

A mathematical compendium; or, useful practices in arithmetick, geometry, and astronomy, geography and navigation, embattelling, and quartering of armies, fortification and gunnery, gauging and dyalling, etc. Explaining the logarithms, with new indices; Nepair's rods or bones; making of movements, and the application of pendulums; with the projections of the sphere for an universal dial, &c; / [Sir Jonas Moore].

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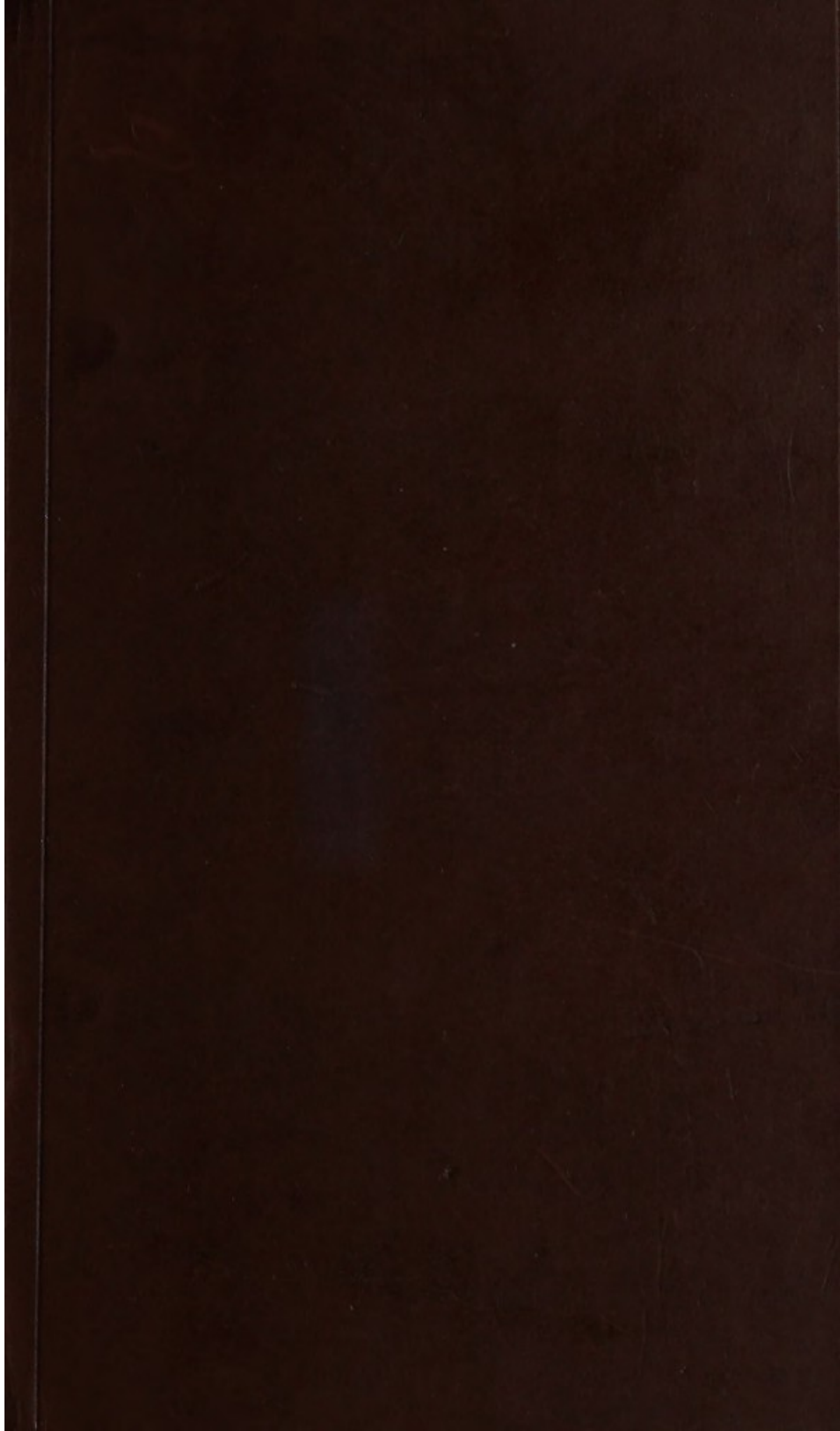
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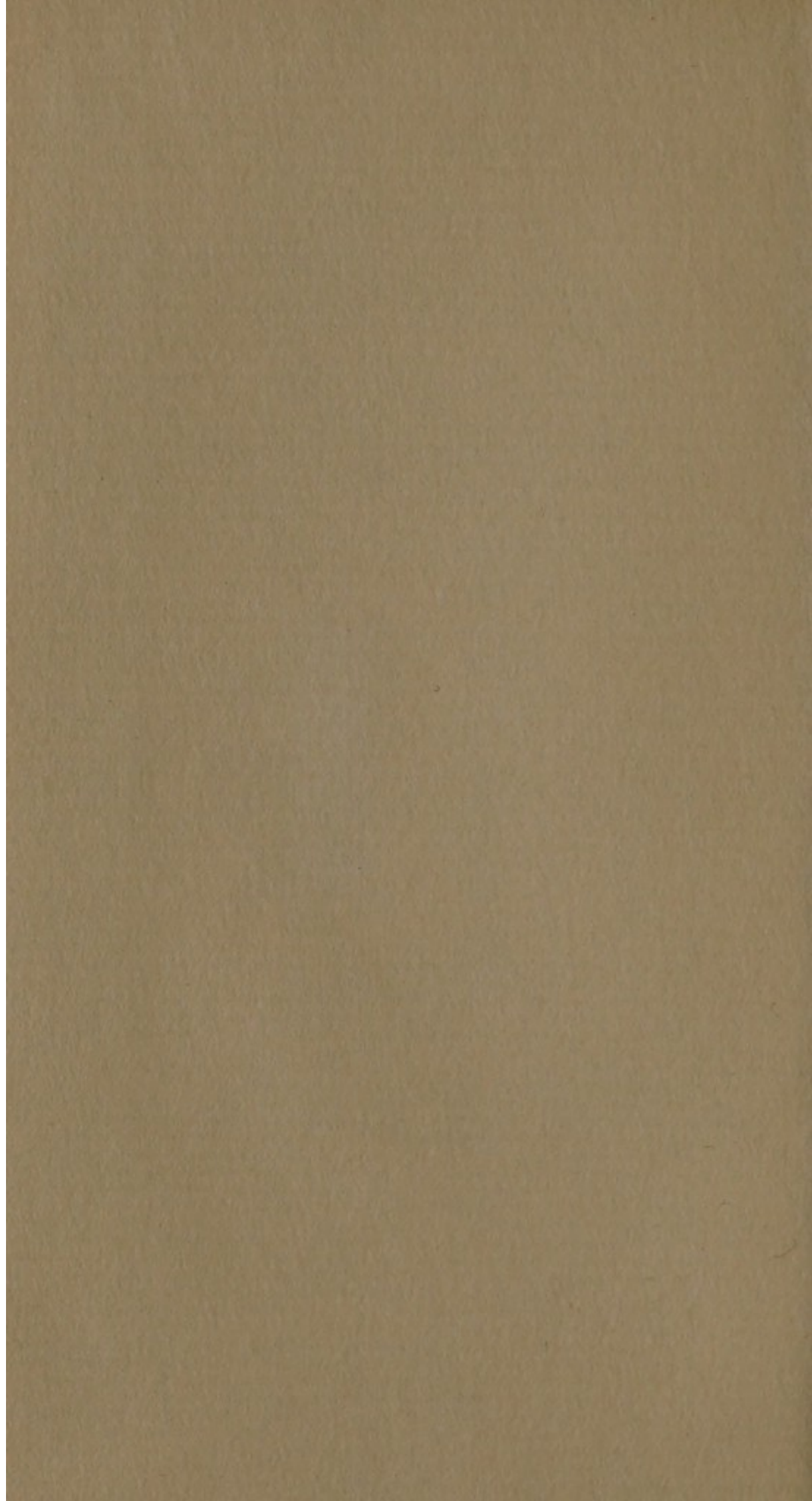
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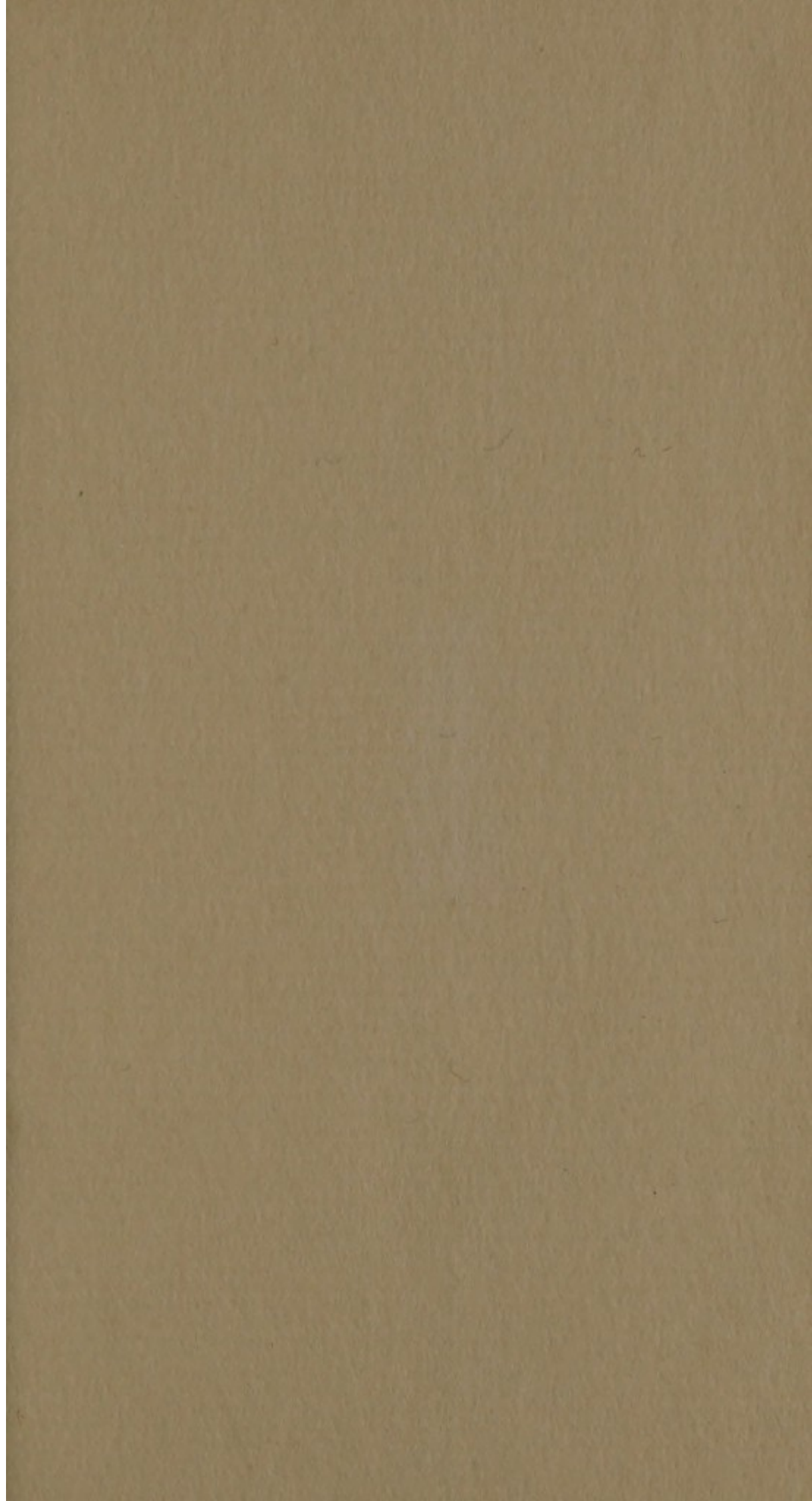


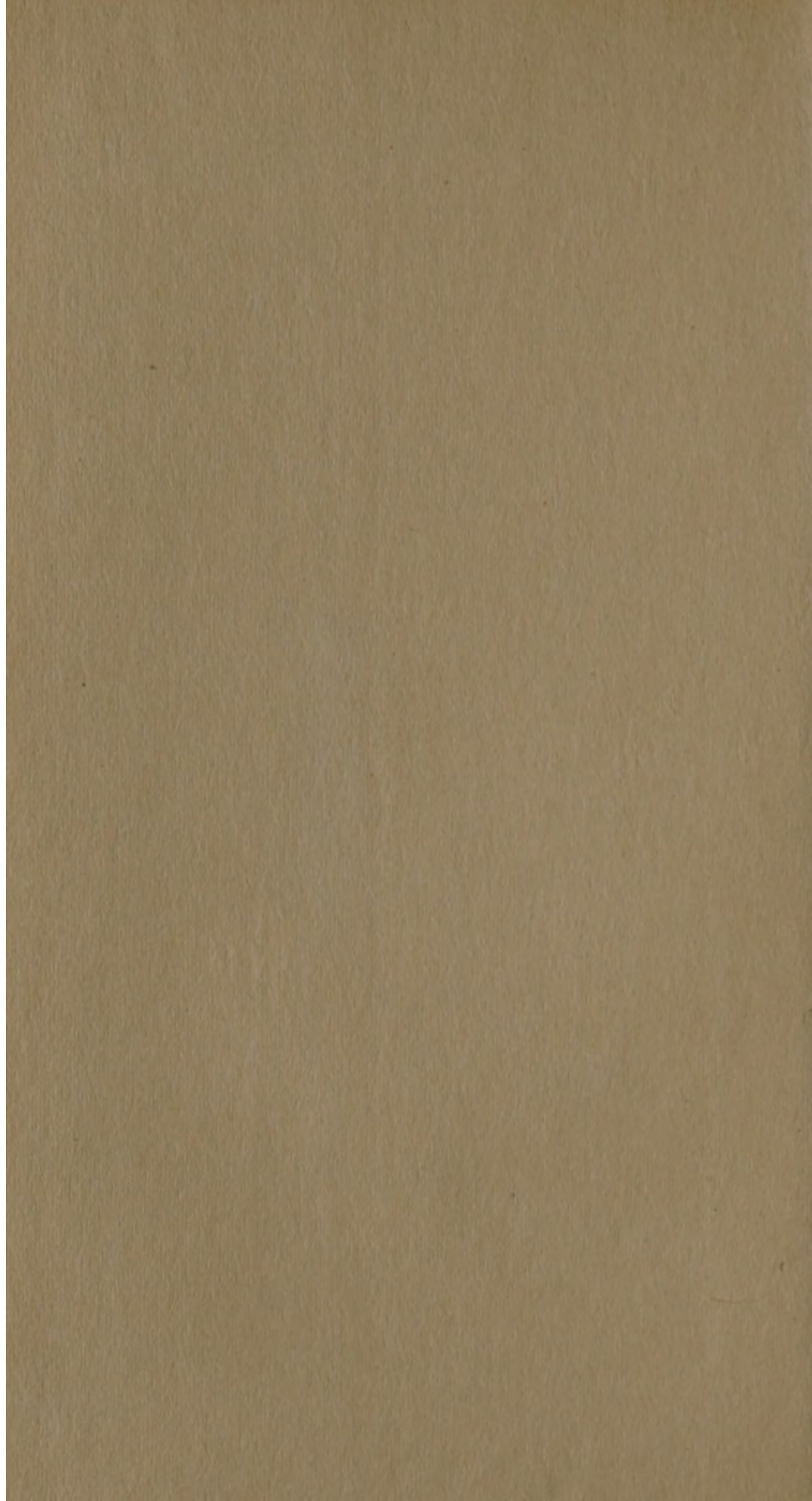


SAM^L. WEGG ESQ^R.

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C A Z
MATHEMATICAL
COMPENDIUM;
OR,
Useful Practices

IN

Arithmetick, Geometry, and Astro-
nomy, Geography and Navigation, Em-
battelling; and Quartering of Armies,
Fortification and Gunnery, Gauging and
Dyalling.

Explaining the *Logarithms*, with
new *Indices*; *Nepair's* Rods or Bones;
making of Movements, and the Applica-
tion of Pendulums; with the Projection of
the Sphere for an Universal Dyal, &c.

By Sir Jonas Moore Knight, Late
Surveyor General of his Majesties
Ordinance.

The Fourth Edition.

L O N D O N,

Printed for J. Philips at the *King's-Arms* in St.
Paul's Church-yard, H. Rhodes at the *Star*, the
Corner of *Bride-Lane* in *Fleet-street*, and J. Tay-
lor at the *Ship* in St. *Paul's* Church-yard, 1705.



TO THE
Right Honourable
G E O R G E
Lord Dartmouth, &c.

Honour'd SIR,

IT is now the fourth time
that this Compendium
appears abroad in the
world, and though the mode-
sty of the learned Author suf-
fered

The Epistle

ferred it first to peep out
under a borrowed Name,
yet the accurate and succinct
method of handling so useful
a subject, speaks the Treatise
to be (what I know it was)
the work of that ingenious
and expert Mathematician,
Sir Jonas Moor Kt. None
have a Title, Sir, to own, or
to give Reputation to Books
of this nature, that within a
thin shell contain a large
Kernel and instruct much in
few words ; but those who
being preferred to publick
charges for Learning and
Merit, prefer the Publick
Good

Dedicatory.

Good before the applause of
the People : And none, Sir,
who know by how indefati-
gable Studies you have per-
fected your self in all the
parts of Mat'ematicks, ani-
mating the practice of them by
the most exact Theory, and
confirming that Theory by the
best of practice ; can doubt,
but that as your extraordinary
Worth hath rendred you
acceptable to those who are
the best Judges, and truest
rewarders of merit ; so your
Loyalty to your Prince, and
Love to your Country, are far
dearer to you, than any particu-

The Epistle

lar concerns whatsoever can be. You have had skill, Sir, to contrive, and valour on many occasions, to make practicable both by Sea and Land, many great things in Navigation, Fortification, Art of War, Gunnery, and all the laudable Arts that give glory to a Nation; but the particulars you have achieved therein, the Publick must expect to learn, from those inspired Pens that shall transmit the History of our Times to future Ages, for I should presume above my reach to attempt the task. I beg

Dedicatory.

beg therefore pardon, Sir, for the boldness I take, in prefixing your Name to this fourth Edition of the Book. It has been already well received in the World, and I am perswaded that your innate Disposition to encourage all endeavours that tend to publick advantage, will incline you to imprint on its intrinsic value the currant stamp of your Patronage and Approbation. As this is the best office I could perform in this publication, so is it, Sir, the only way I could find to testify my gratitude for those

The Epistle, &c.

many undeserved favours,
you have been generously
pleased to heap so liberally
upon my Relations and my
self, having hereby the ho-
nour to profess to the World,
how much I am, and in all
dutifulness aspire to be,

Your Lorships

Most Humble,

And Faithful Servant,

R. H.

The Principal Contents of
this Book, with the Page
and Number answer-
ing.

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☉ Right Ascension. *Page* 1
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erence for every 10 Years, to sup-
ply them for ever.

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This



THIS Note, for the ready taking the height
 of the Pole by the height of the Pole-Star,
 should have ended the Book, but wanting
 room, I place it here. Consider Fig. 23. where P
 is the North Pole, ZPN the Meridian, the Circle
 Z d N b the Circle the Pole * makes about the
 Pole, Z the Pole * above, N under the Pole,
 d the Pole * in any Quarter of the Circle,
 PZ or PN is the Radius = this Year 1674. to
 $2^{\circ} 25' 59''$, or $8759''$, and for every Year to
 come subtracting $20''$, it will be 1675 = 8739 .
 1676 = 8719 , &c. Next thing to know, is the
 Right Ascension of the Pole *, which this Year
 will be $9^{\circ} 12' 46''$ at Z, at every Year ad-
 ding $1' 54''$ to the former, makes it to be
 1675 = $9^{\circ} 14' 40''$, 1676 = $9^{\circ} 16' 34''$, &c.
 which must be turned into Time, allowing every
 Degree $4'$, &c. Subtract the ☉ Right Ascen-
 sion from Pole * Right Ascension, leaves the
 time of the Pole * Right Ascension at Z above
 the Pole, and adding 12 hours at N under.

Now by a true Pendulum Watch, at any time
 when you would find the Latitude, having the
 time of the Night, take the Difference betwixt
 the Pole * Right Ascension at Z, and that
 time, and turning that into Degrees, Minutes,
 and Seconds, it shews in what part of the Circle
 the Pole * is, and in what Quadrant, and
 the L at P. Lastly, Add the Logarithms of
 the

the Cosine $d B o$, and $d B$, or $P z$, and subtract the Radius, it gives the Logarithm of Po . Now the height of the Pole \ast less or more $Po. =$ height of the Pole.

Advertisement.

Modern Fortifications, or Elements of Military Architecture; by Sir Jonas Moore: Illustrated with several Figures.

Decimall Tables to Face Page 7

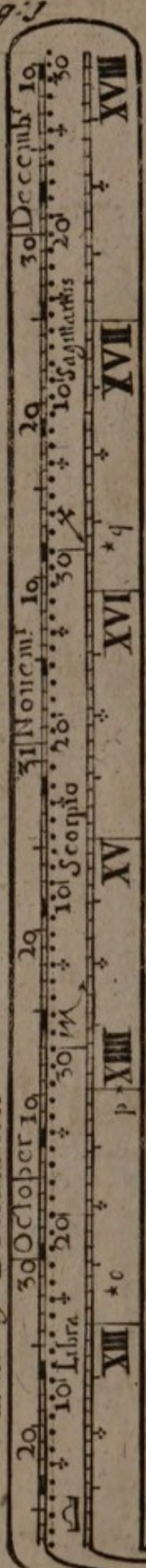
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Decim:		Month	Averd.	Troy	Month
10	60	7	9	12	1
20	70	8	10	13	2
30	80	9	11	14	3
40	90	10	12	15	4
50		11	13	16	5
		12	14	17	6
		13	15	18	7
		14	16	19	8
		15	17	20	9
		16	18		10
		17	19		11
		18	20		12

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Decim:		Month	Averd.	Troy	Month
10	60	7	9	12	1
20	70	8	10	13	2
30	80	9	11	14	3
40	90	10	12	15	4
50		11	13	16	5
		12	14	17	6
		13	15	18	7
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		15	17	20	9
		16	18		10
		17	19		11
		18	20		12

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20	70	8	10	13	2
30	80	9	11	14	3
40	90	10	12	15	4
50		11	13	16	5
		12	14	17	6
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		16	18		10
		17	19		11
		18	20		12

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Decim:		Month	Averd.	Troy	Month
10	60	7	9	12	1
20	70	8	10	13	2
30	80	9	11	14	3
40	90	10	12	15	4
50		11	13	16	5
		12	14	17	6
		13	15	18	7
		14	16	19	8
		15	17	20	9
		16	18		10
		17	19		11
		18	20		12





(1)

C H A P. I.

Of a Perpetual K A L E N D A R

O R

A L M A N A C K.

The Uses of three small *Tables* for finding
the Days of the Month, Sun's place,
Right Ascension, the Prime, Epact,
Moon, Tides, Stars, &c. for Ever.

The first Table or Figures

This Table begins the first of *January*, and contains the days of the Year; the first of *January* is made black, and so every seventh until the years end; there runs along in another Line the place of the Sun answering and opposite to the Days, (*viz.*) every degree of the Ecliptick from γ to χ through the whole Ecliptick, and near to this last Line, there runs a Line expressing the right Ascension of the Sun or Star answering unto 24 hours; each hour is divided into 15 parts; which are four minutes a piece; near it are placed small Asterisks with Letters by them for 20 of the principal Stars set down in the Third Table.

The Second Table or Figure.

