

## IN MEMORIAM FLORIAN CAJORI



Tlorian Cajor:

FOUR FIGURE
MATHEMATICAL TABLES.
,

## FOUR FIGURE

## MATHEMATICAL TABLES:

COMPRISING LOGARITHMIC AND TRIGONOMETRICAL TABLES, AND TABLES OF SQUARES, SQUARE ROOTS, AN゙D RECIPROCALS.
$B Y$
J. T. BOTTOMLEY, M.A., LL.D., D.Sc., F.R.S., F.R.S.E., F.C.S.,

Late lecturer in natural philosorhy in the university of glasgow.

Tondon
MACMILLAN AND CO., Limited
NEW YORK: THE MACMILLAN COMPANY
1905

First Edition 1887.
Reprinted 1890, $1893,1894,1896,1897,1899$ (twice), 1900, 1901, 1902, 1903 (twice). With additions 1904, 1905 (twice).

## CAJORI

GLASGOW: PRINTED AT THE UNIVERSITY PRESS BY ROBERT MACLEHOSE AND CO. LTD.

# EXPLANATIONS AND RULES 

## USE OF THE ACCOMPANYING TABLES.

The logarithm of a number consists in general of two parts, an integer part and a decimal. The integer part is called the Index or Characteristic; the decimal part is called the Mantissa.

RULE I. The Index of the logarithm of a number greater than unity is the number which is less by one than the number of digits in the integral part of the given number.

Thus, the index of the logarithm of 47320 is 4 .
473.2 is 2. 4732 is o.

RULE II. The Index of the logarithm of a number less than unity, and reduced to the form of a decimal fraction, is negative, and is a bigher number by one than the number of zeros that follow the decimal point of the given number.

Thus, the index of the logarithm of 4732 is -1

$$
.004732 \text { is }-3
$$

To denote that the index is negative the sign minus is often written above it ; thus $\overline{1}, \overline{3}$.

RULE III. To find the mantissa of the logarithm of a given number consisting of four figures.-Find the first two figures in the left hand column of the table. Pass along the corresponding horizontal line and take the number in the vertical column headed by the third figure. To this number add the number found in the difference columns under the fourth figure of the given number. The sum with a decimal point prefixed is the required mantissa.

Example. Find the mantissas corresponding to the sequences of figures 4732 and 6985.


RULE IV. To find the logarithm of a given number consisting of four figures.- Find the mantissa corresponding to the given four figures, and to it prefix the proper index. The number thus obtained is the required logarithm.

Examples.

$$
\begin{array}{lllll}
\log 47320 & - & - & \text { - } 4.6751 \\
\log 47.32 & - & - & \text { - } & \text { is } 1.6751 \\
\log 6.985 & - & - & - & \text { is } 0.8442 \\
\log 0.006985 & - & - & - & \text { is } \overline{3} .8442
\end{array}
$$

Note.-A logarithm whose index is negative really consists of a positive mantissa with a negative index algebraically added to it. Thus : $-\overline{1} \cdot 8442=+0.8442-1$. It is important to bear this in mind in numerical operations on logarithms. For example, in taking the square root of 0.6985 , the logarithm of that number is divided by $z$, and in taking the cube by 3. The simplest way of doing this is as follows :-

$$
\begin{aligned}
& \frac{1}{2}(\cdot 8442-1)=\frac{1}{2}(1 \cdot 8442-2)=9221-1 \\
& \frac{1}{3}(\cdot 8442-1)=\frac{1}{3}(2 \cdot 8442-3)=9481-1
\end{aligned}
$$

RULE V. To find the anti-logarithm of a given logarithm, i.e., the number corresponding to the given logarithm.-Find in the table of anti-logarithms, proceeding as in Rule III., the sequence of figures corresponding to the mantissa of the given logarithm. To these figures place a decimal point, in the position indicated by the index of the given logarithm, prefixing or affixing zeros, if necessary. (See Rules I. and II.) The number thus obtained is that required.

Examples. Given the logarithm 2.7834 find the anti-logarithm.

| $783-\quad-$ | 6067 |  |  |
| ---: | ---: | ---: | ---: |
| 4 from dif. col. | - | 6 |  |
|  |  |  | 6073 |

Hence the number whose logarithm is $2 \cdot 7834$ is 6073 .

The number corresponding to the logarithm 6.7834 is 6073000 ; that corresponding to $\overline{4} \cdot 7834$ is 0006073 .

Notc.-The use of Rules I. and II., which are commonly given for the purposes of finding the index and of placing the decimal point in an anti-logarithm, may be dispensed with altogether if the principle on which these rules are founded is kept in view ; and in reality the principle is more simple than the rules and easier to remember. The logarithm, to the base io, of any number greater than I and less than io is a positive proper fraction, and is given in the tables as a decinal without whole number. On the other hand the anti-logarithm of a decimal without whole number is a number greater than I and less than 10.
Thus $\log 7.32=0.8645$; and the logarithm 0.6931 corresponds to the number 4'933.
Any number such as 7320 , or 000732 is derived from 7.32 by multiplying or dividing by a power of 10 ; and the corresponding change in the logarithm is made by adding or subtracting the index of that power of 10 .

Thus

$$
\begin{gathered}
7320=7.32 \times 10^{3} ; \quad \log \cdot 7320=\cdot 8645+3 \\
\cdot 000732=7.32 \times 10^{-4} ; \log .000732=\cdot 8645-4
\end{gathered}
$$

In the same way since 6931 as a logarithm corresponds to 4.933 , it follows that 2.6931 , or ${ }^{6} 6931+2$, corresponds to $4.933 \times 10^{2}$; and $\overline{3} \cdot 693 \mathrm{I}$, or ${ }^{5} 593 \mathrm{I}-3$, corresponds to $4.933 \times 10^{-3}$.

RULE VI. Given any angle less than $90^{\circ}$ to find its natural sine, cosine, tangent, etc., or its value in radian measure.*-Find the degrees in the left hand column of the proper table. Pass along the corresponding horizontal line, and take out the number in the vertical column headed by the number of minutes lower than, and nearest to, the given number of minutes. Take the difference between the number of minutes given and the number of minutes just found, and from the difference columns find in the same horizontal line the corresponding correction. This correction is additive in the cases of the sine, tangent, secant, and radian measure. In the cases of cosine, cotangent, and cosecant it is subtractive.
Note.-It will be observed that the main division of the degree in the trigonometrical tables is into parts of $6^{\prime}$ each. This corresponds to decimals of the degree. Thus, $12^{\circ} 18^{\prime}=12^{\circ} \cdot 3$.
Note.-In the tables of natural sines and cosines the decimal points are omitted. In the other tables the decimal points and the whole numbers which precede them are omitted in all the columns except

[^0]that headed $o^{\prime}$; and excepting also the case of a few numbers at the extremities of the tables, where the variation of the trigonometrical function is extremely rapid. At the extremities of some of the tables differences are not given, as the variation of the function is so rapid as to make the differences unserviceable.

Examples. Find the sine and cosine of $18^{\circ} 27^{\prime}$, and the tangent and secant of $58^{\circ} 44^{\prime}$.


RULE VII. To find the logarithmic sine, tangent, cosine, cotangent, secant, or cosecant of an angle less than $90^{\circ}$. Proceed as in Rule Vi., using the proper table.

Note:-The sines of all angles, and the tangents of angles less than $45^{\circ}$, being less than unity, the logarithms of these sines and tangents are preceded by a negative index. In order to avoid the writing of these negative indices the number 10 is added to the real value of the log. sin. log. tan. etc., and the number so found is entered in the tables. In all calculations this must be borne in mind, and allowance must be made.

RULE VIII. To find the angle in degrees and minutes, or in degrees and decimals of a degree, corresponding to any given natural or logarithmic sine, cosine, tangent, etc. Find in the proper table the number nearest to that given, interpolating, if necessary, by means of the difference columns; and by reversing the process of Rules VI. and VII. obtain the corresponding number of degrees and minutes, or degrees and decimals of a degree.

The preceding explanations are easily applicable to the remaining
tables of squares, square roots, and reciprocals. With regard to the tables of squares and square roots, it is to be noticed that while the square of such a number as 528 is found from the square of 5.28 simply by multiplying by a power of ro, a similar relation does not hold always in the case of the square root. It is necessary, therefore, to have two tables of square roots-one extending from I or 100 to 9.99 or 999 , and the other from Io or 1000 to 99.99 or 9999.*

RULE IX. To find the Neperian or hyperbolic logarithm of a number.-If the number be greater than I and less than io its Neperian logarithm is found directly from the proper table in the manner explained in Rule III. If the number is greater than io or less than I, it may always be expressed as the product of two factors, of which one is a power of 10 , and the other a number greater than 1 and less than 10 ; the latter being simply the original series of figures with the decimal point suitably moved. The sum of the Neperian logarithms of these two factors is the Neperian logarithm of the given number. A table of Neperian logarithms of powers of 10 is given on pp. 54,55 . Eramples.

Find the Neperian logarithms of $3^{\circ} 241,324^{\circ}$, and 0003241 .
(I)
(2) $\quad \log _{\epsilon} 324^{\prime} I=\log _{\epsilon} 3^{\circ} 24^{1} \times 10^{2}$
$\log _{\epsilon} 3.24 \mathrm{I}$ - - II759
$\log _{6} 10^{2}$ - 4.6052
$\log _{\epsilon} 32411-\overline{5.7811}$
(3)

In calculating the value of a fraction, of which the numerator and denominator each consists of two or more factors, it is often of advantage, instead of subtracting the logarithms of the denominator factors, to add in the logarithms of their reciprocals-the complemental logarithms or co-logs as they are sometimes called.

[^1]RULE X. To find the mantissa of the logarithm of a reciprocal.Write down the difference between the mantissa of the logarithm of the given number and $1 \cdot 0000$; or simply, commencing at the left hand, write down the series of numbers which will make each figure of the mantissa of the logarithm of the number up to be equal to 9 , except the last significant figure, which must be made up to 10 .

RULE XI. Otherwise: To find the mantissa of the logarithm of a reciprocal.-Proceed as in Rule III., using the Table of Logarithms of Reciprocals.

RULE XII. To find the index for the logarithm of a reciprocal.If the given number consist of a whole number and a decimal, the index is equal to the number of the digits which constitute the whole number, and is negative. If the given number is a decimal without a whole number the index is equal to the number of zeros which follow the decimal point and is positive.

Examples. Find

$$
\log \frac{1}{237^{\circ} 4}
$$

Mantissa of co-log from talle, p. 16. - $\cdot 6246$.
Index - - - - - - -3

$$
\begin{aligned}
& \log \frac{1}{237 \cdot 4}=6246-3 \text { or } \overline{3} \cdot 6246 \\
& \log \frac{1}{002374}=6246+2 \text { or } 2 \cdot 6246
\end{aligned}
$$

Remark.-In finding the logarithm of the reciprocal of a trigonometrical function it is only necessary to subtract the tabular logarithm from 10 . This will readily be seen from an example.

Since (sce Note to Rule VII.),

$$
\log \sin 36^{\circ}=\text { Tab. } \log \sin 36^{\circ}-10
$$

we have

$$
\log \left(\frac{1}{\sin 36^{\circ}}\right)=-\log \sin 36^{\circ}=10-\text { Tab. log } \sin 36^{\circ}
$$

The subtraction from to is most easily performed by writing down the numbers which make up the figures of the tabular logarithm to 9 , as in Rule X., except in the case of the last significant figure, for which write the number which, if added to it, would make it up to be io.

An example of calculation is given here in order to show a convenient way of writing down the given numbers and their logarithms. It is scarcely possible to overestimate the importance of strict adherence to method; for instance, in physical calculations. In the
first place errors are thus most easily avoided or detected; and it is also frequently useful to be able to return on the arithmetical steps in order to make an alteration of form, or, if improved data are forthcoming, to obtain a result true to a closer degree of approximation.

Erample. Calculate the value of


In bringing out a Second Edition of this Book of Tables, I desire to acknowledge the kind assistance of friends; and in particular the valuable criticisms and suggestions which I have received from Prof. Sir G. Gabriel Stokes, Bart., Pres. R. S., and from Prof. G. H. Darwin, F.R.S.
J. T. B.

February 18, 1890.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 0000 | 0004 | 0009 | 0013 | 0017 | 0022 | 0026 | 0030 | 0035 | 0039 |
| 101 | 0043 | 0048 | 0052 | 0056 | 0060 | 0065 | 0069 | 0073 | 0077 | oosz |
| 102 | 0086 | 0090 | 0095 | 0099 | 0103 | 0107 | OIII | 0116 | 0120 | 0124 |
| 103 | 0128 | OI33 | O137 | 0141 | OI 45 | 0149 | 0154 | 0158 | 0162 | 0166 |
| 104 | 0170 | 0175 | or 79 | 0183 | -187 | 0191 | 0195 | 0199 | 0204 | 0208 |
| 105 | 0212 | 0216 | 0220 | 0224 | 0228 | 0233 | 0237 | 0241 | 0245 | 0249 |
| 106 | 0253 | 0257 | 026I | 0265 | 0269 | 0273 | 0278 | 0282 | 0286 | 0290 |
| 107 | 0294 | 0298 | 0302 | 0306 | 0310 | 0314 | 0318 | 0322 | 0326 | 0330 |
| 108 | 0334 | 0338 | 0342 | -346 | 0350 | 0354 | 0358 | 0362 | 0366 | 0370 |
| 109 | 0374 | 0378 | 0382 | 0386 | 0390 | 0394 | 0398 | 0402 | 0.406 | $0+10$ |
| 110 | 0414 | 0418 | 0422 | 0426 | 0430 | 0434 | 0438 | 0441 | 0445 | 0449 |
| 111 | 0453 | 0457 | 0,461 | -465 | 0.469 | 0473 | 0477 | 04SI | 0484 | 0.888 |
| 112 | 0492 | 0496 | 0500 | 0504 | 0508 | 0512 | 0515 | 0519 | 0523 | 0527 |
| 113 | 0531 | 0535 | 0538 | 0542 | 0546 | $\bigcirc 550$ | 0554 | 0558 | 056r | 0565 |
| 114 | 0569 | 0573 | 0577 | -5So | -5St | -5SS | 0592 | 0596 | 0599 | 0603 |
| 115 | 0607 | 061 I | 0615 | 0618 | 0622 | 0626 | 0630 | 0633 | 0637 | 0641 |
| 116 | 0645 | 0648 | 0652 | 0656 | 0660 | 0663 | 0667 | 067 I | 0674 | 0678 |
| 117 | 0682 | 0686 | -6689 | 0693 | 0697 | 0700 | 0704 | 0708 | 0711 | 0715 |
| 118 | 0719 | 0722 | 0726 | 0730 | 0734 | 0737 | 0741 | 0745 | 0748 | 0752 |
| 119 | 0755 | 0759 | 0763 | 0766 | 0770 | 0774 | 0777 | 0781 | 0785 | 0758 |
| 120 | 0792 | 0795 | 0799 | -SO3 | oSo6 | -810 | ofi3 | o817 | 082I | oS24 |
| 121 | oS2S | 0831 | 0835 | -839 | 0842 | -8, 6 | -849 | 0853 | 0856 | 0860 |
| 122 | 0864 | 0867 | -871 | 0874 | -878 | oSSI | -885 | osss | 0892 | -896 |
| 123 | -899 | 0903 | 0906 | 0910 | 0913 | 0917 | 0920 | 0924 | 0927 | 0931 |
| 124 | 09.34 | 0938 |  |  | 0948 |  | 0955 | 0959 | 0962 | 0966 |
| 125 | 0969 | 0973 | 0976 | 0950 | 0983 | og86 | 0990 | 0993 | 0997 | 1000 |
| 126 | 1004 | 1007 | 1011 | 1014 | 1017 | 1021 | 1024 | 1028 | 1031 | 1035 |
| 127 | 1038 | 1041 | 1045 | 1048 | 1052 | 1055 | 1059 | 1062 | 1065 | 1069 |
| 128. | 1072 | 1075 | 1079 | 1082 | 1086 | 1059 | 1092 | 1096 | 1099 | 1103 |
| 129 | 1106 | 1109 | 1113 | 1116 | 1119 | 1123 | 1126 | 1129 | 1133 | 1136 |
| 130 | 11.39 | 1143 | 1146 | II49 | 1153 | 1156 | II 59 | 1163 | 1166 | 1169 |
| 131 | 1173 | 1176 | 1179 | 1183 | 1186 | 1189 | 1193 | 1196 | 1199 | 1202 |
| 132 | 1206 | 1209 | 1212 | 1216 | 1219 | 1222 | 1225 | 1229 | 1232 | 1235 |
| 133 | 1239 | 1242 | 1245 | 1248 | 1252 | 1255 | 1258 | 1261 | 1265 | 1268 |
| 134 | 1271 | 1274 | 1278 | 1281 | 1284 | 1287 | 1290 | 1294 | 1297 | 1300 |
| 135 | 1303 | 1307 | 1310 | 1313 | 1316 | 1319 | 1323 | 1326 | 1329 | 1332 |
| 136 | 1335 | 1339 | 1342 | 1345 | 1348 | 1351 | 1355 | 1358 | 1361 | 1364 |
| 137 | 1367 | 1370 | 1374 | 1377 | $\mathrm{I}_{3} \mathrm{So}$ | 1383 | 13 S6 | 1389 |  |  |
| 138 | 1399 | 1402 | 1405 | 1405 | I4II | 1414 | 1418 | 1421 | 1424 | 1427 |
| 139 | 1430 | 14.33 | 1436 | 1440 | 1443 | 1446 | 1449 | 1452 | 1455 | 1458 |
| 140 | 1461 | 1464 | 1467 | 1471 | 1474 | 1477 | 1480 | 1483 | 1486 | 1489 |

LOGARITHMS OF RECIPROCALS 1000 TO 1409.

LOGARITHMS.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 45 | $7 \quad 8 \quad 9$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 | 0000 | 0043 | 0086 | 0128 | 0170 | 0212 | 0253 | 0294 | 0334 | 0374 | 4 S 12 | 172125 | 293337 |
| 11 | 0414 | 0453 | 0492 | 0531 | 0569 | 0607 | 0645 | 0682 | 0719 | 0755 | 4811 | 1519 | 263034 |
| 12 | 0792 | -S2S | 0864 | 0899 | 0934 | 0969 | 1004 | 1038 | 1072 | 1106 | 3710 | $14 \quad 1721$ | 242831 |
| 13 | 1139 | 1173 | 1206 | 1239 | 1271 | 1303 | 1335 | 1367 | 1399 | 1430 | 3610 | 1316 | $\begin{array}{llll}23 & 26 & 29\end{array}$ |
| 14 | 1461 | 1492 | 1523 | 1553 | 1584 | 16 | 164 | J673 | 1703 | 17 | 3 | $12 \begin{array}{llll}15 & 18\end{array}$ | 2124 |
| 15 | 1761 | 1790 | 1818 | 1847 | 1875 | 1903 | 1931 | 1959 | 1987 | 2014 | 36 | $\begin{array}{llll}11 & 14 & 17\end{array}$ | 202225 |
| 16 | 2041 | 2068 | 2095 | 2122 | 2148 | 2175 | 2201 | 2227 | 2253 | 2279 | 35 |  | 182124 |
| 17 | 2.304 | 2330 | 2355 | 2380 | 2405 | 2430 | 2455 | 2480 | 2504 | 2529 | 25 | 101215 | 0 |
| 18 | 2553 | 2577 | 2601 | 2625 | 2648 | 2672 | 2695 | 2718 | 2742 | 2765 | 25 | 91214 | $16 \quad 1921$ |
| 19 | 2788 | 2810 | 2833 | 2856 | 2878 | 2900 | 2923 | 2945 | 2967 | 2989 | 24 | 9 II I3 | 16 IS 20 |
| 20 | 3010 | 303 | 3054 | 3075 | 3096 | 3118 | 3139 | 3160 | 3181 | 3201 | 24 | 8 I1 13 | $15 \quad 17 \quad 19$ |
| 21 | 3222 | 3243 | 3263 | 3284 | 3304 | 3324 | 3345 | 3365 | 3385 |  | 24 | 81012 | 1416 IS |
| 22 | 3424 | 3444 | 3464 | 3483 | 3502 | 3522 | 3541 | 3560 | 3579 | 3598 | 246 | 81012 | 141517 |
| 23 | 3617 | 3636 | 3655 | 3674 | $\underline{3692}$ | 37 II | 3729 | 3747 | 3766 | 3784 | 246 | $7 \quad 9$ II | 13 15 17 <br> 12 14  |
| 24 | $3 \mathrm{SO2}$ | 3820 | $3{ }^{8} 38$ | 3856 | $33^{9} 74$ | 3892 | 3909 | 39 | 3945 | 3962 | 24 | 9 II | $\begin{array}{llll}12 & 14 & 16\end{array}$ |
| 25 | 3979 | 3997 | 4014 | 4031 | 4048 | 4065 | 4082 | 4099 | 4116 | 4133 | 23. | $7 \quad 910$ | $12 \begin{array}{llll}14 & 15\end{array}$ |
| 26 | 4150 | 4166 | 4183 | 4200 | 4216 | 4232 | 4249 | 4265 | 42 SI | 4298 | 23 | 7810 | 11 13 15 |
| 27 | 431 | 4330 | 4346 | 4362 | 4378 | 4393 | 4409 | 4425 | 4440 | 4456 | 23 | 8. 9 | $\begin{array}{llll}\text { II } & 1 & 3 & 14\end{array}$ |
| 28 | 4472 | 4487 | 4502 | 4518 | 4533 | 4548 | 4564 | 4579 | 4594 | 4609 | 23 | $6 \quad 8 \quad 9$ | $\begin{array}{lllll}11 & 12 & 14\end{array}$ |
| 29 | 4624 | 4639 | 4654 | 4669 | 4683 | 4698 | 4713 | 4728 | 4742 | 4757 | 13 | $\begin{array}{llll}6 & 7 & 9\end{array}$ | 1012 |
| 30 | 4771 | 4786 | 4800 | 4814 | 4829 | $48_{43}$ | 4 S 57 | 4871 | 4886 | 4900 | 13 | $7 \quad 9$ | 3 |
| 31 | 4914 | 4928 | 4942 | 4955 | 4969 | 4983 | 4997 | 501 I | 5024 | 5038 | 3 | 78 | 0 |
| 32 | 5051 | 5065 | 5079 | 5092 | 5105 | 5119 | 5132 | 5145 | 5159 | 5172 | 13 | 7 | 9 If 12 |
| 33 | 5185 | 519 | -5211 | 5224 | 5237 | 5250 | 5263 | 5276 | 5289 | 5302 | 13 | 5 6 8 | 910 |
| 34 | 5315 | 5328 | 5.340 | 5353 | 5366 | 5378 | 5391 | 5403 | 5416 | 5428 | 13 | $\begin{array}{lll}5 & 6 & 8\end{array}$ | 91011 |
| 35 | 544 I | 5453 | 5465 | 5478 | 5490 | 5502 | 5514 | $55^{27}$ | 5539 | 5551 | 12 | 56 | 9 10 11 |
| 36 | 5563 | 5575 | 5587 | 5599 | 5611 | 5623 | 5635 | $56+7$ | 5658 | 5670 | 12 | 56 | 810 |
| 37 | 5682 | 5694 | 5705 | 5717 | 5729 | 5740 | 5752 | 5763 | 5775 | 5786 | 12 | 5 | 910 |
| 38 | 5798 | 5809 | 582 I | 5832 | 5843 | 5855 | 5866 | 5877 | 5888 | 5899 | I 2 | 56 | 8 9 |
| 39 | 5911 | 5922 | 5933 | 5944 | 5955 | 5966 | 5977 | 5988 | 5999 | 6010 | I 2 | 45 | 89 |
| 40 | 6021 | 6031 | 6042 | 6053 | 6064 | 6075 | 6085 | 6096 | 6107 | 6117 | 123 | 45 | 8 |
| 41 | 6128 | 6I38 | 6I 49 | 6160 | 6170 | 6I80 | 6191 | 6201 | 6212 | 6222 | 12 | 56 | $\begin{array}{lll}7 & 8 & 9\end{array}$ |
| 42 | 6232 | 6243 | 6253 | 6263 | 6274 | $628_{4}$ | 6294 | 6304 | 6314 | 6325 | 12 | $4 \begin{array}{lll}4 & 5 & 6\end{array}$ | 78 |
| 43 | 6335 | 6345 | 6355 | 6365 | 6375 | $63 S_{5}$ | 6395 | 6405 | 6415 | 6425 | 123 | 44 5 6 | 7 S |
| 44 | 6435 | 6444 | 6454 | 6464 | 6474 | $64 S_{4}$ | 6493 | 6503 | 6513 | 6522 | 12 | $\begin{array}{lll}4 & 5 & 6\end{array}$ | 89 |
| 45 | 6532 | 6542 | 6551 | 6561 | 6571 | 6580 | 6590 | 6599 | 6609 | 6618 | 12 | $4 \begin{array}{lll}4 & 5 & 6\end{array}$ | 7 S |
| 46 | 6628 | 6637 | 6646 | 6656 | 6665 | 6675 | 6684 | 6693 | 6702 | 6712 | I 2 | 4 5 6 | 77 |
| 47 | 6721 | 6730 | 6739 | 6749 | 6758 | 6767 | 6776 | 6785 | 6794 | 6803 | 1 |  | $\begin{array}{lll}6 & 7 & 8\end{array}$ |
| 48 | 6812 | 6821 | 6830 | 6839 | 6848 | 6857 | 6866 | 6875 | 6584 | 6893 | 12 | $4 \begin{array}{lll}4 & 4 & 5\end{array}$ | $\begin{array}{llll}6 & 7 & 8\end{array}$ |
| 49 | 6902 | 6911 | 6920 | 6928 | 6937 | 6946 | 6955 | 6964 | 6972 | 6981 | $\begin{array}{lll}1 & 2 & 3\end{array}$ | 4 4 5 | 67 |
| 50 | 6990 | 6998 | 7007 | 7016 | 7024 | 7033 | 7042 | 7050 | 7059 | 7067 | 12 | 34 | $\begin{array}{lll}6 & 7 & 8\end{array}$ |
| 51 | 7076 | 7084 | 7093 | 7101 | 7110 | 7118 | 7126 | 7135 | 7143 | 7152 | 123 | 34 | 8 |
| 52 | 7160 | 7168 | 7177 | 7185 | 7193 | 7202 | 7210 | 7218 | 7226 | 7235 | 12 | 34 | 7 |
| 53 | 724.3 | 7251 | 7250 | 7267 | 7275 | 7284 | 7292 | 7300 | $730 S$ | 7316 | 122 | 34 | 6 |
| 54 | 7324 | 7332 | 7340 | 7348 | 7356 | 7364 | 7372 | 73 | 73 SS | 739 | 122 | 34 | 66 |

LOGARITHMS.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 | 7 | 8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 5 | 740 | 74 | 7419 | 7427 | 7435 | 7443 | 7451 | 7459 | 7466 | 7474 | 12 | 5 |  | 67 |
| 57 | 7482 | 7490 | 7497 | 7505 | 7513 7589 | 7520 | 7528 7604 | ${ }^{75.36} 7$ | 7543 | 7551 7627 | $\begin{array}{ll}1 & 2 \\ 1 & 2\end{array}$ | 3 |  | 6 |
| 57 | 7559 7634 | 7566 | 7574 7649 | 758 | 7589 | 7597 7672 | 7604 7679 | 77686 | $\begin{aligned} & 7619 \\ & 7694 \end{aligned}$ | 7627 <br> 7701 | $\begin{array}{ll}1 & 2 \\ 1 & 2 \\ 1 & \\ 1 & 1\end{array}$ | 3 |  | $\begin{array}{ll}6 & 7 \\ 6 & 7\end{array}$ |
| 59 | 7709 | 77 | 77 | 77 | 77 | 77 | 7752 | 77 | 7767 | 7774 | 11 | 4 |  | 67 |
| 61 | 77 | 7789 7860 | 7796 7868 | 7875 | $7 \mathrm{7SO}_{2}$ | 7889 | 7896 | 7903 | 7910 | 7917 | $\begin{array}{lll}1 & 1 & \\ 1 & 1 & 2 \\ 1 & 1 & 2 \\ 1\end{array}$ | 4 |  | 6 6 6 |
| 62 | 7924 | 7931 | 7938 | $79+5$ | 7952 | 7959 | 7966 | 7973 | 7980 | S05 | 1 | $\begin{array}{lll}3 & 3 & 4\end{array}$ |  | 66 |
| 63 | 79 |  | 8007 |  | 8021 |  | So35 | ${ }^{80}{ }^{1}$ | 80,4 | So55 | 11 | $3 \begin{array}{lll}3 & 3 & 4\end{array}$ |  | 56 |
| 64 | So62 | So69 | 8075 | 8082 | 8089 | 8096 | S102 | 8109 | 8ıI6 | SI | 112 | $3 \begin{array}{lll}3 & 3 & 4\end{array}$ |  | 56 |
| 65 | 8129 | 81 | 8142 | 8149 | 8156 | 8162 | 8169 | 8176 | 8182 | SI | 11 | $\begin{array}{lll}3 & 3 & 4\end{array}$ | 5 | 56 |
| 66 | 8195 | S202 | 8209 | 8215 | 8222 | 8228 | 8235 | S24I | S248 | S25 | 1 | 33 |  | 56 |
| 67 | S26I | 8267 | 8274 | 8280 | 8287 | 8293 | 8299 | 8.306 | S312 | 8319 | 1 I | $\begin{array}{lll}3 & 3 & 4\end{array}$ |  | 5 |
| 68 | S325 | 8331 | S338 | S 344 | S 351 | 8357 | 8363 | 8370 | 8376 | $8_{3} 8^{2}$ | 112 | $\begin{array}{lll}3 & 3 & 4\end{array}$ | 4 | 5 |
| 69 | S3S8 | 8395 | 8401 | 8407 | 8414 | 8420 | 8426 | 8432 | S439 | 8 | 11 | 231 | 4 | 56 |
| 70 | S | 8457 | S463 | S470 | 8476 | 8482 | S488 | 8494 | 8500 | S 506 | 1 I | 234 | 4 | 5 |
| 71 | S513 | 8519 | S525 | S53I | S537 | 8543 | S 549 | 8555 | S56I | 8567 | 112 | 234 | 4 | 5 |
| 72 | 8573 | 8579 | 8585 | 8591 | 8597 | 8603 | 8609 | 8615 | 8621 |  | 112 | 4 | 4 | 55 |
| 73 | S633 | 8639 | 8645 | 8651 | 8657 | 8663 | 8669 | 8675 | 868I | S68 | 112 | 234 |  | 5 |
| 74. | S692 | 8698 | 8704 | 8710 | 8716 | 8722 | 8727 | 8733 | 8739 | 8745 | I | 234 | 4 | $5 \quad 5$ |
| 75 | 8751 | 8756 | \$762 | 8768 | 8774 | 8779 | 8785 | 8791 | S797 | 8802 | 112 | 233 | 4 | 5 |
| 76 | 8508 | 8814 | S820 | 8825 | 8831 | 8837 | S842 | 8848 | 8854 |  | 112 | $2 \begin{array}{lll}2 & 3\end{array}$ | 4 | 5 |
| 77 | S865 | 8871 | 8876 | S8S2 | 88S7 | 8893 | 8899 | 8904 | S910 | S915 | 1 I 2 | 233 | 4 | 45 |
| 78 | S921 | 8927 | 8932 | S93S | 8943 | 8949 | S954 | 8960 | 8965 | S971 | 1 | 2 2 | 4 | 45 |
| 79 | S976 | 89S2 | 8957 | 8993 | 8998 | 9004 | 9000 | 9015 | 9020 | 9025 | 112 | 233 | 4 | 4. 5 |
| 80 | 9031 | 9036 | 9042 | 9047 | 9053 | 9058 | 9063 | 9069 | 9074 | 9079 | 1 | 2 | 4 |  |
| 81 | 9085 |  | 9096 | 9101 | 9106 | 9112 | 9117 | 9122 | 9128 | 9133 | 1 I | 233 | 4 | 45 |
| 82 | 9138 | 914 | 9149 | 9154 | 9159 | 9165 | 9170 | 9175 | 9180 | 918 | 1 | 2 |  | 45 |
| 83 | 9191 | 9196 | 9201 | 9206 | 9212 | 9217 | 9222 | 9227 | 9232 | 9238 | 11 | 2 |  | 45 |
| 84 | 9243 | 9248 | 9253 | 9258 | 9263 | 9269 | 9274 | 9279 | 928 | 9289 | 11 | 23 | 4 | 45 |
| 85 | 9294 | 9299 | 9304 | 9309 | 9315 | 9320 | 9325 | 9330 | 9335 | 93 | 1 I | $2 \begin{array}{lll}2 & 3 & 3\end{array}$ | 4 | 45 |
| 86 | 9345 | 9350 | 9355 | 9360 | 9365 | 9370 | 9375 | 93 So | 9385 | 9390 |  | 2313 |  | 45 |
| 87 | 9395 | 9400 | 9405 | 9410 | 945 | 9420 | 9425 | 9430 | 9435 | 9440 | 0 I | $2 \begin{array}{lll}2 & 2 & 3\end{array}$ | 3 | 44 |
| 88 | 9445 | 9450 | 9455 | 94 | 9465 | 9469 | 9474 | 9479 | 9484 | 9489 | 0 I | $2 \quad 23$ | 3 | 44 |
| 89 | 9494 | 949 | 9504 | 9509 | 9513 | 9518 | 9523 | 9528 | 9533 |  | 01 | $\begin{array}{lll}2 & 2 & 3\end{array}$ |  | 44 |
| 90 | 9542 | 9547 | 9552 | 9557 | 9562 | 9566 | 9571 | 9576 | 9581 | 9586 | 0 I | - | 3 | 44 |
| 91 | 9590 | 9595 | 9600 | 9605 | 9609 | 9614 | 0619 | 9624 | 9628 | 9633 | 01 | $\begin{array}{llll}2 & 2 & 3\end{array}$ | 3 | 44 |
| 92 | 9638 | 964 | 9647 | 9652 | 9657 | 9661 | 9666 | 9671 | 9675 | 9680 | 0 I | 2 |  | 44 |
| 93 | 9685 | 9680 | 9694 | 9699 | 9703 | 970 S | 9713 | 9717 | 9722 | 9727 | 01 | 2 | 3 | 44 |
| 94 | 97.3I | 973 | 9741 | 9745 | 9750 | 9754 | 9759 | 9763 | 976 | 9773 | 01 | 223 | 3 | 44 |
| 95 | 9777 | 978 | 9786 | 9791 | 9795 | 9800 | 9 SO 5 | 9809 | 9814 | 9818 | 0 I | $2 \quad 23$ | 3 | 44 |
| 96 | 9823 | 9827 | 9832 | 9836 | 9841 | 9845 | 9850 | 9854 | 9859 | 986 | 01 | 2.23 |  | 44 |
| 97 | 9868 | 9872 | 9877 | 9881 | 9886 | 9890 | 9894 | 9899 | 9903 | 9908 | $\bigcirc 1$ | 2 | 3 | $4 \quad 4$ |
| 98 | 9912 | 9917 | 9921 | 9920 | 9930 | 9934 | 9939 | 9943 | 9948 | 9952 | 0 I | 2. | 3 | 44 |
| 99 | 995 | 996 | 996 | 9 | 997 | 97 | 99 | 9987 | 9991 | 9996 | - | 3 | 3 | 3 |


