301	1087122	1130942	43823	824	822	823	822	821	821	821	820	819
1481487	1525303	1569118	820	818	819	818	817	817	817	816	815	816
1919628	1963440	2007251	814	815	814	813	813	813	812	812	811	811
2357725	2401532	2445339	810	810	810	809	808	808	808	807	807	807
2795778	2839581	2883383	806	805	805	805	804	804	803	803	802	802
3233787	3277585	3321383	802	801	801	800	800	799	799	798	798	798
3671752	3715546	3759339	797	797	796	796	795	795	795	794	793	793
4109672	4153462	4197251	793	792	792	792	790	791	790	790	789	789
4547548	4591334	4635118	788	788	787	787	787	786	785	786	784	785
4985380	5029161	5072942	783	784	783	782	783	781	781	781	781	780
5423169	5466945	5510721	43779	779	779	778	777	778	777	776	776	775
5860912	5904684	5948456	775	775	774	774	773	773	772	772	772	771
6298612	6342380	6386147	771	770	770	769	769	768	768	768	767	767
6736268	6780031	6823794	766	766	765	765	764	764	764	763	763	762
7173879	7217638	7261397	762	761	761	761	760	759	759	759	759	757
7611447	7655201	7698955	758	757	756	756	756	755	755	754	754	754
8048970	8092720	8136470	753	752	752	752	751	751	750	750	750	749
8486450	8530195	8573940	748	749	747	748	746	747	746	745	745	745
8923885	8967626	9011367	744	744	743	743	742	742	742	741	741	740
9361276	9405013	9448749	740	739	739	738	738	738	737	737	736	736
9798623	9842356	9886087	43735	735	735	734	733	734	732	733	731	732
0235926	0279654	0323382	731	730	731	729	729	729	728	728	728	727
0673186	0716909	0760632	726	727	725	725	725	725	724	723	723	723
1110401	1154120	1197838	722	722	721	721	720	720	720	719	718	719
1547572	1591286	1635001	717	718	717	716	716	716	715	714	715	713
1984699	2028409	2072119	714	713	712	712	712	711	711	710	710	709
2421782	2465488	2509193	709	709	708	708	707	707	706	706	705	705
2858821	2902522	2946223	705	704	704	703	703	702	702	701	701	701
3295816	3339513	3383210	700	700	699	699	699	698	697	697	697	696
3732767	3776460	3820152	696	695	695	694	694	694	693	693	692	692
4169674	4213363	4257051	691	691	691	689	690	690	688	689	688	687