This Table, Entituled an Almanack for 140 Years, has in the middle Dominical Letters, all the seven backward from A to B, above which are years past, and below years to come, with the Prime or Golden Number under the Years, and the Cycle of the Sun below: These Years are express'd by 2 Figures, and sometimes by one, and are all the Leap-years that are betwixt the Year 1600 and 1740; by explaining the lower row you will easily perceive all. In one Line there is 1660 begins, 1672. 1656. 1668. 1610. 1664. and 1676. follow, all which are Leap-years, and has to each Year the Dominical Letter above and Prime below, and those intermediate Years that are not Leap-years are to be supplied. Suppose I begin at 1660, which hath G for Dom. Letter, and Prime 8; for 1661 it will have F for Dom. Let. and 9. for Prime, and is supposed to stand in the room of (72) For 1662 instead of (56) 1663 instead of (68) 1664 instead of (80) and then 1664; so that
Leap

An ALMANACK for 140 years

Page 5

Jan:

Circumcis: 1
Epiphanie. 6
Hil: Ter: be: 25
Car: J: Mart 30

Feb:

Puri: Mary 2
*Shro: Tust: 2
Hil: Ter: en: 13
Valentine 14
S Mathias 24

Mar:

David Arch: 1
*East: O day 25
Lady day 25

Apr:

*East: Ter: be: 7
S George 25

S Mark 25

*Ascension d: 29

May:

S Phil: & Jac 1
*East: Ter: en 3
*Whit: O day 9
Car: 2 nat: 9
*Trinity T: be 25

Jun:

*Trinity T: en 9
S John Bap: 24
S Peter ap: 29

Jul:

S James ap: 25

Aug:

Lamas 1

Years past		Years to come	
Y	P	Y	P
4	9	60	8
16	2	72	1
600	5	56	4
12	17	68	16
24	10	80	9
8	15	64	12
20	6	76	5
32	18	88	17
44	11	700	10
28	14	84	13
40	7	96	6
52	19	8	18
36	3	92	2
48	15	20	11
		32	4
		16	14
		28	19
		12	3
		24	15
		36	7
		48	19
		60	1
		72	13
		84	25
		96	37
		108	49
		120	61
		132	73
		144	85
		156	97
		168	109
		180	121
		192	133
		204	145
		216	157
		228	169
		240	181
		252	193
		264	205
		276	217
		288	229
		300	241
		312	253
		324	265
		336	277
		348	289
		360	301
		372	313
		384	325
		396	337
		408	349
		420	361
		432	373
		444	385
		456	397
		468	409
		480	421
		492	433
		504	445
		516	457
		528	469
		540	481
		552	493
		564	505
		576	517
		588	529
		600	541
		612	553
		624	565
		636	577
		648	589
		660	601
		672	613
		684	625
		696	637
		708	649
		720	661
		732	673
		744	685
		756	697
		768	709
		780	721
		792	733
		804	745
		816	757
		828	769
		840	781
		852	793
		864	805
		876	817
		888	829
		900	841
		912	853
		924	865
		936	877
		948	889
		960	901
		972	913
		984	925
		996	937
		1008	949
		1020	961
		1032	973
		1044	985
		1056	997
		1068	1009
		1080	1021
		1092	1033
		1104	1045
		1116	1057
		1128	1069
		1140	1081
		1152	1093
		1164	1105
		1176	1117
		1188	1129
		1200	1141
		1212	1153
		1224	1165
		1236	1177
		1248	1189
		1260	1201
		1272	1213
		1284	1225
		1296	1237
		1308	1249
		1320	1261
		1332	1273
		1344	1285
		1356	1297
		1368	1309
		1380	1321
		1392	1333
		1404	1345
		1416	1357
		1428	1369
		1440	1381
		1452	1393
		1464	1405
		1476	1417
		1488	1429
		1500	1441
		1512	1453
		1524	1465
		1536	1477
		1548	1489
		1560	1501
		1572	1513
		1584	1525
		1596	1537
		1608	1549
		1620	1561
		1632	1573
		1644	1585
		1656	1597
		1668	1609
		1680	1621
		1692	1633
		1704	1645
		1716	1657
		1728	1669
		1740	1681
		1752	1693
		1764	1705
		1776	1717
		1788	1729
		1800	1741
		1812	1753
		1824	1765
		1836	1777
		1848	1789
		1860	1801
		1872	1813
		1884	1825
		1896	1837
		1908	1849
		1920	1861
		1932	1873
		1944	1885
		1956	1897
		1968	1909
		1980	1921
		1992	1933
		2004	1945
		2016	1957
		2028	1969
		2040	1981
		2052	1993
		2064	2005
		2076	2017
		2088	2029
		2100	2041
		2112	2053
		2124	2065
		2136	2077
		2148	2089
		2160	2101
		2172	2113
		2184	2125
		2196	2137
		2208	2149
		2220	2161
		2232	2173
		2244	2185
		2256	2197
		2268	2209
		2280	2221
		2292	2233
		2304	2245
		2316	2257
		2328	2269
		2340	2281
		2352	2293
		2364	2305
		2376	2317
		2388	2329
		2400	2341
		2412	2353
		2424	2365
		2436	2377
		2448	2389
		2460	2401
		2472	2413
		2484	2425
		2496	2437
		2508	2449
		2520	2461
		2532	2473
		2544	2485
		2556	2497
		2568	2509
		2580	2521
		2592	2533
		2604	2545
		2616	2557
		2628	2569
		2640	2581
		2652	2593
		2664	2605
		2676	2617
		2688	2629
		2700	2641
		2712	2653
		2724	2665
		2736	2677
		2748	2689
		2760	2701
		2772	2713
		2784	2725
		2796	2737
		2808	2749
		2820	2761
		2832	2773
		2844	2785
		2856	2797
		2868	2809
		2880	2821
		2892	2833
		2904	2845
		2916	2857
		2928	2869
		2940	2881
		2952	2893
		2964	2905
		2976	2917
		2988	2929
		3000	2941
		3012	2953
		3024	2965
		3036	2977
		3048	2989
		3060	3001
		3072	3013
		3084	3025
		3096	3037
		3108	3049
		3120	3061
		3132	3073
		3144	3085
		3156	3097
		3168	3109
		3180	3121
		3192	3133
		3204	3145
		3216	3157
		3228	3169
		3240	3181
		3252	3193
		3264	3205
		3276	3217
		3288	3229
		3300	3241
		3312	3253
		3324	3265
		3336	3277
		3348	3289
		3360	3301
		3372	3313
		3384	3325
		3396	3337
		3408	3349
		3420	3361
		3432	3373
		3444	3385
		3456	3397
		3468	3409
		3480	3421
		3492	3433
		3504	3445
		3516	3457
		3528	3469
		3540	3481
		3552	3493
		3564	3505
		3576	3517
		3588	3529
		3600	3541
		3612	3553
		3624	3565
		3636	3577
		3648	3589
		3660	3601
		3672	3613
		3684	3625
		3696	3637
		3708	3649
		3720	3661
		3732	3673
		3744	3685
		3756	3697
		3768	3709
		3780	3721
		3792	3733
		3804	3745
		3816	3757
		3828	3769
		3840	3781
		3852	3793
		3864	3805
		3876	3817
		3888	3829
		3900	3841
		3912	3853
		3924	3865
		3936	3877
		3948	3889
		3960	3901
		3972	3913
		3984	3925
		3996	3937
		4008	3949
		4020	3961
		4032	3973
		4044	3985
		4056	3997
		4068	4009
		4080	4021
		4092	4033

Leap-year is twice accounted, one for that part of the Year, from the beginning of *January*, to the end of *February*, the latter for the other part of the Year, and has two Dom. Letters. Further, 1672 is in the Table, but this present Year 1674 is not there, but imagined to stand in the place of 1688, and has D for the Dom. Letter, and 3 for the Prime, accounting from the last Leap-year 1. On either side of the last Oblong are the Months in order, with the Festivals, Terms, and Notable Days in each Month, when they fall upon. The moveable Feasts are marked with a small star, as in *February* Shrove-Tuesday, and in *March* Easter-Sunday, and have a day set to them, to which every Year another number being added makes them certain.

The Third Table or Figure.

This Table has on the left hand in four small Columns, (1) The Prime expressed by Points and Figures down to 19 ; (2) the Epact answering to the Prime ; (3) the Dominical Letter ; (4) A number answering, which serves for ascertaining the Moveable Feasts. Next the former, are the Names and Declinations of twenty principal fixed Stars, with the Letters of the Alphabet, to direct where these Stars are to be found in the 1 Table for their right Ascensions, and the fourth Column shews whether their Declinations be North or South. The last thing in this Table observable, is, the New Moons or Changes : It has 13 Columns ; the first are the Year of the Lord, every Tenth Year expressed from the 0 which signifies 1600, and so you will find all the figures that stand right, which are 1, 2, 3, 4, 5, 6, 7, 8, 9, stand for 1610, 1620, &c. Then Δ stands for 1700, and so the figures stand down-

The Columns under the 12 Months express the day of the mean Change of the Moon every Month, if the Figure stand right ; that is, with its head up, it stands singly for so much ; if it stand with its head to the right hand, it signifies 10, and so many days besides ; if towards the left hand, then 20 and above ; if downwards, then 30 and above.

The particular use of the three Tables aforesaid.

Use. 1. To find the Prime, Dom. Let. and Cycle of the Sun for any year proposed.

Example, 1674 I find in Tab. 2. among the years 72 last Leap-year ; I tell on 1673, 74, where (68) stands, D is the Dominical Letter, 3 the Golden Number (by accounting from one under (72) and 3 the \odot Cycle. Again, if 1676 were proposed, G and A the Dom. Let. 5 the Prime, and 5 \odot Cycle.

2. To find the Epact, in the third Table under the title of Epacts against the Prime as against 3 the Prime, the Epact is 3, against 5 Epact 25.

3. To find what day the year begins on, because A is always the first of *January*, if that be the Dominical Letter, then it is Sunday ; if any other, as in the year 1674 D, tell back to A, as D Sunday, C Saturday, B Friday, A Thursday : All the black days in (Table 1) are Thursdays that year ; and having the Thursdays, the rest are had : And thus you may find whether any Lease or Bond be right dated, and what day of the Week any day will fall on that is to come.

4. (Table 1) against the day of the week you may find the place of the Sun, and the right Ascension ; as against the 25th of *March*, the 15 degree of *Aries* stands, and the right Ascension 1 h. and 8.

5. The (2 Table) amongst the Months shews the

the Festivals and Terms, if they be fixt; but for the Moveable that have a Star adjoyned, you must find how many days must be added each year to them to make them fixt; suppose 1674, 3 is the Prime, and D the Dom. Let. against 3 the Prime in the (3 Table) you have E the Dom. Let. and 23 a number; now tell how far distant E is from D forwards, *viz.* 6, which 6 added to 23, makes 29 to be added to the number against all the Moveable Feasts, to make them fixt for this year; *viz.* Shrove Tuesday being found on the second of *February*, add 29, makes it the third of *March*, and Easter day the 19th of *April*.

6. For the twenty Stars, if any of these named come into the Meridian, or to any known hour of the night, find the Star in the (3 Table) and observe the Letter that answers; seek that Letter in the first Table, and find what right Ascension it hath; take the Sun's right Ascension from it, (but if it be less, add 24 hours) and the difference in time added to the Star's hour gives the true time of the night.

7. To find what day the Moon changeth each Month, as in the year 1673, look in the (3 Table) against 7 account 1670, tell down, 71, 72, 73, (that is, where E, stands downwards) it changeth in *January* the 8th day, in *February* 7, *March* 8, &c. (this is meant of the mean Change) If when you have got the day of the Change you place that in the Kalendar (Table 1) you may find the Moon's age any day.

8. To find the time of high water at *London-Bridge*, you must very well observe the Column for the Moons Motion and Tides in Table 3 where first you have small figures going down to 15 in one line, and from 16 to 30 in another, being the Moons Age for the Tides, which are had by inspection in the two annexed lines divided into hours and fifth parts, and marked with the

Numerical Letters, (the small figures intermix'd, being for the time of the Moon's shining.) As for Example, D 8 days old, it is high water at 9 h. and 24 minutes; at 22 days old at 8 h. and 36'.

9. To find the length of the Moon's shining; Here the Age of the Moon is accounted down in the first Column to 15, and up again to 30 in the same, and the time is expressed by the small figures amongst the Numeral. As at 8 days old the shining is 6 h. and 24'. at 24 days 4 h. 48'.

10. For the Moons Rising and Setting take this Rule,

Increas. $\left\{ \begin{array}{l} \odot \text{ rising more } \& \text{ shining} = \text{D rising.} \\ \odot \text{ setting more } \text{D shining} = \text{) set.} \end{array} \right.$

Decreas. $\left\{ \begin{array}{l} \odot \text{ rising less } \text{) shining } \text{D rising.} \\ \odot \text{ setting less } \text{D shining} = \text{setting.} \end{array} \right.$

11. To find the time of the night by the Moons shining on any Dial; first, the Tides are three hours more than the D Southing otherwise.

D Southing less by the shadowed hour = Time in the East.

D Southing more by the shadowed hour = Time in the West.

12. These proportions are all near true, but not absolute, because they respect only the mean Motion, having not regard to the D Latitude. Without this Book may be had all the three Tables printed together to use alone.

Of Weights and Measures. Of Metals, Water,
 &c. and other useful Notions.

1. Measures of Application or Length are denominated from the parts of the Body, but are indeed in England taken from the Yard Standard kept in Guild Hall, the third part is a Foot, and the 36 part an Inch; expressed in this Table from an Inch to a Mile.

Inch.	Acres	4	160	17429	4840	43560	Pag. 9
3	P. In.	Rood	40	4356	1210	10890	
9	Span.		Pole	1089	$30\frac{1}{4}$	$272\frac{1}{4}$	39204
12	Foot.			Pace	277	25	36000
18	$1\frac{1}{2}$ Foot.	Cubitt	$1\frac{1}{2}$ Yard			9	1296
36	3	2	$1\frac{1}{4}$ Ells.			Feet.	144
45	4	$2\frac{1}{2}$	$1\frac{2}{3}$				Inche
60	5	$3\frac{1}{3}$	$1\frac{1}{4}$	Pace.			
72	6	4	$1\frac{3}{4}$	$1\frac{1}{5}$	Faddom.		
108	$16\frac{1}{2}$	11	$5\frac{1}{2}$	$3\frac{3}{10}$	Pole		
7920	660	440	220	176	$2\frac{3}{4}$	Furlong.	
63360	880	440	220	132	40	8	Mile.
	7040	3520	1760	1056	320		

Turn the side to you, and then this Table of long Measures, (as all the rest after) may be considered as to the Columns or Spaces betwixt line and line from top to bottom; or linear, or by lines from the left to the right. The Column is of the same name as at the top; suppose inches, 3, 9, 12, 18, &c. are all inches: But in the line do severally belong to the name at the end of the line; as 36 Inches, 12 Palms, 4 Spans, 3 Feet, 2 Cubits make severally a Yard.

Square Measures or Superficial are contained in the other part; as, one Pole square are 1089 square Paces, $30\frac{1}{4}$ square Yards $272\frac{1}{4}$ square Feet 39204 square Inches. In the Table of long Measure it is said a Pole or Perch is $16\frac{1}{2}$ Feet, which is the State Perch; besides which there are other customary Perches or Poles, viz. 18 Feet for Fens and Wood-land, 21 for Forests, *Lancashire* and *Irish* Measure, and $18\frac{3}{4}$ *Scotch*.

The Measure for Horses is by the handful = 4 Inches.

How these Measures of ours agree with others abroad, see a Table Printed in Modern Fortifications; and at the latter end of this Book.

The Ell is five quarters of a Yard, and has 20 Nevles; as a Yard has 16; $\frac{1}{5}$ of an Ell = $\frac{1}{4}$ of a Yard. A *Dutch* Ell or Stick is three quarters of a Yard, by which Tapestry is measured.

2. Before we come to Measures of Application, which depend much upon Weights, we will treat of Troy and Averdupois weight: By Troy weight, Gold, Silver, Jewels, Amber, Electuaries, Bread-Corn, Liquors, are weighed; and from this Troy Pound are taken all Measures for wet and dry Commodities.

Averdupois weight weighs all manner of things

things that can waste, and though the Pound Averd. be greater than the Pound Troy, yet the Ounce is less. The Pound Troy is divided into Ounces, Penny-weights, Grains, &c. and the Pound Averd. into Ounces \mathfrak{z} , Drams \mathfrak{z} , Scruples \mathfrak{z} , Grains Gr. The Tables follow.

<i>Troy Weight.</i>				<i>Apoth. Weight.</i>			
Grains.		Pen. wt.		Gr.			
24				20		\mathfrak{z}	
				60		3	\mathfrak{z}
280	20	Ounce.		480	24	8	\mathfrak{z}
5700	240	12	lb	5760	288	96	12 lb

Apothecaries make up their Medicines by the last Table of Troy weight, but buy and sell Drugs by Averd.

<i>Scruples.</i>		<i>Averd. Weight.</i>	
		Drams.	
3			
24	8	Ounce.	
18	121	16	pound.
43008	14336	1792	112 Hund.
860160	286720	35842	2240 20 Tun.

The great Hundred is always 112 l. and 20 of these make a Tun. Eighty Ounces Averd. make near 73 Ounces Troy; which is 5 l. Averd. to 6 l. Troy, which shews the Ounces Averd. lesser, and the l. Averd. greater than the Ounces or l. Troy.

Dr. Wiberd, who was very diligent, makes 14 l. Averd. equal to 17 l. Troy; therefore let this proportion hold;

$\left\{ \begin{array}{l} \text{Troy l. to Averd l. } 17. 14. \\ \text{Troy ou. to Av. ou. } 51. 50. \end{array} \right.$

And

And by very good Experiments of him and others, it will be very useful to know, that one Ounce of pure running or rain water Troy will fill 1,8949 inch, and 1 oun. Aver. 1,72556 inch. One l. Troy will fill 22,7368 solid inches, and 1 l. Averd. 27,609. One solid Foot will hold 76 l. Troy, and 62,588 Averd.

A Tun weight Averd. is always 20 C. of all things, except Lead, which is 19 C. and a half Allum, Cinnamon, Nutmegs, Pepper and Sugar has $13\frac{1}{2}$ l. to the Stone, and 108 l. to the C. *Essex* Cheefe or Butter the Clove is 8 l. the Wey 32 Cloves, or 256 l. In *Suffolk* the Clove is 8 l. the Wey 42 Cloves, or 336 l. Hay should have 20 C. but is sold for 18 C. 36 Trusses, or 2016 l. Wooll is sold by the Clove, or half Stone 7 l. by the Stone 14 l. Tod 28 l. Wey 182 l. Sack 364 l. Last 4368 l. Iron and Shot are weighed 14 l. to the Stone, 28 l. to the Quarter, 112 l. to the C. 20 C. to the Tun. A Faggot of Steel is 120 l.; a Burthen of Gad-Steel is 2 score, or 180 l. For the weight of Butter and Sope, 56 l. of Butter, and 60 l. of Sope make a Firkin, and four Firkins a Barrel of either.

3. *Dry Measures* of Capacity are raised from the Gallon, containing 8 Pints, which should be contained in $272\frac{1}{4}$ Cubick Inches, and should hold of pure running or rain water 9 l. 13 oun. 12 dr. $\frac{1}{2}$ of Averd. Weight. Therefore to come to a true Gallon for dry measure, if you make a square Vessel that shall have each side 6 inches and 48 hundred parts of an inch, or if you weigh with Averd. weights, 9 l. 13 oun. and 12 drams of clean rain or running water, either of these will find out a Gallon dry Measure.

Corn Measure.

Pints									
8	Gal								
16	2	Peck							
64	8	4	Bush						
128	16	3	2	Strik.					
256	32	16	4	2	Carnock or coomb.				
512	64	32	8	4	2	Seam, raf or quart			
3072	384	192	48	24	12	6	Wey		
5120	640	320	80	40	20	10	10	Last.	
A 11	8 $\frac{1}{2}$	17	68	136	276	542	3072	5120	
B 140	7 l.	17	56	1 C.	2 C.	4 C.	24 C.	40 C.	

The number in the Line A expresseth in pounds Troy the weight of Wheat in all the Measures, in B. Averd weight.

Meal is weighed as Corn, but the Common repute is, that a Gallon of wheaten Meal weighs 7 l. Averd, and 8 l. 6 ou. 4 d. weight Troy; and so a Bushel 56 l. Averd. and 68 l. 1 ounce, 12 penny weight Troy. All other Grain, likewise Salt, Lime, Coles, &c. follow this measure, which is called *Winchester* measure: But note, that as Sea-Cole and Salt are measured with this Bushel, then they are heaped, or else there is allowed five striked Pecks to the Bushel; and this is called Water-measure; 36 such Bushels are a Chaldron of Coles; and on Ship-board they allow 21 Chaldron to the Score.

4. Liquid measure is either Wine, or Ale and Beer measure. The Gallon for Wine measure contains 231 Cubical inches, and should hold of pure rain or running water, 8 l. 1 ou. 11 dr. Averd.

Averd. and 9 l. 10 Oun. $1\frac{1}{4}$ d Troy ; Therefore to get a true Wine Gallon, make a square vessel that shall have all the squares and depth 6 Inches and 13 hundred parts of an inch, or if you weigh with Averd. weigh 8 l. 1 Oun. 11 dr. of pure running water ; either of these will find out a true Gallon of Wine measure.

A Table for Wine Measure.

A Tun of Wine weighing Averd. 17 C. weight.

One Pint is $1\text{ l. }0\frac{1}{2}$ Ounces Troy.

Pints	Gall.	18 Rundlets	1 Barrels	1 $\frac{1}{3}$ Terce	1 $\frac{1}{2}$ Hogheads	1 $\frac{1}{3}$ Puntions	1 $\frac{1}{2}$ Buts	2 Tun
8								
144		18						
252		31 $\frac{1}{2}$	1					
336		42	2 $\frac{1}{3}$	1 $\frac{1}{3}$				
504		63	3 $\frac{1}{2}$	2	1 $\frac{1}{2}$			
672		84	4 $\frac{2}{3}$	2 $\frac{2}{3}$	2	1 $\frac{1}{3}$		
1008		126	7	4	3	2	1 $\frac{1}{2}$	
2016		256	14	4	6	4	3	2 Tun

The same for Honey, Oyl, &c.

5. The Gallon for Ale or Beer holds 282 solid inches, and weighs of pure water 10 l. 3 ou. $\frac{1}{4}$. 26, Therefore the square Vessel ought to be 6 inches and 55 hundred parts of an inch each way, and the water 10 l. 3 ou. $\frac{1}{4}$. 26 Averd to find this Gallon.

A Table

A Table for Beer.

Pints

8	Gall.				
72	9	Firk.			
144	18	2	Kild.		
288	36	4	2	Barrels.	
576	72	8	4	2	Hogsh.

Ale.

Pints

8	Gall				
64	8	Firk.			
128	16	2	Kild.		
256	32	4	2	Barrels	
512	64	8	4	2	Hogsh.

Notethat Vefels for Butter, Fish, Sope, follow the Ale measure of a Gallon ; 8 Gallons make a Firkin, 2 Firkins a Kilderkin, 2 Kilderkins an Ale Barrel, and 12 Ale Barrels a Last.

6. Tale and number of feveral goods.

Of Canvas cloth, the C. is 120 Ells ; of Fuffion 1 Chef is 14 Ells ; of fine Linnen, Silk, and Syndon, 10 Ells.

Codfish, Haberdine, Ling, &c. have 124 to the C and 1240 to the M. Eels 25 to the ftrike, and 10 ftrike to the Bind. Of Herring 120 to the C. 12 C. to the M. laid in a Barrel, and 12 Barrels to a Last.

Tale of Furrs, Filches, Grayes, Jennets, Martins, Mincks, Sables, 40 Skins is a timber : other Skins 5 fcore to the C.

A Seam of Glafs is 24 ftone, or 120 l.

One

One Bale of Paper is 10 Ream, a Ream 20 Quire, a Quire 25 sheets.

One Rowl of Parchment is 5 dozen, a dozen 12 Skins.

Ten Hides are a Dicker, a Last 20 Dikers.

Ten pair of Gloves a Dicker; and so ten Hors-shoes.

Tale of Fuel. All Billets should be 3 Foot long, and so all Faggots; and the band beside the knot 24 inches round, and not flat.

A Last of Powder is 24 Barrels or Firkins, which must hold a 100 l. neat.

Timber is sold either by the Tun or Load; a Tun is 40 Foot solid, a Load is 50 Foot solid.

7. Of Gold and Silver. They are near the proportion of 12 to 1; therefore if an Hebrew Talent of Silver be valued at 375 l. that of Gold will be 4;00 l.

The value of Gold here in *England* is as follows. One peny weight of Angel Gold is worth 4 s. 2 d. ob. of Crown Gold 3 s. 10 d. ob. of Sovereign 3 s. 6 d. ob.

One pound sterling money ought to have 11 ounces 2 penny weight fine Silver, and 18 peny weight Allay.

Fineness of Gold is esteemed by the Karraet; no certain weight, but the $\frac{1}{24}$ of any quantity. This Karraet is divided into Grains and Parts.

The Karraet that weighs Jewels is divided into 4 gr. of which grains 20 make 24 gr. Troy, or 1 peny-weight.

8. Metals, Stone, Liquors, Grain, &c. are compared as in the Table following; where there are four Columns; the first contains the names of them; the second Column A has their weights in Troy Ounces answering to a Cubick inch of Magnitude; the third Column B has their Magnitude in inches and Decimal parts, answering to one Oun. of Troy weight; the third Column

Column C. is the weight of a Cubick inch in the water, in Troy ounces and Decimal parts.

	Ou.	A.	inch.	B.	C.
☉ Gold —————	9.91735	0.10083	9.33962		
♀ Quicksilver ———	7.93388	0.12604	7.35615		
♂ Lead —————	6.16198	0.16229	5.58425		
☾ Silver —————	5.50083	0.18179	4.92310		
♀ Copper ———	4.81342	0.26776	4.23569		
♂ Hammer'd Iron —	4.27115	0.23360	3.69942		
Cast Iron —————	3.96821	0.25253	3.09048		
♂ Tin —————	3.96694	0.25208	3.38921		
Marble. ———	1.59631	0.62644	1.01858		
Common Stone ———	1.09835	0.91045	0.50052		
Honey ———	0.79339	1.26042	0.21566		
Salt water ———	0.57773	1.79490	0.00000		
Fresh wa. or wine —	0.52773	1.77490			
Oyl ———	0.47608	2.10069			
Wheat ———	0.37628	2.65757			
Dried Oak ———	0.40745	2.45609			

The uses of these Tables will appear hereafter in the Rules of Practice

Troy wt. 1 l. fover. Gold } is worth { 42 10
 Averd. wt. fover. Gold } 51 14 ³/₈
 So that 100 l. in Crown gold weighs only 1 l. 12 ou.
 and 100 l. in silv. money will weigh 26 l. 9 ou. Av.

You may find by the former Rule and Tables, that one cannot well be cheated by the bulk of gold and other metals, by reason of the weights.

To end this Chap. I have added the Assize of Bread in Averd. weight; a very useful Table to correct Bakers; the Town-Bakers Prizes being on one side, Foreigners on the other; the Table in it self will be information sufficient. The Officers in towns, and Justices of Peace in the country ought to observe these Rules: On the right side and left there is set down the price of a bushel of wheat, and if the Bakers want 1 ounce in 36, to suffer the Pillory.

The

The Affize for Bread for all Weights.

Free Town. Bakers.		Weight of a Penny Loaf.												Foreigners.	
Troy						Averd.									
s.	d.	white	wh.	hou.		white	wh.	hou.	s.	d.					
2	0	16	13	25	4	33	11	15	7	23	1	30	15	2 3	
2	3	15	17	25	3	30	14	19	2	21	3	28	4	2 6	
2	6	14	4	21	6	28	8	14	0	19	10	26	0	2 9	
2	9	13	3	19	13	26	7	12	1	18	2	24	3	3 0	
3	0	12	5	18	8	14	11	11	5	16	18	22	11	3 3	
3	3	11	9	17	6	23	3	10	11	15	17	21	3	3 6	
3	6	10	14	16	5	21	13	9	19	14	18	19	18	3 9	
3	9	10	5	15	7	20	9	9	8	14	2	18	16	3 0	
4	0	9	12	14	10	19	8	8	10	13	7	17	16	3 3	
4	3	9	4	13	14	18	8	8	9	12	13	16	18	4 9	
4	6	8	13	13	4	17	10	8	1	12	1	16	2	4 9	
4	9	8	7	12	10	16	14	7	13	11	10	15	7	5 0	
5	0	8	1	12	1	16	2	7	7	11	0	14	14	5 3	
5	3	7	11	11	9	15	7	7	1	10	11	14	2	5 6	
5	6	7	6	11	2	14	13	6	15	10	3	13	10	5 9	
5	9	7	2	10	11	14	4	6	10	9	15	13	0	6 0	
6	0	6	14	10	4	13	11	6	5	9	8	12	10	6 3	
6	3	6	10	9	15	13	4	6	0	9	1	12	1	6 6	
6	6	6	6	9	9	12	12	5	16	8	15	11	13	6 9	
6	9	6	3	9	4	12	6	5	12	8	9	11	5	7 0	
7	0	5	15	8	15	11	15	5	9	8	3	10	18	7 3	
7	3	5	12	8	11	11	9	5	5	7	18	10	11	7 6	
7	6	5	9	8	1	11	3	5	2	7	13	10	5	7 9	
7	9	5	7	8	3	10	14	4	19	7	9	9	19	8 0	
8	0	5	4	7	15	10	9	4	16	7	5	9	12	8 3	
8	3	5	2	7	12	10	5	4	14	7	1	9	8	8 6	
8	6	5	0	7	8	10	0	4	11	6	17	9	2	8 9	
8	9	4	14	7	5	9	12	4	9	6	13	8	18	9 0	
0	0	4	12	7	2	9	8	4	6	6	10	8	12	9 3	

CHAP. III.