|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 | 8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 |  | 957 | 9914 | 9872 | 9830 | 9788 | 9747 | 9706 | 9666 | 9626 | 4 S 12 | 172125 | 293337 |
| 11 |  |  | 950 | 94 | 9431 | 9393 | 9355 | 9318 | 9281 | 9245 | 4 S 11 | 151923 | 263034 |
| 12 | 92 | 917 | 9136 | 9101 | 9066 | 9031 | 8996 | 8962 | 8928 | 8 S 94 | 3710 | 141721 | 242831 |
| 13 | 8861 | 8827 | 8794 | 8761 | 8729 | 8697 | 8665 | 8633 | 8601 | 8570 | 3610 | 131619 | 232629 |
| 14 | S | 8508 | 8477 | 8447 | 8416 | 8386 | 8356 | 8327 | 8297 | 8268 | 369 | 121518 | 27 |
| 15 | S239 | 8210 | S182 | 8153 | SI25 | 8097 | 8069 | 8041 | 8013 | 7986 | 3 | 111417 | 202225 |
| 16 | 7959 | 7932 | 7905 | 7878 | 7852 | 7825 | 7799 | 7773 | 7747 | 7721 | 3 |  | 1821 24 |
| 17 | 76 | 767 | 7645 | 7620 | 7595 | 7570 | 7545 | 7520 | 7496 | 7471 | 257 | 10 1215 | 20 |
| 18 | 7447 | 7423 | 7399 | 7375 | 7352 | 7328 | 7305 | 7282 | 7258 | 7235 | 25 | 91214 | 1921 |
| 19 | 7212 | 7190 | 7167 | 7144 | 7122 | 7100 | 7077 | 7055 | 7033 | 7011 | 2.4 | 91113 | 16 IS |
| 20 |  | 696 | 6946 | 6925 | 6904 | 6852 | 6861 | 6840 | 6819 | 6799 | 246 | 81113 | 1517 |
| 21 |  | 675 | 6737 | 6716 | 66 | 66 | 6655 | 6635 | 66 |  | 246 | 1012 | 18 |
| 22 | 65 | 6556 | 6536 | 6517 | 6497 | 6478 | 6459 | 644 | 6421 | 02 | 2 | 810 | 141517 |
| 23 |  | 6364 | 6345 | 6326 | 6308 | 6289 | 6271 | 6253 | 6234 | 6 | 2 | 9 II | 131517 |
| 24 |  | 618 | 6162 | 6 | 6 | 6108 | 6091 | 6073 | 55 |  | 245 | 1 | 16 |
| 25 |  |  | 59 |  | 59 | 5935 | 5918 | 5901 | 5884 |  | $2 \begin{array}{lll}2 & 3 & 5\end{array}$ | 7910 | 121415 |
| 26 | 58 | 58 | 58 |  | 57 | 57 | 5751 | 5735 | 5719 | 57 | $\begin{array}{lll}2 & 3 & 5\end{array}$ | 7 S 10 | 111815 |
| 27 |  | 567 | 5654 | 56 | 5622 | 5607 | 5591 | 5575 | 5560 | 5544 | 2 | $\begin{array}{lll}6 & 8 & 9\end{array}$ | 1314 |
| 28 | 55 | 5513 | 5498 | 5482 | 5467 | 5452 | 5436 | 5421 | 5406 |  | 2 | 6 | 111214 |
| 29 |  | 5361 | 5346 | 5331 | 5317 | 5302 | 5287 | 5272 | 5258 | 5243 |  | $6 \quad 79$ | 10 12 13 |
| 30 | 5 | 521 | 52 | 5186 | 5171 | 5157 | 5143 | 5129 | 5114 | 5100 | 134 | 6 | 101113 |
| 31 |  | 50 |  | 50 | 5031 | 5017 | 5003 | 4989 | 4976 | 4962 | $1 \begin{array}{lll}1 & 3\end{array}$ |  | 101112 |
| 32 | 4948 | 493 | 4921 | 4908 | 4895 | 488 I | 4868 | 4855 | 4841 | 482 | 3 | 5 | 12 |
| 33 | 4815 | 48 | 4789 | 4776 | 4763 | 4750 | 4737 | 4724 | 4711 | 469 |  | 5 | 91012 |
| 34 | 46 | 467 |  | 4647 | 4634 | 4622 | 4609 | 4597 | 4584 | $7^{2}$ | 134 | 68 | 1 |
| 35 |  | 4547 | 45 | 4522 | 4510 | 4498 | 4486 | 73 | 446 r | 49 | $\begin{array}{llll}1 & 2 & 4 \\ 1 & 2 & \end{array}$ | 5 | 1o 11 |
| 35 | 4437 | 4425 | 44 | 4401 | 43 | 4377 | 4365 | 353 | 4342 | 330 | 124 | 5 | 91011 |
| 37 |  | 430 |  | 42 | 4271 |  | 4248 | 4237 | 4225 | 4214 | $1 \begin{array}{lll}1 & 2 & 3\end{array}$ | 567 | $\bigcirc$ |
| 33 |  | 4191 | 4179 | 4168 | 4157 | 4145 | 4134 | 4123 | 12 | 1 | 1 2 3 <br> 1   | 5 | - |
| 39 | 4089 | 4078 | 4067 | 4056 | 4045 | 4034 | 4023 | 4012 | Or | 3990 | $\begin{array}{llll}1 & 2 & 3\end{array}$ |  | 8910 |
| 40 |  | 396 | 3958 | 3947 | 3936 | 3925 | 3915 | 3904 | 3893 | 3883 | $\begin{array}{lll}1 & 2 & 3\end{array}$ | $4 \quad 56$ | 78.9 |
| 41 | 3872 | 3862 | 385 r | 3840 | 3830 | 3820 | $3 \mathrm{SO9}$ | 3799 | 3758 | 3778 | 123 | 456 |  |
| 42 | 3768 | 3757 | 3747 | 3737 | 3726 | 3716 | 3706 | 3696 | 368 | 3675 | 11 2 <br>   | 456 | 9 |
| 43 | 3665 | 3655 | 3645 | 36 | 36 | 36 | 3 | 35 | 3585 | 3575 | 1 2 3 | 456 | 9 |
| 44 | 3565 | 3556 | 3546 | 3536 | 3526 | 3516 | 3507 | 3497 | 3487 | 3478 | $\begin{array}{lll}1 & 2 & 3\end{array}$ | 456 | 9 |
| 45 | 3468 | 3458 | 3449 | 3439 | 3429 | 3420 | 3410 | 3401 | 3391 | 338 | $1 \begin{array}{lll}1 & 2 & 3\end{array}$ | 4 | 9 |
| 46 | 3372 | 3363 | 3354 | 33 | 333 | 332 | 3316 | 3307 | 329 | 3 | $\begin{array}{llll}1 & 2 & 3\end{array}$ | $4 \begin{array}{lll}4 & 5\end{array}$ | 8 |
| 47 | 3279 | 3270 | 3261 | 325 I | 3242 | 3233 | 3224 | 3215 | 3206 | 3197 | 2 | $4 \begin{array}{lll}4 & 5\end{array}$ | 8 |
| 43 | 3188 | 3179 | 3170 | 3161 | 3152 | 3 I 43 | 3134 | 3125 | 3116 | 3107 | 11 2 3 |  | 678 |
| 49 | 3098 | 3089 | 3080 | 3071 | 3063 | 3054 | 3045 | 3036 | 3028 | 3019 | $\begin{array}{lll}1 & 2 & 3\end{array}$ | $\begin{array}{lll}4 & 4 & 5\end{array}$ | 8 |
| 50 |  | 3002 | 299 | 2984 | 2976 | 2967 | 2958 | 2950 | 2941 | 2933 | $1 \begin{array}{lll}1 & 2 & 3 \\ 1 & 2\end{array}$ | $\begin{array}{lll}3 & 4 & 5\end{array}$ | 8 |
| 51 |  | 2916 | 2907 | 2899 | 2890 | 2852 | 2874 | 2865 | 2857 | $28_{4} 8$ | $1 \begin{array}{lll}1 & 2 & 3\end{array}$ | $3+5$ | 8 |
| 52 | 2040 | 2832 | 223 | 2815 | 2807 | 2798 | 2790 | 2782 | 2774 | 2765 | $1 \begin{array}{ll}1 & 2 \\ 1 & 2\end{array}$ | $\begin{array}{llll}3 & 4 & 5\end{array}$ | 7 |
| 53 | 2757 | 2719 | 2741 | 2733 | 2725 | 2716 | 2708 | 2700 | 2692 | 26 | 2 | 3 | 7 |
| 54 | 2676 | 2668 | 2660 | 26 | 26 | 26 | 26 | 2620 | 261 |  | 122 | 34 | 667 |


|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  | 123 |  | 456 |  |  | 789 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 55 |  | 25SS | 25SI | 2573 | 2565 | 2557 | 2549 | 2541 | 2534 | 2526 |  | 2 |  | 3 | 4 | 5 |  |  |  |
| 56 | 2515 | 2510 | 2503 | 2495 | 2487 | $245^{\circ} \mathrm{O}$ | 2472 | 2464 | 2457 | 2449 |  | 2 |  | 3 |  |  |  |  |  |
| 57 |  |  | 24 | $2+1$ S | 2411 | 2403 | 2396 | 23 | 2381 | , |  |  |  |  |  |  |  |  |  |
| 58 | 2366 | 2355 | 2351 | $23+3$ | 2336 | 2325 | 2321 | 2314 | 2306 | 229 | 1 | 1 |  |  |  |  |  | 6 |  |
| 59 | 2291 | $22 \mathrm{~S}_{4}$ | 2277 | 2269 | 2202 | 2255 | 2248 | 2240 | 2233 | 2226 | 1 | 1 |  | 3 |  | 4 | 5 |  |  |
| 60 | 2218 | 2211 | 2204 | 2197 | 2190 | 2 IS 2 | 217 | 2168 | 2161 | 2154 | 1 | 1 |  | 3 |  |  | 5 | 6 | 6 |
| 61 |  | 21 |  | 2125 | 2115 | 2 II | 04 | 209 |  |  |  |  |  |  |  |  |  |  |  |
| 62 | 20 | 206 | 2062 |  | 20.48 | 2041 | 2034 | 2027 |  |  |  | 1 |  |  |  |  |  |  |  |
| 63 | 2007 | 200 | 19 | 19 | 1979 | 1972 | 1965 | 1959 | 1952 | 1945 |  | I |  | 3 |  |  | 5 | 5 |  |
| 64 |  | 1931 | 192 | 101 | 19 |  | 95 | IS91 |  |  |  |  |  |  |  |  |  |  |  |
| 65 | 1871 | IS64 | IS5S | 1851 | IS | $1 \mathrm{~S}_{3} \mathrm{~S}$ | 1831 | IS24 |  |  |  | 1 |  |  |  |  |  |  |  |
| 66 |  | 1795 | 1791 | 1785 | 17 | 1772 | 1765 | 1759 | 1752 | 1746 | I | I |  | 3 | 3 |  | 5 | 5 |  |
| 67 |  | 1733 | 1726 | 1720 | 17 | 1707 | 1701 | 16 | 1688 |  |  |  |  |  |  |  |  |  |  |
| 68 | 1675 | 1669 | 1662 | 1656 | I649 | 1643 | 1637 |  | 1624 |  | I | 1 |  |  |  |  |  |  |  |
| 69 | 1612 | 1605 | 15 | 1593 | 1586 |  | 15 |  | 1561 | 1555 | I | 1 |  |  | 3 |  |  | 5 |  |
| 70 |  | 1543 | 153 | 15 | 15 | 15 | 1512 | 15 | 15 | 14 | I | 1 |  |  | 3 |  |  | 5 | 5 |
| 71 |  | $14{ }_{1}{ }^{\text {S }}$ | 14 | 1469 | 146 | 57 | 51 | 14 | 39 | 433 |  |  |  |  |  |  |  |  | 5 |
| 72 | 1427 | I42I | 141 | 1 | I40 | 1397 | 391 | 138 | 1379 | 1373 |  |  |  |  |  |  |  |  |  |
| 73 | 1367 | 1361 | 1355 | 13 | 134 | 1337 | 1331 | I325 | 1319 | 1314 |  |  |  |  | 3 |  |  |  |  |
| 74 | 1308 | 130 | 129 | 0 | 1284 | 1278 | 1273 | 1267 | 1261 |  |  | 1 |  |  |  |  |  |  |  |
| 75 | 1249 | I244 | 1238 | 1232 | 12 | 1221 | 1215 | 1209 | 1203 |  |  | 1 |  | 2 |  |  |  |  |  |
| 76 | 1192 | IIS6 | 1 ISo | 1175 | I I | I 163 | 1158 | 1152 | 1146 | 1141 | 1 | 1 |  | 2 |  |  |  |  |  |
| 77 |  | 1 | 112 | IIIS | $11_{1}$ | 1107 | 1101 |  |  |  |  | 1 |  |  |  |  |  |  |  |
| 78 |  | 107 | 10 | 1062 | 10 | 1051 | 1046 |  |  |  |  | 1 |  |  |  |  |  |  | 5 |
| 79 |  | Io | 10 | 1007 | 10 |  | 0991 |  |  |  | 1 | 1 |  | 2 | 3 | 3 |  |  |  |
| 80. |  | 0964 |  | 0953 | 094 |  | 0937 | 09 | 09 | 0921 |  | 1 |  |  | 3 |  |  |  |  |
| 81 |  |  | 09 |  | O8 | osss | ${ }_{3}$ |  | 0872 |  |  | 1 |  |  |  |  |  |  |  |
| 82 | OS62 | - | cS51 | oS46 | OS4 1 | 0835 | - |  | -7 |  |  | 1 |  |  |  |  |  |  |  |
| 83 |  |  |  |  |  |  |  |  |  |  |  | 1 |  |  | 3 |  |  |  |  |
| 84 |  | 075 |  |  |  |  |  |  | 0716 |  |  | 1 |  |  |  |  |  |  |  |
| 85 | 0706 | 0701 | 0696 | 0691 | $06 \$ 5$ |  | 0675 |  | 0665 |  | 1 | 1 |  |  |  |  |  |  |  |
| 86 | 0655 | 06 |  |  |  |  |  |  | 0615 |  | 1 | I |  |  | 3 |  |  | 4 |  |
| 87 |  | O60 |  |  |  |  |  | 05 | 0565 |  |  | 1 |  |  |  |  |  |  |  |
| 88 |  | 0550 | - |  |  | 053 I | 0526 | 0521 | 0516 | 0511 |  | - |  | 2 | 2 |  |  |  |  |
| 89 |  | O501 |  |  |  |  | 0477 | 0472 | 0+67 | 0462 |  | 1 |  | 2 | 2 |  | 3 | 4 |  |
| 90 | 04 | 045 | 044 | 044 | 043 | 0434 | 0429 | 0424 | 04 | 04 |  | 1 |  |  |  |  |  | 4 |  |
| 91 |  | 0405 | 0400 | 0395 | 0391 | 0356 | $\mathrm{O}_{3} \mathrm{SI}$ | 0376 | 0372 | 0367 |  | 1 |  |  |  |  |  |  |  |
| 92 | O362 | -357 | 0353 | 0348 | -343 | 0339 | 0334 | O329 | 0325 | 0320 |  | 1 |  |  |  |  | 3 |  |  |
| 93 | 0315 | O3II | 0306 | 0301 | 0297 | 0292 | 02S7 | O2S3 | 027 | 0273 |  | 1 |  | 2 | 2 | 3 | 3 | 4 |  |
| 94 | 0269 | 0264 | 0259 | 0255 | 020 | 0246 | 0241 | 0237 |  |  |  | 1 |  |  |  |  |  |  |  |
| 95 | 0223 | O2IS | 0214 | 0209 | O205 |  | -195 | 0191 | -186 |  |  | 1 |  | 2 | 2 |  | 3 | 4 |  |
| 96 | 0177 | O173 | 016 | 0164 | OI 59 | OI55 | OI 50 | 0146 | OI4 | O1 37 | 0 | I |  | 2 | 2 |  | 3 | 4 |  |
| S |  |  |  |  | O114 |  | OIO6 | OIOI |  | 92 |  |  |  |  |  |  |  |  |  |
| 98 |  |  |  | 0074 | 0070 |  |  | 0057 |  | 4 | $\bigcirc$ | 1 |  |  | 2 | 3 |  | 4 |  |
| 99 | 0044 |  | 0035 | 0031 | 0026 | - | 0017 | OOI 3 |  |  |  |  |  | $=$ | 2 | 3 | 3 | 3 |  |

N.B.-Wambers in Diference Columas to be Subtracted, not Added.



LOGARITHMIC SINES.


LOGARI'THMIC SINES.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | 24' | $30^{\prime}$ | 36 | $42^{\prime}$ | $48^{\prime}$ | $54^{\prime}$ |  |  | 3 |  | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 9 S 495 | S502 | S5IO | S517 | S525 | S532 | S 540 | S 547 | S555 | S562 | I | 2 | 4 | 5 | 6 |
| 46 | $9 \cdot 8569$ | S 577 | S5S4 | S591 | S59S | S606 | S6I3 | S620 | S627 | 8634 | I | 2 | 4 | 5 |  |
| 47 | $9 \cdot 8641$ | S648 | S655 | S662 | S669 | S676 | 8683 | S690 | S697 | 8704 | 1 | 2 |  |  | 6 |
| 48 | $9 \cdot 87$ II | 87 IS | 8724 | S731 | 873 | S745 | S751 | 8758 | 8765 | 8771 | I | 2 | 3 | 4 | 6 |
| 49 | $9 \cdot 877 \mathrm{~S}$ | S784 | S791 | 8-97 | $\mathrm{SSO}_{4}$ | 8810 | 8SI7 | SS23 | 8830 | S836 | I | 2 | 3 | 4 | 5 |
| 50 | $9 \cdot 8543$ | SS49 | SS55 | 8562 | 8S6S | SS74 | SSSo | 8887 | 8S93 | SS99 | I | 2 | 3 |  | 5 |
| 51 | $9 \cdot 8905$ | S91I | S917 | S923 | S929 | S935 | S9+1 | 8947 | S953 | S959 | I | 2 | 3 | 4 | 5 |
| 52 | 9.S965 | S97I | S977 | $\mathrm{S9S3}_{3}$ | S9S9 | S995 | 9020 | 9006 | 9012 | 901S | I | 2 | 3 | 4 | 5 |
| 53 | 9.9023 | 9029 | 9035 | 90+1 | 90.6 | 9052 | 9057 | 9063 | 9069 | 9074 | I | 2 | 3 |  | 5 |
| 54 | 9'90So | 9085 | 909 I | 9096 | 9101 | 9107 | 9112 | 9118 | 9123 | 9128 | I | 2 | 3 | 4 | 5 |
| 55 | 9.9134 | 9139 | 914 | 9149 | 9155 | 9160 | 9165 | 9170 | 9175 | 918I | 1 | 2 | 3 | 3 | 4 |
| 56 | 9.9186 | 9191 | 9196 | 9201 | 9206 | 9211 | 9216 | 922 I | 9226 | 9231 | I | 2 | 3 | 3 | 4 |
| 57 | 9.9236 | 9241 | 9246 | 9251 | 9255 | 9260 | 9265 | 9270 | 9275 | 9279 | I | 2 | 2 | 3 |  |
| 58 | 9.928. | 92 S 9 | 9294 | 929S | 9303 | 9308 | 9312 | 9317 | 9322 | 9326 | I | 2 | 2 | 3 |  |
| 59 | 9.9331 | 9335 | 9340 | 9344 | 9349 | 9353 | 935S | 9362 | 9367 | 937 I | I | I | 2 |  | 4 |
| 60 | 9.9375 | 93So | $93 \mathrm{~S}_{4}$ | 93SS | 9393 | 9397 | 9401 | 9406 | 9410 | 9414 | I | I | 2 | 3 | 4 |
| 61 | 9.9418 | 9422 | $9+27$ | 9431 | 9435 | $9+39$ | 9443 | 9+47 | 945 I | $9+55$ | I | I | 2 | 3 | 3 |
| 62 | 9.9459 | 9463 | 946 | 947 I | 9475 | $9+79$ | 9483 | 9487 | 9491 | 9495 |  |  | 2 | 3 | 3 |
| 63 | 9.9499 | 9503 | 9507 | 9510 | 9514 | 9518 | 9522 | 9525 | 9529 | 9533 | I |  | 2 | 3 | 3 |
| 64 | 9.9537 | 9540 | $95+4$ | 954 S | 9551 | 9555 | 9558 | 9562 | 9566 | 9569 | I | I | 2 | 2 | 3 |
| 65 | 9*9573 | 9576 | 95So | 9583 | 95S7 | 9590 | 9594 | 9597 | 9601 | 9604 | I | I | 2 | 2 | 3 |
| 66 | 9.9607 | 9611 | 9614 | 9617 | 9621 | 9624 | 9627 | 963 I | 9634 | 9637 | I |  | 2 | 2 | 3 |
| 67 | 9.9640 | 9643 | 9647 | 9650 | 9653 | 9656 | 9659 | 9662 | 9666 | 9669 | I | I | 2 | 2 | 3 |
| 68 | 9.9672 | 9675 | 967 S | 96SI | $96 \mathrm{~S}_{4}$ | 9657 | 9690 | 9693 | 9696 | 9699 | 0 | I | I | 2 | 2 |
| 69 | 9.9702 | 9704 | 970 | 9710 | 9713 | 9716 | 9719 | 9722 | 9724 | 9727 | 0 | I | I | 2 | 2 |
| 70 | 99730 | 9733 | 9735 | 973S | 974 I | 9743 | 9746 | 9749 | 975 I | 9754 | - | I | I | 2 | 2 |
| 71 | 9.9757 | 9759 | 9762 | 9764 | 9767 | 9770 | 9772 | 9775 | 9777 | 97 So | 0 | I | I | 2 | 2 |
| 72 | 9.9752 | 97S5 | 97 S 7 | 9789 | 9792 | 97 | 9797 | 9799 | 9SOI | 9 So 4 | - |  | I | 2 | 2 |
| 73 | $9^{\circ} 9{ }^{\circ} \mathrm{So6}$ | 9SoS | 9SII | $9 \mathrm{SS}_{3}$ | 9SI 5 | 9Si7 | 9S20 | 9822 | 9824 | 9S26 | 0 | [ | 1 | 2 | 2 |
| 74 | 9.9S2S | 9S3I | 9833 | 9S35 | 9S37 | 9839 | ${ }_{9} S_{4} 1$ | $9 S_{43}$ | 9845 | 9847 | 0 | I | 1 | I | 2 |
| 75 | 99849 | 9S5I | 9853 | 9S55 | 9S57 | 9S59 | 9S61 | $9 \mathrm{c}_{3}$ | 9865 | 9S67 | 0 | I | I | I | 2 |
| 76 | 9.9S69 | 9S71 | 9873 | 9S75 | 9S76 | 9S7S | 9880 | 9882 | 9S8. | 9855 | 0 | I | I |  | 2 |
| 77 | 9'9S87 | 9SS9 | 989I | 9S92 | 9S9+ | 9896 | 9 S 97 | 9S99 | 9901 | 9902 | $\bigcirc$ | I | I | I | 1 |
| 78 | 9.9904 | 9906 | 9907 | 9909 | 9910 | 9912 | 9913 | 9915 | 9916 | 9918 | $\bigcirc$ | I | I | 1 | 1 |
| 79 | 9.9919 | 992 I | 9922 | 9924 | 9925 | 9927 | 992S | 9929 | 9931 | 9932 | 0 | 0 | I | I | 1 |
| 80 | 9.9934 | 9935 | 9936 | 9937 | 9939 | 9940 | 9941 | 9943 | 9944 | 9945 | 0 | O | 1 | 1 | I |
| 81 | $9.99+6$ | $99+7$ | 9949 | 9950 | 9951 | 9952 | 9953 | 9954 | 9955 | 9956 | O | 0 | 1 | 1 | I |
| 82 | 9.995 S | 9959 | 9960 | 996́1 | 9962 | 9963 | 9964 | 9965 | 9966 | 9967 | 0 | - | I | 1 | I |
| $\varepsilon 3$ | 9.996S | 996S | 9969 | 9970 | 997 I | 9972 | 9973 | 9974 | 9975 | 9975 | 0 | - | o | I | I |
| 84 | 9.9976 | 9977 | 997 S | 9978 | 9979 | 9980 | 99SI | 99SI | 99 S2 | 99S3 | 0 | 0 | 0 | 0 | I |
| $\varepsilon 5$ | 9.9983 | 99S4 | 9985 | 99S5 | 99S6 | 99S7 | 99S7 | 99S8 | 99SS | 9989 | 0 | 0 | 0 | 0 | 0 |
| 86 | 9.9989 | 9990 | 9990 | 9991 | 9991 | 9992 | 9992 | 9993 | 9993 | 9994 | 0 | 0 | 0 | 0 | 0 |
| 87 | 9.9994 | 9994 | 9995 | 9995: | 9996 | 9996 | 9996 | 9996 | 9997 | 9997 | 0 | o | 0 |  | 0 |
| 88 | 9.9997 | 999 S | 999S | 9998 | 9998 | 9999 | 9999 | 9999 | 9999 | 9999 | $\bigcirc$ | 0 | 0 | $\bigcirc$ | 0 |
| 89 | 9*9999 | 9999 | -00 | Cooo |  | 00 | -000 | 0000 | -0000 | -0000 | 0 | 0 | 0 | O | 0 |

LOGARITHMIC COSINES.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | 12' | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | 48' | $54^{\prime}$ | 1 | 2 | 3 | 45 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | 10:0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 9*9999 | 0 | $\bigcirc$ | 0 | 0 | 0 |
| 1 | $9 \cdot 9999$ | 9999 | 9999 | 9999 | 9999 | 9999 | 9998 | 9998 | 9998 | 9998 | 0 | 0 | 0 | 0 | 0 |
| 2 | 9'9997 | 9997 | 9997 | 9996 | 9996 | 9996 | 9996 | 9995 | 9995 | 9994 | $\bigcirc$ | - | 0 | O | 0 |
| 3 | 9.9994 | 9994 | 9993 | 9993 | 9992 | 9992 | 9991 | 9991 | 9990 | 9990 | $\bigcirc$ | 0 | 0 | 0 | 0 |
| 4 | 9.9989 | 9959 | 998S | 9988 | 9987 | 9987 | 99S6 | 9985 | 99S5 | 9984 | 0 | $\bigcirc$ | 0 | O | $\bigcirc$ |
| 5 | $9 \cdot 9983$ | 9983 | 9982 | 9981 | 9981 | 9980 | 9979 | 9978 | 9978 | 9977 |  | 0 | 0 | O | I |
| 6 | 9*9976 | 9975 | 9975 | 9974 | 9973 | 9972 | 9971 | 9970 | 9969 | 9968 | 0 | 0 | 0 | I | I |
| 7 | 9.9968 | 9967 | 9966 | 9965 | 9964 | 9963 | 9962 | 9961 | 9960 | 9959 | 0 | 0 | I | I | 1 |
| 8 | $9 \cdot 9957$ | 9956 | 9955 | 9954 | y953 | 9952 | 9951 | 9950 | 9949 | 9947 | o | O | I | I | I |
| 9 | 9.9946 | 9945 | 9944 | 9943 | 9941 | 9940 | 9939 | 9937 | 9936 | 9935 | - | 0 | I | I | I |
| 10 | 9*9934 | 9932 | 993 I | 9929 | 9928 | 9927 | 9925 | 9924 | 9922 | 9921 | 0 | 0 | 1 | I | 1 |
| 11 | 9'9919 | 9918 | 9916 | 9915 | 9913 | 9912 | 9910 | 9909 | 9907 | 9906 | 0 | I | 1 |  | I |
| 12 | 9.9904 | 9902 | 9901 | 9899 | 9597 | 9896 | 9894 | 9892 | 9891 | 9889 | - | 1 | I |  | I |
| 13 | 9.9887 | 9885 | 98S4 | 9852 | 9850 | 9S78 | 9876 | 9875 | 9873 | 987 I | - | I | I | I | 2 |
| 14 | $9 \cdot 9869$ | 9867 | 9865 | 9863 | 9S6I | 9859 | 9857 | 9855 | 9853 | 985 I | 0 |  | 1 |  | 2 |
| 15 | $9 \cdot 9849$ | 9847 | 9S45 | 9843 | 9S41 | 9S39 | 9837 | 9S35 | 9S33 | 9831 | 0 | I | 1 | 1 | 2 |
| 16 | $9 \cdot 9828$ | 9S26 | 9S24 | 9822 | 9820 | 9817 | 9SI 5 | $9{ }^{9} 13$ | 9SII | 9808 | 0 | I | I | 2 | 2 |
| 17 | 9.9806 | $9{ }^{9} \mathrm{SO}_{4}$ | 980I | 9799 | 9797 | 9794 | 9792 | 9789 | 9787 | 97S5 | 0 | I | I |  | 2 |
| 18 | $9 \cdot 9782$ | 97So | 9777 | 9775 | 9772 | 9770 | 9767 | 9764 | 9762 | 9759 |  | I | I | - | 2 |
| 19 | 9*9757 | 9754 | 9751 | 9749 | 9746 | 9743 | 974 I | 9738 | 9735 | 9733 | 0 | 1 | 1 | 2 | 2 |
| 20 | 9.9730 | 9727 | 9724 | 9722 | 9719 | 9716 | 9713 | 9710 | 9707 | 9704 | 0 | I | I | 2 | 2 |
| 21 | 9.9702 | 9699 | 9696 | 9693 | 9690 | 9687 | 9684 | 968 I | 9678 | 9675 | 0 | I | 1 |  | 2 |
| 22 | $9 \cdot 9672$ | 9669 | 9666 | 9662 | 9659 | 9656 | 9653 | 9650 | 9647 | 9543 |  | I | 2 |  | 3 |
| 23 | $9^{\circ} 9640$ | 9637 | 9634 | 963 I | 9627 | 9624 | 9621 | 9617 | 9614 | 961 I | 1 | I | 2 | 2 | 3 |
| 24 | 9*9607 | 9604 | 9601 | 9597 | 9594 | 9590 | 9587 | 9583 | 9580 | 9576 | I |  | 2 | 2 | 3 |
| 25 | $9 * 9573$ | 9569 | 9566 | 9562 | 955S | 9555 | 9551 | 954 S | 9544 | 9540 | I | 1 | 2 |  | 3 |
| 26 | 9.9537 | 9533 | 9529 | 9525 | 9522 | 9518 | 9514 | 9510 | 9507 | 9503 | I | 1 | 2 | 3 | 3 |
| 27 | 9*9499 | 9495 | 9491 | 9487 | 9483 | 9479 | 9475 | 9471 | 9467 | 9463 | I | I | 2 |  |  |
| 28 | 9*9459 | 9455 | 945 I | 9447 | 9443 | 9439 | 9435 | 9431 | 9427 | 9422 | I | I | 2 |  | 3 |
| 29 | 9*9418 | 9414 | 9410 | 9406 | 9401 | 9397 | 9393 | 9385 | 93 S4 | 9380 | I | 1 | 2 |  | 4 |
| 30 | 9*9375 | 9371 | 9367 | 9362 | 9358 | 9353 | 9349 | 9344 | 9340 | 9335 | I | I | 2 | 3 | 4 |
| 31 | 909331 | 9.326 | 9322 | 9317 | 9312 | 9308 | 9303 | 9298 | 9294 | 9289 | I | 2 | 2 | 3 |  |
| 32 | $9 \cdot 9284$ | 9279 | 9275 | 9270 | 9265 | 9260 | 9255 | 9251 | 9246 | 924 I | 1 | 2 | 2 | 3 |  |
| 33 | $9 \cdot 9236$ | 923 I | 9226 | 9221 | 9216 | 9211 | 9206 | 9201 | 9196 | 9191 | 1 | 2 | 3 | , | 4 |
| 34 | $9 \cdot 9186$ | 9ISI | 9175 | 9170 | 9165 | 9160 | 9155 | 9149 | 9144 | 9139 | 1 | 2 | 3 |  |  |
| 35 | 9*9134 | 9128 | 9123 | 9118 | 9112 | 9107 | 9101 | 9096 | 9091 | 9085 | I | 2 | 3 | 4 |  |
| 36 | $9 \cdot 90$ O | 9074 | 9069 | 9063 | 9057 | 9052 | 9046 | 904 I | 9035 | 9029 | I | 2 | 3 | 4 | 5 |
| 37 | $9^{\circ} 9023$ | 9018 | 9012 | 9006 | 9000 | 8995 | S989 | 8983 | S977 | S971 | 1 | 2 | 3 |  | 5 |
| 38 | $9 \cdot \mathrm{S965}$ | 8959 | S953 | 8947 | 89.11 | 8935 | S929 | 8923 | S917 | 89II | I | 2 | 3 | 4 | 5 |
| 39 | 9.S905 | 8899 | SS93 | SSS7 | 8SSo | 8574 | S86S | 8862 | S855 | 8849 | 1 | 2 | 3 | 4 | 5 |
| 40 | 9.8843 | 8836 | 8830 | \$823 | 8817 | 8810 | 8804 | S797 | 8791 | 8784 | I | 2 | 3 | 4 | 5 |
| 41 | $9 \cdot 8778$ | 8771 | S765 | 8758 | 875 I | 8745 | 8738 | 8731 | 8724 | 87 I 8 | 1 | 2 | 3 |  | 6 |
| 42 | 9.8711 | 8704 | S697 | 8690 | 8683 | 8676 | 8669 | 8662 | 8655 | S648 | 1 | 2 | 3 | 5 | 6 |
| 43 | $9 \cdot 8641$ | 8634 | 8627 | 8620 | S613 | S606 | 8598 | 859 I | S584 | 8577 | 1 | 2 | 4 | 5 | 6 |
| 44 | $9 \cdot 8569$ | S562 | S 555 | 8547 | S540 | $S_{532}$ | $S_{525}$ | S517 | S 510 | S502 | 1 | 2 | 4 | 5 | 6 |

N.B.-Numbers in difference columns to be subtracted, not added. - Sec Ruies.

LOGARITHMIC COSINES.