Numbers 99400–100009. **LOGARITHMS**

Numbers.	Mantissæ.						
	0	1	2	3	4	5	6
9940	9973863844	3907535	3951226	3994917	4038606	4082296	4125986
41	4300738	4344425	4388112	4431798	4475483	4519168	4562853
42	4737588	4781271	4824953	4868634	4912316	4955997	4999677
43	5174394	5218072	5261750	5305427	5349104	5392781	5436457
44	5611156	5654830	5698504	5742176	5785849	5829521	5873193
45	6047875	6091544	6135213	6178882	6222550	6266217	6309884
46	6484549	6528214	6571879	6615543	6659206	6702870	6746533
47	6921179	6964840	7008500	7052160	7095819	7139478	7183137
48	7357766	7401422	7445078	7488733	7532388	7576043	7619697
49	7794309	7837961	7881612	7925263	7968913	8012564	8056213
9950	9978230807	8274455	8318102	8361749	8405395	8449040	8492686
51	8667262	8710905	8754548	8798190	8841832	8885473	8929114
52	9103673	9147312	9190950	9234588	9278226	9321863	9365499
53	9540041	9583675	9627309	9670942	9714575	9758208	9801840
54	9976364	0019994	0063623	0107253	0150881	0194509	0238137
55	9980412644	0456269	0499894	0543519	0587143	0630767	0674390
56	0848879	0892501	0936121	0979742	1023361	1066981	1110600
57	1285071	1328688	1372304	1415920	1459536	1503151	1546765
58	1721219	1764832	1808444	1852055	1895666	1939277	1982887
59	2157324	2200932	2244539	2288146	2331753	2375359	2418965
9960	9982593384	2636988	2680591	2724194	2767796	2811398	2855000
61	3029401	3073000	3116599	3160197	3203795	3247393	3290990
62	3465374	3508969	3552563	3596157	3639751	3683344	3726937
63	3901303	3944894	3988484	4032073	4075663	4119251	4162840
64	4337189	4380775	4424360	4467946	4511531	4555115	4598699
65	4773030	4816612	4860193	4903774	4947355	4990935	5034514
66	5208828	5252406	5295983	5339559	5383135	5426711	5470286
67	5644583	5688156	5731728	5775300	5818872	5862443	5906014
68	6080293	6123862	6167430	6210998	6254565	6298132	6341698
69	6515960	6559524	6603088	6646652	6690214	6733777	6777339
9970	9986951583	6995143	7038702	7082262	7125820	7169378	7212936
71	7387163	7430718	7474273	7517828	7561382	7604936	7648489
72	7822698	7866249	7909800	7953351	7996900	8040450	8083999
73	8258190	8301737	8345284	8388830	8432375	8475920	8519465
74	8693639	8737181	8780723	8824265	8867806	8911347	8954887
75	9129044	9172582	9216119	9259657	9303193	9346730	9390265
76	9564405	9607938	9651472	9695005	9738537	9782069	9825600
77	9999722	0043252	0086780	0130309	0173837	0217365	0260892
78	9990434996	0478521	0522046	0565570	0609093	0652617	0696139
79	0870226	0913747	0957267	1000787	1044306	1087825	1131343
9980	9991305413	1348929	1392445	1435960	1479475	1522990	1566504
81	1740556	1784068	1827579	1871090	1914601	1958111	2001621
82	2175655	2219163	2262670	2306177	2349683	2393189	2436694
83	2610711	2654214	2697717	2741219	2784721	2828223	2871724
84	3045723	3089222	3132721	3176219	3219716	3263213	3306710
85	3480692	3524187	3567681	3611174	3654667	3698160	3741652
86	3915617	3959107	4002597	4046086	4089575	4133063	4176551
87	4350499	4393985	4437470	4480955	4524439	4567923	4611407
88	4785337	4828818	4872299	4915780	4959260	5002739	5046219
89	5220131	5263608	5307085	5350561	5394037	5437512	5480987
9990	9995654882	5698355	5741827	5785299	5828770	5872241	5915712
91	6089590	6133058	6176526	6219993	6263461	6306927	6350393
92	6524254	6567718	6611181	6654644	6698107	6741569	6785032
93	6958874	7002334	7045793	7089252	7132710	7176168	7219626
94	7393451	7436906	7480361	7523816	7567270	7610723	7654176
95	7827985	7871435	7914886	7958336	8001786	8045235	8088684
96	8262475	8305921	8349367	8392813	8436258	8479703	8523148
97	8696921	8740363	8783805	8827247	8870688	8914128	8957568
98	9131324	9174762	9218200	9261637	9305073	9348509	9391945
99	9565684	9609117	9652551	9695983	9739415	9782847	9826279
10000	0000000000	0043429	0086858	0130287	0173715	0217142	0260569

OF NUMBERS. Logarithms 9973863844-0000390848.