OF

ARITHMETICK

And its PARTS;

*And of the most easie performance of Multipli-
cation, Division, and Extraction of the Roots
by Nepayre's Rods: The use of the Table of
Logarithms herewith Printed: Decimal Ta-
bles, Progreſſion and Proportions.*

§1. **O**F the fix principal Parts; Numeration,
Addition, Subſtraction, Multiplica-
tion, Division and Extraction of the Roots;
but firſt notice muſt be taken of theſe few
Charaſters.

+	Addition or more	Diviſ.)	Divid.	(Quot.
—	Subſtraction or leſs			
X	Multiplied by	Z.	Summ	
=	Equal to	X.	difference.	

1. Numeration gives the value we place upon
the 9 Digits; the firſt place is of ſimple Unity
towards the right hand, next Tens, next Hun-
dreds, next Thouſands, &c. And ſo each place
tentimes more to the left hand; as you may ſee
by the value of this number, 75,832 which is 75
thouſand 832.

And as this increaſeth towards the left hand,
in a Decuple proportion, ſo may all parts or fra-
ctions of any whole thing decreaſe from Unity
in the ſame proportion towards the left; as that
after Unity to be Unity into 10 parts, the next
into 100 parts, &c. and though we in England
do

do not divide our money, or measures into these parts, yet to make Arithmetick easie, we turn our accounts into it; and for the better understanding hereof, take notice that at *Rome* their money consists in Ducats, Julios, Baioccas: Ducats is their Integer or whole Unite; ten Julios make a Ducat, and ten Baioccas a Julio: So that to expresse 35 Ducats, 8 Julios, and 7 Baioccas, they set them thus; 35,87, that in respect of Julios it is $\frac{8}{10}$ of Baioccas $\frac{7}{10}$ parts of a Ducat; This is the true Decimal Arithmetick or Natural: But to break into other parts is inartificial, $28\frac{2}{3}$ imagines the whole divided into 3 parts.

2. Addition, whether whole or parts, takes the general Summ, and Subtraction the difference, keeping certain, that

	357,28	Unite be kept under Unite:
Ex.	92.7	
	315,89	Suppose the Ex. here Ducats,
	2781,51	Ju. and Ba. the Summ would
(2)	3547,28	be 3547 Ducats, 3 Julios, and
		8 Baioccas.

Ex. From 562 Ducats, 8 Jul. and 4 Ba. take 381 Duc. 2 Jul. and 7 Baioc.

	562,85	After Subtraction there re-
Ex.	381,27	mains 181 Duc. 5 Jul. and 7
	181,57	Baioc.

Of these parts no more; if any Gentlemen or other, especially Ladies, desire to look into their Disbursements, or layings out, and yet have not time to practise in numbers, they may, from Mr. *Humphrey Adamson*, dwelling near *Turn-stile* in *Holborn*, have those incomparable Instruments, that will shew them to play Addition and Subtraction in l. s. d, any whole Numbers, without Pen, Ink, or help of Memory; which were the Invention of that worthy Person, and Ornament of his Country, Sir *Samuel Moreland* Baronet

3. Multiplication by memory is fit for those that have constant practice, but for certainty and ease no Invention ever came near that of the Lord *Nepair* by Rods, made either of Wood or Ivory. Sir *Samuel Moreland* has devised a neat way upon Circles, but Vastly chargeable, and that has been the reason why they have not been so well known. I have at last cloathed sticks with Papers printed, and at very easie charge they are to be had ready varnished, better for use than made of silver, and sold with this Book as one, with one or more papers ready to be pasted upon sticks, if the Box should be lost, and cannot be false.

To double or treble a number will be found ready by any one, as to double 7584, say, twice 4 is 8, twice 8 is 16, setting down 6, and bearing one in mind ; twice 5 is 10, and 1 I carried is 11, setting down 1 and carrying 1 ; twice 7 is 14, and 1 is 15 ; all which is 15168. The same for multiplying by 3.

Before I come to the use of the Rods, it will be very fit to shew how Multiplication may be wrought by making a Table of the Multiplicand to 9, as follows Suppose I would Multiply 6831, by 693, I take the Multiplicand 6831, and making a line before it, I set down the Digits to 9, I double it and set it against 2, I add the first and second for 3, I double that against 2 for 4, add the second and third for 5, double the third for 6, add the third and fourth for 7, double the fourth for 8, and add the fourth and fifth for 9. See the Table

Table X

Table X.

1	6831	6831 Multiplic.
2	13662	693 Multiplier.
3	20493	
4	27324	20493
5	24155	61479
6	40986	40986
7	47917	4733883 Product.
8	54648	
9	61476	

Now set down the Multiplicand and Multiplier and set in the Table the number against 3, and set it down against 9, and set it one place to the right hand, against 6, and set still one place further, as in

the *Ex.* whereby adding all the three Multiples you have the general Product 4733883. You may try with lesser numbers, and perfect this way in an hours time.

The Rods being set together, make this Table at one work for present view.

First then, having the Box open, you are at the first sight to know what figures stand on each side of the Rod; that next to you is fair, that under it, or the side the Rod lies on, is the complement to 9, and the figures on both sides of the Rod are seen at the bottom by two small figures under the black Line: Suppose you see the Rod 6 upwards, you will know 3, the Remains to 9, is under, and at the bottom you will see 1 on one side and 8 on the other; so at one glance you have four figures, know 6, 3, 8, 1, and this is proper to each Rod, and must be perfectly learnt. From hence you may find, that 10 Rods have all the Digits four times over, that is four 1, four 2, four 3, four 4. &c.

Having learnt quickly to find a Figure, the next is to place the Multiplicand upon the Rod; suppose in the *Ex.* 6831, I find these 4 figures as before, and placing 6 next the Index (fixt in the Box) then 8, then 3 and 1; the Digits are then Tabulated, and against every Digit in the Index you have the very same figures as in the Table

Table foregoing, to be found with this Caution, that you begin at the right hand, and taking out first the single figure that stands in a triangle, after that you must take the two figures that stand in the Rombus, if there be two, and if both be under 10, write the Summ down as one figure; if above 10, write the surplusage above 10 down, and carry one to the next cell; but all will be better seen from the Rods themselves than 100 times from Words. See the (first Figure) in the last page, where you will find the former number 6831 on the top, and against 2 (which is two times the number) you have in the Triangle first 2, then in the next Rombus 6, next 2 and 1, which you set down as 3, last 1, which makes 13662, as in the former Table; next six times is first six, then 8, then (8 and 1) = 9, then (6 and 4) = 0, then (3 and 1) = 4; so the whole will be 40986, and nine times will be 9, 7, (2 and 2) 4, (4 and 7) 1, (5 and 1) 6, (61479) as in the Table before; a small labour will make you read the Rods as quick as you may see them in the Table, either backward or forward.

If there be any decimal parts in the one or both Md or Mr, tell their number of places, for there must be as many places cut off by the distinction as were in both.

Multiply 37, 5, that is 37 Duc. and 5 Jul. by 15 91, that is 15 Duc. and 9 Jul. and 1 B. You shall have the Product 596, 625, that is 596 Duc. 6 Jul. 2 Baioccas and a half; there are 3 places cut off because there was 1 in the Multiplicand, and 2 in the Multiplier.

4. Division has no more difficulty than formerly; tabulate the Divisor on the Rods, one Example will be sufficient; let the Dividend be 4733883, the Product in the former Example, let 6831 be the Divisor to be tabulated on the Rods;

Rods, you have the multiplying of it to 9, before which is here repeated.

	Divisor	Dividend	Quotient
1	6831	4733883	693
2	13662	40986..	
3	20423	63528	
4	27324	61479	
5	34155	20493	
6	40986	20493	
7	47817	0	
8	54648		
9	61479		

The Table of the Divisor stands for the Rods; first, I see that 6831 will not be in 4733, therefore you must go 5 places; then looking on the Rods, or in the Table, for a Number that is equal or next less to 47338, I find it to be 40916, that is 6 times the Divisor; I set 6 in the Quotient, and subtract 40986 from the figures above, rests 6352, to which I add 8 the next figure of the Dividend, and seek again upon the Rods or Table for it, or the next less, which I find to be 9 times, I set 9 in the Quotient, and take 61479, plac'd as in the Example, and subtract it, remains 2049, to which I add 3 the last figure and work as before said, 3 times carries all away, and nothing remains, the Quotient being 693.

For Decimal parts there must be as many places in the Divisor and Quotient as are in the Dividend, in this Example.

12,91)	596,625	(37,5	In the Dividend there are 3 places, in the Divisor 2, therefore the Quot. must have 1 decimal place, which is 37 Ducats and 5 Julios; and in case there be no Decimal or fewer in
	4773..		
	11932		
	11137		
	7955		
	7955		
	0		

in the Dividend than Divisor, put as many Cyphers as you please after the Dividend, which are decimal places, and if you find that there be defect in the Quotient, put Cyphers before it to supply the places.

5 Extraction of the square Root has some difference, but not much, from Division. (1.) Point each other figure beginning with the last, as in the Example, 6, 5, and 7, which shewsthere will be 3 figures in the Root. (2.) Take the Rod called the square Rod that has at the top a square, and set it to the Index, and seek for the Figures; the first prick (57) you will find 49 nearest; set 7 in the Quotient, and subtract 49 from 57, rests 8. (3.) To this Remainder (8) add the next two figures to the next prick (15) makes it 815, (4) Double the Quotient 7, viz. 14, and set it upon the Rods, and place those Rods betwixt the Index and square Rod, each time at the first work: Seek then upon the Rods for the next less or equal number to the figures 815, which I find to be 725, that is 5 times; setting 5 in the Quotient, subtract, and to the Remainder add 2 places to the next point (36;) lastly, double the Quotient 75, which is 150, set this betwixt the Index and square Rod, and work as before, you will find the Root 756, which multiplied by it self produceth the square number 571536. If your Root be not perfect, but something remains after the last Subtraction, add Cyphers to the Square, and proceed.

$$\begin{array}{r}
 \cdot \cdot \cdot \\
 571536 \quad (756 \\
 \underline{49 \cdot \cdot} \\
 14 \quad) \quad 815 \\
 \underline{725} \\
 150 \quad) \quad 9036 \\
 \underline{9036}
 \end{array}$$

6. Extraction of the Cube Root; (1.) Point every third figure from the last, set the Cube Rod that hath Cu. on the head, to the Index in

the Box, seek the next less on the Rod, which

$$\begin{array}{r}
 91733851 \quad (451. \\
 64 \\
 48) \overline{27733} \\
 \underline{24125} \\
 300 \\
 \underline{27125} \\
 6075 \overline{) 608851} \\
 \underline{607501} \\
 135 \\
 \underline{135} \\
 608851
 \end{array}$$

is in the Example 64, that is 4 times, set 4 in the Quotient and subtract, rests 27, to which add 3 figures to the next point, the sum is 27733. (2.) Square the figure found in the Quotient, and triple it (and this must be done each time) for a Divisor, which set betwixt the Index and Cube Rod, in this Example, 4 being the Quotient,

multiply it by it self, makes 16, and that multiplied by 3, makes = 48, which on 2 Rods I place in the box betwixt the Index and Cube Rod for a Divisor. (3.) Seek a Quotient, which will be found 5, which set down, and the number answering 24125 place as in the Example, but before you subtract you must triple the Quotient 4, which is 12, and multiply it by the square of the last figure 5, viz. 25, now 25 by 12 makes 300, which place under 24125 one place forward to the left hand, as in the Example; then add those two numbers makes 27125, and subtract it, rests 608. This work must be repeated for each figure in the Quotient, viz. to 608 add 851 for a Resolvend, square 45, and triple it makes 6075 for a new Divisor, which being placed next before the Cube Rod, shews it will be but 1 for the Quotient, which answers to 607501, which is set down, and tripling 45, and multiplying it by 1, makes 135, which set one short, makes in the whole 608851, so that nothing remains. If something remain add Cyphers, 3 for a figure, and it will give a Decimal fraction.

Thus much with a little practise, and that the Boxes are to be had with the Book, will render all General, and it would too much augment this small Volumn, to teach the use and making of Duodecimal Rods, Sexagenary for the old Astronomy, and Centesimal, all which works two figures at once.

7. *Nepaire's* Rods will reach to great Numbers; but for Numbers under 100000, the said worthy Lord invented a far easier way to perform Multiplication by Addition, Division by Subtraction, Extraction of the square and Cube Roots by halving or trisecting, and all this by certain Numbers in a Table called *Logarithms*, Printed at the end of the Book, where in the first page all Log. answering to all numbers under 100 are easily found, *viz.* the Log. of 38 is 1.579783, of 72 is 1.857332, &c. If the number consists of 3 places, that is a number under 1000, look for the number in the Table under N, and the Log. is found in the Column under O; so the Log. of 349 is 542815, of 893, is .950851. If the number be of 4 places, and under 10000, seek the 3 first figures under N, as before, and the last figure on the top, under which in that Column lineally against the first; 3 figures you have the Log. As for Example: The Log. of 3583 is :554247, finding 358 under N, against which in the Column under 3, is that Log. so the Log. of 4268 is 630224, of 9546, is :979821: But if the number be above 10000, and under 100000, you must find it by the difference and Table of Parts Proportionals Printed at the end of the Table of Log. thus; if the Log. of 35786 be sought, first seek the Log. of 3578, which will be 553649, and the common difference under D, 121; with this difference enter the Table of Parts proportional, and find 121 in the first Column under D, and

B 2

then

then lineally against that number, and under 6 the last figure of the last place of the number 75786, found at the head in the 7th Column you will find 72, which added to the Log. of 7578, viz. 553649, makes 553721 the Log. of 75786.

Now before we proceed to find numbers answering to Log. it will be fit to shew you, what is meant by the first figure placed to the first 100 Log. which Mr. Briggs called a Characteristick or Index, which represent the distance of the first figure of any whole number from Unity, whose Index is a Cypher or 0; and so the Index of Tens is 1, of 100 is 2, of 1000 is 3, and
CM.XM.M.C.X.V.

as in this Line so that

5 4 3 2 1 0

in this Number 687325 the Index of 5 is 0, of 7 is 3, of 6 is 5; But of Decimal parts it proceeds the other way; as that of ten parts is 1, of 100 parts is 2, as in this Line 3,5781, the Index of 3 is 0, of 5 is 1, of 8 is 3, of 1 is 4; or after the proposal of Mr. Christopher Townley, take their Complements to 10; as instead of 1 take 9, of 2 take 8, of 3 take 7, which will make the Addition and Subtraction more easie and plain; if the former be used let it be called the first, if the later, the second manner.

210, 9 8 7 6 5 4 Index the first way.

Of Indices 378, 2 3 4 1 8 9 Number.

210, 9 8 7 6 5 4 Index the second way.

Having laid down the grounds for the Indices, or the first figure in each Log. the absolute Log. will readily be set down, making the first figure the Index of the first figure of the number; as the Log. of 5784, the first Log. in the Table, is 762228. The Index of the first figure of the number 5 is 3, so the absolute Log. is 3. 762228.

N. Log.

$578,4 - 2.762228$
 $57,84 - 1.762228$
 $5,784 - 0.762228$

} So that the Log. is the same, but the Index of the first figure altereth.

$.5784 - \overline{9}.762228$
 $.05785 - \overline{8}.762228$
 $.005784 - \overline{7}.762228$

} In pure parts the Log. is the same, but the Ind. altereth after the 2 way.

Now to find the number answering to a Log. given omitting the Index; seek the rest six places in the Table of Log. and where you find the Sum, or nearest the numbers in the Margent N, and over that Column will make out 4 places; The Log. 3.544821, omitting the Index 3, I find 544821 to answer 3506, and the Index shews they are all Integers, the Index shewing the first figure to be the third from Unity 6; so the Log. 1.544821, would shew 35,06, that is 35 Integers, and $\frac{6}{1000}$ parts, and $\overline{9}.544821$. 3506 all Decimal parts, and $\overline{7}.544821$. 03506 parts. But if the Log. be not exactly to be found, and that you desire to have places to five figures, first, find the number to 4 places as before, with noting the common difference under D on the side, and taking the difference betwixt the Log. given and the Log. found in the Table, then seeking the common Difference in the Table of Prop. parts, in that Line find out the difference of the Log. and over the head you have the fifth figure. Example of this Log. 2.543612, the Log. next less is 543571 answering to 3496, the common difference is 224, the diff. of the Log. is 41, which in the Table of Prop. parts against 124 gives 3, so that the absolute number is 34963, and because the Index is 2, 34963.

Addition of two or more Log.

If the Indices be both (or all) Integers or whole, add them without any more.

If the Indices be some Integers, some parts, that is, be unlike, if the Index upon adding be 10, or above, cast away 10, the Remainder is the Index of Integers, if under 10 Decimal parts.

If the Indices be both Decimal parts, and if added be under 10, add 10 to the same, if just 10 then 0, if above 10 cast 10 away; the Index thus gotten is always of Decimal parts.

2.057821	2.237242	2.397941	2.875061
7.583210	9.875062	2.875062	8.698972
<hr/> 2.641031	<hr/> 8.698971	<hr/> 2.273003	<hr/> 8.574033
	0.811275		

Subtraction of Log.

If the Indices be whole, then as before.

If the Indices be either of them, or both decimal parts, set them one over another, then if the higher be a smaller figure than the lower, add 10 to it, and observe whether the higher be of greater value than the lower; if so, the Remainder will be Integers, if not, decimal parts.

2.033421	2.875062	2.875062	1.235781
2.875062	2.033421	8.574031	3.572141
<hr/> 2.158359	<hr/> 7.841641	<hr/> 1.301031	<hr/> 7.665640

The Log. of a Fraction is found by subtracting the Log. of the Denominator from the Log. of the Numerator: Sometimes it is found necessary to multiply a Log. by 2, 3, 4. &c. which If it be an Index of parts, observe that you use the former Indices, viz. For the first part

123, &c. and that in multiplying the figure next the Ind. the Tens are affirmative, and are to be deducted out of the Product of the Indices of parts.

To divide a Log. of parts, if the Index be even it is ordinary, but if uneven, then add to the Ind. so many Units till it may be divided, setting the Quot. down for a new Index, augmenting the next figure by so many times 10 as you added to the first.

$$\begin{array}{r} 3) \overline{5.321412} \quad 3) \overline{7.232151} \\ \underline{2.440470} \quad \underline{3.744050} \end{array}$$

The Admirable Uses of the Log. Table

To multiply one Number by any other.

Add the Logarithms of the Numbers, the Sum is the Log. of the Product.

N. Log.

$$\begin{array}{r} 32 - 1.505150 \quad 5,12 \quad 0.709265 \\ 51 - 1.716003 \quad 1,55 \quad 0.190332 \\ \hline 1664 \quad 3.221153 \quad 7.9360 \quad 0.899597 \end{array} \left\| \begin{array}{l} 52 \times 32 = 1664 \\ \times 5,12 \times 1,55 \\ = 7,9360 \end{array} \right.$$

To divide one Number by another is to subtract the Log. of the Divisor from the Log. of the Dividend.

	N.	L.		N.	L.
Dividend	7289	— 3.862489		4512	— 3.654369
Divisor	32	— 1.505150		50315	— 8.498311
Quotient	227,8	— 2.357339		14,32	— 1.156058

To extract the square Root of any Number is to half the Log. of that N. or divide it by 2, the Quotient Log is the L. of the Root; and to extract the Cube Root, to divide it by 3.

Number 75832 — 4.879852 4.879852
 Divided by 2) 2.439925 3) 1.626614
 Square Root 275,37 Cube Root is 42,327

To find a mean proportional betwixt 2 numbers, is to add the Log. of them together, and take half;

L.

The numbers are { $\begin{array}{r} 9 — 0.954242 \\ 16 — 1.204120 \end{array}$

|| Z 2.158362

The middle Proportional is || $\frac{1}{2}$ 1.079181

To find 2, 3, 4, 5, &c. mean Proportionals betwixt any two numbers, take their difference and divide it by a number more by one than the number of means desired, as if 3 means divide it by 4, &c. this Log. Quotient added to the least, finds the first mean next it, and so added to the last finds the next, &c. It is desired to have 3 mean Proportionals betwixt 4 and 64, the Log of 4 is 0.602060, of 64 1.806180; these two added makes 1.204120, the $\frac{1}{4}$ is 0.301030, which added to the Log of 4, makes 0.903090, the Log. of 8 the first mean, and again added gives 1.204120 the Log. of 16, and again the Log. of 32, which 8, 16, 32, are the three means betwixt 4 and 64.

8. Of Reduction, Greater names are brought lower by Multiplication; as Pounds are brought to Farthings by multiplying a Pound by 20, 12, and 4, and back again by dividing by 4, 12, and 20. Ordinary Fractions are reduced into Decimals by multiplying the Numerator by 100 or a thousand, and dividing the Product by the Denominator.

Hence are all the Fractions of money, weight, time,

time, &c. turned into Decimals, as follows;
 Table I. of 1 l. Integer. The half of shillings is
 the decimal, as of 16 s. is $\frac{8}{10}$, of 6 s. is $\frac{3}{10}$, of 11
 s. is $\frac{55}{100}$ of 1 s. $\frac{105}{100}$; and note in general once
 for all, that $\frac{1}{4}$ of any thing is $\frac{25}{100}$ $\frac{1}{5}$ and $\frac{3}{4}$ $\frac{75}{100}$

DECIMAL TABLES.

Table I. Pence Eng. Coyn 1 l. Int.			
11	.045833	19	.039583
10	.041666	18	.0375
9	.0375	17	.035416
8	.033333	16	.033333
7	.029166	15	.03125
6	.025	14	.029166
5	.020833	13	.027083
4	.016666	12	.025
3	.0125	11	.022926
2	.008333	10	.020833
1	.004666	9	.01875
f. 3	.00313	8	.016666
2	.002083	7	.014583
1	.001041	6	.0125
Table II. Troy wt. Int. 1. oz.		5	.010416
Peny wt, the same with shil.		4	.008333
gr.		3	.00625
23	.047916	2	.004166
22	.045833	1	.002083
21	.04375	Table III. Averd. great wt. 112 C. 1	
20	.041666	lib.	
		27	.241071
		26	.232142
		25	.223214
		24	.214287
		23	.205357
		22	.196428

21	.1875
20	.178571
19	.169942
18	.160714
17	.151785
16	.142857
15	.133928
14	.125
13	.116071
12	.107142
11	.098214
10	.089285
9	.080357
8	.071428
7	.0625
6	.053571
5	.044642
4	.035714
3	.026785
2	.017857
1	.008928
oun.	
15	.008370
14	.007812
13	.007254
12	.006696
11	.006138
10	.005580
9	.005022
8	.004464
7	.003906
6	.003348
5	.002790
4	.002232
3	.001674
2	.001116
1	.000558

quart.	
3	.000418
2	.000276
1	.000139

Tab. IV. *Averd. little*
weight Int. 1 l.
oun.

15	.9375
14	.875
13	.8125
12	.75
11	.6875
10	.625
9	.5625
8	.5
7	.4375
6	.375
5	.3125
4	.25
3	.18875
2	.1225
1	.06625
dr.	
15	.058593
14	.054087
13	.050781
12	.046875
11	.042968
10	.039922
9	.035156
8	.03125
7	.027343
6	.023437
5	.019531
4	.015625
3	.011718
2	.007812
1	.003906

quart	
3	.002929
2	.001953
1	.000976

Tab. V. *Liq. Measure*
Gal. or Quar. the Int.

7	.875
6	.75
5	.625
4	.5
3	.375
2	.25
1	.125

quart.	
3	.09375
2	.0625
1	.03125

Tab. VI. *Inches in*
Dec. Int. 1 Foot

inches	
11	.916666
10	.833333
9	.75
8	.666666
7	.583333
6	.5
5	.416666

4	.333333
3	.25
2	.166666
1	.083333

quart	
3	.0625
2	.041666
1	.020833
$\frac{1}{2}$ quar.	.010416

Tab. VII. *Decimals*
of a Year.

Month	
1	.083334
2	.166667
3	.25
6	.50
9	.75

Days.	
1	.0027397
2	.0054795
3	.0082193
4	.0109591
5	.0136988
6	.0164386
7	.0191784
8	.0219182
9	.0246579

The uses of the Decimal Tables.

Any parts of money, weight or measure given,
you may turn into Decimals or *contra*. 3 l. 15 s.
7 d. $\frac{1}{2}$ = 3, 78124, for 15 s. = 75. 7d. =
.029166, and $\frac{1}{2}$ = .00208, in all 3 l. 78124. A-
gain,

gain, 16 C. $\frac{3}{4}$ 17 l. Averd. weight = 16,90178.
 If Decimals be to be turned into their natures
 again, as 37 l. ,5692, first 37 l. is the Integer.
 then 55 of the first 2 figures will be 11 s. and
 the remainder ,0192 will be 5d. $\frac{1}{2}$.

9 A short Specimen of Fractions for the bet-
 ter remembling the Rules of

(1.) of the great|| Ex. of 36) 54 (1
 Common measure|| 36 36 C.M. 18) 36 (2
 54 18) 36 (2 54 2

(2.) Reduction 16) $\frac{15}{12}$ $\frac{14}{18}$ are $\frac{15}{36}$ and $\frac{14}{36}$
 3. 2

3. Fractions of Fractions $\frac{\frac{1}{4} \text{ of } \frac{2}{4} \text{ of } \frac{6}{7}}{84} = \frac{12}{84}$

4. Addition and subtract. || $\frac{15}{36} - \frac{14}{36} = \frac{29}{36}$ & 1
 of fractions reduced || $\frac{15}{36} - \frac{14}{36} = \frac{29}{36}$

5. Multiplicat. $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$ (6) Divis. $\frac{4}{5} \div \frac{2}{3} = \frac{10}{12}$

10. Of Progreffions and Combinations.

1. Geometrical progression that begins with
 Unity, you may come at any term of it by mul-
 tiplying the Log. of the second term by the
 number of so many places, as the distance re-
 quires less, 1. Ex. in a progression that is dou-
 ble, have 1, and the second term 2, and you
 desire the 8 term, multiply the Log. of 2 by 7,
 it gives you 2. 10721; the Log. of 128, the 8th
 term,

term, and this holds if the first term be not Unity, if you take the Log. of the Ratio.

2. Combination of things may differ many ways ; Two only are here considered : (1.) In the changing their position, as in ringing of bells, the other in the matter or substance ; for the first, set down a Series of numbers from Unity, multiply 1 by 2 shews

As
2 things can be changed 1, 2, 3, 4, 5, 6,
twice : Again $2 \times 3 = 6$ 2.6.24.120.720.
shews three things may
change 6 times, 4 may change 24, and 5 120.