N.B.-Numbers in difference columns to be subtracted, not added.-See Rules

LOGARITHMIC TANGEN'TS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | 18' | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | $42^{\prime}$ | 48' | $54^{\prime}$ | 123 |  | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | Inf. Neg. | -2419 | 5429 | 7190 | 8439 | 9409 | -200 | -S70 | 1450 | 1962 |  |  |  |
| 1 | S. 2419 | 2833 | 3211 | 3559 | 3 SSI | 4 ISI | 4461 | 4725 | 4973 | 5208 |  |  |  |
| 2 | 8.543I | 5643 | 5845 | 6038 | 6223 | 6401 | 6571 | 6736 | 6594 | 7046 | $2958 \quad 87$ | 116 | 145 |
| 3 | 8.7194 | 7337 | 7475 | 7609 | 7739 | 7865 | 7988 | 8107 | 8223 | 8336 | 214162 | S | 103 |
| 4 | S-8446 | S554 | S659 | S762 | S862 | S960 | 9056 | 9150 | 9241 | 9331 | 163248 |  |  |
| 5 | S.9420 | 9506 | 9591 | 9674 | 9756 | 9836 | 9915 | 9992 | $\overline{0} 06 S$ | ōr43 | 132640 | 53 | 66 |
| 6 | $9^{\circ} \mathrm{O} 116$ | 0289 | 0360 | 0430 | 0499 | 0567 | 0633 | 0699 | 0764 | - 288 | 112234 | 45 | 56 |
| 7 | 9*0891 | 0954 | 101 | 1076 | 1135 | 1194 | 1252 | 1310 | 1367 | 1423 | 102029 |  | 49 |
| 8 | 9.1478 | 1533 | 1587 | 1640 | 1693 | 1745 | 1797 | 1848 | I 898 | 1948 | 91726 | 35 | 43 |
| 9 | 9'1997 | 2046 | 2094 | 2142 | 2189 | 2236 | 2282 | 2328 | 2374 | 2419 | 81623 | 31 | 39 |
| 10 | 9.2463 | 2507 | 2551 | 2594 | 2637 | 2680 | 2722 | 2764 | 2805 | 2846 | 71421 | 28 | 35 |
| 11 | 9.2887 | 2927 | 2967 | 3006 | 3046 | 3085 | 3123 | 3162 | 3200 | 3237 | $\begin{array}{llll}6 & 13 & 19\end{array}$ |  | 32 |
| 12 | $9 \cdot 3275$ | 3312 | 3349 | 3385 | 3422 | 3458 | 3493 | 3529 | 3564 | 3599 | 6 12 IS | 24 | 30 |
| 13 | $9 \cdot 3634$ | 3668 | 3702 | 3736 | 3770 | $3 \mathrm{SO4}$ | 3837 | 3870 | 3903 | 3935 | 6 11 17 | 22 | 28 |
| 14 | $9 \cdot 3968$ | 4000 | 4032 | 4064 | 4095 | 4127 | 4158 | 4189 | 4220 | 4250 | 51016 |  | 26 |
| 15 | 9.4281 | 4311 | 4341 | 4371 | 4400 | 4430 | 4459 | 4488 | 4517 | 4546 | 51015 | 20 | 25 |
| 16 | 9.4575 | 4603 | 4632 | 4660 | 4688 | 4716 | 4744 | 4771 | 4799 | 4826 | $\begin{array}{llll}5 & 9 & 14\end{array}$ | 19 | 23 |
| 17 | 9.4853 | 4880 | 4907 | 4934 | 4961 | 4987 | 5014 | 5040 | 5066 | 5092 | $\begin{array}{llll}4 & 9 & 13\end{array}$ | I | 22 |
| 18 | 9.5118 | 5143 | 5169 | 5195 | 5220 | 5245 | 5270 | 5295 | 5320 | 5345 | 4813 | 16 | 21 |
| 19 | 9.5370 | 5394 | 5419 | 5443 | 5467 | 5491 | 5516 | 5539 | 5563 | 5587 | $4 \quad 8 \quad 12$ | 16 | 20 |
| 20 | 9.5611 | 5634 | 5658 | 5681 | 5704 | 5727 | 5750 | 5773 | 5796 | 5819 | $\begin{array}{llll}4 & 8 & 12\end{array}$ | 15 | 19 |
| 21 | 9.5842 | 5864 | 5887 | 5909 | 5932 | 5954 | 5976 | 5998 | 6020 | 6042 | 47 II | 5 | 19 |
| 22 | $9 \cdot 6064$ | 6086 | 6108 | 6129 | 6151 | 6172 | 6194 | 6215 | 6236 | 6257 | 4711 | 1 | 18 |
| 23 | 9.6279 | 6300 | 6321 | 6341 | 6362 | 6383 | 6404 | 6424 | 6445 | 6465 | 3 7 10 | 14 | 17 |
| 24 | $9 \cdot 6486$ | 6506 | 6527 | 6547 | 6567 | 6587 | 6607 | 6627 | 6647 | 6667 | 710 | 3 | 7 |
| 25 | $9 \cdot 6687$ | 6706 | 6726 | 6746 | 6765 | 6785 | $6 \mathrm{So4}$ | 6824 | 6843 | 6863 | $3 \quad 710$ | 13 | 16 |
| 26 | $9 \cdot 6882$ | 6901 | 6920 | 6939 | 6958 | 6977 | 6996 | 7015 | 7034 | 7053 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 13 | 16 |
| 27 | 9'7072 | 7090 | 7109 | 7128 | 7146 | 7165 | 7183 | 7202 | 7220 | 723 S | 369 |  | 15 |
| 28 | 977257 | 7275 | 7293 | 7311 | 7330 | 7348 | 7366 | 7384 | 7402 | 7420 | 369 | 12 | 15 |
| 29 | $9^{\prime} 7438$ | 7455 | 7473 | 7491 | 7509 | 7526 | 7544 | 7562 | 7579 | 7597 | $3 \quad 6 \quad 9$ | 12 | 15 |
| 30 | 9'70́14 | 763 | 7649 | 7667 | 7684 | 7701 | 7719 | 7736 | 7753 | 7771 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 14 |
| 31 | 977788 | 7505 | 782 | 7839 | 7856 | 7873 | 7890 | 7907 | 7924 | 7941 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | I | 14 |
| 32 | $9 \times 7958$ | 7975 | 7992 | SooS | So25 | $\mathrm{SO}_{4} 2$ | So 59 | So75 | 8092 | Sio9 | $3 \quad 68$ | II | 14 |
| 33 | $9 \cdot 8125$ | S142 | SI5S | SI 75 | S191 | S208 | S224 | 8241 | S257 | 8274 | $\begin{array}{lll}3 & 5 & 8\end{array}$ | 11 | 14 |
| 34 | 9.8290 | S306 | 8323 | S339 | 8355 | S371 | 8388 | 8404 | 8420 | S436 | 358 | I | 14 |
| 35 | $9 \cdot 8452$ | 8468 | 8484 | 8501 | S517 | 8533 | S549 | 8565 | S58I | S 597 | $3 \quad 58$ | II | 13 |
| 36 | $9 \cdot 8613$ | 8629 | 8644 | S660 | S676 | 8692 | 8708 | S724 | 8740 | S755 | 35 | 11 | 13 |
| 37 | 9.8771 | 8787 | SSO3 | S8IS | 8834 | S850 | \$865 | 8881 | SS97 | S912 | 3 lll | 10 | 13 |
| 38 | $9 \cdot 8928$ | 8944 | 8959 | S975 | 8990 | 9006 | 9022 | 9037 | 9053 | 9068 | 358 | 1 | 13 |
| 39 | 9.9084 | 9099 | 9115 | 9130 | 9146 | 9161 | 9176 | 9192 | 9207 | 9223 | 3 5 8 | 10 | 13 |
| 40 | 9.9238 | 9254 | 9269 | 9284 | 9300 | 9315 | 9330 | 9346 | 9361 | 9376 | $\begin{array}{lll}3 & 5 & 8\end{array}$ | 10 | 13 |
| 41 | 9"9392 | 9407 | 9422 | 943 S | 9453 | 9468 | 9483 | 9499 | 9514 | 9529 | 358 | 10 | 13 |
| 42 | $9 \times 9544$ | 9560 | 9575 | 9590 | 9605 | 962 I | 9536 | 965 I | 9666 | 9681 | 3 l | 10 | 13 |
| 43 | $9 \cdot 9697$ | 9712 | 9727 | 9742 | 9757 | 9773 | 9788 | 9 SO 3 | 9SIS | 9833. | 3 5 8 | 10 | 13 |
| 44 | 9:9S48 | 9864 | 9879 | 9 S 94 | 9909 | 9924 | 9939 | 9955 | 9970 | $99 S_{5}$ | 358 | 10 | 13 |

LOGARITHMIC TANGENTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | 12' | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | $42^{\prime}$ | $48^{\prime}$ | $54^{\prime}$ | 123 |  | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 10,0000 | 0015 | 0030 | 0045 | 0061 | 0076 | 009I | 0106 | 0121 | 0136 | 3 |  | 3 |
| 46 | 10.0152 |  |  | 0197 | 0212 | 0228 | 0243 | 0258 | 0273 | 02SS | 35 |  | 13 |
| 47 | 10.0303 | 0319 | 0334 | 0349 | 0364 | 0379 | 0395 | 0410 | 0425 | 0440 | 35 |  | 13 |
| 48 | 10.0.456 | 0.471 | 0486 | 0501 | 0517 | 0532 | 0547 | 0562 | 0578 | 0593 | 35 |  | 13 |
| 43 | 10.0508 | 0624 | 0639 | 0654 | 0670 | -685 | 0700 | 0716 | 0731 | 0746 | 3 |  | 3 |
| 50 | 10.0762 |  | 0793 | oSoS | OS24 | 0839 | OS54 | 0870 | OSS5 | OCOI | 35 |  | 13 |
| 51 | 10.0916 | 0932 | 0947 | 0963 | 0978 | 0994 | IOIO | 1025 | 1041 | 1056 | 35 |  | 13 |
| 52 | 10 | IOSS |  | II 19 | 1135 | 1150 | 11 | I I | 1197 | 1213 | 35 |  | 13 |
| 53 | 10.1229 | 1245 | 1260 | 1276 | 1292 | 1308 | 1324 | 1340 | 1356 | 1371 | 35 |  | 13 |
| 54 | 10*1387 | 1403 | 1419 | 1435 | 1451 | 1467 | 1483 | 1499 | 1516 | 1532 | 35 |  | 13 |
| 55 | 10.15 | 15 | 15 | I 59 | 1612 | 1629 | 1645 | 1661 | 1677 | 1694 | 35 |  | 14 |
| 56 | 10 | 17 | 174 | 1759 | 17 | 9 |  | 5 | 1842 |  |  |  | 4 |
| 57 | 10'IS | I 891 | 1908 | 1925 | 19.1 | 1958 | 1975 | 1992 | 2008 | 2025 | 36 |  | 14 |
| 58 | 10.2042 | 20 | 2076 | 2093 | 2110 | 2127 | 2144 | 2161 | 2178 | 2195 | 36 |  | 4 |
| 59 | 10:221 |  | 22 | 2264 | 22 | 2299 | 2316 | 2333 | 2351 | 2365 | 36 |  | 14 |
| 60 | 10.23S |  | 2421 | 2438 | 2456 | 2474 | 2491 | 2509 | 2527 | 2545 | 36 |  | 15 |
| 61 | $10: 2562$ | 2580 | 2598 | 2616 | 2634 | 2652 | 2670 | 2689 | 2707 | 2725 | $\begin{array}{ll}3 & 6\end{array}$ |  | 15 |
| 62 | 10.274 | 27 | 2780 | 2798 | 28I7 | 2835 | 2854 | 2872 | 2S91 | 10 | 36 |  | 5 |
| 63 | 10.2928 | 29 | 2966 | 2985 | 3004 | 3023 | 3042 | 3061 | 3080 |  | 3669 |  | 16 |
| 64 | 10.3118 | 3137 | 315 | 3176 | 3196 | 3215 | 32 | 3 | 3274 | 3294 | $3 \quad 610$ | 13 | 16 |
| 65 | 10.3 | 3333 | 3353 | 3373 | 3393 | 3413 | 3433 | 3453 | 3773 | 3494 | $3 \quad 710$ |  | 17 |
| 66 | 10 | 3535 | 3555 | 3576 |  |  | 36.3 | 3659 |  | 3700 | 3710 |  | 7 |
| 67 | 10.3721 | 3743 | 3764 | 37 S5 | 3 So6 | $382 S$ | $33_{49}$ | 3871 | 3 S 92 | 3914 | 47111 |  | 18 |
| 68 | 10.3936 | 39 | 3980 | 4002 | 4024 | 4046 | 406S | 4091 | 4113 | 4136 | 47 II | 15 | 19 |
| 69 | 10.4158 | 4ISI | 4 | 4227 | 4250 | 4273 | 4296 | 4319 | 4342 | 4366 | 4 S 12 |  | 19 |
| 70 | 10.4359 | 4413 | 4437 | 4461 | 4484 | 4509 | 4533 | 4557 | 45SI | 4606 | 4 S 12 |  | 20 |
| 71 | 10.4630 | 4655 | 4680 | 4705 | 4730 | 4755 | 47 So | 4 SO 5 | 483I | 4857 | $4 \quad 813$ | 17 |  |
| 72 | 10.4882 | 49 | 4934 | 4960 | 4986 | 5013 | 5039 | 5066 | 5093 |  | 913 |  |  |
| 73 | 10.5147 | 5174 | 5201 | 5229 | 5256 | 5284 | 5312 | 5340 | 5368 | 5397 | $\begin{array}{llll}5 & 9 & 14\end{array}$ |  | 23 |
| 74 | $10 \cdot 5425$ | 5454 | 5483 | 5512 | 5541 | 5570 | 5600 | 5629 | 5659 | 5689 | $5 \quad 1015$ | 20 | 25 |
| 75 | 10.57 | 5750 | 5780 | 5 | 5 | 5 | 5905 | 59 | 59 | 6000 | 51016 |  |  |
| 76 | 10.6032 | 6065 | 6097 | 6130 | 6163 | 6196 | 6230 | 6264 | 6298 |  | 6 II 17 |  |  |
| 77 | 10.6366 | 6401 | 6436 | 6471 | 6507 | 6542 | 6578 | 6615 | 665 I | 66SS | 61215 |  | 30 |
| 78 | 10.6725 | 6763 | 6Soo | 6838 | 6877 | 6915 | 6954 | 6994 | 7033 | 7073 | $6 \begin{array}{llll}6 & 13 & 19\end{array}$ |  | 32 |
| 79 | 10.7113 | 7154 | 7195 | 7236 | 727 S | 7320 | 7363 | 7406 | 7449 | 7493 | 71421 |  |  |
| 80 | 10.7537 | 7581 | 7626 | 7672 | 7718 | 7764 | $7{ }^{7} 11$ | 7858 | 7906 | 7954 | S 1623 |  | 39 |
| 81 | $10 \cdot 8003$ | So52 | SIO2 | 8152 | 8203 | S255 | 8307 | 8360 | S+13 | S467 | 91726 | 35 | 43 |
| 82 | $10 \cdot 8522$ | S577 | S633 | 8690 | 8748 | S806 | 8865 | S924 | S9S5 | 9046 | 102029 |  |  |
| 83 | 10.9109 | 9172 | 9236 | 9301 | 9367 | 94.33 | 9501 | 9570 | 9640 | 97 II | II 2234 |  | 56 |
| 84 | 10.9784 | 9S57 | 9932 | -008 | ōo85 | ŌI64 | - 244 | - 326 | -409 | -0.494 | 132640 | 53 | 66 |
| 85 | I I 0 OSO | 0669 | 0759 | oS50 | 0944 | 10.40 | 1138 | 1238 | 1341 | 1446 | 1632 |  |  |
| 86 | II I I 554 | 1664 | 177 | I893 | 2012 | 2135 | 2261 | 2391 | 2525 | 2663 | 204162 |  |  |
| 87 | II 22806 | 2954 | 3106 | 3264 | 3429 | 3599 | 3777 | 3962 | 4155 | 4357 | 29 5S $\mathrm{S}_{7}$ |  |  |
| 88 | II 4566 | 4792 | 5027 | 5275 | 5539 | 5819 | 6ı19 | 6441 | 6759 | 7167 |  |  |  |
| 89 | 117581 | So3S | S550 | 9130 | 9800 | O591 | I56I | こSIo | 457 I | $\overline{7581}$ |  |  |  |

LOGARITHMIC COTANGENTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | 18' | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | $42^{\prime}$ | 48' | $54^{\prime}$ | 12 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | Inf. | 12.76 | 4571 | 2SIO | 1561 | 0591 | 9Soo | 9130 | S550 | $\overline{\mathrm{So}} 3 \mathrm{~S}$ |  |  |  |
| 1 | II 7 7 58 I | 7167 | 67S9 | 6441 | 6119 | 5S19 | 5539 | 5275 | 5027 | 4792 |  |  |  |
| 2 | II 14569 | 4357 | 4155 | 3962 | 3777 | 3599 | 3429 | 3264 | 3106 | 2954 | 2959 S | IIS | 147 |
| 3 | I I 2 So6 | 2663 | 2525 | 2391 | 2261 | 2135 | 2012 | IS93 | 1777 | 1664 | 2 I 426 | S3 | 104 |
| 4 | II 1554 | 1446 | I 341 | 123 S | 1138 | 1040 | 0944 | OS50 | 0759 | 0669 | 1632 | 65 | SI |
| 5 | I I 0.0580 | 0494 | 0409 | 0326 | 0244 | OI64 | ooS5 | 000S | 9932 | $\overline{9} 557$ | $13 \quad 2640$ |  | 66 |
| 6 | $10.97 S_{4}$ | 9711 | 9640 | 9570 | 9501 | 9433 | 9367 | 9301 | 9236 | 9172 | 1123 | 45 | 55 |
| 7 | 10.0109 | 9046 | S935 | S324 | SS65 | SSo6 | S74S | 8690 | S633 | S577 | 1020 |  | 49 |
| 8 | 10. ${ }^{5} 522$ | 8467 | 8413 | S360 | S307 | S255 | 8203 | SI 52 | Sio2 | So52 | 9 I7 | 35 | 43 |
| 9 | 10.8003 | 7954 | 7906 | 7858 | 7811 | 7764 | 7715 | 7672 | 7626 | 7581 | S I6 | 3 I | 39 |
| 10 | 10.7537 | 7493 | 7449 | 7406 | 7363 | 7320 | 7278 | 7236 | 7195 | 7154 | 7 I4 | $2 S$ | 35 |
| 11 | $10 \% 713$ | 7073 | 7033 | 6994 | 6954 | 6915 | $65_{77}$ | 6S38 | 6 600 | 6763 | 613 | 26 | 32 |
| 12 | 10.6725 | 6655 | 6651 | 6615 | 6578 | 6542 | 6507 | 6471 | 6436 | 6401 | 612 | 24 | 30 |
| 13 | 10.6366 | 6332 | 6298 | 6264 | 6230 | 6196 | 6163 | 6130 | 6097 | 6065 | 6 II | 22 | $2 S$ |
| 14 | 10.6032 | 6000 | 5968 | 5936 | 5905 | 5 S 73 | $5 S_{42}$ | 5 SII | 57So | 5750 | 510 |  | 6 |
| 15 | 10.5719 | 5689 | 5659 | 5629 | 5600 | 5570 | 554 I | 5512 | 5483 | 5454 | 510 | 20 | 25 |
| 16 | $10 \cdot 5425$ | 5397 | $536 S$ | 5340 | 5312 | 5284 | 5256 | 5229 | 5201 | 5174 | 59 | 19 | 23 |
| 17 | 10.5147 | 5120 | 5093 | 5066 | 5039 | 5013 | 4986 | 4960 | 49.34 | 4905 | 49 |  | 2 |
| 18 | 10.4882 | 4557 | 4 S3I | 4 SO 5 | 47 So | 4755 | 4730 | 4705 | 4680 | 4655 | 49 | 17 | 21 |
| 19 | 10.4630 | 4606 | $45^{\text {SI }}$ | 4557 | 4533 | 4509 | $44 \mathrm{~S}_{4}$ | 446 I | 4437 | 4413 | 48 | 16 | 20 |
| 20 | 10.4389 | 4366 | 4342 | 4319 | 4296 | 4273 | 4250 | 4227 | 4204 | 4 ISI | 4 S |  | 19 |
| 21 | 10.4158 | 4136 | $4 \mathrm{II}^{3}$ | 4091 | 4065 | 4046 | 4024 | 4002 | 3980 | 3958 | 47 |  | 19 |
| 22 | 10.3936 | 3914 | 3 S 92 | 3 S71 | 3849 | $382 S$ | 3 So6 | 37 S 5 | 3764 | 3743 | 47 |  | IS |
| 23 | 10.3721 | 3700 | 3679 | 3659 | $363 S$ | 36I7 | 3596 | 3576 | 3555 | 3535 | 37 | 14 | 17 |
| 24 | 10.3514 | 3494 | 3473 | 3453 | 3433 | 3413 | 3393 | 3373 | 3353 | 3333 | 37 |  | 17 |
| 25 | 10.3313 | 3294 | 3274 | 3254 | 3235 | 3215 | 3196 | 3176 | 3157 | 3137 | 36 | 13 | 16 |
| 26 | 10.3118 | 3099 | 30So | 3061 | 3042 | 3023 | 3004 | 2985 | 2966 | 2947 | 36 | 13 | 16 |
| 27 | 10.292S | 2910 | 2891 | 2 S 72 | 2854 | 2 S35 | $2 \mathrm{SI}_{7}$ | 2798 | 2780 | 2762 | 36 | 12 | 15 |
| 28 | 10:2743 | 2725 | 2707 | 2689 | 2670 | 2652 | 2634 | 2616 | 2598 | 25 SO | 36 | 12 | 15 |
| 29 | 10:2562 | 2545 | 2527 | 2509 | 2491 | 2474 | 2456 | $243 S$ | 2421 | 2403 | 36 | 12 | 15 |
| 30 | 10.2336 | 2365 | 2351 | 2333 | 2316 | 2299 | 22 SI | 2264 | 2247 | 2229 | 36 | 12 | 14 |
| 31 | 10.2212 | 2195 | 2178 | 2161 | 2144 | 2127 | 2110 | 2093 | 2076 | 2059 | 36 | I I | 14 |
| 32 | 10:2042 | 2025 | $200 S$ | 1992 | 1975 | 1958 | 1941 | 1925 | 1908 | 1891 | 35 | 1 I | 14 |
| 33 | 10.1875 | IS5S | IS42 | IS25 | I Sog | 1792 | 1776 | 1759 | 1743 | 1726 | 35 | 11 | 14 |
| 34 | 10.1710 | 1694 | 1677 | 166 I | 1645 | 1629 | 1612 | I 596 | 1580 | 1564 | 35 | 11 | 14 |
| 35 | 10.154S | 1532 | 1516 | 1499 | 1453 | 1467 | 1451 | 1435 | 1419 | 1403 | 35 | 1 | 13 |
| 36 | 10.1387 | 1371 | 1356 | 1340 | 1324 | $130 S$ | 1292 | 1276 | 1260 | 1245 | 35 | II | 13 |
| 37 | 10•1229 | 1213 | 1197 | IIS2 | I 166 | I 150 | 1135 | I I I9 | 1103 | IOS8 | 35 | 10 | 13 |
| 38 | 10:1072 | 1056 | 1041 | 1025 | 1010 | 0994 | 0975 | og63 | 0947 | 0932 | 35 | 10 | 13 |
| 39 | 10.0916 | 0901 | oSS5 | 0870 | OS54 | -839 | OS24 | OSoS | 0793 | 0777 | 35 | 1 | 13 |
| 40 | 10.0762 | 0746 | 0731 | 0716 | 0700 | 0685 | 0670 | 0654 | 0639 | 0624 | 35 | 10 | 13 |
| 41 | 10.0608 | 0593 | 0578 | 0562 | 0547 | 0532 | 0517 | 0501 | 0486 | 0471 | 35 | 10 | 13 |
| 42 | 10.0456 | 0440 | 0425 | 0410 | 0395 | 0.379 | 0364 | -349 | 0334 | 0319 | 35 | 10 | 13 |
| 43 | 10.0303 | 0285 | 0273 | 025S | 0243 | 022S | 0212 | -197 | OIS2 | 0167 | 35 | 10 | 1.3 |
| 44 | 10.0152 | 0136 | O121 | 0106 | 009 I | 0076 | 0061 | 0045 | 0030 | 0015 | 35 |  | 13 |

N.B.-Numbers in difference columns to be subtracted, not added.-Sce Riules.

LOGARITHMIC COTANGENTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | $42^{\prime}$ | 48' | 54 | 123 | 45 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 10.0000 | 99S5 | 9970 | 9955 | $\overline{9} 939$ | 9924 | -9909 | 9894 | 9879 | $\overline{9} 864$ | 8 | 10 |
| 46 | 99848 | 9533 | 9SIS | $9 \mathrm{SO}_{3}$ |  | 9773 |  | 9742 | 9727 | 9712 | $3-5$ S | 1013 |
| 47 | 9.9697 | 9631 | 9666 | 9651 | 9636 | 9621 | 9605 | 9590 | 9575 | 9560 | 35 | 1013 |
| 48 | 9.9544 | 9529 | 9514 | $9+99$ | 9483 | 9468 | 9453 | 9438 | 9422 | 9407 | 3 l | 13 |
| 49 | 9'939 | 937 | 936 | 9346 | 933 | 93 | 93 | $92 S_{4}$ |  | 4 | $\begin{array}{lll}3 & 5 & S\end{array}$ | 1013 |
| 50 | 9.923 | 922 | 9207 | 9192 | 917 | 9161 | 9146 | 9130 | 9115 | 90 | 3 l | 3 |
| 51 | $9^{.9084}$ | 906 | 9053 | 9037 | 9022 | 900 | S | S975 | 59 | 8944 | 35 | $10 \quad 13$ |
| 5 |  |  | S897 | 888 | SS6 |  | 8834 | SSIS | 863 | 8787 | 35 | 1013 |
| 53 |  |  | S740 | S724 | 8708 | S692 | 8676 | 8660 | 8644 | 8629 | $\begin{array}{lll}3 & 5 & 8\end{array}$ | $\begin{array}{ll}11 & 13\end{array}$ |
| 54 | $9 \cdot 561$ |  | S5SI | S565 | S549 | S533 | S517 | S | S484 | S46S | $\begin{array}{llll}3 & 5 & 8\end{array}$ | 13 |
| 55 | 9 | S | 8420 | 8404 | S | S371 | S355 | S339 | S | S | $\begin{array}{lll}3 & 5 & 8\end{array}$ | II 14 |
| 56 | 9. |  | S2 |  | S224 | S20S |  |  |  | 8142 |  | 1 I |
| 57 | $9 \cdot \mathrm{SI}_{12}$ | SI | Sog2 | So75 | So59 | So. 42 | So25 | Soos | 7992 | 7975 | 3 | II I 4 |
| 58 | 9.795 | 79 | 7924 | 7907 | 7590 | 7873 | 7856 | 7839 | 7822 | 7 So 5 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | II 14 |
| 59 | 977 | 77 | 77 | 7736 | 77 | 77 | $76 S_{4}$ | 7667 |  | 7632 |  | 14 |
| 60 | $9 * 761$ | 7597 | 7579 | 7562 | 7544 | 7526 | 7509 | 7491 | 7473 | 7455 | $3 \begin{array}{lll}3 & 6 & 9\end{array}$ | 12 |
| 61 | $9 \cdot 743$ | 742 | 7402 |  | 7366 | 7348 | 733 | 7311 | 7293 | 7275 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 1215 |
| 62 |  | 72 | 72 | 72 |  |  | 7146 | 7128 |  |  |  |  |
| 63 | $9{ }^{\circ} 7$ |  |  |  |  |  | 6958 | 6939 | 6920 | 6 | $3 \begin{array}{lll}3 & 6 & 9\end{array}$ | 13 |
| 64 | $9 \cdot 6852$ | 6S6 | 68 | 6824 | 6804 | 6785 | 6765 | 6746 | 6726 | 6706 | $3 \quad 710$ | 13 |
| 65 | 9*668 |  | 6647 | 66 | 66 | 6587 | 6 | 6547 | 65 | 6 | 3710 | 1317 |
| 66 |  |  |  |  |  |  | 6362 |  | 6321 |  | $3 \quad 710$ |  |
| 67 | $9 \cdot 6$ | 6257 | 6236 | 6215 | 61 | 61 | 6I5I | 6129 | 6108 | 6056 | 47 II |  |
| 68 | $9 \cdot 60$ | 6042 | 6020 | 59 | 5976 | 5954 | 5932 | 5909 | 5887 | 5864 | 47 II | 15 |
| 69 |  |  | 5796 | 5773 |  |  |  | 5681 | 565 |  | 4 S 12 | 1519 |
| 70 | $9 \cdot 5$ |  | 5563 | 5539 | 5516 | 5491 | 5467 | 5443 | 5419 | 5394 | 4 S 12 | $16 \quad 0$ |
| 71 | 9.537 | 5345 | 5320 | 5295 | 5270 | 5245 | 5220 | 5195 | 5169 | 5143 | 4813 | 17 |
| 72 | 9 |  |  | 5040 |  |  |  |  |  | 4880 | 13 | $18=2$ |
| 73 | 9.4853 | 4 | 4799 | 4771 | 4744 | 4716 | 4688 | 4660 | 4632 | 4603 | $\begin{array}{llll}5 & 9 & 14\end{array}$ | 1923 |
| 74 | 9.4575 |  | 4517 | 4488 | 4459 | 4430 | 4400 | 4371 | 4341 | 43II | $510 \quad 15$ | $20 \quad 25$ |
| 75 | 9.42SI | 425 | 42 | 418 | 415 | 4127 | 40 | 4064 | 4 C 32 | 4000 | 51016 | 21 |
| 76 |  |  |  |  | 3837 | 3 |  | 375 |  | 3668 | 61117 | $22 \quad 2 S$ |
| 77 | 9:3634 | 359 | 356 | 3529 | 3493 | 3458 | 3422 | 3385 | 3349 | 3312 | 6 12 is | $24 \quad 30$ |
| 78 | $9 \cdot 3275$ | 32 | 3200 | 3162 | 3123 | 3085 | 3046 | 3006 | 2967 | 2927 | $\begin{array}{lllll}6 & 13 & 19\end{array}$ |  |
| 79 |  |  | 2 SO 5 | 2764 |  | 268 |  |  | 2551 |  |  | 2835 |
| 80 | $9 \cdot 2463$ | 241 | 2374 | 2328 | 228 | 2236 | 2199 | 2142 | 2094 | 2046 | 81623 | 3139 |
| 81 | 9'1997 | 1948 | I S98 | $1 \mathrm{I}_{4} \mathrm{~S}$ | 1797 | 1745 | 1693 | 1640 | 1587 | 1533 | 91726 | $35 \quad 43$ |
| 82 | 9.1478 |  | 1367 | 13 | 125 |  | 1135 | 1076 |  |  | 10 2029 | 3949 |
| 83 | $9^{\circ} \mathrm{OS} 91$ |  | 0764 | 0699 | 0633 | -567 | 0499 | 0430 | -36 |  | II 12334 | $45 \quad 56$ |
| 84 | $9 \cdot 0216$ | 0143 | 0068 | 9992 | 9915 | 9836 | 9756 | 9674 | 9591 | 9506 | 133 2740 | 5.3 |
| 85 | 8.9420 | 933 | 924 I | 9150 | 9056 | S960 | SS62 | \$762 | S659 | S554 | $16 \quad 32$ | 6581 |
| 86 | - 8446 | 8336 | S223 | SIO7 | 7958 | 7865 | 7739 | 7609 | 7475 | 7337 | 214263 | 83 |
| 87 | $8 \cdot 7194$ | 7046 | 6594 | 6736 | 6571 | 6401 | 6223 | 6038 | 5845 | 5643 | 2959 | $1{ }^{1} 514$ |
| 88 | S.543I | 5208 | 4973 | 4725 | 4461 | 4 I I | 3 SSI | 3559 | 3211 | 2833 |  |  |
| 89 | S.2419 | 1962 | 1450 | 0870 | 0200 | 9409 | $\bar{S}_{439}$ | $\overline{7} 190$ | $\overline{5429}$ | $\overline{2} 419$ |  |  |

N.B.-Numbers in difference columns to be subtracted, not added.-Sce Rules.

LOGARITHMIC SECANTS.


|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | 12' | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | 48' | $54^{\prime}$ | 123 | 45 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 10.1505 | 1513 | 1520 | $152 S$ | 1536 | I 543 | 1551 | 1559 | 1567 | 1574 | $1 \begin{array}{lll}1 & 3\end{array}$ | 56 |
| 46 | 10 | 1590 | I598 | 1606 | 1614 | 1622 | 1630 | 163 | 1646 |  | 4 | 57 |
| 47 | $10 \cdot 1662$ | 1670 | 1678 | 1657 | 1695 | 1703 | 1711 | 1720 | 1728 | 1736 |  | 7 |
| 48 | 10^1745 | 1753 | 1762 | 1770 | 1779 | 1787 | 1796 | ISO5 | 1Si3 | 1822 | 34 | 67 |
| 49 | $10^{\circ}$ | 1839 | IS48 | IS57 | IS66 | IS75 | ISS3 | IS92 | 1901 | 0 | 134 |  |
| 50 | 10.1919 | 192 S | 19.37 | 1947 | 1956 | 1965 | 1974 | 1983 | 1993 | 2002 | 23 |  |
| 51 | 10.2011 | 2021 | 2030 | 20.40 | 2049 | 2059 | 2068 | 2078 | 2087 | 2097 | 235 | 6 8 |
| 52 | 10:210 | 2 II | 212 | 2136 | 2146 | 2156 | 2165 | 2175 | 2185 | 2195 | $2 \begin{array}{lll}2 & 3 & 5\end{array}$ | 7 S |
| 53 | 10:220 | 221 | 22 | 2236 | 2246 | 2256 | 2266 | 2277 | 2287 | 2297 | 23 | 9 |
| 54 | 10:230S | 2318 | 2329 | 2339 | 2350 | 2360 | 2371 | 23 S 2 | 2393 | 2403 | 24 | $7 \quad 9$ |
| 55 | 10.2414 | 2425 | 2436 | 2.447 | 2458 | 2469 | 24So | 2491 | 2502 | 2513 | $\begin{array}{lll}2 & 4 & 5\end{array}$ | $7 \quad 9$ |
| 56 | 10.25 | 2536 | 2547 | 2558 | 2570 | 2581 | 25 | 2 | 2616 | 2627 | 246 | 810 |
| 57 | 10:2639 | 265 I | 2662 | 2674 | 2686 | 269S | 2710 | 2722 | 2734 | 2746 | 246 | S 10 |
| 58 | $10: 2758$ | 2770 | 2782 | 2795 | 2 SO 7 | 2SI9 | 2 S 32 | 2S44 | 2856 | 2869 | 24 | S 10 |
| 59 | 10:2SS2 | 2 S | 29 | 2920 | 2932 | 2945 | 2958 | 297 | 2984 | 2997 | 6 | S II |
| 60 | 10.3010 | 302 | 3037 | 3050 | 3063 | 3077 | 3090 | 3104 | 3117 | 3131 | $\begin{array}{lll}2 & 4 & 7\end{array}$ | 9 II |
| 61 | 10'3144 | 315 | 3172 | 3186 | 3199 | 3213 | 3227 | 3241 | 3256 | 3270 | $2 \quad 57$ | 912 |
| 62 | 10:328 | 329 | 3313 | 3327 | 3341 | 3356 | 3371 | 3385 | 3400 | 3415 | 2 | 1012 |
| 63 | 10.3430 | 3444 | 3459 | 3474 | 3490 | 3505 | 3520 | 3535 | 3551 | 3566 | 35 | IO I3 |
| 64 | 10.35S2 | 35 | 36 I 3 | 3629 | 3644 | 3660 | 3676 | 3692 | 3708 | 3724 | 35 | 11 1.3 |
| 65 | 10:3741 | 3757 | 3773 | 3790 | 3 So6 | 3 S23 | ${ }_{3}$ S39 | 3 S56 | 3873 | 3890 | $\begin{array}{llll}3 & 6 & 5\end{array}$ | II 14 |
| 66 | 10.3907 |  | 3941 | 395S | 3976 | 3993 | 4 | 402 S | 4046 | 4063 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1214 |
| 67 | 10.40 S | 409 | 4117 | 4135 | 4153 | 4172 | 4190 | 420 S | 4227 | 4246 | 369 | 1215 |
| 68 | 10.426 | 42 S | 4302 | 4321 | 4340 | 4359 | 437 | 4398 | 4417 | 4437 | 3610 | 1316 |
| 69 | 10.4457 | 4477 | 4496 | 4516 | 4537 | 4557 | 4577 | 459S | 4618 | 4639 | 3710 | 1317 |
| 70 | 10:4659 | 46So | 4701 | 4722 | 4744 | 4765 | 4787 | 4SoS | 4830 | $45^{2} 2$ | 4711 | 14 IS |
| 71 | 10.4574 | 4896 | 49 IS | 4940 | 4963 | 4955 | 5008 | 5031 | 5054 | 5077 | 4 S II | 1519 |
| 72 | 10.5100 | 512 | 5147 | 5171 | 5195 | 5219 | 5243 | 5267 | 5291 | 5316 | 4 S 12 | 1620 |
| 73 | 10.534 |  | 5391 | 5416 | 5441 | 5467 | 5492 | 5518 | 5544 | 5570 | $4 \begin{array}{llll}4 & 9 & 13\end{array}$ | 1721 |
| 74 | 10.5597 | 5623 | 5650 | 5677 | 5704 | 5731 | 5758 | 5786 | 5 S14 | 5 S 42 | $5 \quad 9 \quad 14$ | 1823 |
| 75 | 10.587 | 5S9S | 5927 | 5956 | 598 | 6014 | 6043 | 6073 | 6103 | 6133 | 510 I5 | 20 |
| 76 | 10.6163 | 6I94 | 6225 | 6255 | $62 \mathrm{S7}$ | 63 IS | 6350 | 63 S 2 | 6414 | 6446 | 5 11 16 | 2126 |
| 77 | 10.6479 | 6512 | 6545 | 6579 | 6613 | 6647 | 66SI | 6716 | 6750 | 67S6 | 6 II 17 | 23 28 |
| 78 | $10 \cdot 6$ S2 I | $6 S 57$ | 6893 | 6930 | 6966 | 7003 | 7041 | 7079 | 7117 | 7155 | $6 \quad 1219$ | 2531 |
| 79 | 10.7194 | 7233 | 7273 | 7313 | 7353 | 7394 | 7435 | 7476 | 7518 | 7561 | $7{ }^{7} 1420$ | $\begin{array}{lll}27 & 34\end{array}$ |
| 80 | 10.7603 | 7647 | 7690 | 7734 | 7779 | 7524 | 7869 | 7915 | 7962 | Soog | $\begin{array}{lllll}S & 15 & 23\end{array}$ | 3038 |
| 81 | 10.8057 | $\mathrm{SIO}_{5}$ | SI 53 | 8203 | 8253 | S303 | 8354 | S406 | S45S | S51 I | S 17 25 | 3442 |
| 82 | 10.8564 | S619 | 8674 | \$729 | S786 | SS43 | S901 | S960 | 9019 | 90So | IO I9 29 | 3 S 4 S |
| 83 | 10.9141 | 9203 | 9266 | 9330 | 9395 | 9.461 | 9528 | 9597 | 9666 | 9736 | II 22233 | $4+56$ |
| 84 | 10.9SoS | 9880 | 9954 | -̄030 | -106 | -IS4 | -264 | - 345 | - 427 | O5II | $\begin{array}{lllll}13 & 26 & 39\end{array}$ | 5366 |
| 85 | I I `0597 | -6S5 | 0774 | oS65 | 095S | 1054 | I 151 | 1251 | 1353 | 1457 | 163248 | 64 SI |
| 86 | II'I564 | 1674 | 1787 | 1902 | 2021 | 2143 | 2269 | 2398 | 2532 | 2670 |  |  |
| 87 | 11.2S12 | 2959 | 3111 | 3269 | 3433 | 3603 | 3780 | 3965 | 415 S | 4360 |  |  |
| 88 | 11*4572 | 4794 | 5029 | 5277 | 554 I | 582 I | 6120 | 6442 | 6790 | 7168 |  |  |
| 89 | 11.75SI | So39 | S550 | 9130 | 9Soo | 0.592 | - 561 | ב-S 10 | 4571 | $\overline{7581}$ |  |  |