Mantissæ.			Differences.									
7	8	9	0	1	2	3	4	5	6	7	8	9
4169674	4213363	4257051	43691	691	691	689	690	690	688	689	688	687
4606538	4650222	4693905	687	687	686	685	685	685	685	684	683	683
5043357	5087036	5130716	683	682	681	682	681	680	680	679	680	678
5480132	5523807	5567482	678	678	677	677	677	676	675	675	675	674
5916864	5960534	6004205	674	674	672	673	672	672	671	670	671	670
6353551	6397218	6440884	669	669	669	668	667	667	667	667	666	665
6790195	6833857	6877518	665	665	664	663	664	663	662	662	661	661
7226795	7270452	7314109	661	660	660	659	659	659	658	657	657	657
7663350	7707004	7750656	656	656	655	655	655	654	653	654	652	653
8099862	8143511	8187160	652	651	651	650	651	649	649	649	649	647
8536331	8579975	8623619	43648	647	647	646	645	646	645	644	644	643
8972755	9016395	9060034	643	643	642	642	641	641	641	640	639	639
9409135	9452771	9496406	639	638	638	638	637	636	636	636	635	635
9845472	9889103	9932734	634	634	633	633	633	632	632	631	631	630
0281764	0325391	0369018	630	629	630	628	628	628	627	627	627	626
0718013	0761636	0805258	625	625	625	624	624	623	623	623	622	621
1154218	1197836	1241454	622	620	621	619	620	619	618	618	618	617
1590380	1633993	1677607	617	616	616	616	615	614	615	613	614	612
2026497	2070106	2113715	613	612	611	611	611	610	610	609	609	609
2462571	2506176	2549780	608	607	607	607	606	606	606	605	604	604
2898601	2942201	2985801	43604	603	603	602	602	602	601	600	600	600
3334587	3378183	3421779	599	599	598	598	598	597	597	596	596	595
3770529	3814121	3857712	595	594	594	594	593	593	592	592	591	591
4206428	4250015	4293602	591	590	589	590	588	589	588	587	587	587
4642282	4685866	4729448	586	585	586	585	584	584	583	384	582	582
5078094	5121672	5165251	582	581	581	581	580	579	580	578	579	577
5513861	5557435	5601009	578	577	576	576	576	575	575	574	574	574
5949585	5993155	6036724	573	572	572	572	571	571	571	570	569	569
6385265	6428830	6472395	569	568	568	567	567	566	567	565	565	565
6820901	6864462	6908023	564	564	564	562	563	562	562	561	561	560
7256493	7300050	7343607	43560	559	560	558	558	558	557	557	557	556
7692042	7735595	7779147	555	555	555	554	554	553	553	553	552	551
8127547	8171095	8214643	551	551	551	549	550	549	548	548	548	547
8563009	8606553	8650096	547	547	546	545	545	545	544	544	543	543
8998427	9041966	9085505	542	542	542	541	541	540	540	539	539	539
9433801	9477336	9520871	538	537	538	536	537	535	536	535	535	534
9869132	9912662	9956192	533	534	533	532	532	531	532	530	530	530
0304418	0347945	0391471	530	528	529	528	528	527	526	527	526	525
0739662	0783184	0826705	525	525	524	523	524	522	523	522	521	521
1174861	1218379	1261896	521	520	520	519	519	518	518	518	517	517
1610018	1653531	1697044	43516	516	515	515	515	514	514	513	513	512
2045130	2088639	2132147	512	511	511	511	510	510	509	509	508	508
2480199	2523703	2567208	508	507	507	506	506	505	505	504	505	503
2915224	2958724	3002224	503	503	502	502	502	501	500	500	500	499
3350206	3393702	3437197	499	499	498	497	497	497	496	496	495	495
3785144	3828636	3872127	495	494	493	493	493	492	492	492	491	490
4220039	4263526	4307013	490	490	489	489	488	488	488	487	487	486
4654890	4698373	4741855	486	485	485	484	484	484	483	483	482	482
5089698	5133176	5176654	481	481	481	480	479	480	479	478	478	477
5524462	5567936	5611409	477	477	476	476	475	475	475	474	473	473
5959182	6002652	6046121	43473	472	472	471	471	471	470	470	469	469
6393859	6437324	6480789	468	468	467	468	466	466	466	465	465	465
6828493	6871953	6915414	464	463	463	463	462	463	461	460	461	460
7263083	7306539	7349995	460	459	459	458	458	458	457	456	456	456
7697629	7741081	7784533	455	455	455	454	453	453	453	452	452	452
8132132	8175580	8219027	450	451	450	450	449	449	448	448	447	448
8566592	8610035	8653478	446	446	446	445	445	445	444	443	443	443
9001008	9044447	9087886	442	442	442	441	440	440	440	439	439	438
9435380	9478815	9522250	438	438	437	436	436	436	435	435	435	434
9869710	9913140	9956570	433	434	432	432	432	432	431	430	430	430
0303996	0347422	0390848	429	429	429	428	427	427	427	426	426	425

NOTE.—The tabular difference between the mantissæ of any two consecutive numbers should decrease as the numbers increase, but in the foregoing table there are occasional exceptions to this rule, due to the fact that wherever the eleventh and twelfth places of any mantissa exceed 50, the tenth place is increased by unity or 1.

Sometimes when a mantissa whose tenth place has been increased by unity or 1 is followed by a mantissa whose tenth place is not so increased, the tabular difference of such mantissæ will exceed the tabular difference of the preceding mantissæ.

Thus in the table the difference between the mantissæ corresponding to the numbers 90005 and 90051 is 48227, while that between the mantissæ corresponding to the numbers 90051 and 90052 is 48228. Here the greater numbers have the greater difference, which is theoretically incorrect.

As given in the table—

Numbers.	Mantissæ.
90050	.9544837172
90051	.9544885399
Tabular difference	48227

Numbers.	Mantissæ.
90051	.9544885399
90052	.9544933627
Tabular difference	48228

As given with mantissæ to thirteen places—

Numbers.	Mantissæ.
90050	.9544837171555
90051	.9544885399437
Tabular difference	48227882

As the eleventh and twelfth places in the mantissa difference exceed 50, unity or 1 should be added to the tenth place, and the difference then becomes 48228 and not 48227, as given in the table.

Numbers.	Mantissæ.
90051	.9544885399437
90052	.9544933626782
Tabular difference	48227345

As the eleventh and twelfth places in the mantissa difference are less than 50, nothing is added to the tenth place, and the difference then will be 48227 and not 48228, as given in the table.

In selecting the least of two evils it has been deemed prudent to choose the differences between the consecutive mantissæ actually given in the table in preference to those which would result were the mantissæ given to thirteen places.