For the second, suppose $a b c$ be essentially different a Ternary ; There are three Unites, a, b, c . three Binaries, ab, bc, ac , and one ternary abc . and so many Combinations there may be and no more.

Now to find out the Combinations it is easily done by the posterior Table in Mr. Oughtred's *Clavis Matth.* p. (37) he calls it (*plena hac mysteriis pulcherimis Tabula*) I say the numbers set by the Species shew the Combinations desired, only one of the extream Unites must be left out, and the obtaining those numbers is thus ; set down Unity, then repeat two Unites and leave one space, and

then 2 space, 3, 4, &c. the Intermediate are filled by adding the numbers on either side standing above, as to make up the lowest row

$1 + 4 = 5$ standing next above on either side, $4 +$

$6 = 10$, &c. then leaving out the Unites, on the right hand :

1	1	—	=	1
2	2	+ 1	—	= 3
3	3	+ 3	—	= 7
4	4	+ 6 + 4 + 1	—	= 15
5	5	+ 10 + 10 + 5 + 1	—	= 31

&c. Bina-

Binaries and 1 Ternary in all 7 Combinations.

If the matter be 4, there may be 4 Unites, 6 Binaries, 4 Ternary, and 1 Quaternary, $15 = \&c.$

11. *Of Proportion.* Direct is, when more requires more ; and less less : This is called the *Golden Rule*, when 3 numbers are given to find a fourth, and requires that the second and third terms be multiplied together, and the first divide that Product, the Quotient shews the answer : Ex. If 5 yards of any thing cost 15 s. what shall 45 yards cost ? An. 6 l. 15 s. for setting them down thus ; $5. 15 :: 45. 45 \times 15 = 675$ and $5 \over 675 (135 = 6 l. 15 s.$

The Back Rule requires the first and second to be multiplied, and that the third divide that Product. And this Rule is known, because that more will require less, or less more. Ex. if 4 horses eat 5 pecks of oats in 3 days, 8 horses will eat 5 pecks in a lesser time.

The Double Golden Rule, or Rule of 5 Numbers is of great use in many respects, and therefore as it is easily explained in *Moore's Arith.* take it from thence : Let that which is the principal cause of loss or gain, interest, action, &c. be put in the first place ; that which betokeneth Time, distance of Place, &c. be in the second place, and the remaining in the third ; under this Conditional part place the two other terms each under his like ; and there will be a blank to supply under one of those above, either under the first, second, or third. Ex. If one hundred pound in 12 months gain 6 l. (this is the Conditional part) what shall 50 l. get in 3 months, place them down as in the Rule ; and

lib.	m.		here the blank is under the
100.	12.	6 l.	third term, but if the demand
50.	3.		had been, in how many
			Months would 50 l. have
			gained 15 s. or if 100, in
			12 months

12 months gain 6 l. what shall the principal be, that in 3 months would gain 15 s. ; in these two last cases the blank would have been under the first or second terms, there are but these Cases; Rule 1. If the blank be under the third term, multiply the three last for a Dividend, and the two first for a Divisor, the Quotient of these gives the sixth; $6 \times 50 \times 3 = 900$ and $100 \times 12 = 1200$ now $1200 \overline{) 900, 0}$ $(,75 = 15 \text{ s.}$ But if the blank fall under the first or second term, then the rule will be ; Multiply the first, second and last for a Dividend, and the third and fourth for a Divisor, the Quotient is an Answer : This Rule shews simple Interest, and all belongs to it with ease, and was thus found. Set with Mr. Mern, P. T. G. for the principal Time, and Gain in the Conditions, and p. t. g. answering,

it will be $P. G. :: p. \frac{G p}{P}$ and $T. \frac{G p}{P} :: t.$

$\frac{G p t}{T p} = g.$ So that multiplying the 3 last for

Dividend, and 2 first for Divisor is the first Rule, and because $\frac{G p t}{T p} = g.$ it will be $G p t$

$= T P g$ therefore $t = \frac{T p g}{p G}$ and $p = \frac{T p g}{G t}$

which is the second Rule.

12. To any two Tumbers, to find a third in continual proportion, Rule. Square the second, and divide it by the first.

Rules of Practice,
IN
ARITHMETICK

For Interest, plain and spherical Triangles,
Measuring of Plains, Solids, Circles and
Spheres, Gaging, Fortification, Gun-
nery, Astronomy, Dialling, making of
Watches and Movements, Geography,
Navigation.

S¹. Rules of Practice in Arithmetick: First
learn to halfe a number from the left
to the right speedily; As for *Ex.* 8431076, the
half is 4215538, beginning with 8 take 4. of
4 take 2, these are even and easie; but for 3, I
take 1, and carry 10 to the next, which is 11,
I take 5 remains 10, then for the 0, I take 10
and set down 5, for 7, 3, and for 16, 8. This
brings shillings into pounds by cutting off the
last figure, and taking the half of the rest; thus
7946 s. make 3,92 l. 6 s. &c.

2. Because that 12 pence make a shilling, it
will be well to be expert in Multiplying or Di-
viding by 12: A small Paper of Duodecimal
Arith. was 11 years since drawn up at the de-
fire of Sir *Rob. Long*, and it seems admirable
with what ease and fewness of figures, that
Arithmetick will work all measures by foot and
inches, and 12 parts for the inch, and for shil-
lings and pence, and 12 parts of a penny: Here
must two figures or digits be added, *viz.* x for
10, and n for eleven, the Account will be
Unites, Dozens, Groshes, &c. and the parts will
diminish

diminish accordingly : But here is not room to explain it, take an Example : A piece of black Marble 2 feet 9 inches and half broad ; 3 f. 2 inch. and a quarter deep, and 8 foot 3 inches long, how many feet ? And what rate at 1 s. 3 d. 2 q. per foot .

In the first operation,
 $3 \div 6 = 18$, for which set
 down 6 (the overplus a-
 bove 12) and carry one;
 then $3 \div 9 = 27$, and 1 I
 carried makes 28, for
 which I set down 4 the
 overplus above 12 s. and
 carry 2, the 12 s. in 28 ;
 then $3 \div 2 = 6$, and $6 \div 2$
 $= 8$, the which I set down.

Then I come to the Mul-
 tiplier 2, and say $2 \div 6$
 $= 12$, I set down 0 and carry 1; then $2 \div 9 = 18$,
 and $18 \div 1 = 19$, for which I set down 7, and carry
 1, and say $2 \div 2 = 4$, and $4 \div 1 = 5$, which I set
 down. Thirdly, I take

the multiplier 3, and say
 $3 \div 6 = 18$, and setting
 down 6 carry 1, then 3
 $\div 9 = 27$, and $27 \div 1 =$
 28 , for which I set down
 4 and carry 2, then $3 \div 2$
 $= 6$, and $6 \div 2 = 8$, &c.
 which three Products I
 add, carrying 1 for every
 12, and setting down
 the overplus, so is the so-
 lidity of the whole Mar-
 ble 6 dozen and 1 foot,
 or 73 solid feet and 1

third, and by the second operation, the price will
 be 7 dozen 10 s. that is 94 s. 8 d. 3 q.

(Op. 1.) (Op. 2.)

2.96	61.4
3.23	13.6
<u>8.46</u>	<u>3080</u>
570	1640
<u>8.46</u>	<u>614</u>
8.x.946	7x.880
<u>8.3</u>	<u> </u>

2284.

51122

61.4x4=94s. 8d. 3q.

This Table of twelves, or Shillings and Pence is to be got without Book.	d.	s.
	12	1
	24	2
	36	3
	48	4
	60	5
	72	6
	84	7
	96	8
	108	9
	120	10
	132	11
	144	12

3. The Aliquot or even parts of Shillings and Pounds are to be learnt, as 1 *d.* 2 *q.* is the one eighth part, 1 *d.* the twelfth part, 2 *d.* the sixth part, 3 *d.* the fourth part, 4 *d.* the third part, 6 *d.* the half of a Shilling; 1 *s.* the twentieth part, 2 *s.* the tenth, 4 *s.* the fifth part, 5 *s.* the fourth part, 3 *s.* 4 *d.* the sixth part, 6 *s.* 8 *d.* the third part, and 10 *s.* the half of a pound; knowing these, the price of any one thing will be known, if 1 *l.* or 1 Integer of that thing be known. At 6 *d.* the ounce, what comes 372 ounces, because 6 *d.* is the half of a Shilling; take half of 372 = 186 Shillings: The practice you have in every Book of Arith. Likewise you may observe the even parts of other things; suppose the great hundred 112 *l.* the half is 56, the quarter 28, the eighth part is 14, the sixteenth part 7; so that at 54 *s.* the C. what come 15 C. 3 quarters and 18 pounds, the whole hundreds come to 40 *l.* 10 *s.* the 3 quarters is three fourths of 54 *s.* which is 40 *s.* and 6 *d.* Lastly, for the 18 *l.* find what 14 *l.* comes to, *viz.* 6 *s.* 9 *d.* and 4 *l.* to 1 *s.* 11 *d.* in all 42 *l.* 19 *s.* 2 *d.*

4. The hundred weight whether neat, or the great C. which is 112 *l.* it will be worth while to give you the price of either at any small rate the pound weight; Ex. at 3 *d.* 2 *q.* the pound, what comes either C. to: Put the price of a pound into farthings, *viz.* 14; for the Neat C. account twice so many Shillings, and as many pence as farthings; and for the great C. twice so many Shillings, and as many Groats as there be Farthings in the pound weight. Ex. 14 *s.* and 14 *s.* make 28 *s.* and 14 *d.* makes 29 *s.* 2 *d.* the Neat C. and 14 *s.* twice, and 14 Groats make 32 *s.* and 8 *d.* for the great C. So daily expences are for every penny spent a day, one pound; one half pound, one groat, and one penny:

penny : 5 *d.* a day is after that rate 7 *l.* 12 *s.* 1 *d.* There is constant use made of the great hundred, therefore I have annexed a Table, which in the first Column contains the price of one pound from 1 farthing to 2 *s.* and in the second you have the price of the C. weight ; the greater Figures are pence, the lesser farthings. If the price exceed the Table, take half, or a quarter of it, and double or redouble the price ; and so seeking in the Table for the price of a C. weight, you have the price of a pound or unite answering.

A Table

A Table for buying and selling by the C. weight

l. p. C. pr.	l. p. C. pr.	l. p. C. pr.	l. p. C. pr.
l. s. d.	l. s. d.	l. s. d.	l. s. d.
1 0. 2. 4	6. 1 2. 18. 4	1 5. 14. 4	1 8. 10. 4
2 0. 4. 8	2 3. 0. 8	2 5. 16. 8	2 8. 12. 8
3 0. 7. 0	3 3. 3. 0	3 5. 19. 0	3 8. 15. 0
1 0. 9. 4	7 3. 5. 4	13 6. 1. 4	19 8. 17. 4
1 0. 11. 8	1 3. 7. 8	1 6. 3. 8	1 8. 19. 8
2 0. 14. 0	2 3. 10. 0	2 6. 6. 0	2 9. 2. 0
3 0. 16. 4	3 3. 12. 4	3 6. 8. 4	3 9. 4. 4
2 0. 18. 8	8 3. 14. 8	14 6. 10. 8	20 9. 6. 8
1 1. 1. 0	1 3. 17. 0	1 6. 13. 0	1 9. 9. 0
2 1. 3. 4	2 3. 19. 4	2 6. 15. 4	2 9. 11. 4
3 1. 5. 8	3 4. 1. 8	3 6. 17. 8	3 9. 13. 8
3 1. 8. 0	9 4. 4. 0	15 7. 0. 0	21 9. 16. 0
1 1. 10. 4	1 4. 6. 4	1 7. 2. 4	1 9. 18. 4
2 1. 12. 8	2 4. 8. 8	2 7. 4. 8	2 10. 0. 8
3 1. 15. 0	3 4. 11. 0	3 7. 7. 0	3 10. 3. 0
4 1. 17. 4	10 4. 13. 4	16 7. 9. 4	22 10. 5. 4
1 1. 19. 8	1 4. 15. 8	1 7. 11. 8	1 10. 7. 8
2 2. 2. 0	2 4. 18. 0	2 7. 14. 0	2 10. 10. 0
3 2. 4. 4	3 5. 0. 4	3 7. 16. 4	3 10. 12. 4
5 2. 6. 8	11 5. 2. 8	17 7. 18. 8	23 10. 14. 8
1 2. 9. 0	1 5. 5. 0	1 3. 1. 0	1 10. 17. 0
2 2. 11. 4	2 5. 7. 4	2 3. 3. 4	2 10. 19. 4
3 2. 13. 8	3 5. 9. 8	3 3. 5. 8	3 10. 1. 8
6 2. 16. 0	12 5. 12. 0	18 3. 8. 0	24 10. 4. 0

Tuns are brought into hundreds by Multip. by 20.

4. The last Note shall be, that in weighing of Goods, the weights 1 l. 3 l. and 9 l. will weigh all from 1 l. to 13. 1 l. 3 l. 9 l. 27 l. all

all from 1 to 40. 1 l. 3 l. 9. 27 l. 81 l. all from 1 to 120, &c.

At the later end of the Book you have a Table for the summing up of Commodities, the use is plain by Inspection only.

§ 2. Rules of Practice for casting up of Interest Money, whether Simple or Compound, rebates and values of Leases.

1. Note is of simple Interest, of use amongst Merchants, you must know readily to cast up the days betwixt any two named times: In one year 365 $\frac{1}{4}$ in two years 730 $\frac{1}{2}$, in three years

334	Jan.	00
306	Feb.	31
275	March	59
245	Apr.	90
214	May	120
184	June	151
153	July	181
122	Aug.	212
92	Sept.	243
61	Octob.	273
31	Nov.	304
00	Dec.	334

1095 $\frac{3}{4}$, and likewise by this Table to find the days; Ex. 1. From the beginning of the year to the 11th. of Oct. October has 273 days, and 11 makes 284. Ex. 2. from the 12th of March to the 16th of December, subtract Mar. 59 $+$ 12 = 71 from Dec. 3, 4 $-$ 16 350 refts 279 days. Ex. 3. From 10th of June 1673 to the 5th of Febr. 1674. Say

20 $+$ 184 $+$ 31 $+$ 5 = 240 days. The Interest for one day of one Pound at 5l. per Centum is this Decimal, .0001369836, at 6 l. per Centum .000164384, which are gotten by dividing 5 and 6 by 36500; and so of any other: Now to find the Interest of any sum of Money for certain days, first find the Interest of one pound for that time, by multiplying .000164384 for 6 per Cent. by the days; and then that product by

by the Sum of Money gives your desire ; or easily if you add the Logarithm of $\bar{.}21586217$ for 6 per Cent. or $\bar{.}13666528$ for 5 per Cent. to the Log. of days, and the Log. of the Sum of Money proposed together, it gives you the Log. of the Interest ; and to rebate or to know the present worth of any Sum due hereafter, you must find the Interest of 1 l. for that time, adding Integer to it, and divide the Sum propounded by it, the Quot. is the present worth. Here follows a Table of simple Interest of 1 l. for any days under 10000 at 6 per Cent.

D	M	C	X				
	lib.	s.	d.	s.	d.	d.	par.
1		3:	3.452		3.941	.394	.039
2		6:	6.904		7.890	.789	.079
3		9:	10.356		11.835	1.183	.118
4		13:	1.808	1:	3.780	1.578	.157
5		16:	5.260	1:	7.726	1.972	.197
6		19:	8.712	1:	11.671	2.367	.236
7	1:	3:	0.164	2:	3.616	2.761	.276
8	1:	6:	3.616	2:	7.561	3.156	.316
9	1:	9:	7.068	2:	11.506	3.550	.355

The use of this Table is easie ; the first Column are days, and if used with the second Column are thousands ; if with the third are hundreds ; if the fourth are tens, and the fifth are single Unites. Ex. What is the use of 1. l. for 1732 days. An. 5 s. 8 d. $\frac{1}{4}$ for 25 = 1 f. 50 = 1000
2 f. 75 = 3 f. and if you turn the Interest of one pound found as before into decimals, and multiply it by the

Sum propounded in Decimals, It gives the Interest of that Sum. And for equation of payments, or giving of time, as at 2 three Months, or

or at 3 six Months, &c. or Weeks, Years, or Days, or the like; suppose three, 3 Months, multiply the terms 3 and 3 makes 9, add the later 3 makes 12, the half whereof is the equated time, viz. 6 months. So the equation for 4 six months, is 15, viz. $4 \times 6 = 24 \div 6 = 4$ 30 — $\frac{1}{2}$ 30 is 15. To conclude this Note of simple Interest practise is the double Gol. Rule taught before, it answers all questions whether of the principal, time, or gain.

2. Of Compound Interest, or Interest upon Interest. The Logarithms answer questions of this nature with great ease; and first if the Interest be at 6 *per Cent.* find the Log. of 106, divide it by 2 for $\frac{1}{2}$ Years, by 4 for Quarters, by 12 for Months, and by 365 for Days, and keep these Log. for Use. You have six Questions in *Moore's Arith.*

Log. of 1, 06 0.025306
 $\frac{1}{2}$ Year 0.012653
 $\frac{1}{4}$ Year 0.006326
 Month 0.002109
 Week 0.000527
 Day 0.000075

wrought at large, the following Examp. will make all plain for 1 l. viz. Mr. Oughtred's six *Theorems* after 6 *per Cent.* viz. A, B, C, D, E, F.

The. 1. P. lends to R. 1 l. for 3 years, what must P. receive at the end of the term? A.

The. 2. P. hath owing from R. 1 l. at the end of three years, and would know the worth in ready money? B.

Yearly,
 1,06 — 0.025306
 3
 A 1,1010 0.075918
 B ,83962 2,924081 Ar.Co.

So that A answers the first Question; that is, P. must receive 1 l. and ,191 of 2 l. that is, 3 s. and 10 d. And B the

B the second, that is, 16 s. 9 d. ob. *A* is gotten by multiplying the Log. of 1,06 by 3; and *B* is the Arithmetical Complement of *A*.

The. 3. *P* hath an Annuity of 1 l. per. *An.* and *R* forbears payment to the end of three years, what will it amount to? *C.*

The. 4. *R* is to pay 1 l. at the end of three years unto *P*, and would know what rent is to be paid yearly for that Debt? *D.*

First, *A.* 1

is 1,191 — 1 *A* — =,191²281033

=,191, and 1,06 — 1 =,06⁸778151

1,06 — 1 =,06 *C* 3,1833 0.502882

After Sub- *D*, 31413 ⁹.497117 Ar.Com.

straction it leaves the Log. 6 of *C* 3 l. 3 s. 8 d. and the Arithm. Complement is *D.* 6 s. 3 d. ob.

The. 5. *P* has an Annuity of 1 l. per *an.* for three years, and would know the present worth in ready money.

The. 6. *P* hath 1 l. to bestow of an Annuity for three years, and would know the yearly Annuity.

The answer to *C* 3,1833 0.502882
the 5th *Theo.* is *E* *A* 1,191 0.075918

2 l. 13 s. 5 d. ob. *E* 2,6728 0.426964

and the 6th *F* *F*, 37414 ⁹.573036

7 s. 6 d. Thus

for 1 l. the Answers are fitted to all the 6 Questions, and the same is to be perform'd after the like manner, if the payments were half yearly, quarterly, &c. taking the Log. answering as before. And after you have found your Answer for 1 l. by adding its Log. to the Log. of any other Sum, it gives your desire. Ex. if 352 l. 10 s. were due 3 years hence, and I desire to know what it is worth to pay presently; I add the Log. of 352,5 — 2.547159 to the Log.

B² 924081 found as before makes 2. 471240,
which is the Log of 295 97, or 295 l. 19 s. 6 d.
the Answer.

Rules concerning Free-holds to be bought
and sold.

The Annual Rent, divided by the bare Rate
of Interest proposed, produceth the Sum of
ready Money that Free-hold Estate is worth.

Example: 300 l. *per. an.* after the rate 6 *per.*
Cent. is worth 5000 l. $,06) 300,00 (5000.$

And if the Rent be $\frac{1}{2}$ yearly or quarterly,
divide by $,0296$ and $,014674$.

Any sum of Money (1000 l.) lying ready for
a Purchase being multiplied by the bare rate of
Interest, $(,06)$ produceth the yearly Rent. 1000
 $\times ,06 = 60,00$ or 60 l. *per. annum.*

The Annual Rent (60 l.) being divided by a
sum propounded (1000 l.) quotes the bare In-
terest of 1 l. $1000) 60,00 (,06.$

Divide Unity (1) by the bare rate $(,06)$ of
1 l. the Quotient gives the number of Years pur-
chased. $,06) 1,00 (16,6 \quad 5) 1,00 (20 \quad 8) 1,00 (12.$

If the Rents be $\frac{1}{2}$ yearly or quarterly paid,
work as you were formerly directed.

Here follows a Table to Purchase by, at 5, 6, 8, and 10,
per Cent. Interest.

Y.	5 per C.	6 per C.	8 per C.	10 per C.
1	0 10	0 10	0 11	0 11
2	1 11	1 11	1 9	1 9
3	2 9	2 8	2 7	2 6
4	3 7	3 6	3 4	3 2
5	4 4	4 3	4 0	3 9
6	5 1	4 11	4 7	4 4
7	5 9	5 7	5 2	4 11
8	6 6	6 2	5 9	5 4
9	7 1	6 10	6 3	5 9
10	7 9	7 4	6 9	6 2
11	8 4	7 11	7 2	6 6
13	9 5	8 10	7 11	7 1
15	10 5	9 9	8 7	7 7
17	11 2	10 6	9 1	8 0
19	12 1	11 2	9 7	8 4
21	12 10	11 9	10 0	8 11
23	13 6	12 4	10 4	9 1
25	14 1	12 9	10 8	9 3
27	14 8	13 3	10 1	9 4
29	15 2	13 7	11 12	9 6
31	17 1	13 11	11 4	9 9
41	17 7	15 1	11 11	9 11
51	10 3	15 9	12 3	9 11
61	18 11	16 2	12 4	10 0
71	19 4	16 5	12 5	10 0
81	19 7	16 6	12 6	10 0
91	19 9	16 7	12 6	10 0

The first Column is of Years, the second is the time to Purchase, the first Figure being Years, the second Months. A Rent to endure 7 Years, is worth ready Money after 5 l. per Cent. 5 Years and 9 months; the third Column is at 6 l. per Cent. the fourth at 8, and the fifth at 10 l. 5 l. per Cent. is at 20 years purchase, 6 l. at 16 years and 8 months, 8 l. per Cent. at 12 years and an half, 10 l. per Cent. at 10 years. So that 5 l. and 6 l. per Cent. may be used for Freehold Estates, and the 8 l. and 10 l. for Houses. §3.

§ 3. Of Plain and Spherical Triangles.

Instead of Chords, the Sines and Tangents were invented, and brought to a Decimal Radius; and it might be wished, that the Saxagenary Account be left off, and the Centesimal taken.

After the Logarithms, you have a Table of Artificial Sines and Tangents to every degree and minute.

The Sine or Tangent of every degree and Minute, if they be under 45 Deg. are found by looking in the Column on the left side, the Degrees are in greater figures, and if above 45 deg. by looking in the Column on the right side, accounting from the bottom towards the top,

Example: The Sine of $13^{\circ} 30'$ will be found 9.368185; the Tangent 9.380354; the Sine of $67^{\circ} 20'$ will be found 9.965020; the Tang. 10.379213: The Complement of any Degree and Minute being the Remainder of the same to 90° , answers in the same line in the two outmost Columns; as to $22^{\circ} 10'$ answers $67^{\circ} 50'$, and so doth the Sines and Tangents, for the Sine of $22^{\circ} 10'$ being 9.576689, the Sine 9.966653 being its Complement or Cofine of $67^{\circ} 50'$ stands next; and so of the Tangents.

Now to find the degree and minute answering to any Log given; suppose the Sine 9.457584; I seek this in the Table, and find it answers $16^{\circ} 40'$, and to this Tangent 10.475410, $71^{\circ} 30'$, and if you seek for every second, you must take the difference of those two Log. betwixt yours and the lesser; then say, *As the first Difference, Is to the other Difference :: So is 60. To the Seconds sought.* *Ex.* The Sine 9.500163, being given, the next less in the Table 9.499963, the difference 200. The Tabular diff 379, then say, If 379 60, 200, it will give 32, so the cor-

respondent Degree, Minute, and Second, will be $18^{\circ} 20' 32''$. This being learnt, we come to the Doctrine of Plain Triangles, but first know these Characters; \angle an Angle; $rt \angle$ a right Angle; $l.$ a Side; Hyp. the Hypothenuse; Ba. Base; Ca. Cathetus, Δ Triangle; Dat. given; S. Sine; T. Tangent; Cos. Coſine; Cot. Cotangents.

1. Of plain Δ s, let every rt angled Δ be noted with three Letters, A, B, C; let A ($rt. \angle$) be the $rt \angle$, BA the Base, CA the Cathetus or Perpen. and BC the Hypothenuse, and all oblique Δ s with BCD, (F. 1) let BD be the Base; then observe these Propositions.

Prop. I. The Sides and Sines of the opposite Angles are proportional, and in any Triangle where two Sides, and one Angle opposite, are given, and it be required to find the Angle opposite to the other side; As $l. : S. \angle opp. :: l. : S. \angle required$: Or if two Angles, and the Side opposite, the one be given, to find the $l.$ opposite to the other: Say, As $S. \angle l. opp. :: S. \angle l. required$: this reacheth generally to all Δ s, Note, that in a $rt \Delta$ if one acute Angle be known, the other is known, because it is the Complement to 90° , and in an oblique Δ if two Angles be known, the third is given, because the Complement to 180° .

Prop. II. In $rt \angle \Delta$ s. As one Side to the other :: So is the Rad to the Tang. of an \angle opposite to the other, $BA : CA :: Rad. : t. \angle B$.

Prop. III. In every plain Δ . As the sum of the two Sides, is to their Difference: :: So is the Tangent of half the sum of the two opposite Angles, to the Tangent of half their Difference; therefore if two Sides and the Angle included be given, the rest will be known.

Prop. IV. As the greater Side, to the Sum of the

the rest :: So is the Diff. of those two remaining Sides, to the Difference of the Segments of the Base ; the Perpendicular will fall in the middle of the Remainder.

These four *Prop.* will resolve all plain Δ s.