## 30

LOGARITHMIC COSECANTS.

|  | $\mathrm{O}^{\prime \prime}$ | $6^{\prime}$ | $12^{\prime}$ | 18' | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | 48' | $54^{\prime}$ | 123 | 45 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | Inf. | 12.76 | 457 I | 2 SIO | 1561 | 0592 | $\overline{9} \mathrm{So}$ | 9130 | S550 | SO39 |  |  |  |
| 1 | I I 7581 | 7168 | 6790 | 6442 | 6120 | 582I | 5541 | 5277 | 5 | 4794 |  |  |  |
| 2 | II 14572 | 4360 | 4158 | 3965 | 3780 | 3603 | 3433 | 3269 | 3111 | 2959 |  |  |  |
| 3 | I I 2812 | 2670 | 2532 | 2398 | 2269 | 2143 | 2 O 2 I | 1902 | 1787 | 1674 |  |  |  |
| 4 | II 156 | 1457 | I 353 | 1251 | I I 5 I | 1054 | 0958 | OS65 | 0774 | 0685 | 63248 |  | I |
| 5 | I I * 0597 | O5II | 0427 | 0345 | 0264 | OI 84 | 0106 | 0030 | 9954 | - ${ }^{\text {SSO }}$ | 1312639 | 53 | 66 |
| 6 | 10.9808 | 9736 | 9666 | 9597 | 952 S | 9461 | 9395 | 9330 | 9266 | 9203 | 112233 | 44 | 56 |
| 7 | 10.9141 | 9080 | 9019 | 8960 | S901 | S843 | 8786 | 8729 | 8674 | 8619 | 101929 | 38 | 48 |
| 8 | 10.8564 | 85 II | S45S | 8406 | S354 | 8303 | 8253 | 8203 | 8153 | 8105 | S I7 25 | 34 | 42 |
| 9 | 10.8057 | 8009 | 7962 | 7915 | 7869 | 7824 | 7779 | 7734 | 7690 | $76+7$ | S 1523 | 3 | 38 |
| 10 | 10.7603 | 75 | 75 IS | 7476 | 7435 | 7394 | 7353 | 7313 | 7273 | 7233 | 71420 | 27 | 34 |
| 11 | 10\%7194 | 7155 | 7117 | 7079 | 704 I | 7003 | 6966 | 6930 | 6893 | 6857 | 6 12 19 | 25 | 31 |
| 12 | $10 \cdot 6821$ | 6756 | 6750 | 6716 | 668 I | 6647 | 6613 | 6579 | 6545 | 6512 | 6 II I7 | 23 | 28 |
| 13 | $10 \cdot 6479$ | 6446 | 6414 | 6382 | 6350 | 6318 | 6287 | 6255 | 6225 | 6194 | 5 II 16 | 21 | 26 |
| 14 | 10.6163 | 6133 | 6103 | 6073 | 6043 | 6014 | 5985 | 5956 | 5927 |  | 510 J 5 | 20 | 24 |
| 15 | 10.5870 | 5842 | $5^{\text {SI } 4}$ | 5786 | 5758 | 573 I | 5704 | 5677 | 565 | 5623 | 5 | 18 | 23 |
| 16 | 10.5597 | 5570 | 5544 | 55 IS | 5492 | 5467 | 5441 | 5416 | 5391 | 5366 | $4 \quad 913$ | 17 | 21 |
| 17 | 10.534I | 5316 | 5291 | 5267 | 524.3 | 5219 | 519 | 5171 | 5147 | 5124 | 4 S 12 | 16 | 0 |
| 18 | 10.5100 | 5077 | 5054 | 503 I | 5008 | 4985 | 4963 | 4940 | 4918 | 4896 | 4 S II | 15 | 19 |
| 19 | 10.4574 | 4852 | 4830 | 4808 | 4787 | 4765 | 4744 | 4722 | 4701 | 4680 | 47 II | 14 | IS |
| 20 | 10.4659 | 4639 | 4618 | 459 S | 4577 | 4557 | 4537 | 4516 | 4496 | 44 | $3 \quad 710$ | 13 | 17 |
| 21 | 10.4457 | 4437 | 4417 | 4398 | 4379 | 4359 | 4340 | 432 I | 4302 | 4283 | 3610 | 13 | 16 |
| 22 | 10.4264 | 4246 | 4227 | $420 S$ | 4190 | 4172 | 4153 | 4135 | 4117 | 4099 | 366 | 12 | 15 |
| 23 | $10 \cdot 4081$ | 4063 | 4046 | 4028 | 4010 | 3993 | 3976 | 3955 | 3941 | 3924 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 14 |
| 24 | $10 \cdot 3907$ | 3890 | 3873 | 3856 | 3839 | 3 S23 | 3806 | 3790 | 3773 | 3757 | 3668 | II | 14 |
| 25 | $10 \cdot 3741$ | 3724 | 3708 | 3692 | 3676 | 3660 | 3644 | 3629 | 3613 | 3597 | 3 l | I I | 13 |
| 26 | 10.3582 | 3566 | 355 I | 3535 | 3520 | 3505 | 3490 | 3474 | 3459 | 3444 | $\begin{array}{lll}3 & 5 & 8\end{array}$ | 10 | 13 |
| 27 | 10.3430 | 3415 | 3400 | 3385 | 3371 | 3356 | 3341 | 3327 | 3313 | 3298 | 25 | 10 | 12 |
| 28 | $10 \cdot 3284$ | 3270 | 3256 | 324 I | 3227 | 32 I 3 | 3199 | 3 IS6 | 3172 | 3158 | $2 \begin{array}{lll}2 & 5 & 7\end{array}$ | 9 | 2 |
| 29 | $10 \cdot 3144$ | 3131 | 3117 | 3104 | 3090 | 3077 | 3063 | 3050 | 3037 | 3023 | $\begin{array}{lll}2 & 4 & 7\end{array}$ | 9 | I |
| 30 | 10.3010 | 2997 | 2984 | 2971 | 2958 | 2945 | 2932 | 2920 | 2907 | 2894 | 246 | $\delta$ | I I |
| 31 | $10 \cdot 2882$ | 2S69 | 2856 | 2844 | 2532 | 28I9 | 2807 | 2795 | 2782 | 2770 | - 46 | 8 | 0 |
| 32 | 10.2758 | 2746 | 2734 | 2722 | 2710 | 2698 | 2686 | 2674 | 2662 | 2651 | 246 |  | 10 |
| 33 | 10:2639 | 2627 | 2616 | 2604 | 2593 | 2581 | 2570 | 2558 | 2547 | 2536 | 246 | S | 10 |
| 34 | 10.2524 | 2513 | 2502 | 2491 | 2480 | 2469 | 2458 | 2447 | 2436 | -425 | 24 | 7 | 9 |
| 35 | 10.2414 | 2403 | 2393 | 2382 | 2371 | 2360 | 2350 | 2339 | 2329 | 2318 | 245 | 7 | 9 |
| 36 | 10.2308 | 2297 | 2287 | 2277 | 2266 | 2256 | 2246 | 2236 | 2226 | 2215 | 235 | 7 | 9 |
| 37 | 10:2205 | 2195 | 2185 | 2175 | 2165 | 2156 | 2146 | 2136 | 2126 | 2116 | 3 | 7 | 8 |
| 38 | $10 \cdot 2107$ | 2097 | 2087 | 2078 | 2065 | 2059 | 2049 | 2040 | 2030 | 2021 | 235 |  | 8 |
| 39 | 10:2011 | 2002 | 1993 | 1983 | 1974 | 1965 | 1956 | 1947 | 1937 | 1928 | 235 | 6 | S |
| 40 | 10.1919 | 1910 | 1901 | IS92 | IS83 | 1875 | 1866 | 1857 | 1848 | 1839 | $\begin{array}{lll}1 & 3 & 4\end{array}$ | 6 | 7 |
| 41 | 10.1831 | I822 | ISI3 | $1 \mathrm{SO}_{5}$ | 1796 | 1787 | 1779 | 1770 | 1762 | 1753 | 34 | 6 | 7 |
| 42 | 10.1745 | I736 | 1728 | 1720 | I 71 | 1703 | 1695 | 1687 | 1678 | 1670 | I 34 | 6 | 7 |
| 43 | 10.1662 | 1654 | 1646 | 1635 | 1630 | 1622 | 1614 | 1606 | 1598 | 1590 | I 34 | 5 | 7 |
| 44 | $10.15 S_{2}$ | 1574 | I 567 | 1559 | I 551 | 154 | 1536 | 1528 | 1520 | 1513 | 134 | 5 | 6 |

N.B.-Numbers in difference columns to be subtracted, not added.-See Rules.

LOGARITHMIC COSEC.ANTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | 18' | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | 48' | $54^{\prime}$ | 1 | 2 | 3 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 10.1505 | 1498 | 1490 | 1483 | 1475 | 1468 | 1460 | 1453 | 1445 | 1438 | I | 2 | 4 | 5 | 6 |
| 46 | 10*143I | 1423 | 1416 | 1409 | 1402 | 1394 | $13 S_{7}$ | 13 So | 1373 | 1366 |  | 2 | 4 |  |  |
| 47 | 10^1359 | 1352 | 1345 | 133 S | 1331 | I 324 | 1317 | 1310 | 1303 | 1296 | I | 2 | 3 |  | 6 |
| 48 | 10.1259. | 12 S 2 | 1276 | 1269 | 1262 | 1255 | 1249 | 1242 | 1235 | 1229 | I | 2 | 3 | 4 | 6 |
| 49 | 10'1222 | 1216 | 1209 | 1203 | 1196 | 1190 | $1 \mathrm{I}^{\text {S }} 3$ | 1177 | II70 | 116 | I | 2 | 3 |  | 5 |
| 50 | 10'I I 57 | 1151 | II 45 | 113 S | 1132 | I 126 | 1120 | III3 | 1107 | 1101 | I | 2 | 3 |  | 5 |
| 51 | 10.1095 | 1089 | 1083 | 1077 | 1071 | 1065 | 1059 | 1053 | 1047 | $10+1$ | I | 2 | 3 | 4 | 5 |
| 52 | 10'1035 | 1029 | 1023 | 1017 | IOII | 1005 | 1000 | 0994 | ogSS | ogS2 | I | 2 | 3 |  | 5 |
| 53 | 10.0977 | 0971 | 0965 | 0959 | 0954 | 09.48 | o943 | 0937 | 0931 | 0926 | I | 2 | 3 |  | 5 |
| 54 | 10.0920 | 0915 | 0909 | 0904 | 0 089 | -S93 | oSS3 | -Sゝ2 | oS77 | OS72 | 1 | 2 | 3 | 4 | 5 |
| 55 | 10.0866 | 0.561 | OS56 | oS5 1 | OS ${ }_{45}$ | os. 40 | oS35 | 08.30 | OS25 | OSI9 | 1 | 2 | 3 | 3 | 4 |
| 56 | 10.0814 | oSog | OSO4 | 0799 | 0794 | $07 \mathrm{S9}$ | 0784 | 0779 | 07 | 0769 | I | 2 | 2 | 3 | 4 |
| 57 | 10.0764 | 0759 | 0754 | 0749 | 0745 | 0740 | 0735 | 0730 | 0725 | O721 | I | 2 | 2 | 3 |  |
| 58 | 10.0716 | 0711 | 0706 | 0702 | 0697 | 0692 | 06SS | -683 | 067 S | 0674 | I | 2 | 2 | 3 | 4 |
| 59 | 10.0669 | 0665 | 0660 | 0656 | 065 I | 0647 | 06.4 | 0638 | 0633 | 0629 | I | I | 2 | 3 | 4 |
| 60 | 10.0625 | 0620 | 0616 | 0612 | 0607 | -6c3 | 0599 | 0594 | -590 | 05S6 | I | I | 2 | 3 | 4 |
| 61 | 10.05S2 | 057 S | 0573 | 0569 | 0565 | 0561 | 0557 | 0553 | 0549 | 0545 | I | I | 2 | 3 | 3 |
| 62 | 10.0541 | 0537 | 0533 | 0529 | 0525 | 0521 | 0517 | 0513 | 0509 | 0505 | 1 | I | 2 | 3 | 3 |
| 63 | 10.0501 | 0.497 | $0.49+$ | 0490 | 0456 | 04 S 2 | 0.778 | 0475 | 0.47 | 0467 | I | I | 2 | 3 | 3 |
| 64 | 10.0463 | 0.760 | 0456 | $0+52$ | 0.449 | 0.445 | $0+{ }^{2}$ | $043 S$ | 0434 | 043 I | I | I | 2 | 2 | 3 |
| 65 | 10*0427 | 0424 | 0420 | 0417 | 0.413 | 0410 | 0406 | 0403 | 0399 | 0396 | I | I | 2 | 2 | 3 |
| 66 | 10.0393 | $03 \mathrm{S9}$ | 03S6 | $\mathrm{O}_{3} \mathrm{~S}_{3}$ | 0379 | 0376 | 0.373 | 0369 | 0366 | 0363 | 1 | 1 | 2 | 2 | 3 |
| 67 | 10.0360 | 0357 | 0353 | -350 | 0347 | 0344 | O341 | 0338 | 0334 | 0331 | 1 | I | 2 | 2 | 3 |
| 68 | $10.032 S$ | 0325 | 0322 | 0319 | 0316 | 0313 | 0310 | 0307 | 0304 | 0301 | 0 | I | I | 2 | 2 |
| 69 | 10.0298 | 0296 | 0293 | 0290 | 02 S 7 | 0284 | O2SI | 027 S | 0276 | 0273 | O | I | 1 | 2 | 2 |
| 70 | 10.0270 | 0267 | 0265 | 0262 | O259 | 0257 | 0254 | 025 I | 0249 | 0246 | 0 | 1 | I | 2 | 2 |
| 71 | 10.02.43 | 0241 | 0238 | 0236 | 0233 | 0230 | $022 S$ | 0225 | 0223 | 0220 | O | I | I | 2 | 2 |
| 72 | 10.021S | 0215 | 0213 | O2II | 020S | 0206 | 0203 | O20I | O199 | or96 | - | I | I | 2 | 2 |
| 73 | 10.0194 | 0192 | -189 | OrS7 | 0185 | OIS3 | -I So | 0178 | Or76 | 0174 | - | I | I | I | 2 |
| 74 | 10:0172 | 0169 | 0167 | 0165 | 016 | OI6r | Or 59 | O157 | OI 55 | O153 | O | I | I | I | 2 |
| 75 | 10.0151 | 0149 | 0147 | OI45 | OI 43 | OI 41 | Or 39 | 0137 | OI35 | Or 33 | $\bigcirc$ | I | 1 | I | 2 |
| 76 | 10*OI3I | OI 29 | O127 |  | O124 | OI 22 | Or 20 | oriS |  | OII 5 | 0 | I | 1 | I | 2 |
| 77 | 10.0113 | OIII | -109 | -10S | 0106 | 0104 | -103 | OIOI | 0099 | oogS | 0 | 1 | 1 | I | 1 |
| 78 | $10 \cdot 0096$ | 0094 | 0093 | 0091 | 0090 | ooS8 | oo87 | ooS5 | 00S4 | ooS2 | $\bigcirc$ | I | 1 | I | I |
| 79 | 10.00SI |  | 0078 | 0076 | 0075 | 0073 | 0072 | 007 I | 0069 | 006S | 0 | O | 1 | I | 1 |
| 80 | 10:0066 | 0065 | 0064 | 0063 | 0061 | 0060 | 0059 | 0057 | 0056 | 0055 | - | 0 | I | I | 1 |
| 81 | 10.0054 | 0053 | 005 I | 0050 | 0049 | 004 S | 0047 | 0046 | 00.45 | 00+4 | 0 | 0 | I | I | 1 |
| 82 | 10.0042 | 0041 | 0040 | 0039 | 003S | 0037 | 0036 | 0035 | 0034 | 0033 | 0 | O | 0 | I | 1 |
| 83 | 10.0032 | 0032 | 0031 | 0030 | 0029 | $002 S$ | 0027 | 0026 | 0025 | 0025 | - | O | 0 | I | 1 |
| 84 | 10.0024 | 0023 | 0022 | 0022 | 0021 | 0020 | OOI9 | oor9 | oorS | 0017 | 0 | 0 | $\bigcirc$ | 0 | 1 |
| 85 | 10.0017 | 0016 | OOI 5 | 0015 | 0014 | 0013 | 0013 | 0012 | 0012 | OOII | 0 | 0 | 0 | O | 0 |
| 86 | 10.0011 | 0010 | 0010 | 0209 | 0009 | -00S | 000S | 0007 | 0007 | 0006 | 0 | O | 0 | 0 | O |
| 87 | 10:0006 | 0006 | 0005 | 0005 | 0004 | 0004 | 0004 | 0004 | 0003 | 0003 | - | - | 0 | 0 | 0 |
| 88 | 10.0003 | 0002 | 0002 | 0002 | 0002 | 0001 | 0001 | 0001 | 000 I | 0001 | 0 | $\bigcirc$ | 0 | 0 | $\bigcirc$ |
| 89 | 10*0001 | 000I | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0 | 0 | 0 | 0 | 0 |

NATURAL SINES.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | 18 | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | 48' | $54^{\prime}$ | 123 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | 0000 | col 7 | 0035 | 0052 | 0070 | 0087 | 0105 | 0122 | OI40 | OI 57 | 369 | 12 | 15 |
| 1 | 0175 | 0192 | 0209 | 0227 | 0244 | 0262 | 0279 | 0297 | O3I4 | 0332 | $3 \begin{array}{lll}3 & 6 & 9\end{array}$ |  | 15 |
| 2 | 0349 | 0366 | 03 S4 | 0.401 | 0419 | 0436 | 0.454 | 0.471 | 04SS | 0506 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 3 | 0523 | 0541 | 0558 | 0576 | 0593 | 0610 | 062S | 0645 | 0663 | -6So | 366 | 12 | 15 |
| 4 | 0698 | 0715 | 0732 | 0750 | 0767 | 07S5 | -So2 | oSi9 | oS37 | oS 54 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 5 | 0872 | -889 | 0906 | 0924 | 0941 | 0958 | 0976 | 0993 | IOII | 102S | 366 | 12 | 14 |
| 6 | 1045 | 1063 | 1080 | 1097 | III5 | II 32 | II49 | 1167 | I I S 4 | I2OI | 3 6 9 | 12 | 14 |
| 7 | 1219 | 1236 | 1253 | 1271 | 1288 | 1305 | 1323 | 1340 | 1357 | 1374 | 3669 | 12 | 14 |
| 8 | 1392 | 1409 | 1426 | 1444 | 1461 | 1478 | I 495 | 1513 | 1530 | 1547 | 3669 | 12 | 14 |
| 9 | 1564 | I582 | I 599 | 1616 | 1633 | 1650 | I 668 | 1685 | 1702 | 1719 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 12 | 14 |
| 10 | 1736 | 1754 | 1771 | I 788 | ISo5 | 1822 | IS40 | I 857 | IS74 | IS9I | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 12 | 14 |
| 11 | 1908 | 1925 | 1942 | 1959 | 1977 | 1994 | 2011 | 202S | 2045 | 2062 | 3669 | II | 14 |
| 12 | 2079 | 2096 | 2113 | 2130 | 2147 | 2164 | 2181 | 2198 | 2215 | 2232 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | I I | 14 |
| 1.3 | 2250 | 2267 | 2284 | 2300 | 2317 | 2334 | 2351 | 2368 | 2385 | 2402 | $3 \quad 6 \quad 8$ | II | 14 |
| 14 | 2419 | 2436 | 2453 | 2470 | 2487 | 2504 | 2521 | 2538 | 2554 | 2571 | 3168 | I I | 14 |
| 15 | 2585 | 2605 | 2622 | 2639 | 2656 | 2672 | 2689 | 2706 | 2723 | 2740 | 3 | II | 14 |
| 16 | 2756 | 2773 | 2790 | 2307 | 2 S 23 | 2S+0 | 2 S 57 | 2874 | 2S90 |  | 3 l | II | 14 |
| 17 | 2924 | 29.40 | 2957 | 2974 | 2990 | 3007 | 3024 | 30.40 | 3057 | 3074 | $\begin{array}{lll}3 & 6 & 5\end{array}$ | II | 14 |
| 18 | 3090 | 3107 | 3123 | 3140 | 3156 | 3173 | 3190 | 3206 | 3223 | 3239 | $\begin{array}{llll}3 & 6 & 8\end{array}$ | II | 14 |
| 19 | 3256 | 3272 | 3289 | 3305 | 3322 | 3338 | 3355 | 3371 | 3387 | 3404 | 3 5 8 | II | 14 |
| 20 | 3420 | 3437 | 3453 | 3469 | 3486 | 3502 | 3518 | 3535 | . 3551 | 3567 | 3 5 $S$ | II | 14 |
| 21 | 3584 | 3600 | 3616 | 3633 | 3649 | 3665 | 3681 | 3697 | 3714 | 3730 | $\begin{array}{lll}3 & 5 & 8\end{array}$ | II |  |
| 22 | 3746 | 3762 | 377S | 3795 | 3 SII | 3 S 27 | $3 S_{43}$ | 3 S59 | 3 S 75 | 3591 | $\begin{array}{lll}3 & 5 & S\end{array}$ | I I | 1 |
| 23 | 3907 | 3923 | 3939 | 3955 | 397 I | 3987 | 4003 | 4019 | 4035 | 4051 | $3 \quad 5$ | II | 14 |
| 24 | 4067 | 4083 | 4099 | 4115 | 4131 | 4147 | 4163 | 4179 | 4195 | 4210 | 5 S | II | 13 |
| 25 | 4226 | 4242 | 4258 | 4274 | 4289 | $43 \times 5$ | 4321 | 4337 | 4352 | 4368 | 3 F | II | 13 |
| 26 | 4384 | 4399 | 4415 | 443 I | 4446 | 4462 | 4478 | 4493 | 4509 | 4524 | $3 \quad 58$ | 10 | 13 |
| 27 | 4540 | 4555 | 4571 | 4586 | 4602 | 4617 | 4633 | 4648 | 4664 | 4679 | $3 \begin{array}{lll}3 & 5 & 8\end{array}$ | 10 | 13 |
| 28 | 4695 | 4710 | 4726 | 4741 | 4756 | 4772 | 4787 | 4 SO 2 | 4818 | 4833 | 3 5 | 10 | 13 |
| 29 | 4 S 4 S | 4863 | 4879 | 4897 | 4909 | 4924 | 4939 | 4955 | 4970 | 4985 | $3 \quad 58$ | 10 | 13. |
| 30 | 5000 | 5015 | 5030 | 50+5 | 5060 | 5075 | 5090 | 5105 | 5120 | 5135 | 35 | 10 | 13 |
| 31 | 5150 | 5165 | 5180 | 5195 | 5210 | 5225 | 5240 | 5255 | 5270 | $52 S_{4}$ | 257 | 10 | 12 |
| 32 | 5299 | 5314 | 5329 | 5344 | 535 S | 5373 | 5388 | 5402 | 5417 | 5432 | 257 | 10 | 12 |
| 33 | 5446 | 5461 | 5476 | 5490 | 5505 | 5519 | 5534 | 5548 | 5563 | 5577 | 257 | 10 | 12 |
| 34 | 5592 | 5606 | 5621 | 5635 | 5650 | $566+$ | 5678 | 5693 | 5707 | 5721 | $2 \quad 57$ | 10 | 12 |
| 35 | 5736 | 5750 | 5764 | 5779 | 5793 | $5 \mathrm{So7}$ | 5821 | 5835 | $5 S 50$ | 5864 | 257 | 10 | 12 |
| 36 | 5 S 7 S | $5 \mathrm{S92}$ | 5906 | 5920 | 5934 | 5948 | 5962 | 5976 | 5930 | 6004 | $2 \quad 57$ | 9 | 12 |
| 37 | 6018 | 6032 | 60.46 | 6060 | 6074 | 6085 | 6 IOI | 6115 | 6129 | 6143 | 257 | 9 | 12 |
| 38 | 6157 | 6170 | 6 IS 4 | 6198 | 6211 | 6225 | 6239 | 6252 | 6265 | 62So | 257 | 9 | II |
| 39 | 6293 | 6307 | 6320 | 6334 | 6347 | 6361 | 6374 | 63 SS | 6,401 | 6.414 | $2 \quad 47$ | 9 | II |
| 40 | 6428 | 6441 | 6455 | 6468 | 6481 | 6494 | $650 S$ | 6521 | 6534 | 6547 | $2 \begin{array}{lll}2 & 4\end{array}$ | 9 | II |
| 41 | 6561 | 6574 | 6587 | 6600 | 6613 | 6626 | 6639 | 6652 | 6665 | 6678 |  | 9 | II |
| 42 | 6691 | 6704 | 6717 | 6730 | 6743 | 6756 | 6769 | 67 S2 | 6794 | 6 SO 7 | 246 | 9 | II |
| 43 | 6S20 | 6833 | $6 S_{45}$ | $6 S_{5} \mathrm{~S}$ | 6S71 | $65 S_{4}$ | 6S96 | 6909 | 692 I | 6934 | 246 | S | II |
| 44 | 6947 | 6959 | 6972 | 6984 | 6997 | 7009 | 7022 | 7034 | 7046 | 7059 | 246 | S | 10 |

NATURAL SINES $=-120 \div$ hyp33


NATURAL COSINES.

N.B.-Numbers in difference columns to be subtracted, not added.-See Rules.

NATURAL COSINES.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | $43^{\prime}$ | $54^{\prime}$ | 123 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 7071 | 7059 | 7046 | 7034 | 7022 | 7009 | 6997 | $69 S_{4}$ | 6972 | 6959 | 24 | S | 10 |
| 46 | 6947 | 6934 | 6921 | 6909 | 6S96 | 6S84 | 6871 | 6558 | $68+5$ | 6833 | 2 |  | II |
| 47 | 6820 | 6SO7 | 6794 | 6782 | 6769 | 6756 | 6743 | 6730 | 6717 | 6704 | 246 |  | II |
| 48 | 6691 | 6675 | 6665 | 6652 | 6639 | 6626 | 6613 | 6600 | 6557 | 6574 | 247 |  | II |
| 49 | 6561 | $65+7$ | 6534 | 6521 | 650 S | 6.94 | 6481 | 5468 | 6455 | $64+1$ | 247 |  | I I |
| 50 | 6428 | $6+14$ | 6401 | 6385 | 6374 | 6361 | 6347 | $633+$ | 6320 | 6307 | 247 |  | II |
| 51 | 6293 | 62So | 6266 | 6252 | 6239 | 6225 | 6211 | 6195 | $6 \mathrm{I} 8_{4}$ | 6170 | $2 \quad 57$ | 9 | I I |
| 52 | 6157 | 6143 | 6129 | 6115 | 6101 | 60SS | 6074 | 606 | 60.46 | 60.32 | $2 \begin{array}{lll}2 & 5\end{array}$ | 9 | 2 |
| 53 | 6018 | 6004 | 5990 | 5976 | 5962 | 59.48 | 5934 | 5920 | 5906 | 5 S 92 | 257 |  | 2 |
| 54 | 5878 | 5864 | 5850 | 5835 | $5 \mathrm{S2I}$ | 5807 | 5793 | 5779 | 5764 | 5750 | 257 | 9 | 2 |
| 55 | 5736 | 5721 | 5707 | 5693 | 5678 | 5664 | 5650 | 5635 | 5621 | 5606 | $2 \quad 57$ | 10 | 12 |
| 56 | 5592 | 5577 | 5563 | 5548 | $553+$ | 5519 | 5505 | 5490 | 5.7.6 | 5461 | 257 | 10 | 12 |
| 57 | 5446 | 5432 | $5+17$ | 5402 | 5388 | 5373 | 535 S | 5374 | 5329 | 5314 | 25 | 10 | 12 |
| 58 | 5299 | 52 | 5270 | 5255 | 5240 | 5225 | 5210 | 5195 | 5 ISo | 5165 | 25 | 10 | 12 |
| 59 | 51 | 51 | 5120 | 51 | 5090 | 5075 | 5060 | 5045 | 5030 | 5015 | 35 | 10 | 13 |
| 60 | 5000 | 4985 | 4970 | 4955 | 4939 | 4924 | 4909 | 4 S 94 | 4879 | 4863 | $3 \quad 58$ | 10 | 13 |
| 61 | 4848 | 4833 | 48iS | 4SO2 | 4757 | 4772 | 4756 | 4741 | 4726 | 4710 | $3 \quad 58$ | 10 | 13 |
| 62 | 46 | 46 |  | 4 | 4633 | 4617 | . 4602 | 4586 | 4571 | 4555 | 358 | 10 | 13 |
| 63 | 4540 | 4524 | 4509 | 4493 | 4478 | 4462 | 4446 | 4431 | 4415 | 4399 | 3 | 10 | 13 |
| 64 | $43{ }^{4}+$ | 4363 | 4352 | 4337 | 4321 | 4305 | 42 S 9 | 4274 | 4258 | $42+2$ | $\begin{array}{llll}3 & 5 & S\end{array}$ | II | 13 |
| 65 | 4226 | 42 | 4195 | 41 | 4163 | 4147 | 4131 | 4115 | 4099 | 4083 | $\begin{array}{lll}3 & 5 & S\end{array}$ | I I | 13 |
| 66 | 4067 | 40 | 4035 | 40 | 4003 | 3987 | 3971 | 3955 | 3939 | 3923 | 35 | I I | 14 |
| 67 | 3907 | 3 S 91 | 3875 | 3 S59 | $3 S_{43}$ | 3827 | 3SII | 3795 | 3778 | 3762 | 358 | I | 14 |
| 68 | 3746 | 3730 | 3714 | 3697 | 3681 | 3665 | $36+9$ | 3633 | 3616 | 3600 | $\begin{array}{llll}3 & 5 & 8\end{array}$ | 1 | I 4 |
| 69 | 3584 | 3567 | 3551 | 35.35 | 3518 | 3502 | 3486 | 3469 | $3+53$ | 3437 | 3 5 S | II | 14 |
| 70 | 3420 | 3404 | 3387 | 3371 | 3355 | 3338 | 3322 | 3305 | 3289 | 3272 | $\begin{array}{lll}3 & 5 & 8\end{array}$ | II | 14 |
| 71 | 3256 | 3239 | 3223 | 3206 | 3190 | 3173 | 3156 | 3140 | 3123 | 3107 | 3 6 8 | II | 14 |
| 72 | 30 | 30 | 30 | 30 | 3024 | 300 | 2990 | 2974 | 2957 |  | 3.68 | I | 14 |
| 73 | 2924 | 2907 | 2S90 | 2 S74 | 2S57 | 28.0 | 2S23 | 2807 | 2790 | 2773 | $3 \div 68$ | II | 14 |
| 74 | 2756 | 2740 | 2723 | . 2706 | 2659 | 2672 | 2656 | 2639 | 2622 | 2605 | $\begin{array}{llll}3 & 6 & 8\end{array}$ | II | 14 |
| 75 | 25 SS | 25 | 2554 | 253 | 2521 | 2504 | 2487 | 2470 | 2453 | 2436 | $36^{7} \mathrm{~S}$ | II | It |
| 76 |  | 24 | 2385 | 2368 | 2351 | 2334 | 2317 | 2300 |  | 2267 | 365 | 1 I | 14 |
| 77 | 2250 | 2233 | 2215 | 2198 | 2181 | 2164 | 2147 | 2130 | 2113 | 2096 | 366 | I,I | I4 |
| 78 | 2079 | 2062 | 20.45 | 202S | 2011 | 1994 | 1977 | 1959 | 1942 | 1925 | $3 \quad 6 \quad 9$ | I I | 14 |
| 79 | 1908 | I 89I | 1874 | 1857 | I 840 | I S22 | I So 5 | 1788 | 1771 | 1754 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 14 |
| 80 | 1736 | 1719 | 1702 | 1685 | 1668 | 1650 | 1633 | 1616 | 1599 | 1582 | 3669 | 12 | 14 |
| 81 | 1564 | I $5+7$ | 1530 | 1513 | 1495 | 1478 | I 461 | 1444 | 1426 | 1409 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 14 |
| 82 | 1392 | 1374 | 1357 | 1340 | 1323 | 1305 | 1288 | 1271 | 1253 | 1236 | 366 | 12 | 14 |
| 83 | 1219 | I20́I | IIS4 | 1167 | 1149 | I 132 | III5 | 1097 | IOSo | 1063 | 369 | 12 | 14 |
| 84 | 1045 | .102S | IOII | 0993 | 0976 | 0958 | 0941 | 0924 | 0906 | oSS9 | 36 | 12 | 14 |
| 85 | 0872 | 0854 | 0837 | oSi9 | -So2 | 0785 | 0,67 | 0750 | 0732 | 0715 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 86 | 0698 | 06So | 0663 | 0645 | 062S | 0610 | 0593 | 0576 | 055 S | 0541 | 369 | 12 | 15 |
| 87 | 0523 | 0506 | 0.458 | 0.77 | 0454 | 0436 | 0419 | O401 | 0384 | 0366 | 369 | 12 | 15 |
| 88 | 0349 | 0332 | 03:4 | 0297 | 0279 | 0262 | 0244 | 0227 | 0209 | 0192 | 369 | 12 | 15 |
| 89 | 0175 | OI 57 | 0140 | 0122 | 0105 | 0087 | 0070 | 0052 | 0035 | OOI 7 | $3 \quad 69$ | 12 | 15 |

N.B.-Numbers in differeuce co.lumns to be subtracteds not added -See Rules.


NATURAL TANGENTS $=5 p 10: \cdots \int_{i 37}$


NATURAL COTANGENTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | 12' | $18{ }^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | 36' | $42^{\prime}$ | $48^{\prime}$ | $54^{\prime}$ | Difference-columns not useful here, owing to the rapidity with cotangent changes. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | Inf. | 573.0 | 286.5 | $19{ }^{\circ} \mathrm{O}$ | $143 \cdot 2$ | 114.6 | $95^{\circ} 49$ | $81 \cdot 55$ | 71.62 | $63 \cdot 66$ |  |  |
| 1 | 57.29 | 52.08 | 47.74 | $44^{\circ} 07$ | 40'92 | 38.19 | $35^{\circ} \mathrm{So}$ | 33.69 | 31.82 | 30'14 |  |  |
| 2 | 28.64 | 27.27 | 26.03 | $24^{\circ} 90$ | 23.86 | 22.90 | 22.02 | $21^{\circ} 20$ | 20.45 | 19.74 |  |  |
| 3 | 19.08 | 18.46 | 17.89 | 1794 | 16.83 | 16.35 | 15.89 | 15.46 | 15.06 | 14.67 |  |  |
| 4 | 14.30 | 13.95 | 13.62 | 13.30 | 13.00 | 71 | 12.43 | $12 \cdot 16$ | II.91 | II.66 |  |  |
| 5 | 11.43 | It 20 | I0'99 | 10.78 | 10.58 | $10 \cdot 39$ | 10.20 | 10'02 | ${ }^{9}$ 'S45 | $9 \cdot 677$ |  |  |
| 6 | 9.5144 | 3572 | 2052 | 0579 | $\overline{9} 152$ | 7769 | ${ }^{6} 427$ | 5126 | 3863 | $\overline{2} 636$ |  |  |
| 7 | 8.1443 | 0285 | 9158 | $\overline{8} 062$ | 6996 | 5958 | 4947 | 3962 | $\overline{3} 002$ | 2066 |  |  |
| 8 | 71154 | 0264 | 9395 | $\overline{8} 548$ | $\overline{7} 20$ | 6912 | $\overline{6} 122$ | 5350 | 4596 | $\overline{3} 859$ |  |  |
| 9 | 6.3138 | 2432 | 1742 | 1066 | 0405 | 9758 | $\overline{9} 124$ | $\overline{8} 502$ | 7894 | 7297 |  |  |
| 10 | 5.6713 | 6140 | 5578 | 5026 | 4486 | 3955 | 3435 | 2924 | 2422 | 1929 | 123 | 45 |
| 11 | 5.1446 | 0970 | 0504 | 0045 | 9594 | $\overline{9} 152$ | $\overline{8} 716$ | $\overline{8} 288$ | $\overline{7} 867$ | 7453 | 74148222 | 296370 |
| 12 | 4.7046 | 6646 | 6252 | 5864 | 5483 | 5107 | 4737 | 4374 | 4015 | 3662 | 63125188 | 252314 |
| 13 | 43315 | 2972 | 2635 | 2303 | 1976 | 1653 | 1335 | 1022 | 0713 | 0408 | 53107160 | 214267 |
| 14 | 40108 | $\overline{9} 912$ | 9520 | 9232 | - 947 | $\overline{8} 667$ | $\overline{8} 391$ | $\overline{8} 118$ | $\overline{7} 848$ | $\overline{7583}$ | $46 \quad 93$ I | 186232 |
| 15 | $3 \cdot 7321$ | 7062 | 6806 | 6554 | 6305 | 6059 | 5816 | 5576 | 5339 | 5105 | $41 \begin{array}{llll}1 / 22 & 122\end{array}$ | 163204 |
| 16 | 3.4874 | 4646 | 4420 | 4197 | 3977 | 3759 | 3544 | 3332 | 3122 | 2914 | $36 \quad 72 \quad 10 S$ | 144180 |
| 17 | 3.2709 | 2506 | 2305 | 2106 | 1910 | 1716 | I 524 | 1334 | I 146 | -961 | $1 \begin{array}{lll}32 & 64 & 96\end{array}$ | 129161 |
| 18 | 3.0777 | 0595 | 0415 | 0237 | 0061 | 9887 | 9714 | 9544 | -9375 | 9208 | $29 \quad 588$ | 115144 |
| 19 | 2.9042 | 8878 | 8716 | 8556 | 8397 | 8239 | $808_{3}$ | 7929 | 7776 | 7625 | $26 \quad 52 \quad 78$ | 104130 |
| 20 | 2.7475 | 7.326 | 7179 | 7034 | 6889 | 6746 | 6605 | 6464 | 6325 | 6187 | $\begin{array}{llll}24 & 47 & 71\end{array}$ | 95118 |
| 21 | 2.6051 | 5916 | 5782 | 5649 | 5517 | 5386 | 5257 | 5129 | 5002 | 4876 | $\left\lvert\, \begin{array}{lll}22 & 43 & 65\end{array}\right.$ | 87108 |
| 22 | 2.4751 | 4627 | 4504 | 4383 | 4262 | 4142 | 4023 | 3906 | 3789 | 3673 | 208060 | $79 \quad 99$ |
| 23 | 2.3559 | 3445 | 3332 | 3220 | 3109 | 2998 | 2889 | ${ }_{27}{ }^{2} \mathrm{SI}$ | 2673 | 2566 | 18 37 55 | $74 \quad 92$ |
| 24 | 2.2460 |  | 2251 | 2148 | 2045 | 1943 | 1842 | 1742 | 1642 | 1543 |  | $68 \quad 85$ |
| 25 | 2.1445 | I 348 | 1251 | II 55 | 1060 | 0965 | -872 | 0778 | 0686 | $\bigcirc$ | $\begin{array}{llll}16 & 31 & 47\end{array}$ | $63 \quad 78$ |
| 26 | 2.0503 | 0413 | 0323 | 0233 | O145 | 0057 | 9970 | 9883 | 9797 | 9711 | $15 \quad 29$ | $58 \quad 73$ |
| 27 | I 96626 | 9542 | 9458 | 9375 | 9292 | 9210 | 9128 | 9047 | 8967 | 8887 | $\begin{array}{llll}14 & 27 & 41\end{array}$ | 5568 |
| 28 | - $\cdot 8807$ | 8728 | 8650 | 8572 | 8495 | 8418 | 8341 | 8265 | 8190 | SII5 | $\begin{array}{llll}13 & 26 & 38\end{array}$ | $5 \mathrm{I} \quad 64$ |
| 29 | I - 8040 | 7966 | 7893 | 7520 | 7747 | 7675 | 7603 | 7532 | 7461 | 7391 | $\begin{array}{lll}12 & 24 & 36\end{array}$ | 4860 |
| 30 | 1 73321 | 7251 | 7182 | 7113 | 7045 | 6977 | 6909 | 6842 | 6775 | 6709 | II 23 34 | $45 \quad 56$ |
| 31 | I ${ }^{1} 6643$ | 6577 | 6512 | 6447 | 6383 | 6319 | 6255 | 6191 | 6128 | 6066 | $\begin{array}{lll}\text { II } & 21 & 32\end{array}$ | $43 \quad 53$ |
| 32 | I 60003 | 5941 | 5880 | 5818 | 5757 | 5697 | 5637 | 5577 | 5517 | 5458 | 10 2030 | $40 \quad 50$ |
| 33 | I - 5399 | 5340 | 52 S 2 | 5224 | 5166 | 5108 | 5051 | 4994 | 4938 | $4{ }_{4}{ }^{\text {S }}$ | 10 $19 \begin{array}{ll}19 & 29\end{array}$ | $38 \quad 48$ |
| 34 | I.4826 | 4770 | 4715 | 4659 | 4605 | 4550 | 4496 | 4442 | 4388 | 4.335 | 9 IS 27 | $36 \quad 45$ |
| 35 | 1.4281 | 4229 | 4176 | 4124 | 4071 | 4019 | 3968 | 3916 | 3865 | 3814 | 9 | $34 \quad 43$ |
| 36 | 1 13764 | 3713 | 3663 | 3613 | 3564 | 3514 | 3465 | 3416 | 3367 | 3319 | $\begin{array}{llll}8 & 16 & 25\end{array}$ | 3341 |
| 37 | 1.3270 | 3222 | 3175 | 3127 | 3079 | 3032 | 2985 | 2938 | 2892 | 2846 | $\begin{array}{llll}8 & 16 & 23\end{array}$ | 3139 |
| 38 | I 2799 | 2753 | 2708 | 2662 | 2617 | 2572 | 2527 | 2482 | 2437 | 2393 | $8 \quad 15 \quad 23$ | $30 \quad 38$ |
| 39 | 1.2349 | 2305 | 2261 | 2218 | 2174 | 213 I | 208 | 2045 | 2002 | 1960 | $\begin{array}{llll}7 & 14 & 22\end{array}$ | $29 \quad 36$ |
| 40 | 1.1918 | 1875 | 1833 | 1792 | 1750 | 1708 | 1667 | 1626 | 1585 | 1544 | $\begin{array}{llll}7 & 14 & 21\end{array}$ | $28 \quad 34$ |
| 41 | I'1504 | 1463 | 1423 | 1383 | 1343 | 1303 | 1263 | 1224 | II84 | 1145 | $\begin{array}{llll}7 & 13 & 20\end{array}$ | 2633 |
| 42 | I•106 | 1067 | IO2S | 0990 | 0951 | 0913 | 0875 | -837 | 0799 | 0761 | $\begin{array}{lllll}6 & 13 & 19\end{array}$ | $25 \quad 32$ |
| 43 | I.0724 | 0686 | 0649 | 06 I | 0575 | 0538 | 0501 | 0464 | 0428 | 0392 | 12 | $25 \quad 31$ |
| 44 | I 0355 | 0319 | 0283 |  | 212 | 0176 | 0141 | 0105 | 070 | 0035 | 1218 | 24 |

N. ${ }^{\text {B. -Numbers in }}$ difference columns to be subtracted, not added.-See Rules.

NATURAL COTANGENTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | $42^{\prime}$ | $48^{\prime}$ | $54^{\prime}$ | 123 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | I'O | -9565 | - '9930 | 0.9896 | 0.9861 | 0.9827 |  | 759 | -9725 | -9691 | 6 II 17 | 23 | 29 |
| 46 | -9657 | 9623 | 9590 | 9556 | 9523 | 9490 | 9457 | 9424 | 9391 | 9358 | 6 11 17 | 22 | 28 |
| 47 | $\cdot 9325$ | 9293 | 9260 | 922 S | 9195 | 9163 | 9131 | 9099 | 9067 | 9036 | 5 II 16 | 21 | 27 |
| 48 | -9004 | 8972 | S941 | S910 | 8S-8 | $\mathrm{SS}_{4} 7$ | SSI6 | S7S5 | 8754 | 8724 | 5 10 16 | 2 I | 26 |
| 49 | - 6693 | S662 | S632 | S601 | S571 | S 54 I | S511 | 8,4SI | S451 | 8421 | 51015 | 20 | 25 |
| 50 | -8391 | S361 | S332 | S302 | S273 | §243 | 8214 | SIS5 | Si 56 | 8127 | 5 10 10 | 20 | 24 |
| 51 | - Sogs | So69 | S040 | Sol2 | 7983 | 7954 | 7926 | 7898 | 7869 | $7 \mathrm{~S}_{4} 1$ | 5 10 14 | 19 | 24 |
| 52 | ${ }^{7} 7$ SI 3 | 7785 | 7757 | 7729 | 7701 | 7673 | 7646 | 7618 | 7590 | 7563 | $5 \begin{array}{llll}5 & 9 & 14\end{array}$ | 18 | 23 |
| 53 | 7536 | 750 S | $74{ }^{\circ} \mathrm{I}$ | 7454 | 7427 | 7400 | 7373 | 7346 | 7319 | 7292 | 5 | IS | 23 |
| 54 | $\cdot 7265$ | 7239 | 7212 | 7186 | 7159 | 7133 | 7107 | 7080 | 7054 | 7028 | $4 \quad 913$ | IS | 22 |
| 55 | $\cdot 7002$ | 6976 | 6950 | 6924 | 6899 | 6873 | $6 S_{47}$ | 6S22 | 6796 | 6771 | 49 I3 | 17 | 1 |
| 56 | -6745 | 6720 | 6694 | 6669 | 6644 | 6619 | 6594 | 6569 | 6544 | 6519 | 4 S I3 | 17 | 21 |
| 57 | -6494 | 6469 | 6445 | 6420 | 6395 | 6371 | 6346 | 6322 | 6297 | 6273 | 4 S I2 | 16 | 20 |
| 58 | -6249 | 6224 | 6200 | 6176 | 6152 | 6128 | 6104 | 60So | 6056 | 6032 | $4 \quad 812$ | 16 | 20 |
| 59 | - 6009 | 5985 | 5961 | 5938 | 5914 | 5890 | 5867 | 5844 | 5830 | 5797 | $4{ }_{4}^{4} 8512$ | 6 | 20 |
| 60 | - 5774 | 5750 | 5727 | 5704 | 5681 | 5658 | 5635 | 5612 | 5589 | 5566 | 48812 | 15 | 19 |
| 61 | 5543 | 5520 | 5498 | 5475 | 5452 | 5430 | 5407 | $53 S_{4}$ | 5362 | 5340 | 48 II | 15 | 19 |
| 62 | '5317 | 5295 | 5272 | 5250 | 5228 | 5206 | 5184 | 5161 | 5139 | 5117 | 4711 | 15 | 18 |
| 63 | -5095 | 5073 | 5051 | 5029 | 5008 | 4986 | 4964 | 4942 | 492 I | 4899 | 4711 | 15 | IS |
| 64 | $\cdot 4877$ | $45_{56}$ | 4834 | 4813 | 4791 | 4770 | 4748 | 4727 | 4706 | 4684 | 4711 | 14 | I 8 |
| 65 | $\cdot 4663$ | 4642 | 4621 | 4599 | 4578 | 4557 | 4536 | 4515 | 4494 | 4473 | 4710 | 14 | 18 |
| 66 | -4452 | 4431 | 44II | 4390 | 4369 | 4.348 | 4327 | 4307 | 42 S6 | 4265 | 3710 |  | 17 |
| 67 | -4245 | 4224 | 4204 | 4183 | 4163 | 4142 | 4122 | 410 I | 4081 | 4061 | 3710 | 14 | 17 |
| 68 | - 4040 | 4020 | 4000 | 3979 | 3959 | 3939 | 3919 | 3899 | 3879 | 3859 | 3 7 10 | 13 | 17 |
| 69 | -3839 | 3819 | 3799 | 3779 | 3759 | 3739 | 3719 | 3699 | 3679 | 3659 | 3710 | 13 | 17 |
| 70 | - 3640 | 3620 | 3600 | 3581 | 3561 | 3541 | 3522 | 3502 | 3482 | 3463 | 3610 | 13 | 17 |
| 71 | $\cdot 3443$ | 3424 | 3404 | 33 S5 | 3365 | 3346 | 3327 | 3307 | 3288 | 3269 | $3 \quad 610$ | 13 | 16 |
| 72 | - 3249 | 3230 | 3211 | 3191 | 3172 | 3153 | 3134 | 3II5 | 3096 | 3076 | 3610 | 1 | 16 |
| 73 | - 3057 | 3038 | 3019 | 3000 | 2981 | 2962 | 2943 | 2924 | 2905 | 2SS6 | 369 | 13 | 16 |
| 74 | -2867 | 2849 | 2830 | 2 SII | 2792 | 2773 | 2754 | 2736 | 2717 | 269S | 3 6 9 | 13 | 16 |
| 75 | $\cdot 2679$ | 2661 | 2642 | 2623 | 2605 | 25S6 | 2568 | 2549 | 2530 | 2512 | 366 | 12 | 16 |
| 76 | $\cdot 2493$ | 2475 | 2456 | 2438 | 2419 | 2401 | 2382 | 2364 | 2345 | 2327 | 366 | 1 | 15 |
| 77 | -2309 | 2290 | 2272 | 2254 | 2235 | 2217 | 2199 | 2180 | 2162 | 2144 | 369 | 12 | 15 |
| 78 | -2126 | 2107 | $20 S 9$ | 2071 | 2053 | 2035 | 2016 | I99S | I980 | 1962 | $3 \quad 6 \quad 9$ | 12 | 15 |
| 79 | -1944 | 1926 | 1908 | IS90 | 1871 | 1553 | 1835 | 1817 | 1799 | ITS | $3 \begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 80 | -1763 | 1745 | 1727 | 1709 | 1691 | 1673 | 1655 | 1638 | 1620 | 1602 | 3669 | 12 | 15 |
| 81 | - 1584 | I 566 | I 548 | 1530 | 1512 | 1495 | 1477 | 1459 | 1441 | 1423 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 12 | I 5 |
| 82 | $\cdot 1405$ | 1385 | 1370 | 1352 | 1334 | 1317 | 1299 | 12SI | 1263 | 124 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 83 | -1228 | 1210 | II92 | II75 | II 57 | I 139 | II 22 | 1104 | 10S6 | 1069 | $3 \begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 84 | '1051 | 1033 | 1016 | 0995 | - SI | 0963 | 0945 | 092S | 0910 | oS92 | $3 \quad 6 \quad 9$ | 12 | 15 |
| 85 | -OS75 | OS57 | 0840 | 0822 | OSO5 | 0787 | 0769 | 0752 | 0734 | 0717 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 86 | -0699 | 06S2 | 0664 | 0647 | 0629 | 0612 | 0594 | 0577 | 0559 | 0542 | 369 | 12 | 15 |
| 87 | -0524 | 0507 | 0489 | 0472 | 0454 | 0437 | 0419 | 0402 | 0384 | 0367 | 3669 | 12 | 15 |
| 88 | -0349 | 0.332 | 0314 | 0297 | 0279 | 0262 | 0244 | 0227 | 0209 | 0192 | $3 \quad 6 \quad 9$ | 12 | 15 |
| 89 | '0175 | OI 57 | 0140 | 0122 | 0105 | 0087 | 0070 | 0052 | 0035 | 0017 | $3 \quad 6 \quad 9$ | 12 | 14 |

N.B.-Numbers in difference columns to be subtracted, not added.-See Rules.

NATURAL SECANTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | $42^{\prime}$ | 48' | $54^{\prime}$ | 123 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | $1{ }^{\prime} 0000$ | 0000 | 0000 | 0000 | 0000 | 0000 | OOOI | OOOI | OOOI | OOOI | 000 | 0 | O |
| 1 | 02 | O | 0002 | 0003 | 0003 | 0003 | 00 | 0004 | 0005 | 6 | - 0 | 0 | 0 |
| 2 | 1.0006 | 0007 | 0007 | 0008 | 0009 | 0010 | 0010 | OOII | 0012 | 0013 | 000 | 0 | 0 |
| 3 | $1{ }^{\circ} \mathrm{OOI} 4$ | 0015 | 0016 | OOI 7 | 0018 | COI9 | 0020 | 0021 | 0022 | 0023 | 0 O I | I | 1 |
| 4 | 1.0024 | 00 | 0027 | 002 S | 0030 | 0031 | 0032 | 0034 | 0035 | 37 | $\bigcirc 0$ | I | 1 |
| 5 | $1 \cdot 0038$ | 0040 | 0041 | 0043 | 0045 | 0046 | 0048 | 0050 | 0051 | 0053 | $\bigcirc 1$ | I | 1 |
| 6 | I 0055 | 0057 | 0059 | 006ı | 0063 | 0065 | 0067 | 0069 | 0071 | 0073 | 0 I | I | 2 |
| 7 | I ${ }^{\circ} 0075$ | 0077 | 0079 | 0082 | oo84 | 0086 | 0089 | 0091 | 0093 | 0096 | O I |  | 2 |
| 8 | 1.0098 | OIOI | 0103 | 0106 | oio8 | OIII | OII 4 | OII6 | OII9 | O122 | - | 2 | 2 |
| 9 | 1-0125 | 0127 | 0130 | OI 33 | 0136 | OI39 | OI42 | OI45 | OI48 | OI 51 | - | 2 | 2 |
| 10 | I 0 OI 54 | 0157 | O16I | 0164 | 0167 | OI70 | OI74 | 0177 | oiSo | OIS4 | 1 I | 2 | 3 |
| 11 | I'OIS7 | O191 | 0194 | 0198 | O2OI | 0205 | 0209 | 0212 | 0216 | 0220 | $1 \quad 12$ | 3 | 3 |
| 12 | I 0223 | 0227 | 0231 | 0235 | 0239 | 0243 | 0247 | 0251 | 0255 | 0259 | $1 \begin{array}{lll}1 & 2\end{array}$ | 3 | 3 |
| 13 | I 0263 | 0267 | 0271 | 0276 | O2So | O2S4 | 02S8 | 0293 | 0297 | 0302 | $\begin{array}{lll}1 & 1 & 2\end{array}$ | 3 |  |
| 14 | 1.0306 | 0311 | 0315 | 0320 | 0324 | 0329 | 0334 | 0338 | 0343 | 034S | $\begin{array}{lll}1 & 2 & 2\end{array}$ | 3 | 4 |
| 15 | I 0353 | 0358 | 0363 | 0367 | 0372 | 0377 | $03-2$ | 038S | 0393 | 039S | $\begin{array}{lll}1 & 2 & 3\end{array}$ | 3 |  |
| 16 | $1 \cdot 0403$ | 040S | 0413 | 0419 | 0424 | 0429 | O435 | 0440 | 0446 | 045I | 23 | 4 | 5 |
| 17 | I '0457 | c463 | 0468 | 0474 | 0480 | O4S5 | O491 | 0497 | 0503 | 0509 | $\begin{array}{lll}1 & 2 & 3\end{array}$ |  | 5 |
| 18 | I 0515 | 0521 | 0527 | 0533 | 0539 | 0545 | 0551 | 0557 | 0564 | 0570 | $\begin{array}{lll}1 & 2 & 3\end{array}$ | 4 | 5 |
| 19 | 1.0576 | 0583 | -589 | 0595 | 0602 | 0608 | 0615 | 0622 | 062S | 0635 | 23 | 4 | 5 |
| 20 | 1 \% 0642 | 0649 | 0655 | 0662 | 0669 | 0676 | 0683 | 0690 | 0697 | 0704 | 123 | 5 | 6 |
| 21 | $1 \cdot 0711$ | 0719 | 0726 | 0733 | 0740 | 0748 | 0755 | 0763 | 0770 | 0775 | I 214 |  | 6 |
| 22 | I 0785 | 0793 | oSor | - 0 O | oSi6 | -S24 | OS32 | 0840 | 084S | osj6 | $\begin{array}{lll}1 & 3 & 4\end{array}$ |  | 6 |
| 23 | I 0864 | oS72 | oSSo | oSSS | oS96 | 0904 | 0913 | 092I | og29 | 093S | 3 | 6 | 7 |
| 24 | I 0946 | 0955 | 0963 | 0972 | 09SI | 0989 | 0998 | 1007 | 1016 | 1025 | 34 |  |  |
| 25 | I'1034 | 1043 | 1052 | 1061 | 1070 | 1079 | 1089 | 1098 | 1107 | III 7 | $\begin{array}{lll}2 & 3 & 5\end{array}$ | 6 | S |
| 26 | 1-1126 | 1136 | I 145 | I I 55 | I 164 | 1174 | I I $S_{4}$ | 1194 | 1203 | 1213 | 235 | 6 | S |
| 27 | I'I223 | 1233 | 1243 | 1253 | 1264 | 1274 | 1284 | 1294 | 1305 | 1315 | 23 | 7 | 9 |
| 28 | I•1326 | 1336 | 1347 | 1357 | 1368 | 1379 | 1390 | 1401 | 1412 | 1423 | $\begin{array}{lll}2 & 4 & 5\end{array}$ | 7 |  |
| 29 | I'1434 | 1445 | 1456 | 1467 | 1478 | 1490 | 1501 | 1512 | 1524 | 1535 | 246 | S |  |
| 30 | 1'1547 | I 559 | 1570 | 1582 | I 594 | 1606 | 1618 | 1630 | 1642 | 1654 | 2466 |  | 10 |
| 31 | I 1 1666 | 1679 | 1691 | 1703 | 1716 | 1728 | 1741 | 1753 | 1766 | 1779 | 46 |  | 10 |
| 32 | 1•1792 | ISO5 | ISIS | IS3I | IS44 | IS57 | IS70 | ISS3 | IS97 | 1910 | $\begin{array}{lll}2 & 4 & 7\end{array}$ |  | 11 |
| 33 | I•1924 | 1937 | 1951 | 1964 | 1978 | 1992 | 2006 | 2020 | 2034 | 20.48 | $\begin{array}{lll}2 & 5 & 7\end{array}$ | 9 | 12 |
| 34 | I 2062 | 2076 | 2091 | 2105 | 2120 | 2134 | 2149 | 2163 | 2178 | 2193 | 25 | 10 | 12 |
| 35 | I $\cdot 2208$ | 2223 | 2238 | 2253 | 2268 | 2283 | 2299 | 2314 | 2329 | 2345 | 35 | 10 | 13 |
| 36 | I.2361 | 2376 | 2392 | 2408 | 2424 | 2440 | 2456 | 2472 | 2489 | 2505 | 35 | II | 13 |
| 37 | 1.252I | 2538 | 2554 | 257 I | 2588 | 2605 | 2622 | 2639 | 2656 | 267.3 | 365 | I | 14 |
| 38 | I.2690 | 2708 | 2725 | 2742 | 2760 | 2778 | 2796 | 2 SI 3 | 2831 | 2849 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 39 | I 2865 | 2886 | 2904 | 2923 | 2941 | 2960 | 2978 | 2997 | 3016 | 3035 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 12 | 16 |
| 40 | I 3054 | 3073 | 3093 | 3112 | 3131 | 3151 | 3171 | 3190 | 3210 | 3230 | $3 \quad 710$ | I | 16 |
| 41 | 1.3250 | 3270 | 3291 | 3311 | 3331 | 3352 | 3373 | 3393 | 3414 | 3435 | 3710 | 14 | 17 |
| 42 | 1.3456 | 3478 | 3499 | 3520 | 3542 | 3563 | 3585 | 3607 | 3629 | 3651 | 47 II | 14 | 18 |
| 43 | I.3673 | 3696 | 3718 | 3741 | 3763 | 3786 | $3 \mathrm{SO9}$ | 3832 | 3855 | 3878 | 4 S II | 15 | 19 |
| 44 | I 3902 | 3925 | 3949 | 3972 | 3996 | 4020 | 4044 | 4069 | 4093 | 4IIS | $4 \quad$ S 12 | 16 | 0 |

NATURAL SECANTS.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | $48^{\prime}$ | $54^{\prime}$ | 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 1*4142 | 4167 | 4192 | 4217 | 4242 | 4267 | 4293 | 43 I S | 4344 | 4370 | 4 | 8 | 13 | 17 | 21 |
| 46 | 1.4396 | 4422 | 444 S | 4474 | 4501 | 4527 | 4554 | 45 SI | 4603 | 4635 | 4 | 9 | 13 | IS | 22 |
| 47 | 1.4663 | 4690 | 47 IS | 4746 | 4774 | 4 SO 2 | 4 S 3 O | 4859 | $4 S^{\text {S }} 7$ | 4916 | 5 | 9 | 14 | 19 | 23 |
| 48 | I 4945 | 4974 | 5003 | 5032 | 5062 | 5092 | 512 I | 5151 | 5182 | 5212 | 5 | 10 | 15 | 20 | 25 |
| 49 | I-5243 | 5273 | 5304 | 5335 | 5366 | 5398 | 5429 | 546 I | 5493 | 5525 | 5 | 10 | 16 | 21 | 26 |
| 50 | I.5557 | 5590 | 5622 | 5655 | $56 S S$ | 5721 | 5755 | 57 SS | 5822 | $5{ }^{5} 56$ | 6 | 1 I | 17 | 22 | 28 |
| 51 | 1.5590 | 5925 | 5959 | 5994 | 6029 | 6064 | 6099 | 6135 | 6171 | 6207 | 6 | 12 | IS | 24 | 29 |
| 52 | I 6243 | 6279 | 6316 | 6353 | 6390 | 6427 | 6464 | 6502 | 6540 | 657 S | 6 | 12 | 19 |  | 31 |
| 53 | I 6616 | 6655 | 6694 | 6733 | 6772 | 6SI2 | $6 S_{52}$ | 6 692 | 6932 | 6972 | 7 | 13 | 20 | 26 | 33 |
| 54 | $1 \cdot 7013$ | 7054 | 7095 | 7137 | 7179 | 7221 | 7263 | 7305 | 7348 | 7391 | 7 | 14 | 21 | 2 S | 35 |
| 55 | I•7434 | 747 S | 7522 | 7566 | 7610 | 7655 | 7700 | 7745 | 7791 | 7837 | 7 | 15 | 22 | 30 | 37 |
| 56 | I.7SS3 | 7929 | 7976 | S023 | 8070 | SII8 | Si 66 | S214 | S263 | S312 | S | 16 | 24 | 32 | 40 |
| 57 | I $\cdot 5361$ | S410 | 8460 | 8510 | 856I | S6I2 | 8663 | 8714 | 8766 | SSIS | 9 | 17 | 26 | 34 | 43 |
| 58 | I $\cdot 587 \mathrm{I}$ | S924 | 8977 | 903 I | 9084 | 9139 | 9194 | 9249 | 9304 | 9360 | 9 | 18 | 27 | 36 | 45 |
| 59 | 1.9416 | 9473 | 9530 | 95S7 | 9645 | 9703 | 9762 | 9S2I | 98So | 9940 | 10 | 19 | 29 | 39 | 49 |
| 60 | 200000 | 0061 | 0122 | $01 S_{3}$ | 0245 | -30S | 0371 | 0434 | 0498 | 0562 | 10 | 21 | 31 | 42 | 52 |
| 61 | $2 \cdot 0627$ | 0692 | 0757 | -S24 | oS90 | 0957 | 1025 | 1093 | I 162 | 1231 | II | 22 | 34 | 45 | 56 |
| 62 | $2 \cdot 1301$ | 1371 | 1441 | 1513 | $15 \mathrm{~S}_{4}$ | 1657 | 1730 | ISo3 | 1877 | 1952 | 12 |  | 36 |  |  |
| 63 | $2 \cdot 2027$ | 2103 | 2179 | 2256 | 2333 | 2412 | 2490 | 2570 | 2650 | 2730 | I3 | 26 | 39 | 52 | 66 |
| 64 | $2 \cdot 2 \mathrm{SI} 2$ | 2 S 94 | 2976 | 3060 | 3144 | 3228 | 3314 | 3400 | 3486 | 3574 | I4 | 28 | 43 | 57 | 71 |
| 65 | $2 \cdot 3662$ | 3751 | 384 I | 3931 | 4022 | 4114 | 4207 | 4300 | 4395 | 4490 | I 5 | 31 | 46 | 62 | 77 |
| 66 | 2.4586 | 4683 | 4780 | 4579 | 4978 | 5078 | 5180 | 52 S 2 | 5384 | 5488 | 17 | 34 | 50 | 67 | S4 |
| 67 | 2.5593 | 5699 | 5 SO 5 | 5913 | 6022 | 6131 | 6242 | 6354 | 6466 | 6580 | IS | 37 | 55 | 73 | 92 |
| 68 | $2 \cdot 6695$ | 6SII | 6927 | 7046 | 7165 | 7285 | 7407 | 7529 | 7653 | 777 S | 20 | 40 | 60 | SI | 101 |
| 69 | 2.7904 | So32 | SI6I | S291 | $\mathrm{S}_{422}$ | S555 | 86SS | 8824 | 8960 | 9099 |  | 44 | 67 | So | II |
| 70 | 2.9238 | 9379 | 9521 | 9665 | 98II | 9957 | O106 | - 256 | -407 | -561 | 25 | 49 | 74 | 99 | 123 |
| 71 | 3.0716 | 0872 | 1030 | 1190 | 1352 | 1515 | 16SI | IS 4 S | 2017 | $218 S$ | 27 | 55 | S2 | 110 | 137 |
| 72 | $3 \cdot 2361$ | 2535 | 2712 | 2S91 | 3072 | 3255 | 3440 | $362 S$ | $3 \mathrm{SI}_{7}$ | 4009 |  | 6r | 92 | 12 | 54 |
| 73 | 3.4203 | 4399 | 4598 | 4799 | 5003 | 5209 | 5418 | 5629 | $5 S 43$ | 6060 | 35 | 69 | $\mathrm{IO}_{4}$ | 138 | 173 |
| 74 | $3 \cdot 6250$ | 6502 | 6727 | 6955 | 7186 | 7420 | 7657 | 7897 | SI40 | $\mathrm{S}_{3} \mathrm{~S}_{7}$ | 39 | 79 | IIS | 157 | 196 |
| 75 | 3.8637 | SS90 | 9147 | 9408 | 9672 | 9939 | -2 11 | - 486 | -765 | 1048 | 45 | 90 | 135 | I So | 225 |
| 76 | 4.1336 | 1627 | 1923 | 2223 | 2527 | $2 S_{37}$ | 3150 | 3469 | 3792 | 4121 |  | 04 | 156 | 20 S | 60 |
| 77 | 44454 | 4793 | 5137 | 5486 | 5 S4I | 6202 | 6569 | 6942 | 7321 | 7706 | 61 | 22 | 182 | 243 | 304 |
| 78 | $4 \cdot 8097$ | S496 | S901 | 9313 | 9732 | -̄ 59 | -593 | IO34 | İ484 | I942 | 72 | 144 | 216 | $2 S_{7}$ | 359 |
| 79 | $5 \cdot 240$ S | $2 \mathrm{SS}_{3}$ | 3367 | 3860 | 4362 | 4874 | 5396 | 592S | 6470 | 7023 |  | 73 | 259 | 345 | 432 |
| 80 | 5.75SS | SI64 | S751 | 9351 | 9963 | -5S9 | 1227 | ISSo | $\overline{2} 46$ | $\overline{3} 22 S$ |  |  |  |  |  |
| 81 | $6 \cdot 3925$ | 4637 | 5366 | 6III | 6874 | 7655 | S454 | 9273 | O112 | O972 |  |  |  |  |  |
| 82 | $7 \times 1853$ | 2757 | $36 S_{4}$ | 4635 | 5611 | 6613 | 7642 | S700 | 97S7 | -905 |  |  |  |  |  |
| 83 | S. 2055 | 323 S | 4457 | 57 II | $\underline{7004}$ | S 337 | 971 I | İ129 | 2593 | 4105 |  |  |  |  |  |
| 84 | $9 \cdot 566 S$ | 7283 | S955 | $06 S 5$ | 2477 | 4334 | 626I | S260 | I I 03 | II 25 |  |  |  |  |  |
| 85 | I I * 47 | 1171 | I I 95 | 12.20 | 12.47 | 12.75 | 13.03 | 13.34 | 13.65 | I $3 \times 99$ |  |  |  |  |  |
| 86 | 14.34 | 14.70 | 15*09 | $5 \cdot 50$ | 5*93 | 16.38 | $16 \cdot 56$ | 17.37 | 17*91 | IS.4 |  |  |  |  |  |
| 87 | 19*1 1 | $19 \% 7$ | $20 \cdot 47$ | $21 \cdot 23$ | 22.04 | 22.93 | $23 \cdot 85$ | 24.92 | 26.05 | 27.29 |  |  |  |  |  |
| 88 | $2 S \cdot 65$ | $30 \cdot 16$ | $3 \mathrm{I} \cdot \mathrm{S}_{4}$ | 33.71 | $35^{\circ} \mathrm{S}$ I | $3{ }^{5 \cdot 20}$ | $40 \cdot 93$ | $44^{\circ} \mathrm{OS}$ | 4775 | 52.09 |  |  |  |  |  |
| 89 | $57 * 30$ | $63 \cdot 66$ | 71.62 | SI'S | $5^{\circ}$ | 14 | $43^{\circ}$ | $19{ }^{\circ}$ | 256.5 | $573{ }^{\circ}$ |  |  |  |  |  |

NATURAL COSECANTS.

N.B.-Numbers in difference columns to be subtracted, not added.-Sec Rules.