Ex. In the Δ ABC Rad. 90° — 10.000000
 rt \angle at A. Let the Hypothenuse BC be given, and \angle B to find the Side CA. By the *I. Prop.*

BC	1277	—	3.106191
t: \angle B	$28^\circ 20'$	—	9.676321
CA	606	—	2.782519

Having BA the distance from any place to the foot, 1124 feet or yards, and \angle B $28^\circ 20'$, to find the height CA 606 feet or yards: By *Prop. II. Fig. 3.*

Rad.	90°	—	10.000000
BA	1124	—	3.050766
t: \angle B	$28^\circ 20'$	—	9.731746
CA	606	—	2.782512

In the oblique Δ DBC, *Fig. 3.* having the \angle CDB $43^\circ 20'$, and the \angle CBA 58° , the \angle DBC will be 122° , and the \angle DCB $14^\circ 40'$, the first two \angle s are had by observation, the other Complements, by the *I. Prop.* you may have DC 335, and BC 271, which are the distances from D and B to C, though you came no nearer than D. Like-

wise in the rt Δ BCA, supposing CA some height unapproachable, after the Angles at D and B be taken, and the distance BC 271, as before; you may find by the *I. Prop.* CA 230 feet, yards, &c. the height, and BA the distance 143,7; and by these two last Exam.

S. B.	$14^\circ 40'$		9. 403455
DB	— 110		2. 000000
S. C.	$43^\circ 20'$		9. 836477
BC	— 271		2. 433022
S. DBC	— 58°		9. 928420
t. DC	— 335		2. 524965

all heights and distances, whether accessible or no, are taken.

2. Of Spherical Triangles, and first of rt \angle Δ s. In these there are five Parts, besides the rt \angle , (which is no part) to be considered; in the Δ ABC, (Fig. 4.) A is the rt \angle , the Sides B A and C A are taken simply, which make two parts, the \angle C and B, and the Side BC by their Complements, which make three parts, five in all: Three of these always fall into the Question, whereof two are given and one demanded; and these three in the Question either fall all together, as B, BA, AC, or BA, AC and C, or AC, C, BC or BC, B and BA, or C, BC and B, in all which five cases BA, AC, C, B and BC, are the Means, and the other two the Extremes, or a funder or disjunct; as BA, BC and C; BC, BA, CA; C, B and BA, wherein BA, BC and C, which are separated from the other two, are called the Intermedials, the other the Opposites,

Ax. 1. As Tang. of one Extreme, to the Sine of the Mean :: So is Rad. to Tang. of the other.

Ax. 2. As Si. co. of the one opposite, to Sine of the Intermedial :: So Rad. to the Cosine of the other.

By these two Axs. and the former observations, any part of rt \angle Δ may be gotten by knowing two parts: Ex. In

As Rad. —————	10.000000
Si. BC, $34^{\circ} 0'$ ———	9.751284
Si B, $23^{\circ} 30'$ ———	9.600000
Si CA, 13° ———	9.351984

the Δ BAC, where let B represent the Equinoctial Point, and the Angle of the greatest Dec. $23^{\circ} 30'$, and BC a part

of the Ecliptick $34^{\circ} 20'$, I demand CA the Dec. Here B and BC are given, CA demanded, CA are disjoyned, and B, BC, are the opposites; therefore by the second Ax. As R. Cosy.

Cosy. $BC :: Si. co. B. Sine \text{ of } CA$; but you are bid to take the Complements of B and BC , therefore as in the work, $R. Si \ BC :: Si. B. Sine \ CA$; this is plain and sufficient for $rt \ \angle \Delta s.$

Of oblique Spherical Triangles, the Parts are six, three Sides and 3 Angles, whereof three are given, and 1, 2, or 3, may be sought; four of these six are called Ingredients, whereof 3 must be given and one sought: And of these 4, there may be three several Divisions; First, they may be opposed one to another, as $l.$ to \angle , and $l.$ to \angle , or contrarily, and then $S. \angle. S. l. :: S. \angle. S. l.$ or $S. l. S. \angle :: S. l. S. \angle$. Secondly, they all follow together; or, Thirdly, three together, and one removed. In the two latter, the part sought may be found at two Operations and no more, by letting fall a Perpendicular, which must always fall from or upon one of the Ingredients, and never from or upon two. For the Calculation of any of these, observe the Rules following.

I. The Perpendicular being let down, the two Ingredients left entire annexed and given, must be marked with the Letters, B and BC the \angle and Side given.

II. One of these two, either B or BC , must begin the account of the four Ingredients in the Question, and the Perpendicular must always fall upon BD extended if need be.

III. If the $\angle s$ at B and D be both acute, then the Perpendicular will fall within the Δ , and then $DA = BL - BA$, and $\angle DCA = \angle BCD - BCA$ as in the fifth *Fig.* But if the one of B or D be obtuse, and the other acute, then will it fall without, as you may perceive in the 5, 6, and 7 *Fig.* then $DA = BA + BD$, and $\angle DCA = \angle BCD + BCA$, as in the sixth *Fig.* or $DA = BA - BD$ and $\angle DCA = \angle BCA - \angle BCD$, as in the 7th *Fig.*

IV. The order being begun as before, either at B or BC, either all four will follow one another; or else three of them, and the fourth removed from the rest.

V. After the Perpendicular be let fall, the Sides BA, AD, or the \angle s BCA, or ACD, or ACB, are found out, as in rt angled Triangles.

After DA and BA, or \angle BCA, or ACD, be found as before, the Triangles are found and performed by two Cases, and each Case two Problems.

Case I. Where all four Ingredients follow each other.

Probl. 1. Leader BC thus, BC, B, BD, D, and either BD, or D sought; As Sine DA . S^r BA :: t B . t D.

Probl. 2. Leader B thus, B, BC, BCD, DC, and either BCD, or BC, is sought; say, Cof. DCA . Cof. BCA :: t BC . t DC.

Case II. Where three follow immediately and one separated.

Probl. 1. Leader BC thus, BC, C, CD, and BD, and either DC or BD are sought; say, Cof. BA . Cof. DA :: Cof. BC . Cof. DC.

Probl. 2. Leader B thus, B, BC, BCD, and D, and either D or BCD are required; say, Si. BCA . Si. DCA :: Cof. B . Cof. D.

Lastly, in the two Cases, First, where three Sides are given, to find an Angle: For *Exam. Fig. 8. b.* in the $\triangle BCD$, let all the Sides be given viz. BC 38, 30 CD 70, and BD 60; and let the Angle C be sought: First, set down the Arith. Compl. of the Sines of BC and CD including the \angle sought. Take the Difference of these Sides, and under that diff. set down the third Side, take their Sum and Difference and set down their Sines; lastly, sum up all the four Sines, the half Sum will find out an Arch among the Sines, which being doubled, will be the \angle .

		Si.	
BC	38 30	Arith. Co.	0.205850
CD	70 00	Arith. Co.	0.027014
	31 30	Diff	
BD	60 00	Third Side:	
	<u>∠</u> 91 30		
	<u>X.</u> 28 30		
Half Z.	45 45	Si.	9.855096
Half X.	14 15	Si.	9.391205
		Sum — —	19 479163
		Half Sum	9.739582

Sine of $23^{\circ} 18'$, doubled $36 = \angle C$.

And if 3 \angle s be given, to find a Side, if instead of the greatest \angle you take its Complement to 180° , the \angle s will be Sides & Sides \angle s, as in the last.

§4. Of Longimetry, Planometry, & Stereometry.

Note I. The measures used for lengths, as you had them in *Chap.* 2. are either Inches divided into 10 Parts, Feet divided into 100 Parts or 12 Inches, a Gad or Rod divided into 10 Feet, and a Perch or Pole divided into 100 Links, containing 16 Feet and a half, or 18 Feet; these or any of these may be used as occasion requires.

2. Care must be had, that in measuring any Line or Length whatsoever, you derive not from a strait Line; therefore set up small Pickets betwixt you and the mark that may direct the Line; or if you measure by a four-pole Chain, then the hindermost man look that the Leader go strait, or cover the Mark. If a Line decline; and you would know the Horizontal Line in going down a Precipice at the end of the Gad or Rod held Horizontally, let fall a small Stone or any small Weight that will shew the Point where you must hold Horizontally again.

3. To level a length or Line, or to know what difference of height in rising or falling betwixt

place to place, which is a very useful Practice for carrying of water, or of underground Adits or Soughs, take those Rules: Let your Instrument be carefully and truly made, whether it be a Water Level, or (which in my opinion is the best) a Brass T, the Sights to be two Prospect Glasses; which may be had of the *Mathematical-Instrument-makers* about London, with Directions about it: This kind of Instrument will suffer a distance to a quarter of a Mile, or more if need be; and there must be two Mark-boards placed on Pike-staves, that your Companions may lift up or down as you shall direct them.

Set the Level as near as you may in the middle betwixt the two Marks, which your Companions hold upright in their hands with the flipping Marks, and first turning to one, cause him to hold or set his Sight even to the level Sights, and so the other; the difference betwixt those Sights in Inches and tenth Parts gives the ascent or descent; this is for one simple Station: But if it require many Stations with ascents and descents, then in a Note-book set down your back Stations in one Column, and your fore Stations in another, sum up both the Columns, and take the difference of them; if they be equal, the two places are level; if your fore Stations exceed, then the difference is lower; if otherwise, higher; a little practice will inform you sufficiently. In carrying a Stream or River, as the *New Water* from a little above *Ware* to *London*, or elsewhere, you must allow a Foot, or a Foot and two Inches, for a Mile in descent, or more, if your fall require it; and this because of the distance of the Tangent from the Surface of the Globe of the Earth in every Mile; and tho' in a Mile it will be found but 6 Inches, yet it is better to hold to the surer side. Now for Common Sewers or Passages to carry away the Water and Dirt of Streets in Towns;

Towns; for every 10 Feet you ought to allow 2 or 3 Inches as your fall may be, which in every 100 feet will be 1 foot 8 inches, or 2 foot 6 inches.

3. For the length of unapproachable Lines, as those of places beleiged, or of heights or distances, they are found by resolving a Triangle that hath one side, and all the Angles given, as in *Prop. 4.* of Plain Triangles is set down, as you may see in *Fig. 3.* Care must be had, that the Angle BCD be not too acute, viz. never less than 2 degrees, and therefore it will be best if the ground will give leave, to go from B, not in the right Line ABD; but to go off from B towards F at right Angles.

For a diversion, I will give the heights of some Pyramids, Steeples, Obelisks, and Pillars, in the measure of English Feet; as when *S. Paul's Steeple* had its Spire on, the Stone work was 260 feet high, and the Spire as much, which was 520 feet in all, and will be found as high as any Steeple in *Christendom*, only that at *Cremona in Italy* being 528 feet excepted, the Ball on *St. Peter's in Rome* is 466 Feet; the Steeple at *Roan in Normandy* is 399 feet; at *Strasbourg in Germany* 431 feet; at *Landhoven in Bavaria* 451 feet; at *Modena in Italy* 279 feet; the Tower *Asinel in Bononia in Italy* 316 feet; Lanthorn at *Genoua* 324 feet; the highest of the Pyramids 1350 feet, the lower Pyramids 883; *Boston Steeple in England*, a Stone Steeple without Spire, is 264 feet; the height of the Obelisk in *Rome*, (removed by *Fontano* to *St. Peter's*) was of one Stone 78 feet and an half high, 9 feet 2 inches square at the greater end, and 6 feet 2 inches at the top, it stands now upon a Pedestal of 12 feet and an half high, and the height of the brazen gilded Cross is 19 feet and a half, so now the whole height is 110 feet and an half in all,

4. Before we come to the measuring Plains, it will be requisite to shew, 1. To raise a Perpendicular.

dicular from a Line, *Fig. 9.* Suppose on a , take $ab = ac$, open your compasses to above half bc , and cross two arches at d , ad is a Perpendicular.

2. To do it on the end of a Line, strike an Arch ab ; set the same wideness from d to b , and strike another Arch at c , which with a Ruler laid upon d and b cross at c then is ca a Perpendicular. See *Fig. 10.*

3. To let fall a Perpendicular from a upon the Line bc , *Fig. 11.* setting one foot in a , cross the Line in b and c , from b and c , opening the Compasses, make a cross at e , lay a Ruler by a and e , & draw ad , which is a Perpendicular to bc .

Lastly, because hereafter there is great use made of a Square, I shall shew you, how any *Joyner* or skilful *Carpenter* may make one that will very well serve your turn for surveying or plotting any Grounds, Yards, or Courts, and for measuring the same. Get a dried piece of Box or Pear-tree that will bear 3 inches or 3 inches and an half Diameter, and turn it flat on the top round, with a neck to fit for the head of a Staff; find the Center, and draw 2 or 3 Concentric Circles, as you see, *Fig. 12.* and Circles on the edge, divide the Circles into four Parts, as you see in the Figure $adbc$, then take a Whipfaw very thin, and saw by the marks the two Lines ab and cd at the right Angles pretty deep; this will make a good Instrument for setting off Perpendiculars when you have occasion.

Suppose (*Fig. 13.*) a, b, c, d, e, f, g, h , were a Field, I come to a , and setting a Beacon there and at the corners, I measure ac , and as I go, find at what length by the square the Perpendiculars id and kb will be, I measure all those Perpendiculars, and set them down in my Book, I measure cb and the Perpendiculars mp and no , and so all the rest as you see in the Figure; and to lay the observations down, I do no more but draw a Line ac by the scale, and prick down the points ik and x , and raising Perpendiculars I set off ih, kb , and

and $k d$, which give me $a b c, d$ and h , I draw $c b$, and upon it prick down n, y , and m , and set off $n o$ and $m p$, and so I work with the rest of the Figure, and I deal so with the rest of the Clofes if there be more, and add all together.

1	.017453292	Lastly, to find the length
2	.034906585	of a Circular Line, either
3	.052359877	whole or part, from Degrees
4	.069813170	and Decimal Parts, may be
5	.087266463	done by this Table; the first
6	.004719755	Column are De-
7	.022173047	grees or Decimal
8	.139626340	Parts, second Ra-
9	.157079633	dus is Unity: As
		for <i>Ex.</i> 32° and

30.52359

2.03491

1.00174

6.00104

16th Dec. Parts; *An.* .56128 of 100000. .56128

Note II. Planometry, or the measuring the superficies or planes of things, is done with the squares of such measures, as a square foot, square inch, square yard, square perch, that is by squares, whose Sides are an inch, a foot, a yard, a perch; so that the *Area* of any superficies is said to be found, when I know how many such square inches, feet, yards, &c. it containeth.

1. The *Area's* of squares and oblongs are known, if you multiply one side by another.

2. The *Area* of any plain Triangle is gotten by multiplying the Base by the Perpendicular, and taking half the Sum, or the Base by half the Perpendicular, or the Perpendicular by half the Base.

Or without the Perpendicular at all, add up all the sides and take half the sum, from this half sum take every side, which call the three Differences, multiply these three Differences and the half Sum continually together, the square Root of the last Product shall be the *Area* of the Triangle.

3. To measure any regular Figure that has equal sides, multiply half the sum of the sides by the Perpendicular from the Centre to one of these sides;

To

To find the Perpendicular, conceive a Triangle, whereof one Side is the Side given, the Angle opposite is the \angle at the Centre, the other Angles half of its Complement, to find the Perpendicular.

	\angle	L.	
Δ	.658	1.520	ly give you the Quadratrix
L	1.000	1.002	under \angle or the Side under
5	1.312	.7624	L. for any of the ten Regular
6	1.612	.620	Figures, whose Side is 1.
7	1.904	.525	Ex. Suppose the Side of a
8	2.196	.455	Pentagon be 70.51, what
9	2.487	.402	is the Superficies? Say,
10	2.769	.361	As 1. 1.312 :: 70.51 ;

Ans. 92.52 the Quadratrix, and $92.52 \times 92.52 = 8558$. Having the Superficies, take the sq. Root of it, and say, As 1. .7624 :: So \angle to Side.

4. The *Area* of any four-sided Figure, two sides whereof are parallel, is gotten, if you multiply the Perpendicular from the one parallel side upon the other by the half sum of those parallel sides.

5. If the figure be of many sides, cast them into Triangles, as you may see in *Fig. 13*. And if any side be crooked, as you see *bg* in that *Fig.* draw a Line that shall leave as much out as it takes in; or if it be irregular towards a round, as in *Fig. 14*. form a Triangle, as *cbd* that shall equal it.

6. The dimension of Circles, and other round Figures, are gathered from their Diameters or Circumferences: Let D. signifie the Diameter; P. the Periphery; Dq, Pq, the Square of the D. or P; l. the Side, as before; \odot . the Circle; R. Radius, or half of the D. Then

As 7. 22, or 113. 155, or 1. 3. 1415926 :: So is any D. to P; and so Dq, to the Superficies of a Sphere; and so is Dx the Axis of a Cylinder, to its Superficies; and so is half D. into the Side, to the Superficies of a Cone; and so is the square of the Chord of half the Segment of a Sphere, to the superficies of that Segment.

As 22. 7, or 355. 113, or 1.0 :: 3.8310 :: So P. D. so Superficies, to the Dq. of the Sphere.

As $7 \times 4. 22$, or 14. 11, or as 1 to .785399 :: So Dq. *Area*; and so is the Sq. of the Dx 1 solid Cylinder; So Dq $\times \frac{1}{3}$ Ax. to the solid of the Cone.

As 22. 7×4 , or 11. 14, or as 355. 452, or 1.1.273239 :: So is the *Area* of the \odot , to the Dq.

As 22 $\times 4. 7$, or as 88. 7, or as 1420. 113, or 1 to .079577 :: So Pq. Area of a \odot , and so Pqxl. to the solid of a Cylinder.

As 1 to 707107 :: D. to the Root of a square to be inscribed in a \odot . As 1. 886227 :: D. to the Root of a sq equal to the \odot , which is the squaring of a \odot .

As 1 to .80604 :: D. to the Root of a Cube equal to the Sphere.

As 1 to 1.772454 :: D. to the Root of a Sq. equal to the superficies of a Sphere.

As 1 to .523599 :: Cube of D. to the Sphere.

As 1 to 1.909859 :: Sphere to Cube of the D.

As 1 to .282095 :: \odot to Root of a square = to the Area \odot .

As 7 . 22×4 , or 1 . 12.56371 :: \odot . Pq.

As 1. .225072 :: So is P. to the Root of the inscribed sq. in the \odot .

As 1 to .256556 :: P. to the Root Cube of a Solid = the Sphere.

As 1 to .564189 :: P. Root sq. = superficies of the Sphere.

As 1 to 016887 :: Cube P. to the Sphere.

As 1 . 59.217626 :: Sphere, to Cube of the P.

As $7 \times 6. 22$, or 1 to .5236 :: D. cubed, to the solid of a Sphere.

As 22. 7×6 , or 1 to 1.90989 :: Solidity to D. cubed of a Sphere.

A Cone, a Sphere, and a Cylinder, that have the same height and Diameter, if the greatest Circle be equal, are as 1, 2, 3; therefore a Cone is 1 third, and a Sphere 2 thirds, of a Cylinder of the same height

Height and D. therefore, As 1 to 25.1327 :: So D. cubed, to the Cylinder.

7. The Practice followeth. *I.* In surveying and measuring of Land, measure with a Perch or Pole = 16 feet and an half, divided into 100 parts; then by the aforesaid Rules, how many square Perches there are, that is the Area of that Close or Ground, which divided by 160 square Perches (for so many are in an Acre = 40×4) it gives you Acres. the Remainder, accounting 40 Perches for a Rood, are Roods and Perches.

This little Table turns Perches into Acres, Roods, and Perches, upon sight; the Numbers

M.			C.			X.			under ac. are Acres,
ac.	r.	p.	ac.	r.	p.	r.	p.		under r. are Roods,
1	6	1	0	0	2	20	0	10	and under p. are
2	12	2	0	1	1	0	0	20	Perches: The first
3	18	3	0	1	3	20	0	30	Column are either
4	25	0	0	2	2	0	1	0	so many Thousands
5	31	1	0	3	0	20	1	10	under M. so many
6	37	2	0	3	3	0	1	20	Hundreds under G.
7	43	3	0	4	1	20	1	30	or so many Tens
8	50	0	0	5	0	0	2	0	under X.
9	56	1	0	5	2	20	2	10	

As for Example: 7854 Perches are given, which I set down as you see, and take the number of Acres, Roods, and

	ac.	r.	p.	Perches, answering each Fi-
7000	— 43	3	0	gure, and it makes in all
800	— 5	0	0	49 Acres and 14 Perches:
50	— 0	1	10	Sometimes as in small Back-
4	— 0	0	4	fides, Courts, or other small
				places, the measure may be
	49	0	14	by the Foot, and then this

Table turns any number of Feet into Acres Roods and Perches, at the first view, to be operated with Feet, (as the last Ex.) Roods, Perches; the,

C.M.				X.M.				M.		C.		
	a.	r.	p.	f.	a.	r.	p.	f.	p.	f.	p.	f.
1	2	1	7	86	0	0	36	189	3	183	0	100
2	4	2	14	171	0	1	33	126	7	94	0	200
3	6	3	21	257	0	2	30	53	11	05	1	28
4	9	0	29	70	0	3	25	252	14	189	1	128
5	11	1	36	156	0	0	23	179	18	99	1	228
6	13	3	3	240	0	1	20	100	22	11	2	56
7	16	0	11	54	1	2	17	33	25	194	2	156
8	18	1	18	145	1	3	13	232	29	106	2	256
9	20	2	25	225	2	0	10	159	33	17	3	84

the numbers under feet are odd feet; the second Column is one Hundred Thousands, the third Tens of Thousands, the fourth Thousands, and the last Hundreds.

One Superficies is to another as the squares of their like Sides; therefore, As the square of 8.5, to sq. of 16.5; or, As the sq. of 12 (= 144) to the sq. of 11 (= 121) :: So are the Content in Statute Acres, to the Content in Woodland Acres. And, As 144. to 196 :: So Forest Acres, to Woodland Acres. And, As 121, to 196 :: So Forest Acres, to Statute Acres.

II. In measuring of Pavings, Plaisterings, Wainscotings, and Paintings, you use the Yard square; or if you measure by feet and tenth parts, then every 9 feet sq. makes a yard, all of them require the whole superficies, therefore you must measure wherever the plane or brush goes. The Paviers must lay good Foundations, and ram well; the Plaisterers work with good Materials and Size; the Wainscoting well wrought; and the Painters to lay a good Ground, and work with Oyl and White Lead.

III. Carpenters work, as Flooring, Partitioning, Roofing, and so Tiling, Slating, nay, lately in London, the Ground-plot of whole Buildings, are measured by the square of 10 feet = 100 sq feet; so that if you measured by a 10 foot Rod, and every

every foot divided into 10 parts, all will come in to feet, and cutting off the two last figures, the Remain will be Flores or sq. of 10 = 100.

Brickwork is measured by the Perch of 16 feet and an half, the best way is to Measure by the 10 foot Rod last spoken of, and casting up the Area by multiplying one side by another, it will produce sq. feet, which by this Table is presently brought into square Perches. The first Column are Feet, or Thousands or Hundreds, or Ten Feet, as the either so many X.M. second, third, fourth, and fifth Columns answer.

X M.			M.			C.			X.	
p.	q.	f.	p.	q.	f.	p.	q.	f.	q.	f.
1	36	2 63	3	2	41	1	3	1	10	
2	73	1 58	7	1	26	2	6	2	20	
3	110	0 53	11	0	5	1	0	26	30	
4	146	3 55	14	2	52	1	1	57	40	
5	183	2 40	18	1	31	1	3	20	50	
6	220	1 35	22	0	10	2	0	52	60	
7	257	0 43	25	2	57	2	2	14	1	2
8	293	3 41	29	1	36	2	3	47	1	12
9	330	2 25	33	0	15	3	1	10	1	22

Exam. In 36542 square feet, what perches, quaters, and feet? *Ans.* 134 perches, 0 q. 57 feet.

This supposeth that the
 30000 110 0 53 brickwork is brick and
 6000 22 0 10 half thick, but if the wall
 500 1 3 20 be more or less thick, ac-
 40 40 count it by half bricks, as
 2 2 3 for brick and half, 4 for
 2 bricks, 6 for 3 bricks &c.
 134 0 57 and say, As 3, to any other

wall in half bricks :: So are the perches found by measure, to the perches to that other wall in half bricks. *Note,* That 272 one quarter of square feet is a perch, 68 one quarter, 136 half, and 204 three quarters. Tapestry

Tapestry is measured by the Stick = 27 inches
or 3 quarters of a yard, in a Stick = 729 square
inches. This Table gives *Sticks*, *Quarters*, and
Inches, answering to any number of *Square*
Inches measured by *Inches*.

	X M			M			C.	
	s	q.	inch.	s.	q.	inc.	q.	inc.
1	13	2	159	1	1	88		100
2	27	1	135	2	2	177	1	18
3	41	0	112	4	0	84	1	118
4	54	3	89	5	1	172	2	36
5	68	2	65	6	3	79	2	136
6	82	1	41	8	0	168	3	54
7	96	0	19	9	2	74	3	154
8	109	2	176	10	3	161	4	72
9	123	1	153	12	1	70	4	172

Board, Glass, &c. are measured by the foot,
divided into 10 or 100 parts, or by inches and
10 parts, and then this Table will turn the

	M.			C.			X.	
	f.	q.	inc.	f.	q.	inc.	q.	inc.
1	6	3	28	0	2	28		10
2	13	3	20	1	1	20		20
3	20	3	12	2	0	12		30
4	27	3	04	2	3	04	1	4
5	34	2	32	3	1	32	1	14
6	41	2	24	4	0	24	1	24
7	41	2	16	4	3	16	1	34
8	55	2	08	5	2	08	2	8
9	62	2	00	6	1	00	2	18

Inches Square into *Feet*, *Quarters*, and *Inches*,
9842 sq inches = 68 f. 1 q 14 in.

	f.	q.	inc.
9000	62	2	0
800	5	2	8
40		1	4
2			2
<hr/>			
	68	1	14
	In.		

In ei-her Board or Glais, if the breadth be gi-
ven, to find how much of that breadth will
make a foot in length. Divide 1 by the breadth
in feet and 100 parts, the Quotient gives part of
a foot; if by inches, divide 144 (12×12) by
inches and parts.

If you measure by inches and 8 parts in the
Figure adjoyning, you may turn them in feet
and 10 parts by inspection, the two middle lines
being inches and 8 parts, above you have feet
and 10 parts, below Timber measure.

Note III. Stereometry, or measuring of Bo-
dies, has two Multiplications or three Dimen-
sions, and is valued by the Cube of some famous
measure; as an inch Cube, a foot, a yard, or perch
Cube.

A perfect Cube is known, by multiplying the
side into it self, and that product by the side
again.

A Parellepipedon, or an oblong Cube, a Pris-
ma, or a Cylinder or Pillar; first, get the super-
ficies at the end, and multiply that by the height
or perpendicular, from the top of the body to
the plane below.

A Pyramid or Cone is measured by the super-
ficies of the Base, multiplied into one third of
the height.

The five Regular Bodies, *viz.* Tetrahedrum,
Cube, Octohedrum, Dodecahedrum, and Icosa-
hedrum, are measured as in the Table. Say,

			As 1 . side of the Dod :: So
	<i>Cube. Side.</i>		.778 . Cube.
<i>Tet.</i>	.490 2.040	As 1 . Cubat. of the Dod ::	
<i>Oct.</i>	.778 1.285	So 1.285 . Side.	
<i>Cube</i>	1.000 1.000	The Cubatrix multiplied	
<i>Icos.</i>	1.318 .771	into it self twice, gives the	
<i>Dod.</i>	2.003 .507	Solid, and is the Cube Root	
		of that solid body.	

To measure the Frustrums or parts of Pyra-
mids

mids or Cones, (as tapering Timber is) supply the Pyramid or Cone, saying, *As* differ. of the breadth at the two ends, *To* the length between them : : *So* the breadth of the greater end, *To* the whole length of the Pyramid or Cone.

This gives you the length of the top-part; find as before the solidity of the top-part, and the whole severally, subtract the solidity of the top from the whole, leaves the solid. of the Frustum. *Fontana* found the Obelisk, by him removed to *St Peters*, to weigh 529 Tuns, 11 Hundred, 2 Quarters, and 3 pound, *Averdupois*.

The usual way for this tapering Timber, is to measure the superficies in the midst, and multiply it by the length, which though is be a false Rule, yet if it be done at many lengths, suppose at every 5 or 6 feet, it will be very near.

All bodies one to another are in proportion as the Cubes of their like Sides

The measuring of all bodies that have curved superficies, or plain-curved, follows.

Spheres, Cylinders, and Cones, you have their dimensions and measures amongst the dimensions of Circles and round Figures in Plainimetry.

To measure the Truncus or part of a Cylinder that leans, take the superficies of the Circle, and adding the longer and shorter sides of the Truncus, take half, let that be the height.

The sector of a Sphere is measured, by multiplying its superficies spherical by one third of the height.

The segment of a Sphere, measure it as if a Sector, and subtract from the Sector the solidity of a Cone, whose Apex is in the Centre, and Base the Area of the Segment.

The solidity of a Spheroid is gotten, by multiplying the greatest Circle into two thirds of the Axis about which the Spheroid is made.

The

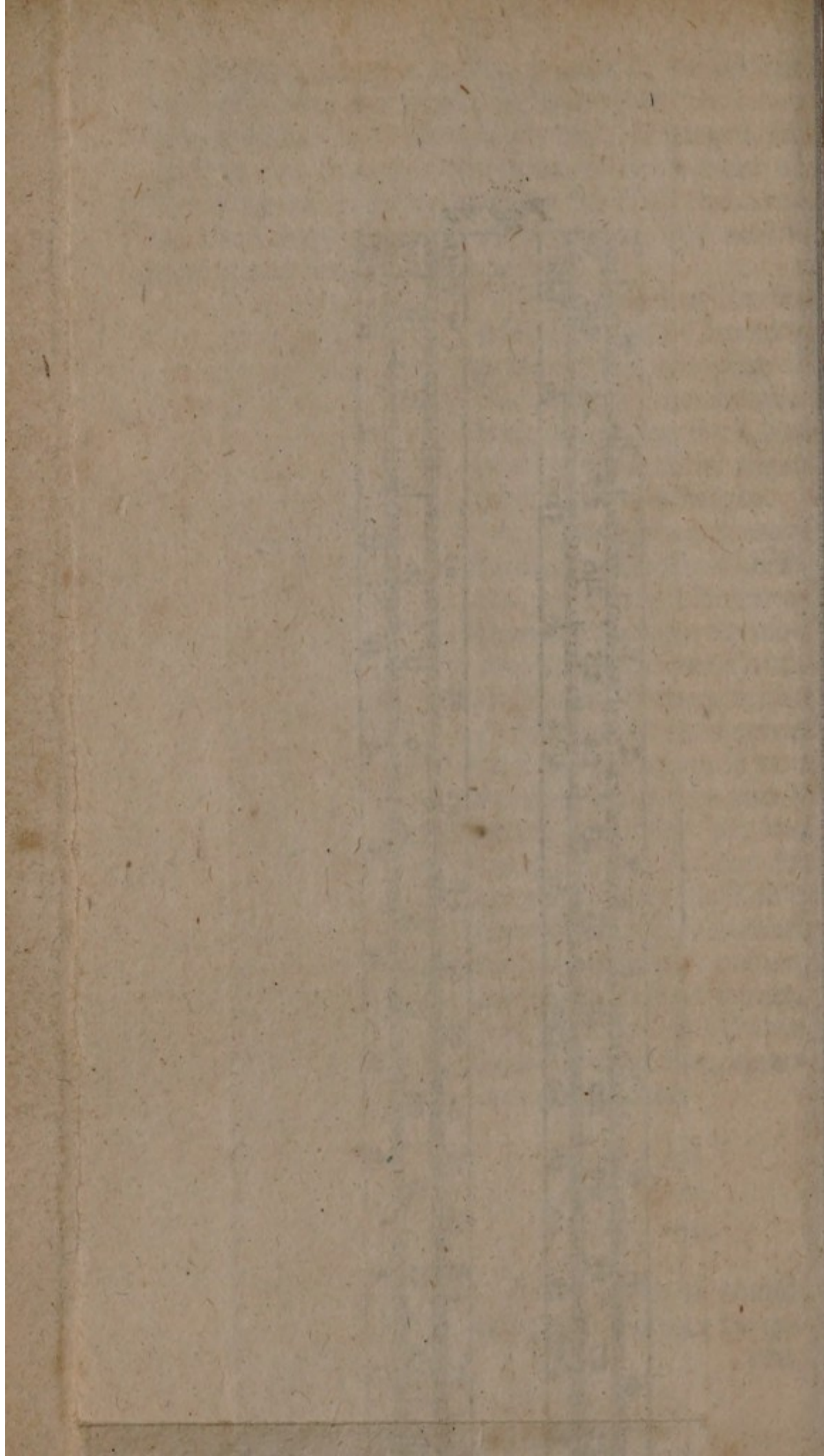
The solidity of the Trunk of a Spheroid cut off with two Circles at right Angles with the Base, such as our Wine Cask are, is gotten, by adding two thirds of the Area of the Circle at the bung or middle, and one third of the Area of the Circle at the head together, and multiplying the sum by the length.

The solidity of an obtuseParabolical Conoid is gotten by multiplying of the Area of the circular Base in half the Axis, but of an Acute one into eight fifteens of the height.

2. The practice of measuring Solids follows; first, for measuring Timber or Stone by the foot divided into 10 or 100 parts, multiply as before taught, the Answer will be in feet and decimal parts; and if you measure by inches and 8 parts, you may put the measure into feet and decimal parts by the Table annexed. But if you must measure by inch measure, cast all up in solid inches, and then by this Table find the solid feet, quarters and inches.

324		3 qu.
216		2 qu.
108		1 qu.

If any piece of round or square Timber be given,



ven, and it be desired what length of it will make a foot, divide 1728 by the inches square at the end, it answersthe Question.

		X M.	M.	C.
		f. q. in.	f. q. in.	q. in.
But if you have	1	5 3 64	0 2 136	0 100
the superfic. Con-	2	11 2 128	1 0 272	0 200
tent at the end	3	17 1 192	1 2 408	0 300
of the Timber or	4	23 0 256	2 1 112	0 400
Stone, and desire	5	28 3 320	2 3 248	1 068
to know the so-	6	34 2 384	3 1 384	1 168
lidity of one foot,	7	40 2 16	4 0 88	1 268
the Table fol-	8	46 1 80	4 2 224	1 368
lowing will give	9	52 0 144	5 0 360	2 036
it you quickly.				

Exam. A piece of Timber at the end is 836 square Inches, what Timber in one foot in length. *An.* 5 foot 3 quarters in every 12 inches.

800 — 5.555

30 — .208

6 — .041

5.804

This Table is of Excel- lent Use.	In Feet & Pts.	
	1	.00694444
	2	.01388888
	3	.02083333
	4	.02777778
	5	.03472222
	6	.04166666
	7	.04861111
	8	.05555555
	9	.06250000

In the last figure upon the edge you have a Line called *Timber Measure*, by which, and the length of any square Timber, you may find the content; thus in stead of the side of your Timber in inch measure and parts, take that of this Line, and multiply that by the length gives the measure.

The *General Rule* for measuring of Timber that is not square at the ends, is to add both the sides, and take half for the side of the true squ. but this is Erroneous, and so much the more as the

the sides are more unequal, therefore the Area of the end is to be taken. The other Error is in measuring round Timber by girding it, and taking one quarter for the side of the Square equal, but let it be what it will, you must take such measures as the Country useth.

Earth-work, as Cellars, Vaults, &c. are measured by the Yard-solid, *viz.* 27 solid feet, and so much ought to be a Cart-load, and will be contained well; the Carts ought to be 2 feet 8 inches broad at the Axle-tree within, 2 feet high, and 5 long.

All Banks that are made to hold out the Sea or Rivers, and all Ramperts, Perapets and Motes, and New Rivers, are wrought by the Flore, consisting of 18 feet square and one foot deep, which is 324 solid feet, which are 12 Cart-loads, the fo-

	X M.			M.			C.		
	Fl.	qu.	fe.	Fl.	qu.	fe.	Fl.	qu.	fe.
1	30	3	37	3	0	28	0	1	19
2	61	2	74	6	0	56	0	2	38
3	92	2	30	9	1	03	0	3	57
4	123	1	67	12	1	31	1	0	76
5	154	1	23	15	1	59	1	2	14
6	185	0	60	18	2	06	1	3	33
7	216	0	16	21	2	34	2	0	52
8	246	3	53	24	2	62	2	1	71
9	277	3	09	27	3	09	2	3	09

	Fl.	qu.	fe.	
7000	— 21	2	34	solid feet, this Table shews
800	— 2	1	17	the Floors <i>quarters</i> , and
57	— 0	0	57	Feet ; 7857 solid feet will
	24	0	27	make 24 Floors, as you
				may see in this Example.

For measuring Ships, multiply the length of the Keel, the breadth of the Mid-ship Beam, and the depth of the Hold, together, divide by 100, it

it gives you the Turns, or instead of the depth it is usual to take half the breadth instead thereof: But for Merchants that allow nothing for Guns, Masts, &c divide by 95. This may give a guess at the Tunnage, but there is a great deal more required to give the true measure of a Ship, or the burthen she will bear in salt water, for in fresh water the Ship will sink more.

To double a Cube, or to give the Cube Root of a Cube that shall be double to another given, double the Cubick Inches and parts of the Cube given, extract the Cube Root; and thus by knowing the measures of the Ship of one burthen, to make another Ship of the same mould which shall be double, treble, &c. or any proportion more or less, multiply the measure of the length, breadth, and depth in solid feet, then double, treble, &c. the feet, and extract the Cube Root.

The next thing is concerning the solidity and proportion in Weight, several Metals, Minerals and Water, have one to another.

Note IV. Concerning Metals, and of the manifold uses of the Table, *page 17.*

1. If you have the magnitude of any body in solid inches, and desire to know the weight of it in Troy ounces: As 1 is to the number of Ounces and Decimal Parts answering the Metal, Stone, &c. in the Table A :: So is the Cubick Inches given, to the Ounces in weight required.

2. If you have two several Bodies named in the Table, both of the same magnitude or capacity, together with the weight of one, to find the weight of the other: As the number in the Column A answering the first, to the number of the second :: So the weight of the first, to the weight of the second.

3. The uses of the Column B are likewise

D

two,

two ; 1. To know the magnitude in Inches of any Body by the weight in Ounces : As 1, to the inches and parts in the Column of the Metal, &c. proposed :: So the weight given, to the inches in magnitude sought.

4 Two several Metals, Stones, &c. both of one weight, and the bigness of one in inches ; say, As the number in Column B standing against the first, is to the number against the second :: So is the magnitude of the first, to the magnitude of the second in inches.

5. The uses of the Column C shews the weight that every inch of the several Bodies will weigh in water. From *Archimedes* we may say, That all Bodies let into water, are either heavier, equal, or lighter, than so much water equal the magnitude ; if heavier, then the body will sink ; if equal, then the bodies utmost surface will swim even with the top of the water ; if lighter then so much of the body will sink into the water, so as the quantity of water which might be equal in bulk to so much body as shall sink, shall weigh equal to the weight of the whole body proposed. Again, a body heavier than water, is lighter in water when weighed, by the weight or so much bulk of water equal to that body : Hence it is easie to discern the weights of several bodies in and out of water by the Columns A and C, A is the weights in Air, C in water, where it is plainly seen, that Gold being scarce, the half quantity of Silver or Brass doth scarce lose half so much of its weight as Silver or Brass will ; and from this consideration *Archimedes* judged of King *Aiero's* Crown. By the Column C, As 1 is to the number answering the body :: So is the solid inches of any body given, to the weight in water.

Now it will be convenient to give you these Tables for converting solid inches into weights of water Averdupois.

The

the first	(1.)	(2.)
turns solid	1 0.579522	1 1.72555
inches of	2 1.159044	2 3.45112
water into	3 1.738566	3 5.17668
ounces A-	4 2.313088	4 6.90224
verdupois.	5 2.897611	5 8.62780
The second	6 3.477133	6 10.353.6
turns oun-	7 4.056655	7 12.07892
ces Averd.	8 4.636177	8 13.80448
of water in-	9 5.215699	9 15.53004
to solid Inc.		

Averdupois Ounces.

Inches and Parts.

Example. In an Ale-Gallon = 282 solid inches, how many ounces Averdupois?

Ans. 163 ounces.426 = *By the (1.)*
 16 l 3 ounces .426. 200--115.904406
 So in 500 ounces of wa- 80-- 46.361776
 ter, there is 862.78 solid 2-- 1.159044
 inches by the (2)

And in a foot solid, there 163. .426
 will be answering 1728 solid inches, 62 l 9. ounces 414.

The nearest proportion in Troy weight, that 36 solid inches will hold 19 ounces Troy of water, and one pound Troy of water will fill 22.7368 inches, and one pound Averdupois 27.609. A foot square of water is equal to 76 pound Troy.

Hence is found a very good way for measuring any irregular body, that by no Mechanical Art otherwise can be done. Fill any Vessel brim full of water, and then dipping in your body, receive carefully all the water that runs over, and weigh it, and by the last two Tables turn that weight into solid inches. Otherwise, if your Vessel be regular that holds the water, observe the rising of the water, and find the solid feet or inches answering.

Hence it is, that expert Builders of Ships have great consideration of all the premises in this

Section, for by the weight of the Ship, and all Appurtenances, they judge to what depth she will sink ; and herein the ingenious Sir *Anthony Dean*, one of His Majesty's Commissioners of the Navy, has exercised abundance of Skill, though for all the Art one can have, long experience and good judgment will be required, for as I had it from the said Sir *Anthony Dean*, that the proportion betwixt dried Oak and fresh Feld, is as 14 to 17, So that considering the strange forms of the Bodies of Ships, and many such and more accidents, as that before of Oak wet and dry, it is a difficulty insuparable, to give to an inch the depth a Ship will draw when rigg'd and fitted out.

Lastly, if it be proposed to make a piece of Iron swim in pure water, you must make it so hollow, that it may be capable to hold as much water that will be equal in weight to the Iron and something more.

Note V. Of Gauging of Vessels. The Gallon, which is the ground for this Work, take as it is now allowed and used ; Gallon for dry measure is 272 solid inches and a quarter ; for Wine 231 ; for Beer and Ale 282.

		X M.			M.			C.			X.		
		g.	p.	in.	g.	p.	in.	g.	p.	in.	g.	p.	in.
I.	Sol. Inches into Wine G.	1	43	2	9	4	2	18	3	13			0
		2	86	4	13	8	5	7	6	26			20
		3	129	6	27	12	7	26	1	2	11	1	1
		4	173	1	8	17	2	15	1	5	24		11
		5	216	3	17	21	5	5	2	1	9	1	21
		6	259	5	26	25	7	23	2	4	23	2	2
		7	303	0	6	30	2	11	3	0	6	2	12
		8	346	2	16	34	5	3	3	3	19	2	22
		9	389	4	25	38	7	20	3	7	5	3	3

X M				M.			C.			X.	
	g.	p.	in	g.	p.	in.	g.	p.	in.	p.	in.
1	35	3	24	3	4	13	0	2	29	0	10
2	70	7	13	7	0	26	0	5	23	0	20
3	106	3	2	10	5	3	1	0	18	0	30
4	141	6	26	14	1	16	1	3	14	1	4
5	177	2	15	17	5	29	1	6	5	1	14
6	212	6	4	21	2	7	2	1	0	1	24
7	248	1	28	24	6	29	2	3	30	1	34
8	283	5	17	28	2	33	2	6	24	2	8
9	310	1	6	31	7	11	3	1	18	2	18

III	Inch. into dry Measure.	1	36	6	4	3	5	14	0	2	32	0	10
		2	73	4	8	7	2	28	0	5	30	0	20
		3	110	2	12	11	0	8	1	0	28	0	30
		4	147	0	16	14	5	22	1	3	26	1	6
		5	183	6	20	18	3	2	1	6	24	1	16
		6	220	4	24	22	0	16	2	1	22	1	26
		7	257	2	28	25	5	30	2	4	20	2	2
		8	294	0	32	29	3	10	2	7	18	2	12
		9	330	7	2	33	0	24	3	2	16	2	27

So that by these three Tables, if you cast up the Content of any Measure or Cask into solid Inches; you may easily find the Gallons under *g.* Pints under *p.* and Inches under *in.* either for Wine by the first, Beer and Ale by the second, and dry Measure by the third. One Example for all:

In Wine, suppose	9845				
Inches, it will make	42	9000	— 38	7	20
Gallons, 4 Pints, and	26	800	— 3	3	19
Inches.		45	— 0	1	15

Thus for all Bushels,
Pecks, and all other Mea-
sures in Cylinders, get
the Area of the Circle in Inches, and multi-
ply

ply it by the length, it gives the solid Inches. For the Area, say, As 1 . 0.78539 :: So Dq . Area. Or easily by the Logarithm, Add the Log. of the Diameter doubled, to this Log. $\bar{9}$.895085, it gives you the Area desired: But in measuring the Spheroid or Hogheads, and other Vessels so figured (as you were taught before) you must take two Thirds of the Area of the Circle at the Bung.

Viz. As 1 . 0.5236 :: So Dq to two Thirds of the Area.

And, As 1 . 0.2618 :: So Dq. to one Third of the Area.

The Logarithm for two Thirds is $\bar{9}$.718999, for one Third $\bar{9}$.417969, to be used as before.

If you will not measure by Inches, but by a Gallon Rod, you must take the Cube Roots of 272,25, of 231 and 282, which are 6.481, 6.134, and 6.557, and making Scales of Gallons, yet these Measures by Compasses taken from a Diagonal Scale of an Inch, upon your Ruler exactly, and divide the same into 100 Parts, so is your Rod fitted to measure by Gallons and 100 Parts. *Ex.* A Vessel at the Head by the Rod 3 Gallons, whose square is 9, at the Bung 5,5, whose Square is 30.25, say As 1 . 9 :: 2618 . 2.336 = one third of the Area; and, As 1 . 30.25 :: .5236 . 15.839, two thirds of the Area at the Bung; and 2.336 + 15.839 = 18.145: Now 18.195 x 6.8 the length, produceth 123.73, that is, 123 Gallons, and almost 6 Pints.

Here is a Printed Figure has all the 3 Lines, Wine Measure, Beer and Ale Measure, and Dry Measure; the first two are one third of the Area's, the last for Cylinders is the whole Area; on either edge is a Line of 8 Inches, every Inch into 10 Parts, the Scale is broken into 5 Parts, which make 40 Inches; by an Example it will be plain.

A Vef-

A Vessel of Wine, at the head 18 inches, at
the bung 32 inches, length 30 inches,

I seek 8, I find it in the second Row 3642, and
37 in Wine Measure; for a third, against 37

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	40	32	24	16	8	0	
1	50	5	I	50	20		1
2	40	I	I	60			2
3	30	3	I	70			3
4	20	2	I	80			4
5	10	I	I	90			5
6		4	I				6
7		3	I				7
8		2	I				8
		I	I				
		3	I				
		2	I				
		I	I				
		4	I				
		3	I				
		2	I				
		I	I				
		4	I				
		3	I				
		2	I				
		I	I				
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I find 1.16, which doubled gives 2.32; now
 $.374 \times 2.32 = 2.69 \times 40 = 107.60$, which is 107
 Gallons and an half.

For Dry Measure take the whole Area, be-
 cause of Cylinders.

At the later end of the Book I have inserted
 Mr. *Philips* his Table for the Gaging of Wine-
 Casks that are not full, it is made to Gallons and
 half Gallons, and by proportioning may go near-
 er. Find the Content of the whole Cask, and find
 how deep the Liquor is within the Cask; say, As
 the Diameter at the bung in inches, to the depth
 of the Liquor :: So the Rad. of the Table 10000,
 to the Proportional Part. Find in the Table the
 Gallons and Parts that answer that Part Propor.
 then say, As 63 Gallons the Gallons of the Rod,
 is to the proportional Gallon found :: So is the
 Content of the whole Cask, to the Content of
 the Liquor in the Cask.

§. 5. This Parapgraph shews Rules of Practice,
 1. In the Embatteling and Ordering of Soldiers;
 2. In the Quartering and Encamping; 3. In
 Fortification; and, 4 In Gunnery

1. Though this Curiosity to a skilful Sergeant
 Major will not be material, yet to a young begin-
 ner, and even to the better practised Soldier, it
 will be helpful.

To order Soldiers into a square Battle of Men,
 take the square Root of the Number, that shall
 be the side both for Rank and File: But if they
 be to be ordered into a double Battle, take the
 square Root of half the Number, and that will be
 the number in File, and twice so many in Rank,
 and if it be demanded to order them for times
 as many in Rank as in File, take the square
 Root of a fourth part.

To order them into a square Battle of ground,
 you may distinguish them into Order and open
 Order:

Order: Order, when the Centres of their places are distant 3 feet and an half in Rank, and 7 in File; open Order, when the Centres are 7 feet both ways. If it be a square Battel of Ground, and the Centre of their Distances in Order, then As 1 . 2 :: So the Number of Men, to another Number, whose square Root is the Number of Men in Rank: So by the help of extracting of a square Root, these sort of Questions are easily resolved.

2. For the Quartering and Encamping of Soldiers, called *Castramentation*, it is requisite the Quarter-Master General be skilled in Measuring, and all the under Quarter Masters ought to be skill'd at Foot Measure, that they may lay out their Quarters as directed.

Three hundred feet is the common Allowance for the depth of ground that a Regiment, whether of Horse or Foot, should take up, the wideness must be answerable to the number of Men Two hundred feet for the Huts in length, and one hundred for the Commanders and Sutlers before them; every two Soldiers to a Hut 8 feet broad and 8 deep, two feet one Hut from another, so that there may be 20 Huts stand in the 200 feet; the Alley betwixt Hut and Hut may be 8 feet, that is, 16 feet in width and 200 in length for 40 men, which is 3200 feet, and for the 100 feet more 1600 feet, in all 4800, and there must be 25 Rows for 100 Men; so that for a Regiment of 1000 Foot, with Officers and Sutlers, will take up 120000 feet, which by the Table afore-going, for turning Feet square into Acres, will be 2 *ac.* 3 *r.* which, because of ways, may be made 3 *ac.* of Ground for every Regiment, which may be 350 feet deep, and 370 wide, or near 360 square.

Now if 1000 Men, Officers, Sutlers, Highways and all, take up a square of 360 feet, how

many feet shall the side of a square be, to lodge 10000 Foot Men? &c. Say, As 1000 . 10000 :: So is the square of 360 = 129600, to the square 1296000, whose Root is the feet required, viz. 1138 feet, which is very near 30 Acres of Ground.

For Quartering of Horse, you must keep the same depth of 300 feet for all, and take 200 feet for the Huts, the Horse Huts must be 10 feet deep and four wide, 12 Horses will stand in a Hut together, which is 48 feet long and 10 wide, and 6 feet a Street; the Huts for the Troops will be 6 for 12 Troops, and so imagine a Regiment consist of 8 Troops, 50 to a Troop, it will take up, leaving 20 feet Streets and Crossways, very near as much Ground as the Regiment of Foot, ways and all, 360 feet = 3 Acres; so that 10 Regiments will take up 30 Acres: You may very well allow as much ground, as both Horse and Foot will take, for the General, Train of Artillery, Victuallers, &c, and Parade places; so that 120 Acres will well Camp 15000 Horse and Foot, and all Provisions besides. From these Considerations, you may be enabled to Encamp an Army.

Note III. Concerning Fortifications; by custom and use (neither great nor small Shot bringing such danger as the Fear) Forts and Fortifications are less considerable, and are taken in a short time; therefore the late Engineers have thought it to lay open the Flanks, and to dispose the Works, so as they may receive more Cannon, that the Enemy may be kept back from approaching too fast, for all that can be done is to get and obtain time.

I have not room to enlarge, you may peruse *Modern Fortifications*, and there you may find several Varieties.

I will

I will set down these two Tables, and their Uses, which are so short and plain, and will be at hand, that more shall not benEEDED, supposing the Reader already seen in the Rudiments of the Art.

Table I.

Capital,	Gorg	Flank,	Curtain.
333	200	150	600

Table II.

	4	5	6	7	8	9	10
Capital.	398	437	367	333	312	300	291
Gor. Li.	155	196	203	242	252	260	363

Both the Tables supposeth the Interior Polygon to be divided into 1000 Parts. Then if you desire that the Flanks shall stand at right Angles with the Curtain, then by *Table I* if your Figure be an Hexagon, divide pp (*Fig. 16*) into 1000 Parts, make pa 333, pc 200, and raising ef at right Angles to pp , make it 150, draw fa the Faces, and cc the Curtain, you may complete the Work: But if you will not make the Flank at right Angles to the Curtain, but open it a little, and have no second Flank, according to *Travaux de Mars*, set off the Capital and Gorg. as before, raise the Flank at 98 degrees to the Curtain, and laying your Ruler on a , & c . draw the Faces.

Note: That this Proportion is one Third of the Interior Polygon for the Capital, and if you use one Fifth or one Seventh for the Gorg. and Flank, it will be well.

The second way sets the Flanks at right Angles to the Lines of Defence. For *Example*: In *Fig. 17*. let it be an Heptagon, divide the Side into 1000 parts, look in *Table II*. under 7, set off 333 for the Capital, and 242 for the Gorges, draw occult Lines from a to c , which are the Lines of Defence, and raise Perpendiculars from the Points c , and draw ef for the Flanks,

Flanks, and *f a* for the Faces; this being well understood, may be applied likewise to Irregular Figures.

The fourth and last *Note* concerns *Gunnery*, or the Qualifications that able Gunners ought to have.