NATURAL COSECANTS.

|  | 0 | $6{ }^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | $24^{\prime}$ | $30^{\prime}$ | $36^{\prime}$ | 42' | 48' | $54^{\prime}$ | 123 | 45 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 1 4142 | 4118 | 4093 | 4069 | 4044 | 4020 | 3996 | 3972 | 3949 | 3925 | 4 S 12 | 1620 |
| 46 | 1 3902 | $3^{878}$ | 3855 | 3832 | 3809 | 3756 | 3763 | 3741 | 3718 | 3696 | 11 | 1519 |
| 47 | $1 \cdot 3673$ | 3651 | 3629 | 3607 | 3585 | 3563 | 3542 | 3520 | 3499 | 3478 | 7 II | 1418 |
| 48 | 1.3456 | 3+35 | $3+14$ | 3393 | 3373 | 3352 | 333 I | 3311 | 3291 | 3270 | $3 \quad 710$ | 1417 |
| 49 | I.3250 | 3230 | 3210 | 3190 | 3171 | 3151 | 3131 | 31 | 3093 | 3073 | $3 \quad 710$ | 1316 |
| 50 | $1 \cdot 3054$ | 3035 | 3016 | 2997 | 2975 | 2960 | 2941 | 2923 | 2904 | 2 SS6 | 369 | 1215 |
| 51 | 1.2868 | 2849 | 2831 | $2 \mathrm{SH}_{3}$ | 2796 | 2778 | 2760 | 2742 | 2725 | 2708 | 36 | 1215 |
| 52 | I 2690 | 2673 | 265 | 2639 | 2622 | 2605 | 2588 | 2571 | 2554 | 2538 | 365 | II 14 |
| 53 | 1.2521 | 2505 | 2489 | 2472 | 2456 | 2440 | 2424 | 2408 | 2392 | 2376 | $3 \quad 5$ | 1113 |
| 54 | 1.2361 | 2345 | 2329 | 2314 | 2299 | 2283 | 2268 | 2253 | 2238 | 2223 | 3 | 1013 |
| 55 | I. 220 S | 2193 | 2178 | 2163 | 2149 | 2134 | 2120 | 2105 | 2091 | 2076 | 5 | 1012 |
| 56 | 1-2062 | 2048 | 2034 | 020 | 2006 | 1992 | 1978 | 1964 | 1951 | 1937 | $2 \quad 57$ | 912 |
| 57 | I•1924 | 1910 | IS97 | $18 S_{3}$ | 1870 | IS 57 | $1 \mathrm{~S}_{4}+4$ | 1831 | 1 SiS | ISo5 | 24 | 9 II |
| 58 | 1•1792 | 1779 | 1766 | 1753 | 1741 | 1728 | 1716 | 1703 | 1691 | 1679 | 2 | 0 |
| 59 | 1•1666 | 1654 | 1642 | 1630 | 1618 | 1606 | 1594 | 1582 | 15 | 5 | 246 | S 10 |
| 60 | $1 \cdot 154$ | 1535 | 1524 | 1512 | 1501 | 1490 | 1478 | 1467 | 1456 | 1445 | 4 | S 9 |
| 61 | I.1434 | 1423 | 1412 | 1401 | 1390 | 1379 | 1368 | 1357 | 1347 | 1336 | - |  |
| 62 | I•1326 | 1315 | 1305 | 1294 | 1284 | 1274 | 1264 | 1253 | 1243 | 1233 | 235 | 9 |
| 63 | 1-1223 | 1213 | 1203 | 1194 | 1184 | 1174 | 1164 | 1155 | 1145 | 1136 | 2 |  |
| 64 | 1•1126 | 1117 | 1107 | 1098 | 1089 | 1079 | 1070 | 1061 | 1052 | 1043 | 2 | S |
| 65 | I•1034 | 25 | 1016 | 1007 | 0998 | -989 | ogSI | 0972 | o963 | 0955 | 3 | 67 |
| 66 | 1.0946 |  | 09 | 21 | 0913 | O904 | oS96 | oSSS | -880 | -872 | $\begin{array}{lll}1 & 3 & 4\end{array}$ | 7 |
| 67 | 1.0864 | -856 | - ${ }^{\text {S }} 88$ | -S40 | -832 | oS24 | -Si6 | oSos | -80 | 0793 | $\begin{array}{lll}1 & 3 & 4\end{array}$ | 7 |
| 68 | 1.0785 | 0778 | 0770 | 0763 | 0755 | 0748 | 0740 | 0733 | 0726 | 0719 | I 24 | 6 |
| 69 | I 0711 | 0704 | 0697 | 0690 | -6S3 | 0676 | 0669 | 0662 | 0655 | 0649 |  | 6 |
| 70 | 1.0642 | 0635 | 0628 | 0622 | 0615 | 0608 | 0602 | 0595 | 0589 | 0583 | 2 | 5 |
| 71 | 1.0576 | 0570 | 0564 | 0557 | 055 I | 0545 | -539 | 0533 | 0527 | 0521 | $\begin{array}{lll}1 & 2 & 3\end{array}$ | 5 |
| 72 | 1.0 | 0509 | 0503 | 0497 | 0491 | 0485 | O4So | 0.474 | 0468 | 04 | 2 | 5 |
| 73 | I 0457 | 0451 | 0446 | 0440 | 0435 | 0429 | 0424 | 0419 | 0413 | -40 | 2 | 44 |
| 74 | 1.0403 | 0398 | 0393 | 038S | $\bigcirc 3{ }^{\circ} \mathrm{S}$ | 0377 | 0372 | 0367 | -363 | 0358 | $1 \begin{array}{lll}1 & 2 & 2\end{array}$ |  |
| 75 | I 0353 | 0348 | 0343 | 0338 | 0334 | 0329 | 0324 | 0320 | 0315 | 0311 | I 22 | 34 |
| 76 | I 0306 | 0302 | 0297 | 0293 | 0288 | 0284 | 02SO | 0276 | 0271 | 0267 | 1 l | 4 |
| 77 | 1 O263 | 0259 | 0255 | 0251 | 0247 | 0243 | 0239 | 0235 | 023I | 0227 | $1 \begin{array}{lll}1 & 1 & 2\end{array}$ | 3 |
| 78 | $1 \cdot 0223$ | 0220 | 0216 | 0212 | 0209 | 0205 | - | -19 8 | -194 | -191 | 1 I 2 | 3 |
| 79 | I 0187 | OIS4 | OISO | 0177 | O174 | 0170 | 0167 | -164 | -16ı | OI 57 | $\begin{array}{lll}1 & 1 & 2\end{array}$ | 3 |
| 80 | I 0154 | 0151 | 0148 | 0145 | 0142 | -139 | 0136 | 0133 | OI 30 | OI 27 | - | $2 \quad 2$ |
| 81 | I 0125 | 0122 | O119 | 0116 | 0114 | OIII | -10S | -106 | 0103 | oioi | - | 22 |
| 82 | I 00098 | 96 | 0093 |  | oo89 | oo86 | 0084 | 0082 | 0079 | 0077 | - |  |
| 83 | I 10075 | 0073 | 007 I | 0069 | 0067 | 0065 | 0063 | 0061 | 0059 | 0057 | - | 12 |
| 84 | 1.005 5 | 0053 | 0051 | 0050 | 0048 | 0046 | 0045 | 0043 | 0041 | 0040 | 0 I I | I I |
| 85 | $1 \cdot 0038$ | 0037 | 0035 | 0034 | 0032 | 0031 | 0030 | 002 | 0027 | 0026 | 0 0 1 | 1 |
| 86 | $1 \times 0024$ | 0023 | 0022 | 0021 | 0020 | 0019 | OOIS | 0017 | 0016 | 0015 | - | 1 |
| 87 | 1.0014 | 0013 | OOI2 | OOI I | 0010 | 0010 | 0009 | 000S | 0007 | 0007 | 0 O 0 | 1 |
| 88 | I 00006 | 0006 | 0005 | 0004 | 0004 | 0003 | 0003 | 0003 | 0002 | 0002 | - 0 | 0 |
| 89 | 1.0002 |  | 0001 | 0001 | -001 | 0000 | 0000 | 000 | 0000 | 0000 | - 0 | 0 |

N.B. -Numbers in difference columns to he subtracted, not added.-See Rutles.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | 24' | 30' | $36^{\prime}$ | $42^{\prime}$ | 48' | $54^{\prime}$ | 123 | 45 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $0^{\circ}$ | $0 \cdot 0000$ | 0017 | 0035 | 0052 | 0070 | 0087 | 0105 | 0122 | 0140 | OL57 | 369 | 1215 |
| 1 | 0.0175 | 0192 | 0209 | 0227 | 02 | 0262 | 02 | 0297 | 0314 | 0332 | 9 | 12 |
| 2 | 0.0349 | 0367 | 03 S 4 | O401 | 0419 | 0436 | 0454 | 0471 | 0489 | 0506 | 3669 | 1215 |
| 3 | 0.0524 | 0541 | 0559 | 0576 | 0593 | 0611 | 0628 | 0646 | 0663 | 0681 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 |
| 4 | 0.069 | 0716 | 0733 | 0750 | O | 0755 | 0803 | 0820 | -83S | 0855 | 9 | 12 |
| 5 | -0.0S73 | -S90 | 0908 | 0925 | O942 | 0960 | 0977 | 0995 | 1012 | 1030 | 369 | 12 |
| 6 | $0 \cdot 1047$ | 1065 | 1082 | 1100 | III7 | I 134 | I 152 | 1169 | 1187 | 1204 | 36 | 12 |
| 7 | O-1222 | 1239 | 1257 | 127 | 1292 | I 309 | 132 | 13 | 1361 | I379 | 3669 | 12 |
| 8 | 0•1396 | 1414 | 1431 | 1449 | 1466 | 1484 | 150 | 151 | 1536 | I 553 | 3669 | 12 |
| 9 | $0 \cdot 1571$ | 15 SS | 1606 | 1623 | I64I | 1658 | 1676 | 1693 | 1710 | 1728 | 36 | 12 |
| 10 | $0 \cdot 17$ | 1763 | 1780 | I79 | ISI 5 | IS33 | IS 5 | I 868 | I 885 | 1902 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 11 | - '1920 | 1937 | 1955 | 197 | 1990 | 200 | 202 |  | 20 | 2077 | 369 | 1215 |
| 12 | $0 \cdot 209$ | 2112 | 2129 | 2147 | 2164 | 2182 | 2199 | 22 | 2234 | 2251 | 369 | 12 |
| 13 | $0 \cdot 2269$ | 2286 | 2304 | 2321 | 2339 | 235 | 2374 | 2391 | 2409 | 2426 | 36 | 12 |
| 14 | $0 \cdot$ | 2461 | 2478 | 249 | 2 | 2531 | 2548 | 2566 | 25 | 2601 | 369 | 1215 |
| 15 | $0 \cdot 261$ | 2635 | 2653 | 2670 | 2688 | 2705 | 2723 | 2740 | 2758 | 2775 | 3669 | 1215 |
| 16 | $0 \times 2793$ | 2 SIO | 2827 | 2345 | 2862 | 2SSo | 2897 | 2915 | 2932 | 2950 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 |
| 17 | 0.2967 |  | 300 | 3019 | 303 | 305 | 307 | 3089 | 31 | 3124 | 3669 | 12 |
| 18 | $0 \cdot 3142$ | 3159 | 3176 | 3194 | 32 II | 3229 | 3246 | 3264 | 3281 | 3299 | 36 | 1215 |
| 19 | $0 \cdot 3316$ | 3334 | 3351 | 3368 | 33S6 | 3403 | 342 I | 3438 | 3456 | 3473 | 36 | 1215 |
| 20 | $0 \cdot 3$ | 3508 | 3526 | 3543 | 3560 | 357 S | 3595 | 3613 | 3630 | 3648 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 21 | $0 \cdot 36$ | 3683 | 37 | 3718 | 3735 | 375 | 37 |  | 3 So5 | 3822 | 69 | 12 |
| 22 | 0.384 | 3857 | 3875 | 3892 | 3910 | 3927 | 3944 | 3962 | 3979 | 3997 | $3 \begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 23 | 0.4014 | 4032 | 4049 | 4067 | 40 S 4 | 4102 | 4119 | 4136 | 4154 | 4171 | 369 | 12 |
| 24 | 0.418 | 4 | 4 | 4241 | 4259 | 4276 | 4 | 4311 | 432 S | 4346 | 369 | 1215 |
| 25 | 0.4363 | 4381 | 4398 | 4416 | 4433 | 4451 | 4468 | 4485 | 4503 | 4520 | 369 | 1215 |
| 26 | 0.4538 | 4555 | 4573 | 4590 | 4608 | 4625 | 4643 | 4660 | 4677 | 4695 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 I 5 |
| 27 | 0.47 | 4730 | 4747 | 4765 | 4782 | 4SOO | 4SI7 | $4{ }^{\text {S }} 35$ | $4{ }^{\text {S }} 52$ | 4869 | 9 | 1215 |
| 28 | 0.4857 | 4904 | 4922 | 4939 | 4957 | 4974 | 4992 | 5009 | 5027 | 5044 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 29 | $0 \cdot 5061$ | 5079 | 5096 | 5II4 | 5131 | 5149 | 5166 | 5184 | 5201 | 5219 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 30 | 0.523 | 525 | 5271 | 52 | 530 | 5323 | 5341 | 5358 | 5376 | 5393 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 31 | 0.541 | 542 S | 5445 | 5463 | 5480 | 5498 | 5515 | 5533 | 5550 | 556S | 369 | 12 |
| 32 | 0.5585 | 5603 | 5620 | 5637 | 5655 | 5672 | 5690 | 5707 | 5725 | 5742 | 3669 | 1215 |
| 33 | 0.5760 | 5777 | 5794 | 5812 | 5 529 | 5 S47 | 5864 | 5 SS 2 | 5899 | 5917 | $3 \begin{array}{lll}3 & 6\end{array}$ | 1215 |
| 34 | - 5934 | 5952 | 5969 | 5986 | 6004 | 6021 |  |  | 607 | O0, | 369 | 1215 |
| 35 | 0.6109 | 6126 | 6144 | 6161 | 6I7S | 6196 | 6213 | 6231 | $624 S$ | 6266 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 36 | $0.62 S_{3}$ | 6301 | 6318 | 6336 | 6353 | 6370 | 63 SS | 6405 | 6423 | 6440 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 I 5 |
| 37 | 0.6458 | 6475 | 6493 | 6510 | 652 S | 6545 | 6562 | 6580 | 6597 | 6615 | 369 | 12 I 5 |
| 38 | 0.6632 | 6650 | 6667 | 6685 | 6702 | 6720 | 6737 | 6754 | 6772 | 6789 | 3 l | 1215 |
| 39 | 0.6507 | 6S24 | $6 S_{42}$ | 6559 | $65_{77}$ | 6894 | 6912 | 6929 | 6946 | 6964 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 40 | 0.6981 | 699 | 7016 | 7034 | 7051 | 7069 | 7086 | 7103 | 7121 | 7138 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 |
| 41 | - 7156 | 7173 | 7191 | 7208 | 7226 | 7243 | 7261 | 7278 | 7295 | 7313 | 369 | 12 I 5 |
| 42 | $0 \cdot 7330$ | 7348 | 7365 | 7383 | 7400 | 7418 | 7435 | 7453 | 7470 | 7487 | $3 \cdot 69$ | 1215 |
| . 43 | $0 \cdot 7505$ | 7522 | 7540 | 7557 | 7575 | 7592 | 7610 | 7627 | 7645 | 7662 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 1215 |
| 44 | $0 \cdot 7679$ | 7697 | 7714 | 7732 | 7749 | 7767 | 7784 | 7802 | 7819 | 7837 | 3169 | 1215 |

RADIAN MEASURE.

|  | $\mathrm{O}^{\prime}$ | $6^{\prime}$ | $12^{\prime}$ | $18^{\prime}$ | 24' | $30^{\prime}$ | $36^{\prime}$ | 42' | 48' | $54^{\prime}$ | 123 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $45^{\circ}$ | 0.7554 | 7571 | $7 S 59$ | 7906 | 7924 | 7941 | 7959 | 7976 | 7994 | SOII | 369 | 12 | 15 |
| 46 | $0 \cdot \mathrm{SO} 2$ | So4 | So63 | SoSi | Sog | Sil6 | SI | SI | 816S | SIS6 | 9 |  | 5 |
| 47 | 0.8203 | S221 | 8238 | 8255 | 8273 | 8290 | 8308 | 8325 | 8343 | S360 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 48 | 0.5378 | S395 | $\mathrm{S}_{4} 12$ | 8430 | S447 | 8465 | 8482 | S500 | 8517 | S535 | 36 | 12 | 15 |
| 49 | 0.5552 | S57 | $\mathrm{S}_{5} \mathrm{~S} 7$ | 8604 | 8622 | S639 | 8657 | S674 | S692 | S709 | 3669 |  | 15 |
| 50 | 0.5727 | S744 | S762 | 8779 | 8796 | SSI4 | 8531 | SS49 | SS66 | SSS4 | 3669 | 12 | 15 |
| 51 | 0.8901 | S919 | S936 | S954 | S971 | 89SS | 9006 | 9023 | 9041 | 9058 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 52 | 0.907 | 9 | 9111 | 9125 | 9146 | 916 | 9ISo | 9198 | 9215 | 9233 | 3669 | 12 | 15 |
| 53 | 0.9250 | 926 | 9285 | 9303 | 9320 | 933 S | 93.55 | 937 | 9390 | 9407 | 3669 | 12 | 15 |
| 54 | 0.9425 | 9442 | 9460 | $9+77$ | 9495 | 9512 | 9529 | 9547 | 9564 | 95 S2 | 3 6 9 | 12 | 15 |
| 55 | $0 \cdot 9$ | 96 | 9634 | 9652 | 9669 | 9687 | 9704 | 9721 | 9739 | 9756 | $3 \begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 66 | 0 |  | 9 | 9 | 9S44 | 986I |  | 9 | 9913 | 9931 | 36 |  | 5 |
| 57 | 0.994 | 996 | $99 \mathrm{~S}_{3}$ | 0001 | OOIS | -0,36 | -05 | -071 | OoSS | ō105 | 3669 | 12 | 15 |
| 58 | I'0123 | 0140 | 0158 | 0175 | 0193 | 0210 | 02 | 0245 | 0263 | ozSo | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 59 | 1 | O | 03 | 0350 | 0367 |  | 0402 | O4 |  |  | 3669 | 12 | 5 |
| 60 | 1 0472 | 04 S 9 | 0507 | 0524 | 0542 | 0559 | 0577 | 059 | 0612 | 0629 | 3169 | 12 | 15 |
| 61 | $1 \cdot 0647$ | 0664 | -6SI | 0699 | 0716 | 0734 | 0751 | 0769 | 0786 | OSo4 | 3169 | 12 | 15 |
| 62 | $1{ }^{\text {coS } 2}$ |  | OS | 0873 | oS9I | 0908 | 0926 |  | 0961 | 097S | 369 | 12 | 15 |
| 63 | 1.099 | 1 | 1030 | 104 S | 1065 | IoS3 | 1100 | I | II 35 | 1153 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 64 | I'II70 | 1 ISS | 1205 | 1222 | 1240 | 1257 | 1275 | 1292 | 1310 | 1327 | 36 | 12 | 15 |
| 65 | 1•13 | 13 | 13 S | 1397 | 1414 | 1432 | 1449 | 14 | 14 | 1502 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | I2 | 15 |
| 66 |  | 153 | 1554 |  | I5S9 | 1606 |  |  |  |  | 369 |  | 15 |
| 67 | I I 6 | 171 | 1729 | 1746 | 1764 | 1781 | 1 | iSi6 | $1{ }^{1} 3$ | I 8 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 68 | I I IS6 | 1856 | 1903 | 192 I | 1938 | 1956 | 1973 | 1990 | 200S | 2025 | 36 | 12 | 15 |
| 69 | $1 \cdot 2043$ |  | 20 | 20 | 211 |  | 47 |  | 2182 | 2200 | 3669 | 12 | 15 |
| 70 | 1.2217 | 22 | 2252 | 2270 | 2287 | 2305 | 2322 | 2339 | 2357 | 2374 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 71 | $1 \cdot 2392$ | 2409 | 2427 | 2444 | 2462 | 2479 | 2497 | 2514 | 2531 | 2549 | $\begin{array}{lll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 72 | I 256 | 25 | 2601 | 26 | 2636 | 265 |  | 26S9 | 2706 | 273 | 3 | 1 | 15 |
| 73 | I 2741 | 2758 | 2776 | 2793 | $2 \mathrm{SII}^{\text {I }}$ | 2 S 2 S | 2846 | $2 S 63$ | 2SSI | 2898 | 36 | 12 | 15 |
| 74 | 1•2915 | 2933 | 2950 | 2968 | 2985 | 3003 | 3020 | 3038 | 3055 | 3073 | 36 | 12 | 15 |
| 75 | 13 | 3 | 3125 | 31 | 3160 | 31 | 3195 | 3212 | 3230 | 3247 | 36 | 12 | 15 |
| 76 | 1 326 |  | 3299 | 3317 | 3334 | 3352 |  |  | 3404 |  | 36 | 12 | 15 |
| 77 | 1.3439 | 3456 | 3474 | 3491 | 3509 | 3526 | 3544 | 3561 | 3579 | 3596 | 36 | 12 | 15 |
| 78 | 1•3614 | 3631 | 364 S | 3666 | $36 S 3$ | 3701 | 37 IS | 3736 | 3753 | 3771 | $\begin{array}{llll}3 & 6 & 9\end{array}$ | 12 | 15 |
| 79 | I.37SS | 3 S06 | 3 S23 | 3 S40 | 3 S 5 S | 3875 | 3893 | 3910 | 392 S | 3945 | 36 | 1 | 15 |
| 80 | 1-3963 | 39 So | 399 S | 4015 | 4032 | 4050 | 4067 | 40 S 5 | 4102 | 4120 | 36 | 12 | 15 |
| 81 | 1.4137 | 4155 | 4172 | 4190 | 4207 | 4224 | 4242 | 4259 | 4277 | 4294 | 36 | 12 | 15 |
| 82 | 1.431 | 4329 | 4347 | 4364 | 43 S 2 | 4399 | 4416 | 4434 | 4451 | 4469 | 36 |  | 15 |
| 83 | I.44S6 | 4504 | 452 I | 4539 | 4556 | 4573 | 4591 | 4608 | 4626 | 4643 | 36 | 12 | 15 |
| 84 | 1.466 | 4678 | 4696 | 4713 | 4731 | 4748 | 4765 | 4783 | 4800 | 4 SI8 | $\begin{array}{ll}3 & 6\end{array}$ | 12 | 15 |
| 85 | I*4S35 | 4853 | 4870 | 4885 | 4905 | 4923 | 4940 | 4957 | 4975 | 4992 | $3 \quad 6$ | 12 | 15 |
| 86 | I'5010 | 502 | 5045 | 5062 | 50So | 5097 | 5115 | 5132 | 5149 | 5167 | 369 |  | 15 |
| 87 | I. 5184 | 520 | 5219 | 5237 | 5254 | 5272 | 52 S 9 | 5307 | 5324 | 5341 | 36 | 12 | 15 |
| 88 | 1-5359 | 5376 | 5394 | 5411 | 5429 | 5446 | 5464 | 54 SI | 5499 | 55 I 6 | 3 6 | 12 | 15 |
| 89 | I 5533 | 5551 | $556 S$ | 55S6 | 5603 | 5621 | 5638 | 5656 | 5673 | 5691 | 369 | 12 | 15 |

SQUARES.


SQUARES.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 | 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $5 \cdot 5$ | 30:2 | $30 \cdot 3$ | O.47 | 30.5 | 9 |  | O*91 | $3 \mathrm{I}^{\circ} \mathrm{O} 2$ | 3I'14 | 3I 25 | 123 | 467 | S 910 |
| 5 |  |  | 31.5S |  | 3I Si |  |  | 32'15 |  |  | I | 5 | S 910 |
| 5 |  | 32.60 | $32 \cdot 72$ | $32 \cdot 83$ | 32.95 | $33^{\circ} 06$ | 33.18 | $33 \cdot 29$ | 33.41 | 33.52 | $1=3$ | 5 | S 910 |
| 5.S | $33^{\circ} 6+$ | 33.76 | $33 \cdot 87$ | $33^{\circ}$ | $34^{\circ 11}$ | $34^{\circ} 22$ | 34.34 | $34^{46}$ | $34 \cdot 57$ | $34 \cdot 69$ | $\begin{array}{lll}1 & 2 & 4\end{array}$ | 5 | S 9 II |
| 5. | $34^{\circ} \mathrm{S}$ I | 34 |  |  |  |  |  |  |  |  | 2 | 7 | S 10 II |
| 6.0 | 36.00 |  |  |  |  |  |  |  |  |  | I 24 | 5667 | 9 10 II |
| $6 \cdot 1$ | $37^{\circ} 21$ | $37 \cdot 33$ | 37.45 | 37.5 | $37 \cdot 70$ | $37 \cdot 82$ | 37.95 | $33^{3 \cdot 07}$ |  |  | 1 2 4 | 56 | 910 II |
| 6.2 |  |  |  | 3 S -SI |  |  | 39*19 | 39.3I |  |  | I | 56 S | 9 IO II |
| $6 \cdot 3$ | 13969 | $39 \cdot 82$ | $39^{\circ} 94$ | 40.07 | $40^{\circ} 20$ | 40'32 | +0.45 |  |  |  | 134 | 56 S | 9 Io II |
| 6.4 | $40 \cdot 96$ | 41.09 | 41•22 | +1.34 | +1.47 | 41 '60 | 4173 | 4I-S6 | $4 \mathrm{I} \times 99$ | 42.12 | $\begin{array}{llll}1 & 3 & 4\end{array}$ | 568 | 9 10 12 |
| 6 | 42 | 42 | 42 | $42 \cdot 64$ | 42.77 | 42.90 | $+3.03$ | 43'16 | $43 \cdot 30$ | $43 \cdot 43$ | 11 3 | 577 | 9 10 I2, |
| 6 |  |  |  |  |  |  |  |  |  |  | 34 | 5 | 9 II I2 |
| $6 \cdot 7$ |  |  |  |  | +5.43 |  |  |  |  |  | 134 | $578$ | 9 II 12 |
| 6.8 | $46 \cdot 24$ | $46 \cdot 38$ | $46 \cdot 51$ | $46 \cdot 65$ | +6.79 | $46 \cdot 92$ | $47^{\circ} \mathrm{O}$ |  | $47 \cdot 33$ | 47.47 | 1 3 4 | $578$ | 10 II 12 |
| 6 |  | $47^{\circ} 75$ |  | $48^{\circ} \mathrm{O} 2$ | $4{ }^{4 \cdot 16}$ |  |  |  |  | $4 \mathrm{~S} \cdot \mathrm{S6}$ | $\begin{array}{lll}1 & 3 & 4\end{array}$ | 678 | IO II I3 |
| $7 \cdot 0$ | $49^{\circ} \mathrm{O}$ | $49 \cdot 14$ | $49^{\circ} 28$ | $49^{\circ} 42$ | 49.56 | $49^{\circ} 70$ | $49 \cdot 8$ |  |  |  | $1 \begin{array}{lll}1 & 3 & 4\end{array}$ | 678 | IO II I 3 |
| 7 | 50.41 | $50 \cdot 55$ | 50.69 | $50 \cdot{ }^{\circ}$ | 50.9S | $51 \cdot 12$ | $5 \mathrm{I} \cdot 27$ | 5 I 4 4 | 51 55 | 5178 | I 3 4 4 | 6 | 10 II I3 |
| $7 \cdot 2$ | $5 \mathrm{I} \cdot S_{4}$ | $51^{\circ} 9 \mathrm{~S}$ |  |  | 52.42 | $52 \cdot 56$ | 52.71 |  |  | $53^{\circ} 14$ | 134 | $\begin{array}{lll}6 & 7 & 9\end{array}$ | 101213 |
| $7 \cdot 3$ | $53 \cdot 29$ | 53.44 | 53.5S | 53.73 | $53 \cdot 8 S$ | $54^{\circ} \mathrm{O}$ | $54^{\circ} 17$ | $54 \cdot 32$ | 54.46 | $54 \cdot 61$ | 134 | $\begin{array}{llll}6 & 7 & 9\end{array}$ | 101213 |
| 7 | $54 * 76$ | $54^{\circ 91}$ | $55^{\circ} \mathrm{0} 6$ | $55^{20}$ | $55 \cdot 35$ | $55^{\circ} 50$ | $55 \cdot 65$ | $55^{\circ} \mathrm{Bo}$ | $55^{\circ} 95$ | $55^{\circ} 10$ | $1 \begin{aligned} & 1 \\ & 1\end{aligned}$ | $\begin{array}{llll}6 & 7 & 9\end{array}$ | 101213 |
| 7 | $56 \cdot 25$ | $56 \cdot 40$ | $56 \cdot 55$ | 5670 | $56 \cdot 85$ | $57^{\circ} 00$ | 5715 | 57:30 | $57^{\circ} 46$ | 5761 | $2 \begin{array}{lll}2 & 3 & 5\end{array}$ | 6 S 69 | 1112 |
| 7.6 | 5776 | 57.91 | 58.06 | $5 \mathrm{~S} \cdot 22$ | $58 \cdot 37$ | 58.52 | $55 \cdot 68$ | $5 \mathrm{~S} \cdot 83$ |  |  |  | 6 S 6 | 214 |
| 7.7 | 59:29 | 59.44 | $59^{\circ} 60$ | $59^{\circ} 75$ | $59^{\circ} 91$ | 60.06 | $60 \cdot 22$ | 60:37 |  |  | $\begin{array}{llll}2 & 3 & 5\end{array}$ | 6 S S 9 | 111214 |
| $7 \cdot 8$ | 60'S4 | $61^{\circ} 00$ | $61 \cdot 15$ | 61.31 | 61.47 | 6I:62 | 6178 | 6194 | $62 \cdot 09$ | $62 \cdot 25$ | 235 | $6 \quad 8 \quad 9$ | 11 13 14 |
| 7 | 62 |  |  |  | 63.04 |  |  |  |  |  | 2 | 6 8 10 | $\begin{array}{llll}\text { II } & 13 & 14\end{array}$ |
| 8.0 | 64.00 |  | 6432 |  |  |  | $64 * 96$ | $65 \cdot 12$ | $65 \cdot 29$ | 65.45 | $2 \begin{array}{lll}2 & 3 & 5\end{array}$ | 6 S 10 | $\begin{array}{lllll}11 & 13 & 14\end{array}$ |
| 8 | $65^{\circ} \mathrm{II}$ |  |  |  | $66 \cdot 26$ |  |  | $66 \cdot 75$ | $66 \cdot 91$ | $67.0 S$ | $2 \begin{array}{lll}2 & 3 & 5\end{array}$ | 7 S 10 | 111315 |
| 8 |  |  |  |  |  |  |  |  |  | $6 \mathrm{~S} \cdot 72$ | 2 | 7 S 10 | 12 I 35 |
| $8 \cdot 3$ | $68$ |  |  | $69 \cdot 39$ | $69 \cdot 56$ |  |  | 70.06 | $70 \cdot 22$ | $70 \cdot 39$ | $\begin{array}{llll}2 & 3 & 5\end{array}$ | 7 S 10 | 121315 |
| $8 \cdot 4$ | $70 \cdot 56$ | $70 \%$ | 70.90 | $7 \mathrm{I} \cdot 06$ | $71 \cdot 23$ | 71.40 | 7 I 57 | 7174 | 71.91 | 72.08 | 2 3 5 | $7 \quad 810$ | 121415 |
| 8 | $72 \cdot 25$ | $72 \cdot 42$ | $72 \cdot 59$ | $72 \cdot 76$ | 72.93 | $73 \cdot 10$ | 73.27 | 73.44 | $73^{\circ} 62$ | $73 \cdot 79$ | 235 | 7910 | 121415 |
| $8 \cdot 6$ | $73^{\circ}$ |  | 74 | 74.48 | $74 \cdot 65$ | $74 \cdot 82$ |  | 75*17 | 75 | 75.52 | 2 | $7 \quad 910$ | 121416 |
| 8.7 | $75^{\circ}$ | $75 \cdot 56$ | $76 \cdot 04$ | $76 \cdot 21$ | $76 \cdot 39$ | $76 \cdot 56$ | $76 \cdot 74$ |  |  | $77 \cdot 26$ | $2 \begin{array}{lll}2 & 4 & 5\end{array}$ | $7 \quad 9$ II | 121416 |
| 8 | $77^{\circ} 44$ | $77 \cdot 62$ | $77 \cdot 79$ | $77 \cdot 97$ | $75 \cdot 15$ | $75 \cdot 32$ | 78.50 |  | $78 \cdot 5_{5}$ | $79^{\circ} 03$ | $2 \begin{array}{llll}2 & 4 & 5\end{array}$ | 79 II | 121416 |
| 8 | $79^{\circ} \mathrm{I}$ |  |  |  |  |  |  |  |  | So-S2 | 24 | 79 II | 131416 |
| $9 \cdot 0$ | SI.OO | 8I'IS |  | SI. 54 | SI 72 |  |  |  |  |  | 245 | 79 II | 13 I4 16 |
| $9 \cdot 1$ | $82 \cdot 8 \mathrm{I}$ | 82.99 | $83 \cdot 17$ | $83 \cdot 36$ | 83.54 | S3.72 | S3.91 | S4 | S4.27 | S4.46 | $2 \quad 45$ | 79 II | 13 15 16 |
|  |  |  |  |  | $85 \cdot 3$ S |  |  |  |  |  |  | 79 II | 131517 |
| $9 \cdot 3$ | $86^{\circ}$ | 86 | S6.86 | S7.05 | 87.24 | S7.42 |  |  |  | SS•I 7 | $2 \begin{array}{lll}2 & 4 & 6\end{array}$ | $7 \quad 9$ II | 131517 |
| $9 \cdot 4$ | SS.36 | -8S.55 | S8.74 | SS.92 | S9II | $89 \cdot 30$ | S9:49 | S9 | S9.87 | 90.06 | 2 4 6 | S 9 II | 131517 |
| 9.5 | 90'25 | 90.44 | 90'63 | 90.82 | 91.01 | 91.20 | 91•39 | 91.58 | 9178 | 91 97 | 246 | S 1011 | 131517 |
| 9 | $92^{1}$ | 92.35 | 92 | 92' | 92'93 | 93*12 |  | 93.51 |  |  | 246 | S 1012 | 1415 |
| $9 \cdot 7$ | 94.09 | $994^{\circ} 25$ | $94^{\circ} 48$ | 94.67 |  | 95 | 95:26 |  |  |  | $2 \div 6$ | S 10.12 | 14 16 IS |
| 9•8 | 96.04 | $96 \cdot 24$ | 96:43 | $96 \cdot 63$ | $96 \cdot 83$ | 97.02 | 97.22 | 97*42 | $97 \cdot 61$ | 97.8 I | 246 | S 10'12 | $14 \quad 16$ IS |
|  | 98.OI | 95.2 I |  | 98.60 | 9S.So |  |  |  |  |  | 246 | S. 1012 | IS |

SQUARE ROOTS FROM 100 то 999.9.

\begin{tabular}{|c|c|c|c|c|c|c|c|c|c|c|c|c|c|}
\hline \& 0 \& 1 \& 2 \& 3 \& 4 \& 5 \& 6 \& 7 \& 8 \& 9 \& $\cdot 1 \cdot 2 \cdot 3$ \& 4 \& $7 \cdot 8 \cdot 9$ <br>
\hline 10 \& \& 10.05 \& 10.10 \& 10'15 \& 10:20 \& 10:25 \& $10 \cdot 30$ \& 10`34 \& 10'39 \& $10^{\circ} 44$ \& 0 I I \& $2 \begin{array}{lll}2 & 2 & 3\end{array}$ \& 344 <br>
\hline 11 \& 10.49 \& 10.54 \& \& \& 10.68 \& $10 \cdot 72$ \& 10.77 \& $10 \cdot 82$ \& 10.86 \& 10.91 \& 0 I \& \& 4 <br>
\hline 12 \& 10.95 \& I 1.00 \& 11.05 \& 11.09 \& II 14 \& II 18 \& II'22 \& I I 27 \& II 31 \& 11.36 \& 0 I I \& 22 \& $3-4$ <br>
\hline 13 \& II 40 \& I 1.45 \& II 149 \& I I 53 \& II•58 \& II ${ }^{\circ} 62$ \& I I 66 \& I $1 \times 70$ \& II'75 \& I I 79 \& 0 I \& $\begin{array}{llll}2 & 2 & 3\end{array}$ \& $\begin{array}{llll}3 & 3 & 4\end{array}$ <br>
\hline 14 \& I I $\cdot \mathrm{S}_{3}$ \& 11 \& 11 92 \& II 96 \& 12.00 \& 12 \& 12.08 \& 12.12 \& $$
2|12.17|
$$ \& 12.21 \& O I \& $2 \quad 22$ \& $\begin{array}{lll}3 & 3 & 4\end{array}$ <br>
\hline 15 \& 12 \& 12.29 \& \& 12.37 \& 12.41 \& 12.45 \& \& \& \& 12.61 \& O I \& 22 \& $\begin{array}{lll}3 & 3 & 4\end{array}$ <br>
\hline 16 \& 12.65 \& $12 \cdot 69$ \& 12.73 \& 12.77 \& 12.81 \& $12 \cdot 85$ \& $12 \cdot 88$ \& 12.92 \& 12.96 \& 13.00 \& 0 I \& $2 \quad 2 \quad 2$ \& 3 <br>
\hline 17 \& 13 \& \& 13.11 \& 13.15 \& \& \& 13.27 \& \& 13.34 \& \& 0 I \& 22 \& $\begin{array}{lll}3 & 3 & 3\end{array}$ <br>
\hline 18 \& \& \& 13.49 \& 13.53 \& 13.56 \& 13.60 \& 13.64 \& 13.67 \& 13.71 \& 13.75 \& 0 I I \& 2 \& $3{ }^{3}$ <br>
\hline 19 \& 13.78 \& 13.82 \& 13.86 \& 13.89 \& 13.93 \& 13.96 \& $14^{\circ} 00$ \& 14.04 \& $14^{\circ} 07$ \& $14^{\circ} 11$ \& 0 I \& $1 \begin{array}{lll}1 & 2\end{array}$ \& 3 <br>
\hline 20 \& 14 \& $14^{\circ} 18$ \& 14.21 \& 14.25 \& 14.28 \& 14.32 \& 1435 \& 14.39 \& 14.42 \& 14.46 \& 0 I \& $2 \quad 2$ \& $3 \quad 3$ <br>
\hline 2 \& \& 14.53 \& \& 14.59 \& 14.63 \& 14.66 \& 1470 \& 14.73 \& 14.70 \& 14.80 \& 0 I \& 2 \& 33 <br>
\hline 22 \& 14.83 \& 14.87 \& 14.90 \& 14.93 \& 14.97 \& 15.00 \& $15^{\circ} \mathrm{O} 3$ \& $15^{\circ} 07$ \& $15 \cdot 10$ \& 15.13 \& 0 I I \& 2 \& $\begin{array}{llll}2 & 3 & 3\end{array}$ <br>

\hline 23 \& 15.17 \& $15^{\circ} 20$ \& $15^{\circ} 23$ \& $15^{\circ 26}$ \& $15^{\circ} 30$ \& 15.33 \& $15^{\circ} 36$ \& $15 \cdot 39$ \& 15.43 \& 15.46 \& 0 I \& 2 \& | 2 | 3 | 3 |
| :--- | :--- | :--- | :--- | <br>