First, He ought to have competent Skill in *Arithmetick*, to keep his Accounts fair, and to enter in his Diary all notable Shots and Occurrences in his Art, to be able to cast up the quantity of Powder fit for each Piece, the weight of Shot of all sorts. whether Lead, Iron or Stone; to work the Golden Rule in Proportions, to extract the Cube Root, which are formerly taught in this Book: He ought to have Skill in *Geometry*, to take Heights and Distance, to know the Divisions of his Circle, Quadrant, and Quadrate, to know how to Level, and to lay Platforms, and to raise Batteries; and though ordinary Gunners may be excused from all this Knowledge, yet Master-Gunners, and those that desire to be knowing in this Profession, must not hereof be ignorant.

He must know his Piece and Name, which are taken from the height of the Bore, as in this following Table annexed, which gives in the first Column the Names of the Pieces; next, the weight of fortified Guns; the third, the height of the Bore; the fourth, the height of the Shot; the fifth the weight of the Shot; the sixth, Powder for Proof; the seventh, Powder for Service; the eighth, Paces (5 foot to a Pace) the Piece shoots point-blank upon the Level; the ninth, the utmost random the Piece mounted to 45 degrees; the tenth, the Horses; and the eleventh, the Men required to draw a Piece.

Names.

Names.	Guns weight.	Height bore.	Height shot.	Weight of shot.	Powder for proof.	Powder for service.	Paces point Blank.	Utmost Random.	Horses to draw.	Men to draw.
	C			li.	lib.	li.				
Can. 8.	70	8	7.57	63	28	23	180	1800	18	100
Can. 7.	60	7	6.75	12	24	18	180	1800	16	80
Dem C.	50	6.3	6.05	32	20	15	180	1800	12	60
24 l.	40	5.87	5.62	24	17	11	180	1810	10	50
Culv.	40	5.32	5.07	18	14	10	184	1840	8	50
12 l.	35	4.46	4.64	12	10.5	8	178	1780	6	40
Dem. C.	30	4.25	4.03	9	9	7	175	1750	6	35
Saker.	20	3.58	3.40	5 ¹ / ₄	5.25	4	160	1600	4	25
Minion	12	3.35	3.18	4	4	3	120	1200	3	16
Falcon.	5	2.68	2.54	2 ¹ / ₂	2	1.5	106	1200	2	10

Next he must learn from some Gunner the Parts of a Piece of Ordnance, the *Caliber* or height of the *Bore*, the *Hollow Cylinder*, the *Chamber* from the touch-hole to 2 feet or 18 inches where the Powder and Shot lie, the uppermost part next the Breech is the *Base Ring*, those Rings from whence the Piece grows less are called the *Freezes*, the uppermost of the Metal or *Freeze* at the Mouth is called *Muzzle-Ring*; those two knobs that hold the Piece in the Carriage are the *Trunions*, the thickness of the Metal is commonly measured at the Touch-hole, the Trunions, and the Neck: And all these as the measure of Ladles, the length and the thickness, and bigness of the Carriage, the Trunions and many other things, were formerly taken from the height of the bore. He must also
be

be ready at all the Names about the Carriage of his Piece, *viz.* to know the Sides or Cheeks, the Axtree, Spokes, Nave, Hoops, Tranfomes, Bolts, Plates, Hooks to draw by, the Clout, the hole for the Linspin, the Shafts, the Thill and Thill-bolt, the Fore-locks and Forelock Keys, Cap squares, the Fore-lock Pins and Chain, the Pintle and Bolt-hole, the Fellows, Nayles, Bars over the Fellows, Stirrops, the Ruts of the Wheel, Dowledges, Beds, Coins, Levers, Handscraws, &c. and to have ready his Ladles, Spunges, Cartridges, whether of Paper or Canvas, Formers of all sorts, Sheepskins to make Spunges, Powder, Shot, Needles, Thread, Starch, Marlyn, Twine, Nails, Handspikes, Crows of Iron, Budg barrels, Baskets, &c. These being the General things he is to know and have ready, he is in particular.

1. To *Tertiate* his Gun, that is to know the thickness of the Metal, at the Touch hole, Trunion and Neck, by which you judge at the strength of the Gun, whether well fortified or no, this you do with a Coliper pair of Compasses, and if the Piece be home bored, the Diameter less by the height divided by 2 is the thickness at any place, he must search his Gun for honey-combs with a searcher, or by reflection of a Looking-glass, that the Trunions be well placed, that the Piece be neither top-heavy or otherwise, whether the Piece be bored away or no.

2. To *Dispart* his Piece, that is, to set such a mark upon the Muzzle Ring or thereabouts, that a sight line taken upon the top of the Base Ring against the Touch-hole by the mark set at or near the Muzzle may be parallel to the Axis of the Concave Cylinder. To do this, rake the Diameters of the base Ring, and the

the place at the Muzzle where you intend the Dispart to stand, divide the Difference of these two into two equal parts, and one of them will be the Dispart, which set upon the Gun with Pitch or Wax, or which is the best way to name a Dispart as you see in the *Fig.* (18.) and tie it about the neck of the Gun with Marlyn or Twine: But if you have not Compasses, measure the Circles about, and work with them.

3. To be knowing in the weights of his Shot, which he may do by knowing the weight of one; as a Bullet of Iron of 4 inches Diameter, is found by Experience to weigh 9 l. Say, as the Cube of 4 is to 9 l. so is any other Diameter Cubed to its weight: or as 9 l. is to the Cube of 4, so is any other weight to the Cube Root of its Diameter. Lead and Iron are in their weight near, as 2 to 3, that is, a shot of 2 l. of Iron, and a shot of 3 l. of Lead will have the same Diameter or height. Iron to Stone is as 3 to 8, Lead to Stone as 4 to 1, that is, a Bullet of Stone of 10 l. is equal in height to a Bullet of Lead of 40 l. Therefore knowing what a Bullet of Iron or any Diameter weighs, you may find the weight of a Bullet of the same Diameter of Lead or Stone, by saying, for Lead having the weight of 9 l. of Iron for 4 inches: if 3 give 2, what shall 9, 6? And for Stone, if 8 give 3, what shall 9 l. 3, 37? And so of any other: if more exactness be required, seek for it in the Table of Metals, *Page* 17.

4. As the Shot is regulated by the Cubes of the Diameter, so is the Powder; suppose one pound and half of Powder be a charge for a Falcon of 2, 68 Bore or Diameter, what weight in Powder will be fit for a charge of Cannon of 7. Say, as the Cube of 2, 68, to 1, 5 l. of Powder, so Cube of 7 to 26.

The

The Logarithms facilitate this work, the Log. of 2, 68 is 0.428135 $\times 3 = 1.284405$ of 1, 50 176091. of 7 is 0.845098 $\times 3 = 2.535294$ now 0. 176091 4 2535294 $= 2.711385$ ——— 1 284405 $= 1.926980$, which is the Log. of 26, 73, which is much above the allowance.

5. To know whether his Piece be true bored, the Master Gunner must shew him, for that is only practice, by taking the differences of the Disparts from a fitted Cylinder of Wood for the Bore.

6. For the shooting in great Guns, and the knowledge of the true distance that any Piece will carry to, is a matter that depends upon many uncertainties, an exact answer will never be given to such questions there is such varieties in the trunels of the Bore, in the heights of the Shot, in the levelling and direction, in the Air, wind, &c. But for all these difficulties an able Gunner will go near the mark, and he considers *Point blank*, or *Right Ranges*, the *Middle Ranges* and *utmost Ranges*; the former Table gives you the level Ranges of each Piece, under the Title of Paces point Blank, five feet to a Pace, which is the best distance for Batteries; the same gives you the utmost Random accounted near ten times the former level Range; and for all other Mountures while Gunners have agreed, which I shall not live to see, take this Table to every six points of the Gunners Quadrant for these Guns, viz. to 450.

	1	2	3	4	5	6
Cannon of 8	750	1275	1590	1710	1785	1800
Cannon of 7	675	1147	1431	1489	1606	1620
Dem. Cannon	625	1062	1325	1425	1487	1500
Culv.	750	1275	1590	1710	1785	1800
Dem. Culv.	725	1232	1537	1653	1725	1740
Saker.	625	1062	1325	1425	1487	1500
Minion.	450	765	954	1026	1071	1080
Falcon.	550	550	1166	1254	1309	1320

For shooting in Mortar-Pieces which are elevated above 45 degrees, and nearer to 90; you must use much practice to come to be perfect, after a shot or two be made you will be best able to judge how you must order your Gun, keeping still to the same Powder, the alteration whereof will alter the shots Random, you may have Tables in most Books of Gunnery, which you may prove and approve.

§. 6. *Problems for Practice of Plain and Spherical Triangles upon the Sphere in Plano; with the ordinary proportion thereupon; Problèmes In Geography and Navigation; Dyalling, a New Projection of the Sphere; a particular Dial.*

Prob. 1. Of these three, the length of a *Perpendicular style* upon an *Horizontal Plain*:
 2. The length of the *Shadow*: 3 The *Altitude* of the ☉ above the *Horizon*, any two being given to find the third, see (*Fig. 19*) Say, as in plain Δ s, as $AC : AB :: \text{Rad. cot. of } ABC$ the upper edge of the ☉ 4 15^t the height of the *Centre*. Turn the *Figure* upwards, it is the same upon a *Wall*.

Prob. 2. Of these Three; 1. The *Meridian Alt.* of the ☉ or *; 2. The *Elevation of the Pole*;

Pole ; 3. The *Declination* of the ☉ or * any two given, to find the third. For Alt. Equinoctial (which is always the Complement of the height of the Pole) — Merid. Alt. = Declination South or Merid. Alt. — Alt. Equi. = Declination N. The greatest Declination is found now constantly to be 23 deg. 30⁴.

Prob. 3 Of these Five ; 1. the greatest Decl. ☉ 3 2 Longitude of the ☉, from the next Equi. point ; 3. the ☉ Right Ascension ; 4 The Decl. ☉ in that place ; and 5ly, The Angle of the Ecciptick, with the Meridian, any two being given to find the rest : For in (*F.g. 20.*) the Δ , \vee ☉ a right \angle at a , \angle at \vee is the first part in the *Problem*, \vee ☉ the second, $\vee a$ the third, a ☉ the fourth, and the Angle ☉ the fifth, any two being given, the other 3 may be found by the Rules for right Angl'd Δ s before taught. Note that the Longitude of the ☉ and its right Ascension from the beginning of *Aries* are true in the first Quadrant, but must be subtracted in the second Quadrant, and added in the third from or to 180 deg. in the fourth Quadrant must be subtracted from 360.

Prob. 4. The *Right Asc.* ☉ the hour of the day, the right Ascension of Mid-heaven, any two being given to find the third, for the right Asc. ☉ 4 Time from Noon = right Asc. of Mid-heaven and Time from Noon = right Asc. of Mid-heaven — right Asc. ☉, and right Asc. ☉ right Asc. of Mid-heaven — Time from Noon.

Prob. 5. Of these Six : 1. Elevation of the Pole ; 2. Decl. ☉ or * ; 3. Altitude of the ☉ or * ; 4. The distance of the ☉ or * from the Meridian ; 5. The Azimuth of the ☉ or * from the North ; 6. The Angle of the ☉ or ☉ shewing its Position in respect of the Pole or Zenith, any three given to find the rest : For in the Oblique angled Δ , Z ☉ N . Z . N . is the complement of the Elevation, the first, N . ☉ the Comple-

complement of Dec. the second, Z. \odot the complement of the \odot Alt. the third: The Angle at N. is the distance of the \odot or \star from the Merid \equiv to the time of the day the fourth, the Angle at \odot is the fifth, and at Z the sixth.

Prob. 6. Of these Five; 1. The Elev Pole; 2. \odot Decl. 3. \odot Alt. at 6; 4. \odot Azimuth. at 6; 5. The \odot Position in respect of the Pole and Zenith; any two given to find any one of the rest, for in the right Angled $\triangle b Y c$. \angle at Y is the first, Y b the second, b c the third Y c the fourth, and the \angle at b the fifth.

Prob. 7. Of these Five. 1. Decl. \odot . 2. Elevation of the Pole; 3. The Amplitude of the \odot rising or setting; 4. The Angle of the Horizon and Merid: at the \odot rising; 5. The time from Midnight, any of these two being given to find any of the rest: for in the right $\angle W d N O$, D N is the complement of Declination the first, N O the second, d O the Complement of the third, $\angle d$ the fourth, 7 N the fifth.

Note, That the Angle at N or $\angle d N \odot$, is the compl. of the Ascens. Diff. which might be found also more clearly in the $\triangle Y f d$, under the Hor.

Note, That the Ascensional Difference turned into time, by allowing for every degree 4' of time sheweth how far the \odot riseth from six a Clock, may be the time of the \odot ris. and setting.

Note, That if the Elevation of the Pole, and \odot Decl. be both either North or both South, then the right Asc. ——— Asc. Diff. = obl. Ascension, and added = oblique Descension; but if the Elevation of the Pole, and \odot Dec. be the one North and the other South, then add for the oblique Ascens and subtract for the Descension.

Note, For the Not-rising or Not-setting of certain Stars. 1. If the Elevation of the North Pole be greater than the Complement of the North Declination, then that Star setteth not, or
than

than the South Decl. then the Star riseth not, and if the Elevation of the South Pole be greater than the Complement of the South Declination of the Star, then that Star setteth not, if greater than the North Declin. then that Star riseth not

Note, That if you double the ☉ setting it is the length of the day, ☉ rising the length of the night, and half of that is the semi diurnal Arch.

Note, Because the obtaining of the Hour and Azimuth is very useful by taking the height of the ☉, I will here set down an *Exam.* of them both, after the manner of the last *Problem* in Spherical Δ s. In the Lat. $51. 30.$ the ☉ height 32° the Decl. 18° first for the hour, then the Azimuth.

Hour.

Co. pole $38\ 30$ ar. si. 0.205850

Co. Dec. $72\ 00$ ar. si. 0.021723

X — $33\ 30$

Co. Ht — $58\ 00$

Z — $91\ 30$

X — $24\ 30$

Half Z $45\ 45$ sine 9.855069

Half X $12\ 15$ sine 9.326699

Z. 19.409368

Sine $30^\circ\ 26'$ half Z. 9.704684

The hour 8 a Clock and 1 min.

Azimuth.

Co. pole $38\ 30$ az. si. 0.250850

Co. Ht. $58\ 00$ az. si. 0.071579

X — $19\ 30$

Co. Dec. $72\ 00$

Z — $91\ 30$

X — $52\ 30$

Half Z — $53\ 45$ sine 9.645706

Half X. — $26\ 15$ sine 9.645706

19.778231

$50^\circ\ 47'$ half 9.889115

The Az $50^\circ\ 47'$ from the South.

Note,

Note II. Of Geography, which is the knowledge of the Habitable World, and the measures thereof; first, you must know that the Latitude of any Place is the distance of it in degrees and parts from the Equinoctial; the Longitude is the distance from the first Meridian placed by *Ptolemy* in the *Canaries*, but the most of the latest Geogr. place it in the *Azores*. From West to East the account is by degrees and parts, or by hours, accounting 15 degrees to an hour, and for every degree four minutes, and every minute four seconds.

The *Zones* are five; 1. The *Torrid* Zone betwixt the Tropicks, two *Temperate* betwixt either Tropick and the Artick and Antartick Circles, and two *Frigid* from them to both the Poles.

The *Climates* and Parallels lie parallel to the *Equator*. A *Climate* is a *Zone* or Girdle that is contained betwixt two Circles parallel to the *Equator*, those Circles have the longest days differing half an hour, the middle Circle betwixt them has a quarter of an hour difference from the Extremes.

In respect of the shadows, the Inhabitants are differenced into *Amphisceii*, whose shadows are sometimes in a year round about them. East, West, North and South, being those that inhabit the *Torrid* Zone. *Heterosceii* those that have their shadows one way as in the *Temperate* Zones. *Perisceii*, those that in a day may have their shadows round about, as in the *Frigid* Zones.

In respect of the situation, the Inhabitants are *Periecians* that dwell under the same Meridian, and in one Parallel diametrically opposite in that parallel, they have the same Winter and Summer at contrary times, unless in the *Frigid* Zone; *Anteciens* dwell in like parallel from the Equator,

Equator, the one North, the other South, and under the same Meridian and Longitude; *Antipodes* are those that are Diametrically opposite by the Centre of the Earth: they have contrary Winters and Summers, and days and nights contrary, if out of the Torrid Zone.

The next thing is to consider the Maps, first of the World in General; which have these Circles, the *Equinoctial*, *Ecliptick*, *Tropicks* of *Cancer* and *Capricorn*, *Circles*, *Artick* and *Antar-tick*, *Meridians* and *Parallels*, such a Map shews the Effigies of the Globe of Earth in *Plano*, and in it you consider what places are North, South, East or West by the Meridians and Parallels, and considering any Province or Place, you presently see how it is posited to the North or South by its Latitude, to or from the first Meridian by its Longitude, then in what Zone or Climate, what is the longest day, Latitude, Longitude; and it is considerable that Geographers make the right side of a Map the East, the left West; the North the highest, and South the lowest parts; next for the distance of Miles, the *Italians* and *We* account sixty to a degree, which would answer a mile for a minute, but it holds not true in either, for according to Mr. *Norwood*, near 70 miles *English* make a degree, and in *Italy* at *Bononia* according to *Ricciolus* 66; however let the account be 60 to a degree, and then to reduce those to *English*, say, as 6 to 7, so is *English* miles to *Astro.* miles; and contrarily, as, 7, 6, so *Astr.* miles to *Engl.* How measures in Feet of most Countries agree, you may find in the Table at the end of the Book, Entituled, *Foreign Measures and Weights compared with the English*. In all particular Maps you have a scale of miles to measure the distance of places, if those places lie within the opening of the Compasses, if further,

ther, then by a Ruler turn the Compasses oftner about. The Globe of the Earth hath for its Superficies, Land and Sea, near the one equal to the other, the great Continents of *Europe*, *Asia*, *Africk* and *America*, are called the *Firm Lands* or *Continents*; the rest are *Islands* rounded by the Sea; *Peninsula's* joined only by a neck of Land to the greater, as the *Morea*, &c. *Isthmus* that very neck, *Promontory* high ground that juts out into the Sea.

Again, the Seas are divided Into *Oceans* or Main Seas, and the *Mediterraneum* or Midland Sea. A *Gulf* is part of the Sea, almost cut off, as the *Baltick* Sea. A *Streight* is the part cut off, as the Streights of *Gibraltar*, these are the General Heads: And for a more particular practice, consider *Figure 21.* wherein N. is the North Pole, S. the South Pole, E Q part of the Equinoctial, A and B two Places in the Northern Hemisphere, D, C two in the Southern, A B, A C, add D C are part of great Circles passing betwixt those several places; Q B the Latitude of B, E A the Latitude of A, both North, F D and C Q the Lat. of D and C South. $\angle ANB = \angle DSC$ is the Difference of Longitude, of A and B or D and C, the $\angle s$ N A B and A B N shews the position, how one place lies from another: Therefore first. if two places lie in the same Meridian, both on the North-side of the Equinoctial; as B and F: Q B being the Lat. of B and Q F of F, the difference of their Latitudes B F is their distance in degrees; if one lie on the Equinoctial, th' other not, as Q B the Lat. of B. is the Distance, if one have N. Lat. the other South as B and C, the sum of both their Latitudes is their Distance B C. All which, and some other varieties, as being both upon the Equinoctial, are easily understood upon the Scheme.

And

And for more Exact Rules to know the Distances, and Positions of Places, consider the Triangle ANB , there are six parts in this oblique Spher. Δ . AN the Complement of the Latitude of A , NB the Complement of the Lat. of B , AB the Distance of A and B in a great Circle, $\angle ANB$ the Difference of Longitude of A and B , the $\angle NAB$ the position how B bears from A , from the Merid. towards the East, and the $\angle NBA$ how A bears from B towards the West, Any three parts of these six being given, to find any of the rest, use the Doctrine taught before in oblique Spher. Δ s. if both the places be in South: Lat. as BC it is the same with the former, if one be North the other South resolve the ΔNAC . These Rules serve to find the distances and position of any two Stars after the same manner. The ΔCAB may by help of the former Rules be likewise resolv'd.

Lastly, To know how many square miles or perches there are in the whole Earth, or in any parcel or part thereof included in a Triangle, as ANB for the former, find how many square degrees there are on a Sphere, whose circumference of its greatest Circle is 360; say, by the Rules before taught; As 7. 22 :: so square of 360 ($= 129600$) to the superficies of the whole Sphere in square degrees 407314, and supposing sixty miles in a degree, there will be 3600 square miles in a square degree (though there be more in the Curve) which gives 1466330400 square miles in the whole; but to reduce these to *English* miles: say, $Q. 6 = 36$. $Q. 7 = 49$:: so 1466330400 to 1077303266 *English* miles by the Back Rule.

But if it be a Spherical Triangle, as ANB , or any other, as ABC , and it be required to give the proportion of that Δ to the whole Sphere, according to Mr. *John Leak's* Rule, demonstrated

monstrated by Mr. *Foster*, add all the Angles of the Spherical Triangle together, from which subduct 180 deg. div de the rest by 720, it leaves the deg. and min. in Proportion to 360, as that Triangle to the Sphere.

Note III. Of Navigation, which teacheth how and by what means a Ship may be directed on the Sea to the Place or desired Port.

In short Passages, where you are but a small time without sight of Land, the Compass and knowledge of the Land and Sea-marks are sufficient; but in long Passages, where, besides the Compass, Lead and Log line, there are required Instruments to take the Latitudes, and to enquire after the Longitude and Distances. You may consider the same as one simple Course, or compounded of many: There are three ways of performing both Courses; 1. By the *Plain Sea-chart*; 2. By *Mercator's Chart*, or lastly, by a *Great Circle*. The last is in part taught by the Rule in *Geography* last mentioned, of the distance and position of Places, but is not practicable at Sea. The first may serve near the Equinoctial, but farther off and in long Courses is false; the second is true in all Courses, and ought to be most practised; the first and second ways are practised alike in plain Triangles, the Difference only, that the *Meridians* are not equally divided in *Mercator's* way; but you must use the Table at the latter end of the Book, called, *A Table of Meridional Miles*, whereas in *Plain Sailing* all the Lines are equally divided: The Practice will best appear by these few *Problems*.

Probl. I. To convert the *Rumbs* or Points of the Compass into Degrees of Inclination towards the Meridian Line and contrarily. The Mariners divide their Compass (which repre-
E senteth

senteth the Horizontal Circle) into 32 parts, called Rumbs; but it had been far better to have used 360 degrees, to have been accounted from both ends of the Meridian Line towards East and West: But because this Division is not used, take this Table, which will convert the Points of the Compass into degrees and minutes of the \angle of Inclination with the Meridian, and contrarily.

<i>These on this side of the West incline towards the North-end of the Meridian.</i>	<i>Angles of Inclination with the Mer. L.</i>	<i>These on this side of the East incline towards the North end of the Meridian.</i>
Rumbs.	North.	Rumbs.
North by West.	11° 15'	North by East.
N. N. W.	22 30	N. N. E.
N. W. by N.	33 45	N. E. by N.
North West.	45 00	North East.
N. W. by W.	56 15	N. E. by E.
W. N. W.	67 30	E. N. E.
W. by N.	78 45	E. by N.
West.	90 00	East.
West by South.	78 45	East by South.
W. S. W.	67 30	E. S. E.
S. W. by W.	56 15	S. E. by E.
South West.	45 00	South East.
S. W. by S.	33 45	S. E. by S.
S. S. W.	22 30	S. S. E.
S. and by W.	11 15	S. by E.
Rumbs.	South.	Rumbs.
<i>These on this side W. incline to the S. end of the Meridian.</i>		<i>These on this side E incline to the S. end of the Meridian.</i>

If you account to quarter of Points, add $2^{\circ} 48'$ for one quarter, $5^{\circ} 37'$ for two quarters, and $8^{\circ} 26'$ for three quarters.

Prob. II. A Ship sailing under a great Circle, to know how many English miles answers the degrees: If it sail directly N. and S. it is under the Meridian, if E. and W. under the Equinoctial; say, As 1 degree gives 70 miles :: So degrees gone give the English mile.

Prob. III. A Ship sailing under any Parallel, to know how many English miles answer to the number of degrees in that Parallel; say, As Rad. Si. co. to the Lat. or the Parallel :: So is the number of the degrees in that Parallel, to the number of Great Circle degrees; which turned into miles, gives the Answer.

Prob. IV. The *Rumb*, the *Distance* upon the *Rumb* in miles, (60 to a degree,) the *Difference of Latitude* in miles, the *Difference of Longitude* in miles, any two of these given, to find the other two: In a plain right \triangle (see Fig. 22.) where A is the place from whence the Ship sails, the Rumb N. E. by N. therefore the Angle of Inclination BAC by the Table is $33^{\circ} 45'$, its Complement BCA $56^{\circ} 15'$, C the place to which the Ship is to sail, AC the distance in miles 909 miles, AB is the difference in Longitude 853 miles, B is in Latitude $59^{\circ} 36'$ = A. C in Latitude 47° , therefore AC is 856 miles; this is according to the plain Sea-Chart: But according to *Mercator's*, you must find the distance AC by the Table of Meridional miles, thus; Use the same directions given in the Note for *Geography*, the places being both on one side of the Equinoctial, subtract the Merid. miles answering 47° , viz. 3202 from the Merid. miles answering $59^{\circ} 36'$, viz. 4480, rest 1278 miles for the distance AC. This being the only difference in these two kinds of sailing, and thus observed, the Resolution of this

E 2

\triangle will

Δ will perform all simple Courses; and if it be compounded of many Courses, you must so many times multiply your operation.

Note IV. Concerning Dialling To make an Horizontal Dial, you must calculate the distances on the Horizon to the Meridian, to each hour, half hour, and quarter by this Rule; As Rad. to Sine of the Latitude :: So Tang of the Equinoctial hour from Noon, to the Tangent of the Horizontal Distance from the Meridian, of that hour, half, or quarter.

If you desire to calculate for every minute, then you take every minute for the Equi. hour, if for every quarter, then begin with $3^{\circ} 45'$, $7^{\circ} 30'$, $11^{\circ} 15'$, and 15 for an hour, &c. To make a Dial for a full South Wall, is the same with the former, only changing the Sine of the Latitude to the Cosine.

For a declining upright Plane, you must first find the Angle of the *Meridian* and *Substyle* thus, as Rad. to Cotang. Lat :: Sine Decl. to Tang. \angle desired. Secondly, the height of the Style above the Substyle, thus, As Rad. to Cosi. Decl. :: Cosi; Lat. to the Sine of the height desired. Thirdly, the difference between the Merid. of the Plane and Place, As Si Lat. to Ran. :: So Tan. Decl. to Tang. desired. Fourthly and lastly, you must find the Angles which the Hour lines make with the Substyle line, which is the Merid. of the Plane; As Rad. to Si. of the Style height above the Plane :: So is the Tang of the Hour line from the Merid. of the Plane, to the Tang desired. For a Meridian Dial, where the Plane looks full East or West, the Hour lines are all parallel to the Line that passeth from Pole to Pole, which is the hour of 6; then say, As Rad. to the height of the Style in any known parts of a Scale :: So is the Tangent of any hours distance from 6, to the distance thereof in the same parts.