\hline 24 \& \& \& \& 15.59 \& i 5.62 \& 15.65 \& 15.68 \& 15.72 \& \& 15.78 \& 0 \& $1 \begin{array}{lll}1 & 2 & 2\end{array}$ \& 3 <br>
\hline 25 \& I 5 \& $15 \cdot 84$ \& 15.87 \& $15^{\circ} 91$ \& 15.94 \& 15.97 \& 16.00 \& 16.03 \& 16.06 \& 16.09 \& 0 I \& $\begin{array}{lll}1 & 2 & \\ \text { i }\end{array}$ \& 33 <br>

\hline 26 \& 16.12 \& $16 \cdot 16$ \& 16.19 \& $16 \cdot 22$ \& 16.25 \& 16.28 \& $16 \cdot 31$ \& $16 \cdot 34$ \& $16 \cdot 37$ \& $16 \cdot 40$ \& 0 \& $\begin{array}{lll}1 & 2 & 2\end{array}$ \& | 2 | 2 | 3 |
| :--- | :--- | :--- | <br>

\hline 27 \& \& \& \& \& \& \& \& \& \& \& 0 I I \& 2 \& 23 <br>
\hline 28 \& 16.73 \& $16 \cdot 76$ \& $16 \cdot 79$ \& $16 \cdot 82$ \& 16.85 \& \& 16.91 \& I6.94 \& 16.97 \& $17 \%$ \& 0 I I \& 2 \& $\begin{array}{llll}2 & 2 & 3\end{array}$ <br>

\hline 23. \& 17.03 \& $17^{\circ} 06$ \& 17.09 \& I7.12 \& 17.15 \& $17 \times 18$ \& $17^{\circ} 20$ \& 17.23 \& $17 \cdot 26$ \& $17 \cdot 29$ \& 0 I \& $\begin{array}{lll}1 & 1 & 2\end{array}$ \& | 2 | 2 | 3 |
| :--- | :--- | :--- | :--- | <br>

\hline 30 \& 17 \& 17.35 \& \& \& 17.44 \& 17.46 \& $17 \times 49$ \& 17.52 \& 17.55 \& 17.58 \& 0 I \& I I 2 \& $2=3$ <br>
\hline 31 \& \& \& \& $17 \cdot 69$ \& \& \& 17.78 \& \& \& \& 0 I \& 2 \& 23 <br>
\hline 32 \& \& 17.92 \& \& 17.97 \& IS 00 \& 18.03 \& 18.06 \& 18.08 \& 18.11 \& \& 0 I \& - \& 22 <br>
\hline 33 \& $18 \cdot 17$ \& $18 \cdot 19$ \& \& $18 \cdot 25$ \& 18.28 \& $18 \cdot 30$ \& $18 \cdot 33$ \& $18 \cdot 36$ \& $18 \cdot 38$ \& 18.41 \& 0 I \& $\begin{array}{llll}1 & 1 & 2\end{array}$ \& 22 <br>
\hline 34 \& \& 18.47 \& \& 18.52 \& \& $18 \cdot 57$ \& $18 \cdot 60$ \& 18.63 \& 18.65 \& \& 0 I I \& 2 \& 2 <br>
\hline 35 \& 18.71 \& 18.73 \& \& $18 \cdot 79$ \& I $8 \cdot 8 \mathrm{I}$ \& I $8 \cdot 84$ \& 18.87 \& $18 \cdot 89$ \& \& 18.95 \& 0 I I \& 2 \& $2 \quad 2 \quad 2$ <br>
\hline 36 \& 18.97 \& $19^{\circ} 00$ \& $19^{\circ} 03$ \& 19.05 \& 19.08 \& $19^{\circ} 10$ \& $19^{\circ} 13$ \& $19^{\circ} 16$ \& $19^{\circ} 18$ \& $19^{\circ} 21$ \& $0 \quad 1$ \& , \& 22 <br>
\hline 37 \& \& \& \& \& \& \& \& \& \& \& \& 2 \& $2 \quad 2 \quad 2$ <br>
\hline 38 \& \& 19.52 \& 19.54 \& 19.57 \& 19.50 \& 19.62 \& 19.65 \& $19^{\circ} 67$ \& 19\%70 \& 1972 \& 0 I I \& 2 \& $2 \begin{array}{lll}2 & 2 & 2\end{array}$ <br>
\hline 39 \& 19.75 \& $19^{\circ} 77$ \& \& $19 \cdot 82$ \& $19 \cdot 85$ \& $19 \cdot 87$ \& $19^{\circ} 90$ \& 19.92 \& 19.95 \& 19.97 \& 0 O 1 \& $1 \begin{array}{lll}1 & 1 & \end{array}$ \& 22 <br>
\hline 40 \& $20^{\circ} 00$ \& $20^{\circ} 02$ \& 20 \& 20.07 \& 20'10 \& $20 \cdot 12$ \& $20^{\circ}$ \& $20 \cdot 17$ \& 20:20 \& $20^{\circ} 22$ \& 0 \& 1 I I \& $2 \quad 2$ <br>
\hline 41 \& \& \& \& \& \& \& \& \& \& \& 0 \& \& <br>
\hline 42 \& $20 \cdot 49$ \& 20.52 \& $20 \cdot 54$ \& 20.57 \& 20.59 \& 20.62 \& $20^{\circ} 64$ \& $20 \cdot 66$ \& \& \& 0 O I \& $1 \begin{array}{lll}1 & 1\end{array}$ \& $2 \quad 2$ <br>
\hline 43 \& 20.74 \& $20^{\circ} 76$ \& $20 \cdot 78$ \& 20.81 \& $20 \cdot 83$ \& $20 \cdot 86$ \& 20:88 \& 20.90 \& $20^{\circ} 93$ \& 20.95 \& 0 \& $1 \begin{array}{lll}1 & 1\end{array}$ \& 2 <br>
\hline 4 \& 20.98 \& 21 \& 21.02 \& \& \& \& \& \& \& \& O 0 \& I I 1 \& 2 <br>
\hline 45 \& \& 2I•24 \& \& \& 21.31 \& \& \& \& \& 21.42 \& 0 \& I I I I \& $\begin{array}{llll}2 & 2 & 2\end{array}$ <br>
\hline 46 \& 2I*45 \& 21.47 \& 21.49 \& 21-52 \& 21.54 \& 21.56 \& 2 I•59 \& 21 \& 21.63 \& 21.66 \& 0 \& $1 \begin{array}{lll}1 & 1\end{array}$ \& 222 <br>
\hline 47 \& \& \& \& \& 21 77 \& 21.79 \& \& \& \& \& 0 \& I I I \& 2 <br>
\hline 48 \& 21.91 \& \& \& 21.98 \& 22.00 \& 22.02 \& 22.05 \& $22^{\circ} \mathrm{O} 7$ \& \& \& 0 O I \& 111 \& $2 \quad 2 \quad 2$ <br>
\hline 49 \& 22.14 \& $22 \cdot 16$ \& 22.18 \& $22^{\circ} 20$ \& 22.23 \& 22.25 \& 22.27 \& $22 \cdot 29$ \& $22 \cdot 32$ \& $22 \cdot 34$ \& - 0 \& $1{ }^{1}$ I 1 \& 22 <br>
\hline 50 \& $22 \cdot 36$ \& 22.38 \& 22.41 \& 22.43 \& 22.45 \& 22.47 \& $22^{\circ}$ \& $22 \cdot 52$ \& 22.54 \& 22.56 \& 0 \& I \& 22 <br>
\hline 51 \& \& 22.6 \& 22.63 \& \& \& \& 22'72 \& \& \& $22 \cdot 78$ \& 0 \& I I I \& 22 <br>
\hline 52 \& 22.80 \& 22.83 \& 22.85 \& $22 \cdot 87$ \& $22 \cdot 89$ \& \& 22.93 \& 22.96 \& 22.98 \& $23^{\circ} 00$ \& 0 \& $1 \begin{array}{lll}1 & 1 & 1 \\ 1\end{array}$ \& $\begin{array}{lll}2 & 2 & 2\end{array}$ <br>

\hline 53 \& $23^{\circ} \mathrm{O}$ \& 23.04 \& 23.07 \& 23.09 \& $23^{\circ} \mathrm{II}$ \& $23^{\prime} 13$ \& 23.15 \& 23.17 \& $23^{\prime} 19$ \& $23^{\circ} 22$ \& 0 \& 1 I I \& | 2 | 2 | 2 |
| :--- | :--- | :--- | <br>

\hline 54 \& 23.24 \& 23 \& 23.2 \& 23.30 \& $23 \cdot 32$ \& 23.35 \& $23 * 37$ \& 23.39 \& 2341 \& 23.43 \& 00 \& I \& 122 <br>
\hline
\end{tabular}

SQUARE ROOTS FROM IOO TO 999 .9.
49

$5^{\circ}$
SQUARE ROOTS FROM 1000 TO 9999.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 | 789 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 | 1.62 | $3 \mathrm{~F} \cdot 7$ S | 3 | -09 | 5 | 3 | 32.56 | 32.71 | $32 \cdot 86$ | $33^{\circ} \mathrm{O} 2$ | 235 | 689 | 111214 |
| 11 | $33 \cdot 17$ | 33 | 33.47 | 33.62 | 33.76 | 33.91 | 134.06 | 34.21 | 34 | $34 \times 50$ | 134 | 679 | IO 1213 |
| 12 | $34^{\circ} 64$ | 34 | $34^{\circ} 9$ | 35.07 | 35.21 | 35.36 | 635.50 | $35 \cdot 64$ | 35.78 | $35^{\circ} 92$ | I 34 | 678 | 10 II I3 |
| 13 | 36.06 | 36 | 36.33 | 36.47 |  |  |  | $37^{\circ} \mathrm{I}$ | 37'15 | 37.28 | 134 | 578 | 10 II I2 |
| 14 | 37 |  |  | 37.82 | 37.95 | 38 | $38 \cdot 21$ | $38 \cdot 34$ | 38.47 | $38 \cdot 60$ | 134 | 578 | 91112 |
| 15 |  |  | 38.9 | $39^{\text {¢ }} 2$ | 39.24 | 39.3 | 39.50 | $39 \cdot 62$ | $39 \cdot 75$ | $39 \cdot 8$ | 134 | 568 | 910 II |
| 16 | $40 \cdot 00$ |  | $40 \cdot 25$ | 4037 | 40.50 |  | $40 \cdot 74$ | $40 \cdot 87$ | 40'99 | $41^{\circ} \mathrm{II}$ | 12 | 567 | 91011 |
| 17 | 4 | 4 I |  |  |  | 4 | 4 ${ }^{\text {9 }}$ | $42 \cdot 07$ | 42'19 | 42.31 | 12 |  | 81011 |
| 18 |  |  |  |  | 42.90 | 43. | 43 '13 | $43 \cdot 24$ | 43.3 | $43 \cdot 47$ | 123 | 567 | 8910 |
| 19 | 43.59 | 43.7 | $43 \cdot 82$ | 43.93 | $44^{\circ} \mathrm{O}$ |  | 44.27 | 44.38 | 44.5 | $44^{\cdot 61}$ | 123 |  | 8910 |
| 20 | $44^{\circ}$ |  |  | $5^{\circ}$ | $45^{\circ} 1$ | 45 | 45.39 | $45^{\circ} 50$ | 45.61 | $45 \cdot 72$ | 1 | 467 | 8910 |
| 21 | $45^{\circ} 8$ |  |  |  | $46 \cdot 26$ | 46 | 46.48 | $46 \cdot 58$ | $46 \cdot 6$ | $46 \cdot 80$ | 123 | 456 | 8910 |
| 22 | 46.90 | $47^{\circ} \mathrm{O}$ | $47 \cdot 12$ | $47^{2} 2$ | 47.33 | 47 | $47 \cdot 54$ | 47.64 | 47.75 | $47 \cdot 8$ | 123 | 456 | 7 |
| 23 | $47^{\circ} 96$ |  |  |  |  |  | 48.58 | $48 \cdot 68$ | $48 \cdot 79$ | 48.89 | 12 | 45 | 7 |
| 24 | 48.99 | $49^{\circ}$ | 49 |  |  |  | 49.60 | $49^{\circ} 70$ | $49^{\circ} \mathrm{So}$ |  | $\begin{array}{ll}1 & 2 \\ 1 \\ 1 & 3\end{array}$ | 456 | 7 |
| 25 | 50.00 | 50'10 |  | , | $50 \cdot 4$ | 50 | $50 \cdot 60$ | 50\% 7 | 50.79 |  | 123 | 45 | 7 |
| 26 | 50'99 | $51^{\circ}$ |  | 51.28 | 51.38 | 51 | 51•58 | 51.67 | 51.77 | $51 \cdot 8$ | I 23 | 456 | 7 |
| 27 | 51.96 | 52.06 | 52 | 52.25 |  |  |  | 52.63 |  | $52 \cdot 82$ | $\begin{array}{lll}1 & 2 & 3\end{array}$ |  |  |
| 28 | 52.92 | 53.1 | $53 \cdot 10$ | 53.20 | 53 | 5 | 53.48 | $53 \cdot 57$ | 53.67 | 53.76 | $\begin{array}{ll}1 & 2 \\ 1\end{array}$ | 456 | 77 |
| 29 | $53 \cdot 85$ | 53 | 54.04 | $54^{\circ} \mathrm{I}$ |  | 54-31 | 54.41 | 54.50 | 54.59 | 54.68 | 12 | 455 | 6 |
| 30 | 54.77 | 54 | 54 | $55^{\circ} \mathrm{O}$ | $55^{\prime} 14$ | $55^{\circ} 2$ | $55 \cdot 32$ | $55^{\circ} 41$ | $55^{\circ} 50$ | $55^{\circ} 59$ | 123 | 445 | 6 |
| 31 | $55^{\circ} 68$ | 55 | $55^{\circ}$ | 55*95 | 56.04 | $56 \cdot 12$ | 56.21 | $56 \cdot 30$ | 56.39 | 56.48 | I 2 | 345 | 6 |
| 32 | $56 \cdot 57$ |  | 56.75 | $56 \cdot 83$ | $56 \cdot 92$ | $57^{\circ} \mathrm{O}$ | $57 \cdot 10$ | $57^{\text {'18 }}$ | 57.27 | 57.36 | 1 1 1 | 34 | 6 |
| 33 | 57.45 | $57 \times 53$ | $57 \cdot 62$ | 5771 | $57 \times 79$ | $57 \cdot 88$ | 57.97 | $58.0=$ | 58.14 | 58.22 | 123 | 34 | 6 |
| 34 | 58.31 | $58 \cdot 4$ | 58.48 | $8 \cdot 57$ | $55^{\circ} 6$ | 58.74 | $58 \cdot 82$ | 58.91 | 58.99 | $59^{\circ} \mathrm{O}$ | 123 | 34 | 678 |
| 35 | 59'16 | 59 | 59.33 | $9{ }^{4} 4$ | 59.50 | 59 | 59.67 | 5975 | 59.83 | 59.92 | 12 | 34 |  |
| 36 | $60 \cdot 00$ |  | 60 | $60 \cdot 25$ | 60.33 | 6 | $60 \cdot 50$ | $60 \cdot 5$ | $60 \cdot 66$ | 60.75 | 1 | 34 | 6 |
| 37 | 60 |  |  | 6107 | 6•16 | 61 | 32 | 61.40 | 61.48 | 6 I 56 | 122 | 34 | 677 |
| 38 | $6 \mathrm{I} \cdot 6$ | 617 | $6 \mathrm{I} \cdot \mathrm{S}_{1}$ | 6I.89 | 61.97 | 62. | $62 \cdot 13$ | 62.21 | 62.29 | 62.37 | $1 \begin{array}{llll}1 & 2 & 2 \\ 1\end{array}$ | $\begin{array}{llll}3 & 4 & 5\end{array}$ |  |
| 39 | $62 \cdot 45$ | 62.53 | $62 \cdot 61$ | 62.69 | 62.77 |  | 62.93 | $63^{\circ} \mathrm{O}$ | 63.09 | $63 \cdot 17$ | 12 | 345 | 6 |
| 40 | 63.25 | $63^{\circ}$ | 63.40 | $63^{\circ} 4^{8}$ | 63.56 | 63 | 63.72 | $63 \cdot 80$ | $63 \cdot 87$ | $63^{\circ} 95$ | 12 | 345 | 667 |
| 41 | 64 |  |  | $64^{\circ} 27$ |  |  | 50 | 64.58 | $64 \cdot 65$ | 64.73 | 122 | , |  |
| 42 | 64. | 64 | 1 | ${ }^{\circ}$ | 65 | 6 | 5 | 65 | $65^{\circ} 42$ | $65^{\circ} 50$ | $\begin{array}{llll}1 & 2 & 2 \\ 1 & 2 \\ 1\end{array}$ | 34 | 5 |
| 43 | 65.57 | 65 |  |  | 65 | $65^{\circ} 95$ | 3 | 66 | $66 \cdot 18$ | $66 \cdot 2$ | 12 | 34 | 56 |
| 44 | $66 \cdot 3$ | 66.4 |  |  | $66 \cdot 63$ | 66.71 | 66.78 | 66.86 | 66.93 | 67.01 | 122 | 345 |  |
| 45 | $67^{\circ} \mathrm{O}$ | 67.16 | 67 | 6731 | $67 \cdot 38$ | 67.45 | 67.53 | 67.60 | 6.-68 | 6775 | 11 | 344 | 5 |
| 46 | $67 \cdot 82$ | $67^{\circ} 90$ | 67 | $68^{\circ} \mathrm{O}$ | $68^{\text {. } 12}$ | 68 |  | 68.34 | $684^{1}$ | 68.48 | 11 | 344 | 5 |
| 47 | 68.56 | 68.6 |  | 68.77 | $68 \cdot 8$ | 6 | 6S.99 | $69^{\circ} 07$ | $69^{\prime} 14$ | 6c 21 | 112 | 344 |  |
| 48 | 69.28 | 69.35 | 69.43 | 69.50 | $69 \cdot 57$ | $69 \cdot 64$ | $4^{6} 71$ | 69.79 | $69 \cdot 86$ | 69.93 | 11 | 344 | 5 |
| 49 | $70^{\circ} 00$ | 70.07 | 70 | 70:21 | 70:29 | $70 \cdot 36$ | 70\%43 | 70.50 | $70 \cdot 57$ | $70 \cdot 64$ | 112 | 344 | 5 |
| 50 | 70 |  |  |  | $70^{\circ} 99$ | 71.06 | 7 I •13 | 71.20 | $71 \times 27$ | 71*34 | I I | 344 | 5 |
| 51 | 7 | 71. |  |  | 71 |  | $7 \mathrm{I} \cdot{ }^{3}$ | 71*90 |  |  | 112 |  | 566 |
| 52 | 72.1 | $72 \cdot 18$ | 72 | 73 | 723 | $72 \cdot 46$ | $72 \cdot 53$ | 72.59 | 72.66 | 72.73 | 112 | 334 | 566 |
| 53 | 72 | $72 \cdot 87$ | 72.94 | $73^{\circ}$ |  | 73. | 73.21 | 73.28 | 73.35 | 73.42 | 11 | 3 34 | $5 \quad 56$ |
| 54 | 73 | 55 | 7 | 69 | 37 | 3 | 3-89 | $73 \times 96$ | $74{ }^{\circ} \mathrm{O}$ | $74^{\circ} \mathrm{O}$ | 1 12 | 33 | 55 |

SQUARE ROOTS FROM 1000 to 9999.
51

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 |  | 8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 55 | $74 \times 16$ | 74.23 | 74.30 | '36 | 43 | $74^{\circ} 50$ | 74.57 | $74 \cdot 63$ | $74 \%$ | $74 * 77$ | 112 | 334 | 5 | 56 |
| 56 | 74 |  |  |  | 75 | 75 17 |  | 75.30 | 75.37 | 75.43 | I 12 | 334 | 5 | 56 |
| 57 |  | 75 |  | 75 70 |  |  |  | 75 |  | 76.09 | 1 I 2 | 334 |  | 56 |
| 58 | 76.16 |  |  |  |  |  |  | $76 \cdot 62$ | $76 \cdot 68$ | $76 \cdot 75$ | 1 I | 334 | 5 | 6 |
| 59 | 76.81 |  |  |  | $77^{\circ} \mathrm{O}$ | $77 \cdot 14$ | 477.20 | 77:27 | 77.33 | 77.40 | 1 I | 4 |  | 6 |
| 60 | $77 \times$ | 77.5 |  | - | 77.7 |  | 77-85 | 77.91 | 77.97 | $78^{\circ} 04$ | 1 I 2 | 334 |  | 5 |
| 61 |  | $78 \cdot 17$ |  | 78.29 | $75 \cdot 36$ | 78 | 78.49 | 78.55 | $78 \cdot 61$ | $78 \cdot 68$ | 1 I | 334 | 4 | 56 |
| 62 |  | $75 \cdot 5$ | 78 |  | 78 | 79.06 | 79*12 | 79 | $79^{\prime 25}$ | 31 | 1 I | 334 | 4 | 6 |
| 63 |  |  |  |  |  |  | 75 | $79^{\circ} \mathrm{SI}$ | $79 \cdot 87$ | $79 \cdot 94$ | 1 I 2 | 3 | 4 | 6 |
| 64 |  | $80^{\circ}$ |  |  |  | O.31 | So'37 | So'44 | So. 50 | So. 5 | 1 I | 23 | 4 |  |
| 65 | So | So | So'75 | So. $\mathrm{SI}_{1}$ | 80 | So | 80.99 | 81.06 | SI'I | SI.IS | 1 I | 23 | 4 | $5 \quad 5$ |
| 66 |  |  |  |  |  |  | SI•61 | $8 \mathrm{I} \cdot 67$ | 817 | 81.79 | I 1 | 234 |  | 5 |
| 67 | SI.S | SI.9 |  | S2 | S2'IO | 2 | S2.22 | 82. | 82.34 | S2.40 | 112 | 234 |  |  |
| 68 | S2.46 | 82.52 |  | S2.6 | 82.70 | S2 76 | $82 \cdot 8_{3}$ | S2.89 | 82.95 | $83^{\circ} \mathrm{O}$ | 11 | 234 | 4 | 5 |
| 69 | 83 | 83 |  |  | 83. |  |  | 8 | 83.55 | 83.61 | 112 | 234 | 4 | 5 |
| 70 | $83 \cdot 67$ | $8{ }^{8} 7$ |  | S3.85 |  | 8 | $\mathrm{S}_{4}{ }^{\circ} \mathrm{O}$ | S4.08 | $\mathrm{S}_{4} \cdot 14$ | $84^{\circ} 20$ | I 12 | 234 | 4 | 5 |
| 71 | 84.26 | 84.32 | 84.38 | S4.44 | 84.50 | 84.56 | 84.62 | 84.68 | 84.73 | 84.79 | I | 234 | + | 5 |
| 7 |  |  |  |  |  |  |  |  | $85 \cdot 32$ | 85.38 | 11 | 3 |  | 55 |
| 73 |  |  |  |  |  |  |  | 85.85 | $85^{\circ 91}$ | 85.97 | I 12 | 233 | 4 |  |
| 74 |  |  |  |  |  |  | 37 | 86.43 | 86.49 | 86.54 | I 12 | 23 | 4 | 55 |
| 75 | S6 | 86.66 |  |  | $86 \cdot S_{3}$ | S6 | S6.95 | 87.01 | 87.06 | 87-12 | 11 | 233 | 4 | 5 |
| 7 | 87 |  |  |  | 87.41 |  |  |  | 87.64 | 87.69 | 11 | 2 | 4 | 5 |
| 77 | 87.75 | 87.81 |  | 9, |  | S | 88.09 | 8S. 15 | 85.20 | 88.26 | 112 | 233 | 4 |  |
| 78 | $88^{\circ} 2$ | 88.37 |  | 88.49 | SS. 54 |  |  | 88.71 | 88.77 | SS*S ${ }^{\text {S }}$ | 1 I 2 | 233 |  | 5 |
| 7 | 88.88 | 88 |  |  | S9. II |  | 89.22 | S9.27 | 89.33 | S9.39 | 1 I | 233 |  | 45 |
| 80 | S9.44 | S9*50 |  | S9.61 | $89 \cdot 67$ | - | $8{ }^{89} 78$ | $89 \cdot 83$ | 89.89 | 89.94 | $1{ }_{1} 12$ | $2 \begin{aligned} & 2 \\ & 3\end{aligned}$ | + |  |
| 81 |  | $90 \cdot 06$ |  | $0 \cdot 1$ |  |  | $90 \cdot 33$ | 90'39 | 90'44 | 90'50 | 1 I 2 | 23 |  | 5 |
| 82 |  |  |  |  |  |  |  |  | 90'99 | 91.05 | $1{ }^{1} 12$ | $2 \begin{array}{lll}2 & 3 & 3\end{array}$ |  | 5 |
| 83 | 91'10 | 91'16 | - | 91.27 | 91-32 |  | 91*43 | 91.49 | 91.54 | 91.60 | 1 I | $2 \begin{aligned} & 2 \\ & 3\end{aligned}$ |  |  |
| 84 | 91 65 | 9171 |  |  |  |  | 91.98 | 92.03 | 92.09 | $92 \cdot 1$ | 112 | 23 |  | 5 |
| 85 |  | 92 | $92 \cdot 30$ | 2. | 92.41 | 92.47 | 92.52 | 92.57 | 92.63 | 92.68 | 1 | 233 | 4 | 45 |
| 86 |  |  |  |  |  |  | 93.06 | $93^{\circ} \mathrm{I}$ | $93 \cdot 17$ | $93 \cdot 22$ | 112 |  |  | 5 |
| 87 | 93.27 | 93'33 | 93 3 | 93.43 | 9349 | 93 | 9359 | $93 \cdot 65$ | $93 \cdot 70$ | 9375 | 112 | 233 |  | 45 |
| 88 | $93 \cdot 81$ |  |  | 93 |  |  | 94.13 |  | 94*2 | 94*29 | 112 | 23 |  |  |
| 89 |  |  |  |  | 94.5 |  |  | $94^{\circ} 71$ | $94 \times 76$ | 94•S2 | 1 I | 233 |  | 45 |
| 9 | $94 \cdot 87$ | $94^{\circ} 9$ | 9497 | $95^{\circ} \mathrm{O}$ | $95^{\circ} \mathrm{O}$ | $95 \cdot 13$ | 95'IS | $95^{\circ} 24$ | $95^{\circ} 29$ | $95^{\circ}$ | $1 \begin{array}{ll}1 & 1 \\ 1 \\ 1\end{array}$ | 23 | 4 |  |
| 9 | 95.39 | 95.45 | 95'50 | 95.55 | $95^{\circ} 60$ | $95^{\circ} 6$ | $95^{\circ} 7 \mathrm{I}$ | $95^{\circ}$ | $95^{\circ}$ | 95. | 112 | 23 |  | 45 |
| 92 |  | 95*97 |  | 96.07 | $96 \cdot 1$ |  |  | 96.28 | 96.33 | 96.38 | 1 I 2 | 233 |  |  |
| 93 | 96.44 | 96.49 | $96 \cdot 54$ | $96 \cdot 59$ | $96 \cdot 64$ | $96 \cdot 70$ | 96•75 | 96-So | $96 \cdot 85$ | 96.90 | I 12 | 233 |  |  |
| 94 | 96.95 | $97^{\circ} \mathrm{O}$ |  | $97^{\circ} 11$ |  | 97.21 | 97.26 | 97*3I | 97•37 | $97 \times 2$ | 1 | 233 | 4 | 45 |
| 9 | 97* 47 | $97 \times 5$ | 97.57 | 97.62 | $97 \cdot 67$ | 97’プ | 97.78 | $97 \cdot{ }^{\text {c }}$ | 97.88 | $97^{\circ} 93$ | 11 | 23 |  | 45 |
| 9 |  | 98 |  |  |  |  | 38.29 | 98.34 | 98.39 | 98.44 | 1 I | 23 |  |  |
| 97 | 98.49 | 98.5 | 98.59, | 98.64 | 98.69 | 98.74 | 49879 | $98 \cdot 84$ | 98.S0 | 98.9 | I | 23 |  |  |
| 98 | 98.99 | $99^{\circ} 05$ | 99'10 | 99'15 | $99^{20}$ | 99.25 | 99*30 | 99.35 | $99^{\circ} 40$ | $99^{\circ} 4$ | $\bigcirc$ | 223 |  |  |
| 99 |  |  |  |  |  |  |  | $99 \cdot 85$ | 99*90 | 99.95 | O I I | 22 | 34 | 44 |

52 RECIPROCALS OF NUMBERS FROM Iooo To 9999.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 | 78 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 | 0.0010000 | 9901 | 9 SO 4 | 7709 | $\overline{9615}$ | 9524 | 9434 | 9346 | -9259 | 9174 | 9 IS 27 | 364555 | 5647382 |
| 11 | 0.0009091 |  | 8929 | 8850 | 8772 | 8696 | 862 I | 8547 | 847 | 8403 | 81523 |  |  |
| 12 | $0 \cdot 0008333$ | ${ }_{4}$ | 8197 | 8130 | So65 | 8000 | 7937 | 7874 | 781 | 7752 | 61319 | 26 | 455158 |
| 13 | $0 \cdot 0007692$ | 7634 | 7576 | 7519 | 7463 | 7407 | 7353 | 7299 | 7246 | 7194 | 51116 | 222733 | 384449 |
| 14 | 0.0007143 |  |  | 6993 | 69 | 6897 | 6849 | 6803 | 6757 | 711 | 51014 |  | 333843 |
| 15 | $0 \cdot 0006667$ | 662 | 6579 | 6536 | 6494 | 6452 | 6410 | 6369 | 6329 | 6289 | 4 S 13 | 172 | 293338 |
| 16 | $0 \cdot 0006250$ | 6211 | 6173 | 6135 | 6098 | 6061 | 6024 | 5988 | 5952 | 5917 | 4711 | 15 I8 22 | 262933 |
| 17 | $0 \cdot 0005882$ |  | 5814 | 5780 | 5747 | 571 | 5682 | 5650 | 5618 | 5587 | 3610 | 13 | 32629 |
| 18 | - 00005556 |  | 5495 | 5464 | 5435 | 5405 | 5376 | 5348 | 5319 | 5291 | 369 | 121 | 202326 |
| 19 | - 00005263 | 523 | 5208 | 5181 | 515 | 5128 | 5102 | 5076 | 5051 | 5025 | 35 | 11 I | 182124 |
| 20 | 0.0005000 | 49 | 49 | 4926 | 490 | 4878 | 4854 | 483 I | 4808 | 4785 | 257 | 1012 | 171921 |
| 21 | 0.0004 | 473 | 47 | 4695 | 46 | 4651 | 4630 | 46 | 45 | 4566 |  |  | 51720 |
| 22 | $0 \cdot 0004545$ | 45 |  | 4484 | 4464 | 4444 | 4425 | 44 | 43 | 4367 | 24 | 8 IO 1 | 141618 |
| 23 | 0.0004348 |  |  | 4292 | 4274 | 425 | 4237 | 4219 | 42 | 4 | 24 | 7911 | 131416 |
| 2 | 0.0004167 | 414 |  | 415 | 4098 | 4082 | 4065 | 4049 |  |  |  | 7810 | 121315 |
| 25 | -0004000 | 3984 | 3968 | 3953 | 3937 | 3922 | 3906 | 3891 | 387 |  | 2 | 6 | 111214 |
| 26 | $0 \cdot 0003846$ | 3831 | 3817 | 3802 |  | 3774 | 3759 | 3745 | 3731 | 3717 | I | 6 | 101113 |
| 27 | $0 \cdot 0003$ | 369 | 3676 | 3663 | 3650 | 3636 | 3623 | 3610 | 3597 | 3584 | 1 |  | 91112 |
| 28 | $0 \cdot 0003571$ | 35 | 3546 | 3534 | 3521 | 3509 | 3497 | 3484 | 3472 | 346 | I 2 | 5 | 91011 |
| 29 | $0 \cdot 0003448$ | 34 | 3425 | 3413 | 3401 | 3390 | 3378 | 3367 | 3356 | 334 | I | 5 | 8910 |
| 30 | 0.0003333 | 3322 | 3311 | 3300 | 328 | 3279 | 3268 | 3257 | 3247 | 3236 | I 2 | 4 | 7910 |
| 31 | $0 \cdot$ |  |  | 3195 |  | 3175 | 3165 | 3155 |  |  | I 2 |  | 9 |
| 32 | 0.0003125 |  |  |  |  |  | 3067 |  | 3049 |  | I 2 | 456 | 9 |
| 33 | $0 \cdot 0003030$ |  | 3012 | 3003 | 29 | 30 | 2976 | 2967 | 2959 | 2950 | 12 | 4 | 8 |
| 3 | $0 \cdot 0$ | 29 | 2924 | 2915 | 2907 | 28 | 90 | S2 | 287 |  | I | 34 | 8 |
| 35 | $0 \cdot 000285$ | 2 | $2{ }^{1}$ | 283 | 2825 | 28 |  | 2 SOI | 2793 | , | I 2 | 3 | 7 |
| 36 | 0.0002 | 2770 | 27 | 2755 | 27 | 27 | 2732 | 2725 | 2717 | 2710 | I | 3 | 567 |
| 37 | 0.0002703 | 2695 | 2688 | 2681 | 2674 | 2667 | 2660 | 2653 | 2646 | 2639 | 1 | 344 | 6 |
| 38 | $0 \cdot 0002632$ | 2625 | 2618 | 261 | 2604 | 2597 | 2591 | 2584 | 2577 | 2571 | I | $3 \quad 3$ | 556 |
| 39 | $0 \cdot 00025$ | 2558 | 255 | 2545 | 2538 | 2532 | 2525 | 2519 | 2513 | 250 | I | 33 | 556 |
| 40 | 0.000 | 24 | 2488 | 2481 | 2475 | 2469 | 2463 | 2457 | 2451 | 2445 | I | 234 | 5 |
| 41 |  |  | 2427 | 2421 |  | 2410 | 2404 | 2398 | 2392 | 2387 | I |  | 5 |
| 42 | $0 \cdot 00023$ SI |  | - | 2364 | 2358 | 2353 | 23 | 2342 | 2336 | 2331 | 1 | 2 | 5 |
| 43 | $0 \cdot 0002326$ | 23 | 2 | 2309 | 2304 |  |  |  | 22 | 227 | I | , | 445 |
| 44 | $0 \cdot 0002273$ |  | 2262 | 2257 |  | 224 | 2242 | 2237 | 2 | 27 | 1 |  | 445 |
| 45 | $0 \cdot 0002222$ | 22 | 2212 | 2208 | 2203 | 2198 | 2193 | 21 | 2103 | 2179 | $\bigcirc 1$ |  | 3 |
| 46 | 0.000217 | 210 | 2165 | 2160 | 2155 | 2151 | 2146 | 21 | 2137 | 2132 | $\bigcirc$ | 3 | 34 |
| 47 | $0 \cdot 0002128$ | 2123 | 2119 | 2114 |  | 2105 | 2101 | 2096 | 2092 | 2085 | - | 223 | 344 |
| 48 | $0 \cdot 0002083$ | 2079 | 2075 | 2070 | 66 | 2062 | 2058 | 2053 | 2049 | 2045 | $\bigcirc 111$ |  |  |
| 49 | $0 \cdot 0002041$ | 2037 | 2033 | 202 | 2024 | 2020 | 2016 | 201 | 2008 | 2004 | 0 I 1 |  | $3 \quad 34$ |
| 50 | 0 0002000 | 199 | 1992 | 1988 | 1984 | 198 | 1976 | 1972 | 1969 | 1965 | $\bigcirc$ | 222 | 33 |
| 51 | 0.0001961 | 19 | 1953 | 1949 | 1946 | 942 | 1938 | 1934 | 1931 | 1927 | 0 I | 222 |  |
| 52 | 0'0001923 | 1919 | 1916 | 1912 | 1908 | 1905 | $1901$ | $1898$ | IS94 | 1890 | 0 | $\begin{array}{llll}1 & 2 & \\ 1 & 2 & 2 \\ 1 & & \\ \end{array}$ | 33 |
| 53 | 0.0001887 | 1883 | I880 | 1876 | 18 | 86 | $1866$ | 1862 | 1859 | 1855 | O 1-I | 2 | 23 |
| 54 | $0 \cdot 0001852$ |  |  | S42 | 18 |  | S32 | IS | 182 |  | O ! 1 | 112 | $2{ }^{7} 3$ |

N.E.-Three zeros follow the decimal point in the reciprocal of any four figure whole number except the number 1000 .
Note.-Numbers in difference columns to be subtracted, not added.-Sec Rzele:

RECIPROCALS OF NUMBERS FROM 1000 To 9999. 53

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 | 789 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 55 | $0 \cdot 0001518$ | ISI 5 | 1 SI2 | ISoS | ISO5 | I SO2 | 1799 | I795 | 1792 | 1789 | $\bigcirc 1$ | 122 | 233 |
| 56 | 0.0001786 | 1753 | 1779 | 1776 | 1773 | 1770 | 1767 | I 764 | I761 | 1757 | 0111 | I 22 | 233 |
| 57 | 0.0001754 | 1751 | 1748 | 1745 | 1742 | 1739 | 1736 | 1733 | 1730 | 1727 | 0 O 111 | 122 | 223 |
| 58 | $0 \cdot 0001724$ | 1721 | 1718 | 1715 | 1712 | 1709 | 1706 | 1704 | 1701 | 1698 | 0 I | 1 I | 223 |
| 59 | $0 \cdot 0001695$ | 1692 | 16S9 | 1686 | $16 S_{4}$ | I6SI | 1678 | 1675 | 1672 | 1669 | 0 I | 112 | 223 |
| 60 | $0 \cdot 0001667$ | 1664 | 1661 | 1658 | 1656 | 1653 | 1650 | 1647 | 1645 | 1642 | $\bigcirc 1$ | I 112 | 223 |
| 61 | $0 \cdot 0001639$ | 1637 | 1634 | 1631 | 1629 | 1626 | 1623 | 1621 | 1618 | 1616 | $\bigcirc 1$ | 112 | 222 |
| 62 | $0 \cdot 000$ | 1610 | $160 S$ | 1605 |  | 0 | 1597 |  |  | 1590 | $\bigcirc 1$ | $\begin{array}{lll}1 & 1 & 2\end{array}$ | 222 |
| 63 | 0.0001587 | 1585 | 1582 | 1580 | I 577 |  | 1572 | 1570 |  | 1565 | 00 | 1 I 1 | 222 |
| 64 | $0 \cdot 0001563$ | 1560 | 1558 | I 555 | 1553 |  | 1548 | I 546 | 1543 | I54 I | 001 | 11 | 222 |
| 65 | 0'00015 | 1536 | 1534 | 1531 | 1529 | 1527 | 1524 | 1522 | 1520 | 1517 | 00 | 1 I | 22 |
| 66 |  | 15 |  | 1508 |  | 1504 | 1502 | 1 | 1497 | 1495 | 00 | I I I | 222 |
| 67 | $0 \cdot 0001493$ | 14 | 1485 | 1486 | $14 S_{4}$ | 1481 | 1479 | 1477 | 1475 | 1473 | 00 | 1 I I | 222 |
| 68 | $0 \cdot 000147 \mathrm{I}$ | 1468 | 1466 | 1464 | 1462 | 1460 | 1458 | 1456 | 1453 | 1451 | 00 | $1 \begin{array}{lll}1 & 1 & 1\end{array}$ | 22 |
| 69 | $0 \cdot 0001449$ | 1 | 1445 | 1443 | I4 | 14 | 1437 | 1435 | 1433 | 1431 | $\bigcirc$ | 1 | 222 |
| 70 | $0 \cdot 0001429$ | 1427 | 1425 | 1422 | 1420 | 141 | 1416 | 1414 | 1412 | 1410 | 00 | I | 122 |
| 71 | $0 \cdot 0001408$ | 1406 | 1404 | 1403 | 1401 | 13 | 1397 | 1395 | 1393 | 1391 | 00 | 1 I | I 22 |
| 72 | $0 \cdot 000$ |  |  | 13 |  | 13 | 1377 | 1376 | 1374 | 72 | 00 | 1 I | 2 |
| 73 | 0.0001370 | 13 | I 36 | 1364 | 1362 | 1361 | 1359 | 1357 | 1355 | 1353 | 0 | 1 I | 22 |
| 74 | 0.00013 | 13 | 1348 | 1346 | 13 | 1342 | 1340 | 1339 | 1337 | 1335 | 00 | 1 I | 1 I |
| 75 | $0 \cdot 0001$ | 1332 | 1330 | 132 S | 1326 | 1325 | 1323 | 132 I | 1319 | 1318 | 001 | 1 I | 1 |
| 76 | $0 \cdot 000$ |  | 1312 | 1311 | 1309 | 1307 | 1305 |  | 2 | 1300 | 00 | I | 2 |
| 77 | $0 \cdot 0001$ | 12 | 1295 | 1294 | 1292 | 1290 | 1289 | 12 |  | 1284 | 000 | I | $1 \begin{array}{ll}\text { I } & \text { I }\end{array}$ |
| 78 | $0 \cdot 0 \mathrm{COI2S2}$ | 12 So | 1279 | 1277 | 12 | 1274 | 1272 | 12 | 1269 | 1267 | 000 | I | I |
| 79 | 0.000 |  |  | 12 |  |  | 1256 |  |  |  | O 0 | I I | I |
| 80 | 0.00012 | 12 | 1247 | 1245 | 1244 | 1242 | 1241 | 1239 | 123 S | 1236 | 000 | I | 1 |
| 81 | $0 \cdot 000123$ | 1233 | 1232 | 1230 | 1229 | 1227 | 1225 | 1224 | 1222 | 1221 | 000 | I I | $1 l^{1}$ I 1 |
| 82 | 0 |  |  | 12 |  | 1212 | I2II |  | S | 1206 | O | 1 | $1 \begin{array}{lll}1 & 1\end{array}$ |
| 83 | $0 \cdot 0001205$ | 1203 | 1202 | 1200 |  | 1198 | 1196 | 1195 | 1193 | 1192 | 000 | I 1 | $\begin{array}{lll}1 & 1 & 1\end{array}$ |
| 84 | $0 \cdot 0001190$ | 1189 | 1188 | I IS6 | I I S5 | 1183 | I I 82 | IISI | II 79 | II 78 | 000 | 1 I | $1 \begin{array}{lll}1 & 1\end{array}$ |
| 85 | 0 | 11 | I 174 | 1172 | 11 | 1170 | I 168 | 1167 | I 166 | I 164 | 000 | 1 I | 1 I I |
| 86 | 0.0001163 |  |  | I159 | 1157 | II 5 | II 55 | I 153 | 1152 |  | - | I I I | $\begin{array}{lll}1 & 1 & 1\end{array}$ |
| 87 | $0 \cdot 0001149$ | II4S | I 147 | II45 | 1144 | II 43 | II 42 | 1140 | II39 | 1138 |  | 1 I I | 1 I 1 |
| 88 | $0 \cdot 0001136$ | II 35 | 1134 | 1133 | II3I | 1130 | I 129 | 1127 | 1126 | II25 | 000 | I I | 1111 |
| 89 | O |  |  | I 120 |  | III7 | 1116 | III5 | II 14 | III2 |  | 1 1 1 | $\begin{array}{lll}1 & 1 & 1 \\ \\ 1 & 1\end{array}$ |
| 90 | 0 | 1110 | 1109 | 1107 |  | 1105 | 1104 | 1103 | I IOI |  |  | I | 1 I I |
| 91 | $0 \cdot 0001099$ | IogS | 1096 | 1095 | 1094 | 1093 | 1092 | 1091 | IoS9 | IoSS | 000 | 0 I | I |
| 92 | 0,00010 | Io86 | 1 | 1083 | IoS2 | SI | IoSo |  |  |  | - 00 |  | $\begin{array}{lll}1 & 1 & 1\end{array}$ |
| 93 | $0 \cdot 0 \mathrm{coio75}$ | 1074 | 1073 | IO72 | 1071 | 1070 | 1068 | 1067 | 1066 | 1065 | 000 | 0 | $\begin{array}{lll}1 & 1 & 1\end{array}$ |
| 94 | $0 \cdot 0001064$ | 1063 | 1062 | 1060 | 1059 | 1058 | 1057 | 1056 | 1055 | 1054 | 000 | $\bigcirc$ I | I |
| 95 | 0.00010 | 1052 | 1050 | 1049 | 104S | 1047 | 1046 | 1045 | 1044 | 1043 | 000 | O I | 111 |
| 96 | $0 \cdot 0 \mathrm{COI}$ | 104 | 10 | 103S | 1037 | 1036 | 1035 | 10 |  | 1032 | 000 | 0 | 1 I |
| 97 | 0.000103 | 1030 | 1029 | 1028 | 1027 | 20 | 1025 | 102 | 1022 | 1021 | 000 | $\bigcirc$ | $1 \begin{array}{lll}1 & 1 & 1\end{array}$ |
| 98 | $0 \cdot 0001020$ | 1019 | 1018 | 1017 | IOI6 | 1015 | 1014 | IOI 3 | 1012 | 101 1 | 000 | $\bigcirc \mathrm{I}$ | I |
| 99 | $0 \cdot 0001010$ | 1009 | $100 S$ | 1007 | 1006 | 1005 | 1004 | 1003 | 1002 | 1001 | 000 | $\bigcirc$ | 1 I I |

N.S.-Three zeros follow the decimal point in the reciprocal of any four figure whole number except the number 1000.
Note.-Numbers in difference columns to be subtracted, not added. - See rules.

## 54 NEPERIAN OR HYPERBOLIC LOGARITHMS.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 4 | 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1.0 | O.0 | 010 | 0198 | 0296 | 039 | 0488 | 0583 | $\underline{0677}$ | 077 | 086 |  | 38485 | 67 |
|  |  |  | 1980 | 2070 | 2151 | 2231 | 1484 | 2300 | 1655 | 1740 |  |  |  |
| $1 \cdot 3$ | $0 \cdot 1823$ <br> 0.2624 | 1906 | 1989 2776 | 28 | 2151 | 2231 | 2311 | 2390 | 2469 | 2546 3293 |  | 32 40 | 566472 $52 \quad 5967$ |
|  |  |  |  |  |  |  |  | 385 |  |  |  |  |  |
| 1.5 |  |  | 4187 |  | 4 |  |  | 451 | 457 | 4637 |  | 26 | $55^{2} 58$ |
|  | $\bigcirc$ | 47 | 4824 |  | 4947 |  |  |  |  | 5247 |  | 243 | 5 55 |
| 17 | 0 | 5 |  | 5481 | 5539 |  |  |  | 5766 | 5822 |  |  | - 4651 |
| 1. |  |  |  |  |  |  |  |  | 6313 | 6 |  |  |  |
| 1.9 |  |  | 6523 | 6575 | 6627 | 6678 | 67 | 67 | 683 r | 6881 |  |  | I |
| 2. | 0.6931 | 69 | 7031 | 708 | 7129 | 717 | 72 | 27 | 732 | 73 |  |  | 343944 |
| $2^{\circ}$ | O | 74 | 7514 | 7561 8020 | 7608 | 7655 | 7701 8154 |  |  |  |  | 1923 |  |
| 2. |  | 8 | 8 | S459 | 8502 | 8544 |  |  | 8671 | 8713 | 9 | 1721 | 6303438 |
| $2 \cdot 4$ |  | 87 | 88 | 88 | - | S961 |  |  |  |  | 4812 | 1620 |  |
| $2 \cdot 5$ |  |  |  |  |  | 9361 | 940 | 9439 | 9478 |  | 4812 | 1620 | 30 |
| 2 | $0 \cdot$ | 95 | 9632 | 96 |  | 9746 | 9783 | 9821 | 9858 | 989 | 481 | 1519 | 3034 |
| 2 | - | 92 | O 006 |  | -080 |  |  | OıI88 |  | O26 |  | 15 IS |  |
| $2 \cdot 3$ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 |  |  |  | 075 |  |  |  |  | 09 |  | 3. 710 | 1417 | +2731 |
| $3 \cdot 0$ |  | 1019 | 1053 |  | 1119 | 115 | 118 | 1217 | 124 |  |  |  | 23.26 30 |
| $3 \cdot$ |  |  |  |  |  | 1474 |  |  | 15 |  |  | 1316 |  |
| 3 | $1 \cdot$ | 1663 |  | 1725 |  | 1787 | 1817 | 184 | 187 |  |  | 1215 |  |
| 3 | $1 \cdot 1$ | 1969 |  | 2030 |  | 20 | 2119 | 214 | 2179 |  |  | 1215 | 7 |
| 3. |  |  |  |  |  |  |  |  |  |  |  | 12 |  |
| 3 |  | 2556 |  | 2613 | 2641 |  | 2698 |  | 2754 |  |  | II |  |
| $3 \cdot$ |  | 2837 |  | 2892 | 2920 | 2947 | 2975 |  | 302 | 30 | 3 | I | 22 |
|  |  |  | 31 |  |  |  |  |  |  |  |  |  |  |
| 3.8 |  |  |  |  | 3455 | 3481 |  |  |  |  | 3 | 1 |  |
| 3 |  |  |  |  |  |  |  |  |  |  | , | 101 |  |
| 4.0 |  | 38 | 3913 | 39 | 39 | 398 |  | 40 |  |  |  | 101215 | 5172022 |
| 4 |  |  | 415 | 4183 | 4207 | 4 |  | 427 |  |  |  | 10121 |  |
| 4.2 | I 4 | 4375 | 4390 | 4422 | 4446 | 4469 | 4493 | 451 | 454 | 45 | $2 \begin{array}{llll}2 & 5 & 7\end{array}$ | 9 |  |
| 4 | $1 \cdot$ | 46 | 463 | 46 | 4679 | 470 | - 4725 | 47 |  | 479 | $\begin{array}{llll}2 & 5 & 7\end{array}$ | 912 |  |
| 4. | 1.48 |  | 4861 |  |  |  | 5 |  |  |  |  | 9 |  |
| 4 | I•5041 | 5063 | 5085 | 5107 | 5129 | 5151 | 5173 | 519 | 521 | 5 | - | 9 II | 517 |
| 4.6 | I•5261 | 5 | 5304 | 5326 | 5347 | 53 | 530 | 5412 | 513 | 545 | 4 | - 1 | 1517 |
| 4.7 |  |  |  |  |  | 5581 | 02 | 5623 | 5644 | 5 | 246 | 11 | 5179 |
| 4.8 | I $\cdot 5686$ | 5 | 57 | 5748 | 576 | 5790 | 5810 | 5831 | 5851 | 5 | 2 | 10 |  |
| 4 |  | 5 | 5933 | 53 | 59 |  |  | 6034 | 6054 | 607 | - | 10 | 14 |
| 5 | I ${ }^{\circ}$ | 6114 | 6134 | 6154 | 6174 | 6194 | 6214 | 623 | 625 | 627 | 246 | 8 10 12 | 14 |
| 5. |  | 63 | 6332 | 6351 | 6371 | 639 |  | 6 |  |  |  |  |  |
|  | 1.6 | 65 | 6525 | 6544 | 6563 | 6582 | 6601 |  |  |  |  | 8 10 11 | $1{ }^{1}$ |
| $5 \cdot 3$ | $1 \cdot 6677$ | 669 | 6715 | 6734 | 6752 | 6771 | 6790 | 6808 | 682 | 684 | 246 | $7 \quad 9$ | 315 |
| $5 \cdot 4$ | I $\cdot 686$ | 6882 | 690 |  | 6938 |  |  |  |  | 70 | 245 | 79 | 315 |

TABLE OF NEPERIAN LOGARITHMS OF $\mathrm{o}^{+\mathrm{n}}$

| $n$ | I | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\log _{\epsilon} \mathrm{IO}^{\mathrm{n}}$ | $2 \cdot 3026$ | $4 \cdot 6052$ | $6 \cdot 9078$ | $9 \cdot 2103$ | $1 \mathrm{I} \cdot 5129$ | $13 \cdot 8155$ | $16 \cdot 11 \mathrm{~S}_{1}$ | $18 \cdot 4207$ | $20 \cdot 7233$ |

NEPERIAN OR HYPERBOLIC LOGARITHMS.

|  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 123 | 456 | 789 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 5 | I'7047 | 7066 | 7084 | 7102 | 7120 | 7138 | 7156 | 7174 | 7192 | 7210 | 245 | 79 II | 131416 |
| $5 \cdot 6$ | I'722 | 7246 | 7263 | 72 SI | 7299 | 7317 | 7334 | 7352 | 7370 | 7387 | 24 | 79 II | 121416 |
|  | 17405 | 7422 | 7440 | 7457 | 7475 | 7492 | 7509 | 7527 | 754 | 756 I | $2 \begin{array}{lll}2 & 3 & 5\end{array}$ | 7910 | 121416 |
| $5 \cdot 8$ | I 7579 | 7596 | 7613 | 7630 | 7647 | 7664 | 7681 | 7699 | 7716 | 7733 | 23 | 7910 | 121415 |
| $5 \cdot 9$ | I 7750 | 7766 | 7783 | 7800 | 7817 | 7834 | 7851 | 7867 | $7 \mathrm{SS}_{4}$ | 7901 | 23 | 7810 | 121315 |
| 6 | 1.7918 | 7934 | 7951 | 79 | 7984 | Sooi | SOI 7 | 8034 | 8050 | 806 | $2 \begin{array}{lll}2 & 3\end{array}$ | 7810 | 121315 |
|  | 1 | Sog9 | 8ı16 | 8132 | 8148 | 8165 | SI | 8197 | 8213 | 8229 | 235 | 6810 |  |
| 6 | I S245 | S262 | 8278 | 8294 | 8310 | 8326 | S342 | 8358 | 8374 | S390 | 2 | 6 \& 10 |  |
| $6 \cdot 3$ | $1 \cdot 8405$ | $8_{421}$ | S437 | S453 | 8469 | 8485 | 8500 | S516 | S532 | 8547 | 2 3 5 | 689 | II I 1314 |
| 6 | 1 856 | 8579 | 8594 | S610 | S625 | 8641 | 8656 | 8672 | 8687 | 8703 | $\begin{array}{llll}2 & 3 & 5\end{array}$ | 689 | 4 |
| $6 \cdot 5$ | I-8718 | 873 | 8749 | 8764 | 8779 | 8795 | 8810 | SS25 | SS40 | 8856 | 3 | 6 S 69 | II 1214 |
| $6 \cdot 6$ | $1 \cdot 8871$ | S8 | 8901 | S9I6 | 893I | 8946 | S96I | 8976 | 899I | 9006 | $\begin{array}{llll}2 & 3 & 5\end{array}$ | $\begin{array}{llll}6 & 8 & 9\end{array}$ | 111214 |
| 6.7 | - | 9036 | 9051 | 90 | 9081 | 9095 | 9110 | 9 |  | 9155 | 3 | $\begin{array}{lll}6 & 7 & 9\end{array}$ | 3 |
| 6 | I 9 | 9184 | 9199 | 9213 | 9228 | 9242 | 9257 | 92 | 9286 | 9301 | 3 | $\begin{array}{lll}6 & 7 & 9\end{array}$ | 101213 |
| 6 | $1{ }^{1} 9$ | 9330 | 9344 | 9359 | 9373 | 9387 | 9402 | 9416 | 9430 | 9445 | 3 | 6789 | 101213 |
| 7.0 | I 945 | 947 | 948 | 95 | 95 | 9530 | 95 | 9559 | 957 | 95 | 3 | 6 7 9 | 10113 |
| 7 | 1 | 9615 | 9629 | 964 | 9657 | 9671 | 9685 | 9699 | 9713 | 9727 | 34 | 6778 | IO II 13 |
| $7 \cdot$ | 1.974 | 9755 | 9769 | 9782 | 9796 | 9810 | 9824 | 9838 | 9851 | 9865 | 3 4 | 6778 | 10 II 12 |
| $7 \cdot$ | 19879 | 9892 | 9906 | 9920 | 9933 | 9947 | 9961 | 9974 | 9988 | OOOI | 3 | 578 | ío II 12 |
| 7 |  | OO | 0042 | 00 |  | OOS2 | 00 |  | OI |  | I 3 | 578 | 9 II 12 |
| 7 | 2. | OI62 | 0176 | OI 89 | O | 0215 | 0229 | 02 | 0255 | 02 | 3 | $57{ }^{5} 8$ | 9 II 12 |
| 7 | $2{ }^{\circ}$ | 0295 | 0308 | 032 I | 033 | 0347 | 0360 | 0373 | 0386 | 0399 | 3 | 57.8 | 91012 |
|  | 2.0 | 0425 | 0438 | 0451 |  | 0477 |  |  |  |  | I 3 | 568 | 91012 |
| $7 \cdot 8$ | $2{ }^{\circ}$ | 0554 | 0567 | 058 | 0592 | 0605 | 06 | 0631 | 0643 | 0656 | 3 | 56 | 91012 |
| 7 | 206 |  | 0694 | 0707 | 0719 | 0732 | 074 | 0757 | 0769 | 0782 | 3 | 5 | 9 Io II |
|  | 2.079 | OS | 08I9 | 083 | OS4 | oS57 | o869 | 0882 | 0894 | 0906 | 34 | 568 | 9 IO II |
|  | 2 | 093 |  | 09 |  | O9 | 0 |  |  |  | $1 \begin{array}{lll}1 & 2 & 4\end{array}$ | 5667 | 9 IO II |
| $8 \cdot 2$ | $2 \cdot 1041$ | 1054 | I | 107 | 1090 | I 102 | II 14 | II 126 | 1138 | II 50 | 2 | 566 | 91011 |
| 8 | $2 \cdot 1163$ | 1175 | 1187 | 1199 | 1211 | 1223 | 1235 | 1247 | 1258 | $12 \%$ | 2 | $5 \quad 6 \quad 7$ | 8 Io II |
|  | 2 | 1294 | 130 | 1318 | 1330 | 1342 | 1353 | 136 | 1377 |  | 2 | 567 | S IO II |
| 8.5 | $2 \cdot 1$ | 1412 | 1424 | 1436 | 1448 | 1459 | 1471 | 1483 | 1494 | 1506 | 24 | 567 | 89 II |
| 8 | $2 \cdot 15$ | 1529 | 1541 | 1552 | 1564 | 1576 | 1587 | 1599 | 1610 | 1622 | 23 | 5 6 7 | 8910 |
|  |  | 1645 | 1656 | 1668 | 1679 | 1691 | 17 | 1713 | 1725 | 173 |  | 5 | S 910 |
| 8.8 | 2.174 | 1759 | 1770 | 1782 | 1793 | I SO4 | 1815 | 1827 | 1838 | 1849 | $2 \begin{array}{ll}2 & 3\end{array}$ | 567 | 8910 |
| 8.9 | $2^{\circ} 1861$ | 1872 | 1883 | I894 | 1905 | 1917 | 1928 | 1939 | 1950 | 1961 | 23 | 467 | 8910 |
| 9.0 | 2•197 | 1983 | 1994 | 20 | 2017 | 2028 | 2039 | 2050 | 2061 | 2072 | $2 \begin{array}{ll}2 & 3\end{array}$ | 467 | S 910 |
|  | $2 \cdot 2083$ | 209 | 2105 | 2 | 2127 | 2138 | 2148 |  | 2170 | 2181 | $1 \begin{array}{lll}1 & 2 & 3\end{array}$ | 45 | S 910 |
| 9 | $2 \cdot 2192$ | 2203 | 2214 | 2225 | 2235 | 2246 | 2257 | 2268 | 2279 | 2289 | 23 | 45 | 8. 910 |
| 9 | $2 \cdot 2$ | 2311 | 2322 | 2332 | 2343 | 2354 | 2364 | 2375 | 2386 | 2396 | 23 | 45 | 7910 |
| 9 | $2 \cdot 2407$ | 241 | 2428 | 2439 | 2450 | 2460 | 2471 | 2481 | 2492 | 2502 | , | 45 | 7810 |
| $9 \cdot 5$ | 2.2513 | 2523 | 2534 | 2544 | 2555 | 2565 | 2576 | 2586 | 2597 | 2607 | 23 | 456 | 7889 |
| $9 \cdot 6$ | $2 \cdot 2618$ | 2628 | 2638 | 2649 | 2659 | 2670 | 2680 | 2690 | 2701 | 2711 | 23 | 456 | 77 8 9 |
| 9 | 2.2721 | 2732 | 2742 | 2752 | 2762 | 2773 | 2783 | 2793 | 2803 | 2814 |  | 45 | $7 \quad 8 \quad 9$ |
| $9 \cdot 8$ | $2 \cdot 2824$ | 2834 | 2844 | 2854 | 2865 | 2875 | 2885 | 2895 | 2905 | 2915 | $1 \begin{array}{lll}1 & 2 & 3\end{array}$ | 456 | $\begin{array}{llll}7 & 8 & 9\end{array}$ |
| 9 | $2 \cdot 2925$ | 2935 | 29.46 | 2956 | 2966 | 2976 | 2986 | 2996 | 3006 | 3016 | 23 | 4.56 | $7 \quad 89$ |

TABLE OF N゙EPERIAN LOGARITHMS OF ron.

| 1 | I | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\log _{\epsilon} 10^{-n}$ | $\overline{3} \cdot 6974$ | $\overline{5} 3948$ | $7 \cdot 0922$ | -7897 | $12 \cdot 487$ | 4.18 | $7 \cdot 8819$ | 19.5793 | $\overline{21} 2767$ |







$\begin{array}{ll}\epsilon^{-\frac{1}{2}} & 0.6065 \\ \epsilon^{-\frac{3}{2}} & 0.2231 \\ \epsilon^{-\frac{6}{2}} & 0.0821 \\ \epsilon^{-\frac{7}{2}} & 0.0302 \\ \epsilon^{-\frac{3}{1}} & 0.7788 \\ \epsilon^{-\frac{1}{3}} & 0.8825 \\ \epsilon^{-\frac{1}{16}} & 0.9394 \\ \epsilon^{-\frac{7}{3}} & 0.9692\end{array}$
$20788 \times 10^{-5}$


$\stackrel{\infty}{\circ}$
凚
0
0
0
0
ò
in
$\stackrel{\circ}{\circ}$
$\frac{0}{6}$
$\stackrel{n}{m}$


| $\epsilon^{-1}$ | 0.3679 |
| :--- | :--- |
| $\epsilon^{-2}$ | 0.1353 |
| $\epsilon^{-3}$ | 0.04979 |
| $\epsilon^{-4}$ | 0.01832 |
| $\epsilon^{-5}$ | 0.006738 |
| $\epsilon^{-6}$ | 0.002479 |
| $\epsilon^{-7}$ | 0.0009119 |
| $\epsilon^{-8}$ | 0.0003355 |
| $\epsilon^{-9}$ | 0.0001234 |
| $\epsilon^{-16}$ | 0.0000454 |





$23 \cdot 1407$

$k_{0}^{k}{ }_{0}^{k}{ }_{0}^{k}{ }_{0}^{k}{ }_{0}^{k}$

## USEFUL FORMULAS AND NUMBERS.

## Binomial Theorem.

$$
(\mathrm{I} \pm e)^{n}=\mathrm{I} \pm n e+\frac{n \cdot \overline{n-\mathrm{I}}}{1.2} e^{2} \pm \frac{n \cdot \overline{n-\mathrm{I}} \cdot \overline{n-2}}{1.2 \cdot 3} e^{3}+\mathbb{S} \mathrm{c}
$$

Hence, when $n e$ is so small that its square and higher powers may be neglected,

$$
(\mathrm{I} \pm e)^{n} \fallingdotseq \mathrm{I} \pm n e .
$$

## Examples-

$\varepsilon=.01 ;(\mathrm{I}+.0 \mathrm{I})^{2} \fallingdotseq \mathrm{I} .02 ;(\mathrm{I}+.01)^{\frac{1}{2}} \fallingdotseq \mathrm{I} .005 ;(\mathrm{I}+.0 \mathrm{OI})^{-\frac{1}{3}} \fallingdotseq 0.9967$.
Barometric Formula.-Let $P$ and $p$ be the atmospheric pressures observed by the barometer at the lower and upper stations respectively; and let $T$ and $t$ be the respective atmospheric temperatures on the Fahrenheit scale ; then $H$, being the difference of levels in feet,

$$
H=60360\{\log P-\log p\}\left(1+\frac{T+t-64}{9^{86}}\right) .
$$

Base of Hyperbolic or Neperian Logarithms, . . . . $\epsilon=2 \% 7$ I 823 .
To convert common into hyperbolic logarithms, multiply by . . . . . . . . . . . . . . . . 2030258 .
To convert hyperbolic into common logarithms, multiply by 0.43429.

Ratio of circumference of circle to diameter, . . . . . $\pi=3.14159$.
Number of degrees in one radian (the unit angle, which is the angle subtended by arc equal to radius), $57^{\circ} 2958=57^{\circ} 17^{\prime} 45^{\prime \prime}=206265^{\prime \prime}$.

$$
\begin{aligned}
& \pi=3.14159 \\
& \epsilon=2.71828
\end{aligned} \quad . \quad . \quad . \quad . \quad \begin{array}{r}
\text { Logarithm. } \\
0.4975 \\
0.43+29
\end{array}
$$

| Metre in inches, | 3 | d |  |
| :---: | :---: | :---: | :---: |
| Foot in centimetres, | $30 \cdot+797$ | water at $4^{\circ} \mathrm{C}$, | 252.89 grains. |
| Mile in kilometres, | I*6093 | Cubic foot of watcr at |  |
| Gramme in grains, | 15.43235 | $4^{\circ} \mathrm{C}$, | $62^{\circ}+3 \mathrm{lbs}$. |
| Pound in grammes, | 453.593 | Cubic inch of mercury |  |
| Kilogramme in pounds, | $2 \cdot 2046$ |  |  |
| British ton in French tons |  | Do. | 4913 lbs . |
|  |  | Titre of dry |  |
| Cubic inch in cubic centin | $\begin{array}{r} 6 \mathrm{I} \cdot 0253 \\ \mathrm{es}, 16 \cdot 3866 \end{array}$ |  |  |
| Cubic foot in cubic centimet | 2831 $6^{\circ}$ | Density of mercury, | 13.596. |

I centim. gramme . . . . . . . . 98 I ergs.
I metre kilogramme . . . . . . . $9.81 \times 10^{7}$.
Ift. lb. . . . . . . . . . $13^{\circ} 5^{6} \times 10^{6}$ ergs.
I ft. poundal (independent of $\sigma_{0}$ ) . . . . . 421390 ergs.
I joule (I watt for I second) . . . . . . $10^{77}$ ergs.
I horse power. . . . . . . . . $7.46 \times 10^{9}$ ergs per sec.
I watt (rate of working of I volt through I ohm, or of I volt carrying I ampere) $=10^{7}$ ergs per second.

Earth's mean radius, $6^{\circ} 371 \times 10^{8}$ centims
Earth's niean radius (approx.), . $2 \mathrm{I} \times 10^{6}$ fcet.
Mass of earth, as-
suming 5.67 as mean density, $\quad .6 \cdot 14 \times 10^{27}$ grammes
Earth's mass (approximately), $.13 .5 \times 10^{24} \mathrm{lbs} .=$ $6 \times 10^{21}$ tons.

Seconds pendulum at
Greenwich, . . $39^{\circ} 139$ inches $=$ $99^{\circ}+14$ centims.
Gravity of I pound
at Greenwich, $\quad 3^{\circ} 191$ poundals.
Gravity of I pound
mass in lat. $55^{\circ} 35^{\prime}$
(approximately that
of Edinburgh or
Glasgow), $\quad .32^{\circ} 2$ poundals.
Gravity of I gramme
in same latitude, . 98I 424 dynes.

Mass of moon, . I/8I 5 of earth's mass Distance of moon from earth, $\quad .3 .8 \times 10^{10}$ centims. Sun's radius, $\quad .697 \times 10^{8}$ centims. Mass of sun, $3^{2} 4000$ earth's mass. Distance of sun from earth, . I* $498 \times$ Io $^{13}$ centims. Distance of sun from earth, $.93^{\circ} 1 \times 10^{6}$ miles.

Mass in grammes which
concentrated at a
point I centimetre distant from a point at which another equal mass is concentrated would attract it with a force of I dyne,
Same where the foot, 3928 grammes. pound, and poundal are units of length, mass, and force, $3 \mathrm{I}, 075 \mathrm{lbs}$.

Height of Homogeneous atmosphere at Greenwich at $c^{\circ} \mathrm{C}, 26,210 \mathrm{ft} .=$ $7.988 \times 10^{5}$ centims.
Newtonian velocity of sound in air at $0^{\circ} \mathrm{C}, \ldots 918 \cdot 5$ feet per second, $=27996$ centims. per second.

True velocity at $t^{\circ} \mathrm{C}=33240 \sqrt{1+{ }^{\circ} \operatorname{co3} 66 t}$ centims. per second.
Joule's Equivalent. $\quad 777^{\circ}$ Greenwich foot-pounds of work will raise I lb. pure water from $60^{\circ}$ to $61^{\circ}$ Fahrenheit.
This is equivalent to 1399 ft .-lbs. per pound degree centigrade,-or $4184 \times 10^{6}$ ergs per gramme degree centigrade, -or 42600 centi-metre-grammes per gramme degree.
Latent heat of water, $79^{\circ} 25^{\text {. }}$ Latent heat of steam at $100^{\circ}, 537$
Specific heat of air pressure constant, 0.237 ;

$$
\frac{\text { sp. heat of air pres. const. }}{\text { sp. heat of air vol. const. }}=14
$$

I litre of hydrogen at $0^{\circ} \mathrm{C}$ and 760 mm . pressure weighs 0.0896 gm .
Density of hydrogen compared with air $=0.0693=\frac{I}{14.43^{\circ}}$.

Conductivity of heat. Quantity, in gramme-water-centigrade units; conducted per second ; per square centimetre of area ; per degree, per centimetre of thickness, of difference of temperature of two sides of plate.


Velocity of light in vacuum $=3.004 \times 10^{10}$ centims. per second. Mean wave length $5.3 \times \mathrm{IO}^{-5}$ centim.

One electromagnetic unit $=3 \times 10^{10}$ electrostatic units of electricity
I B. A. Unit $=\stackrel{9}{ } 866$ Ohın. I Ohm $=101358 \mathrm{~B} . \mathrm{A}$. Unit.
Resistance of 100 metres of pure annealed round wire, 1 mm . in diameter, at $0^{\circ} \mathrm{C}$, Copper, . . . . 2.028 ohms.

| $"$ | $"$ | Iron,. | . | . | . | 12.34 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $"$ | $"$ | Platinum, . | . | . | . | II.50 |
| $"$ | $"$ | Platinoid, | . | . | . | $4 I^{\circ} 17$ |

Electro-motive force of I Daniell's cell, . . . . 1•07 volt.
I Grove's cell, . . . . I.95 ,,
", ", Standard Clark cell at $15^{\circ} \mathrm{C}$, . . 1.435 volt.
" " $\quad, \quad t^{\circ} \mathrm{C} \quad \mathrm{I} 435[\mathrm{I}-0.0077(t-\mathrm{I} 5)]$

One volt through one ohm (I watt) generates per second $\frac{1}{4^{\circ} \mathrm{IS} 4}$ of a thermal unit (gramme-water-centigrade).

Electro-Chemical Decomposition.-

Element.
Atomic Weight.
Chem. Equivalent.
Electrolytic Decomposition, Grammes per second, per ampere.

| Hydrogen, | I | I |
| :--- | :---: | :---: |
| Potassium, | $39^{\circ} 03$ | $39^{\circ} 03$ |
| Sodium, | $23^{\circ}$ | $23^{\circ}$ |
| Silver, | 107.7 | $107^{\circ} 7$ |
| Copper,* | $63^{.35}$ | $31^{.68}$ |
| Zinc, | $64^{\circ} .88$ | $32^{\circ} 44$ |
| Lead, | 206.4 | $103^{\circ} 2$ |
| Oxygen, | $15^{\circ} 96$ | 7.98 |
| Chlorine, | $35^{\circ .37}$ | $35^{\circ} 37$ |

-00001038
.000405I
-0002387
-00III 8
-0003290
-0003367
-001071

- 00008283
-0003671

[^2]GLASGOW: PRINTED at the UNiversity press by robert maclenose and co. ltd.

YD 09882

## 14 DAY USE RETURN TO DESK FROM WHICH BORROWED LOAN DEPT．

This book is due on the last date stamped below，or on the date to which renewed．
Reneqed bogks are subject to immediate recall．

| 2HMAT：G2JE |  |
| :---: | :--- |
|  |  |
| RECD LD |  |
| MAR D 1962 |  |


| 5 May |
| :--- | :--- |
|  |



## 311380


[^0]:    * Formerly called " circular measure."

[^1]:    * That which canses the necessity for two such tables gives rise also to the necessity for watchfulness on the part of the calculator. Probably the 'jest preventive against mistakes is the habit, excellent in all calculations, of making a mental estimate of the number to be expected as the result of taking the square root. Mistakes may also be avoided easily and with little loss of time by comparing with the table of squares.

[^2]:    * For cathode surface of 50 sq. centims. per ampere, the quantity of copper deposited per ampere per second is 0003287 gms . For increments in cathode surface subtract $1-16$ th p.c. per 50 sq. centims. The numbers given for silver and copper are the results of direct experiment.