Now

Now for a Mechanical way to make any Dial to any Plane, whether declining, reclining or inclining, crooked, bended, or any ways uneven, without any notice taking of any such declination, reclination, &c. by the help of a large and good Horizontal Dial, which must have a small hole in the Centre to suffer a silk Thread or hair to go through; you may work thus under the Plane: Where you intend to make a Dial, draw a *Level Horizontal Line* by a Carpenter's or other Level, to this Line set a Scaffold or frame of any board or boards deep according to the bigness you intend the Dial to be; this Scaffold must be level likewise

This being fitted, and by any other true Dial, Equinoctial Ring, or by the height of the ☉, your Minute-Watch rectified, or other way, find the true Time of the Day, and placing your Horizontal Dial upon the level Plane, keeping it to the true time of the day, by removing it to and fro, you may by the thread from the Centre, carried by the edge of the Gnomon, find out the Centre of the new Dial, if it will have a Centre, which mark, and by small tacks fasten your Horizontal Dial in that place, that it may not move the thread or hair carried by the edge of the Gnomon, if continued in either Pole, and is the Gnomon to the new Dial; the perpendicular Line under it taken by a square is the Substyler, and the Style may be fastened to the Plain by help of that thread.

Now to draw the Hour lines, do this; Lay the thread, fixed to the Centre of the Horizontal Dial, over the Hour lines and Quarters, and mark out in the Horizontal Line on the plain where they intersect; Lines drawn from the Centre of the new Dial to these Points, are the Hour lines: But some Hour lines may run off the Plain, or by reason of the crookedness, or some Pillars

may hinder ; to help this, draw as large a square or oblong upon the Horizontal Plain as you may, and transfer (by help of the Centre thread) all the hours from the Horizontal Dial into the Lines of the outside of the said square or oblong ; now if you bring a thread from the Centre of the new Dial, and rest it upon the hour Points marked in the said square, the Centre thread of the Horizontal Dial, carried only to touch the other thread, will describe the Hour line desired, whether upon an even or uneven Plain that have Centres for the new Dial ; but if the Line carried by the edge of the Gnomon of the Horizontal Dial will not meet with the Plain, as in all East and West Plains much declining, then must you fix up a board or other matter to receive the Centre by the side of the Plain, and then fixing a thread there, by that and the other thread you may strike all the Hour lines, as was before shewed in crooked Plains, and the thread from the Centres being the new Gnomon, must be fixed to the Wall by two stays

This may be practised with as much curiosity as any other, and will be sure and exact.

Note V. The Description and Use of an Universal Dial for all Latitudes, being a Projection of the Sphere in Plano, presented to his Royal Highness, Anno 1665. for his particular Use at Sea.

One Hemisphere being circumscribed by a Cylinder, wherein the Equinoctial and Cylinder touch, let the Hemisphere be conceived so to extend from the Equinoctial, that the two Colures, and all the Meridians, may touch the Cylinder in the Tangents of the Degrees and Minutes of the Meridians, all the Meridians will be streight Lines, all the Parallels Circles distant from one another as their Tangents ; and for particular uses, let the Hemisphere have upon the
Interfection

Intersection of the Equinoctial Colure and Equinoctial Semicircles, at each degree distance.

These, as likewise the Ecliptick, and all other Circles described from that Point, will be Ellipses on the Cylinder: Having this Cylinder thus furnished, laying it upon a Plain, so that the Equinoctial Colure may touch the Plain, let this Cylinder be orthographically or perpendicularly projected on that Plain; so have you the Dial or Hemisphere now before you, the demonstration whereof will be too tedious for this place. The description thus: The Point of ∇ and Ξ is the Centre, the uppermost Line divided both ways into 90 degrees is the Equinoctial, the Line $\nabla\Theta$ that goes at right Angles down is the semicircle of the Equinoctial Colure, the two edges are the Solstitial Colures, and stand for the Meridian of 12 a Clock, all the streight Lines from top to bottom are the Meridians or Hour lines to every quarter of an hour, 15° of the Equinoctial above being an hour; the Meridians on both edges are number'd, from the Equinoctial to the Pole, and from the Pole to the Equinoctial to 90° . The Parallels to the Equinox are drawn through every degree of the Meridian, and are so numbered both on the edges and on the middle being the Axis of the Sphere, upon the Quadrant on the left hand are drawn several Elliptical lines, which represent the Circles formerly spoken of, describ'd upon the Centre, being the point of East and West to every two degrees. The Ecliptick is drawn both ways from the Centre ∇ and Ξ , declining 23 degrees 30 minutes upon the Meridian, and divided into Signs and Degrees by those Elliptick Lines.

The back side of the Instrument has many Uses shewed in the beginning of the Book; those of this Projection follow.

Use 1. Having the ☉ place, to find his Declination, Right Ascension, or by either of these to find the place. First, find by the day of the Month on the back side the ☉ place, which seek in the Ecliptick, the Parallel that passeth by that place shews the ☉ Declination, and the Meridian the ☉ Right Ascension in the Equinoctial; so likewise the Declination, or Right Ascension given, shews the ☉ place.

Use 2. To rectifie the Centre Thread to shew any Horizon, or any Line of East and West which passeth to the Zenith, or any Inclination to the Horizon or Equinoctial, that any point upon the Hemisphere shall make with the Horizon. The Centre thread laid to the Latitude of the place on the left hand in Summer, or on the right hand in Winter, will represent the Horizon of that Latitude by the greater figures which come numbred from the Pole. And if you lay it to the Latitude from the Equinoctial numbred by the smaller figures on the right hand in Summer, or left hand in Winter, it represents the Line of East or West, and the point in the Meridian shew the Zenith. Or any point upon the face being set out by the parallel and time of the day, laying the Centre thread thereto, it shews on the edge how many Degrees it inclines or declines to or from the Equinoctial, and that being added in all Northern Signs, or subtracted in Southern to or from the Equinoctial height (which is always \equiv to the Complement of the Latitude,) it gives the Inclination or Angle a great Circle passing by the point given makes with the Horizon.

Use 3. To know the time of Rising and Setting of the ☉, the Ascensional Difference, the Amplitude, and the length of the Day or Night.
By

By the last Proposition lay the Centre thread to the Meridian for an Horizon, wherever the ☉ parallel cuts it, amongst the Hour lines, it gives the ☉ rising and setting, and the Elliptical line which passeth by that place gives the Amplitude, or the distance in degrees from the East; the Meridian of the ☉ rising carried to the Equinoctial shews the Ascensional Difference in degrees; lastly, double the ☉ setting for the length of the days, and rising for night.

Use 4. To find what time the ☉ will come East or West, and what height the ☉ shall have at that time. By the second Proposition, lay the Thread to the Latitude told from the Equinoctial in the edge on the contrary side to the Horizon that is the Line of East and West, and following the ☉ parallel to that Line, the Point where the Intersection shall be amongst the hours gives the time, and among the Ellipses the ☉ height at that time

Use 5. To know the height of the ☉ at fix a clock, and the Azimuth or distance the ☉ shall have from East to West. Follow the ☉ parallel to fix a clock, the crooked lines shew you the ☉ height; and laying the Centre Thread to the point of East or West, mark where the Parallel cuts it, and follow the Hour line to the Equinoctial, (which now shall represent the Horizon) the distance from the Centre is the Azimuth.

Use 6 To find the ☉ height at any time of the day. Setting the Horizon right, find the point of the ☉ rising, then setting one point of the Compasses there, extend the other to the Zenith, and by a black lead Point make an Arch that shall end upon the hour of the ☉ rising.

the degrees of that Circle cut by the Hour-lines, shew the ☉ height.

Use 7. To rectifie the Hook, Bead and Plummet. At the end of the Hook (which by its skrew may be moved at liberty) there hangs a Thread and Plummet with a moveable Bead, the very end of the Hook, from whence the Plummet hangs, must be skrewed fast to the place where the ☉ riseth on the Horizon, and the Bead must be set to the Zenith on the contrary side.

Use 8. To find the hour of the day at any time, the ☉ shining. After the Hook and Bead be rectified, as is set down in the last use, lift up the Instrument, (so that the Bead and Plummet do freely play) that the ☉ may shine through the least sight upon the other, the Bead shews the time of the day amongst the Hour lines.

Use 9. By the ☉ height or hour, to know the ☉ Azimuth. By the second Use, observe where the Meridian of the ☉ Hour and the Parallel meet, and thereby on the side find the Inclination of the Point to the Horizon, where lay the thread, then by the 6th Use, find the ☉ height; now let the Equinoctial represent the Horizon, and accounting the height amongst the Parallels, where Parallel crosseth the thread laid to the Inclination, follow the Meridian to the Equinoctial, the number from the Centre is the Azimuth from the East.

Use 10. All the former Propositions may be applied to the Stars, remembering the ☉ shews the hour; therefore use the Right Ascension of the ☉, which take from the Right Ascension of the

the

the Star, (if it be bigger, if not, add 24 hours) rests the time of that Star's coming to the Meridian; and if you know the Stars hour before midnight, take it from the time of the Stars Southing; if after, add it, you shall have the true time of the night. These excellent Uses you have from this Instrument, sold, if you desire it, with the Book: If you desire it of Metal, and larger, Mr. Hayes Mathematical-Instrumentmaker, living in *Moorfields*, will make them. Lastly, upon the inside of the Cover you have a perpendicular Dial will serve within 30 miles from *London* presently to know the hour of the day, the Parallels up and down answer the day of the Month, the other streight lines that are parallel shew the ☉ height, and wherever that crosseth the other, there is the hour, the long hours for Summer, and short ones for Winter, and placing a Pin in the Point *VI*, letting it shade in the Line *VI*, *IV*, a Line and Plummert playing from it, will shew the ☉ height on the right side.

§. 7. *Of the Nature and Making of Watches, Clocks, and other Movements, Collected from Mr. Oughtred's Antomata; with several Additions and Notes about Pendulums.*

THE great Wheel, whereon the Fusie or String with Weights are fixed, divides the Nature of the Work in any *Movements*, that is, all the Wheels and Pinions from that to the Ballance or Fly only prepares the Motion, but the other way effect it. Things to be noted, are.

1. The Fusie, and how many Turns it hath.
2. The number and names of the Wheels, Teeth,

Teeth, and Pinions, viz. in a Watch of four Wheels, (supposing the Numbers annexed to be the Teeth;) First, The *Great Wheel* (Number 55 Teeth) turning the *Pinion*, (number 5) fixt to the *Second Wheel*, (Number 45.) turning the *Pinion*, (Number 5.) fixt to the *Contrat Wheel*, (Number 40) turning the *Pinion*, (Number 5.) fixt to the *Crown Wheel*, (Number 17.) having odd Teeth, working upon the *Pallats* of the Ballance, (Number 2.) But in Watches of five Wheels, there will be a third Wheel before the *Contrat Wheel*.

3. The *Pinion of Report* fixt to the Arbor of the *Great Wheel*, (Number 4) which lies hid betwixt the Plates in Watches, and turns the Hour-wheel (Number 36) which carries the Hand about upon the Face, divided into 12 or 24 hours.

For brevity-sake, let *M* stand for the *Movement*, whether Watch or Clock, *F.* the *Fusie.* *A* the *Great Wheel*, *a* the *Pinion of Report* on its Arbor, *E* the second Wheel, *e* the *Pinion* on its Axis, *I* the *Contrat Wheel*, *i* the *Pinion* on its Axis, *O* the *Crown Wheel* carrying *o* its *Pinion* on its Axis; *B* the *Dial wheel* carrying the Hand, in *H.* Hours, *T.* Time, *t.* turns, *N.* Notches or Beats of the Ballance; *Con.* Continuance and length in Time of the Watches going.

The work will stand, both in Letters and Figures, as in the Example.

<i>a</i>)	<i>B</i>	(<i>d</i> 4)	36	(9)
<i>e</i>)	<i>A</i>	(<i>f</i> 5.)	55	(11)
<i>i</i>)	<i>E</i>	(<i>g</i> 5.)	45	(9)
<i>o</i>)	<i>I</i>	(<i>k</i> 5.)	40	(8)
<i>o</i>			17	Crown Wheel.
			2	Pallats.

Where

where every wheel is divided by the Pinion it moves from A to O. viz. 15 by 5 = 11 = f. 41 by 5 = 11 = 9. = 40 by 5 = 8 = k. But B divided by a gives 9 that is B by a = d.

1. Rule. fgk $O_2 = 11 \times 9 \times 8 \times 17 \times 2 = 26928$ equal to N. Notches or Beats made in one turn of the great Wheel, and $26928 \times 9 = 242352$ the beats that are made in one turn of the hand, whether 12 or 24. Lastly, divide 242352 by 12 it gives the beats in an hour, 20196, and by 60 gives the Beats in a minure, 336, 6. Thus far I question not, is very plain, and must be practised to be well understood, as being the Foundation of the whole work; and by it you may easily know how many turns any Wheel or Pinion, makes for one turn of the Fusie or Hour wheel.

2. Rule. As the Beats for one turn of the great Wheel or Fusie ————— 26928
 . Is to the Beats gone in one hour ——— 20196
 :: So continuance of the Watches going — 16
 . To the number of the turns about the Fusie ————— 12
 :: And so are the hours of the Face ————— 12
 . To the Quotient of the hour Wheel divided by a ————— 9

These proportions holding, that any three given, (not the same kind,) you may find the fourth :: As for *Example*,

To know the continuance of the Watches going, that hath 12 turns in the Fusie, and 26928 Beats in one turn; and 20196 Beats in an hour. Say, N in an H. N one t F :: 12 t. of F. to Con. 20196) 26928 x 12 (16. But if it be demanded by the Beats, and the time of the Watches going to know the Turns of F. 26928) 20196 x 16 (12. Or if it be demanded, what Quotient shall be laid upon

upon the Pinion of Report ; Say, 16. 12 :: 12. 9 ; or as 26928. 20196. Note that the lesser B is taken, the longer shall be the continuance of the Watches going at an equal T.

Rule 3. Concerning Pendulums. The spring in a Watch, drawing harder at the first than at the last ; and likewise in Clocks with weights and strings, there is added the weight of the string gotten every moment, to the Clock weight, and for that no Motion can by hand be made so fit, but there will come some unequality, as you may hear by the Beats either of Watch or Clock, to justen and regulate these inequalities *Monsieur Hugen* invented the way of applying *Pendulums* to either, for which his Name will be ever Remembred.

Pendulums, whose Vibrations are of the same Degrees and Minutes are equal, or if they rise not above a Degree, and the squares of their Vibrations are in proportion to the lengths : For a Standard or Rule *Monsieur Hugen* gives the length of a *Pendulum* that shall swing seconds, to be 881 to the *Parisian* feet 864. The *English* Feet to the *Paris* Feet by my Table are, As, 1000. 1068. Therefore, 864. 881 :: 1. 058. 1.089 and $1.089 \times 3 = 3,267$ equal to three feet three inches, and two tenths of an inch.

The Honourable Lord *Brunker*, and Mr. *Hook*, found the length to be thirty nine inches and 25 parts, which a little exceeds the other, and may be, was Justned by Master *Hugen's* Rule for the Centre of Oscillation ; for *Montous Pendulum* that shall vibrate one hundred thirty two times in a minute, it will be found likewise 8, 1 inches agreeing to 39,2 inches *English* : Therefore for certain 39,2 inches may be called the universal measure, and relied on, to be the near length of a *Pendulum* that shall swing seconds each vibration : With this caution and Rule, As the length

length of the string from the point of suspension to the Centre of a round Ball, is to Radius :: so is Radius to a fourth number. Let two fifths of that fourth be added to the former length, for the length of the *Pendulum*. Having this Standard, the next Rule is this: That the lengths of two *Pendulums* are in proportion to the squares of their several vibrations, which will be equal to the Beats of the Ballance; therefore the Beats that shall be proposed in a minute, being given to be 50, and it be demanded to give the length of a *Pendulum*; Say, as the square of 50 (2500) is to the square of 60 (3600) :: so is 39,2 to 56,4 the length required for (2500) 3600 x 39,2 (56,1.) And if the lengths be given to know the swings or beats in a minute, As Altitude given, To Altitude known :: so square vibr. known. To square vibr. req. whose square Root is the Answer: And because the two middle terms stand in all such Questions, and will be always 141120: Therefore divide 141120 by the square of the swings in a minute, it gives the length sought; or by the length it gives the square of the Swings. And thus as the Ingenious Master *Hook* first proposed, I have hang'd a swing by my Clock to regulate it upon a Pin, that it may freely vibrate.

$$\begin{array}{r}
 48) \text{ --- } 4 \quad (12 \\
 \underline{\hspace{1.5cm}} \\
 \phantom{48) \text{ --- }} 56 \text{ --- } 7 \quad (8 \\
 \phantom{48) \text{ --- }} \phantom{56 \text{ --- }} 54 \text{ --- } 6 \quad (9 \\
 \phantom{48) \text{ --- }} \phantom{56 \text{ --- }} \phantom{54 \text{ --- }} 21
 \end{array}$$

The numbers of the great Wheel 56, its Pinion 4, turning the hour Wheel 48. The great Wheel turns a Pinion of 7 fixt to the Crown Wheel 54, which turns a Pinion of 6 fixt to the Ballance Wheel 21. The Quotients $8 \times 9 \times 21 \times 2 = 3024$ the beats in an hour, because the great Wheel turns once in an hour, else $12 \times 9 \times 21$

$x 21 x 2 = 36288.12$) 36288 (3024 and 60)
 3024 (50,4 beats in a minute, and as was shewed
 before, the length of the *Pendulum* will be 55,
 5 inches, fix a weight upon a Wire running into
 a Rod, that shall have four feet 7, 5 inches be-
 low the Pin whereon it plays, and about a foot
 or above, a Wire beaten flat with several holes
 to fit to the top of this Rod, and to a Pin placed
 upon the Ballance towards the back side, will
 regulate the Motion exceedingly well, and may
 be done without trouble or charge.

For the regulating the inequality of a swing,
 when it may rise sometimes higher, sometimes
 lower: There are two ways, either by making
 the Line play betwixt two Cheek parts of a Cy-
 cloid, as Monsieur *Hugens* has directed, which
 may easily be effected to any length of the *Pen-
 dulum*, and are made, if any desire them, by
 Mr. *Humphery Adamson* (near Turnstile in *Hyl-
 bourn*.) Or else by not suffering the *Pendulum* to
 vibrate above an inch from its settlement. For
 my part, after some time and charge of Experi-

$$\begin{array}{r}
 \text{D} \quad \text{B} \\
 6 \text{ --- } 72 \\
 \text{a } 30 \text{ } 30 \text{ a} \\
 \hline
 \text{A } 80 \text{ --- } 8 \text{ --- } (10 \\
 \text{E } 48 \text{ --- } 8 \text{ --- } (6 \\
 \text{I } 48 \text{ --- } 24 \text{ (2} \\
 \text{O } 15
 \end{array}$$

ments, I believe the
 first the better way.
 Monsieur *Hugens* in
 his Book of *Pendu-
 lum* Clocks, pro-
 poseth a Watch a-
 bout a Mans height,
 to go 30 hours, and

to have these numbers. The great Wheel 80,
 &c. which turns about in an hour, and shews
 minutes; therefore for an hour multiply the
 Quotients, $10 \times 6 \times 2 \times 15 \times 2 = 3600$ being the
 seconds in an hour ($60 \times 60 = 3600$) or beats.
 Now the third Wheel I turns about in one mi-
 nute for $10 \times 6 = 60$, and carries a plate divided
 into 60 seconds, and shews the seconds; and
 upon the Arbor of the great Wheel is fixed a
 Wheel

Wheel *a* turning another wheel *a*, both of 30 Teeth, both turning about in an hour; the later has on it a Pinion *b* of 6 Teeth turning B 72 in 12 hours. This Watch has a pully tied to its weight, by which you may pull it up and not stop the Watch; the *Pendulum* plays betwixt two Checks, part of a Cycloid.

The next question (supposing there be a screw below or above the *Pendul.* to lift it up or let it down upon a squ. Brass Ruler divided into inc. and tenth parts) to know how many minutes and seconds every tenth part of an inch will make the Watch go faster or slower in a day. I take the *Pendulum* which swings seconds length 39.2. Then by the Log. I make this Table.

I.	II.	III.	IV.	V.
38.7	1.587711	1.780988	60;39 9 21	
38.6	1.588832	1.780378	60;31 7.26	
38.9	1.589949	1.779819	60;23 5.31	
39.0	1.591065	1.779261	60;15 3.36	
39.1	1.592177	1.778705	60; 8 1.55	
39.2	1.59286	1.778151	60.	
39.3	1.594393	1.777597	59 92 1.55	
39.4	1.595496	1.777046	59.85 3.36	
39.5	1.596597	1.776495	59.77 5.31	
39.6	1.597695	1.775996	59.70 7.26	
39.7	1.59879	1.775399	59.62 9.20	

The first Column has in the middle the length of the *Pendulum* 39.2 inches, upwards it diminisheth one tenth, and downwards it creaseth one tenth

The second Column are the Log. of the first.

The third Column are half of the Log. of the difference of the *II* taken out of the Log. 5.149588, which is of the standing number 141120 aforesaid: The *IV* Col. are the numbers

bers of the *III* and the *V* Column are the minutes and seconds that these augmentings or diminishings will cause in a day, and are gotten by Multipling $24 \times 80 = 1440$ the minutes in a day, by the decimals above or under 60, which work may be done easily to any length of a *Pendulum*.

Rule 4. Of finding out fit Numbers for the Wheels and Pinions

1. Any two Fractions, whose Terms are proportional perform the same Motion ; as
9. 36. 45. 63.

————— *Ec.* The upper for the Wheel,
1. 4. 5. 7.
the lower for the Pinion.

2. If it be as one Wheel to one Pinion ::
so is the product of many Wheels, to the product of many Pinions, both will perform the

same Motion. *Exam.* $\frac{1440}{28}$ equal to $\frac{36 \times 8}{28 \times 1}$

$\frac{5}{1}$ or $\frac{36}{4} \times \frac{8}{7} \times \frac{50}{10}$ for $\frac{36 \times 8 \times 50}{4 \times 7 \times 10} =$

$\frac{14400}{280} = \frac{1440}{28}$

nor matters it in what order the
Wheels and Pinions are set, or which Pinions
stand under every Wheel.

3. These Factor's 36×8 given, may thus be varied, viz Divide them by such numbers as will measure them, and multiply the Quotients by the Altern Divisors, the Product of 9. 8
those two last numbers shall be two $\frac{36}{4} \times \frac{8}{1}$
to the product of the Factor's given, for $32 \times 9 = 288$.

4. If fit numbers cannot be had by
any of the three former ways, you must seek
some Ratio as near as possible in this manner, as
one

one of the two Numbers is to the other:: so is 360 to 2 4th. Divide that 4th number, and also 360, by 4, 5, 6, 7, 8, 9, 10, 12, 15; or which of them bringeth a Quotient nearest to an Integer; as if the two Numbers be 147, 170 which are too great to be cut into Wheels, and yet cannot be reduced into less, because they have no greater common measure than Unity. Say therefore,

170. 147:: 360. 3114 6) 311(52- 8) 311(39.
 147. 170:: 360. 4164 6) 360(60 8) 360(45.
 8) 360(45- | wherefore for the two Num-
 416(52 | bers 147 and 170, you may take
 52 and 60; 39 and 45, or 45 and 52.

Rule 5. The Diameter or Circumference of any Wheel being given in inches and one hundred parts, and the number of Teeth it is divided into, to give the Diameter or Circumference of a lesser Wheel or Pinion, with a number of Teeth given that shall exactly agree with the Teeth of the greater Wheel: *Exam.* The great Wheel has one inch Diameter, and fifty Teeth, the lesser Wheel or Pinion ten Teeth; say if 7, 22:: 1. 3, 14; then if 50. 3. 14:: 10. 6; for the Circumference of the Pinion, whose Diameter will be, 2 of an inch.

Rule 6. To give numbers to a Watch that shall have a swift train, about 20000 beats in an hour, that may have turns about the Fusie, and go 16 hours, and the number of the Crown Wheel 17. Say by the second *Rule* 12. 16:: 20000. 26666. the Beats for one turn of the Fusie; and because by the first *Rule* 26666 is equal to all the Quotients multiplied together into 17 and into 2, that number being halv'd is 13333, and that again divided by 17 gives for the Quotient 784, which being broken into three numbers, that multiplied together will
 be

be 792, or near to it; let them be 11, 9, 8. multiplied are 792. Then $792 \times 17 \times 2 = 26928$; and say, 16. 12 :: 26928 10196 the Beats in an hour. Also 16. 12 :: 12. 9 and $\frac{2}{1} = \frac{3}{4}$. Lastly, by the three Quotients, assured

$$\begin{array}{r} 4) 36 \quad (9 \\ 5) 55 \quad (11 \\ 8) 45 \quad (2 \\ 5) 40 \quad (8 \end{array}$$

11. 9. 8 find out the 3 Wheels and Pinions, by taking the Pinions as you desire, as is done in the side: You may try several Experiments to make the Watch go longer by altering the Beats and Pinion of Report.

Examp. Of a Clock or Watch proposed to go a week or 8 days with this Order, that the Ballance Wheel, or that which moves the *Pendulum* may go about in a minute, with an Index to shew seconds, that the great Wheel may go about in 12 hours, and that the Wheel next it may go about in one hour to shew minutes: First, how many seconds there are in 12 hours, and that $12 \times 60 \times 60 = 43200$ these are the Beats that shall be in one turn of the Great Wheel. These are double, because there are two swings to one Tooth of the Ballance Wheel, the half 43200 is 21600 now the Ballance Wheel must needs be 30, divide 21600 by it the Quotient is 720 to be broke into three Quotients, whereof the first must needs be 12 for the Teeth of the great Wheel, divide 720 by it, the Quotient is 60 for the two Quotients remaining, which may be either 10 and 6, or 5 and 12, or 8 and $7\frac{1}{2}$, which last let stand, then the work will stand thus, and the Pinions taken as you please to be all 8, the Wheels must be 96. 64. 60. So then the great Wheel will

$$\begin{array}{r} 8) 96. \quad (12 \\ 8) 64. \quad (8 \\ 8) 60 \quad (\frac{3}{2} \\ \hline 30 \\ \hline 10-140 \\ 8-128 \\ 8-120 \\ 72 \end{array}$$

go about in 12 hours, the second Wheel in an hour, and the Ballance Wheel in a minute, as desired. I gave my Watch these Numbers to go above a year.

In my large Sphere going by clock work, there is a motion for the Revolution of the (☉) Apogee writ down on the Circle to be made in 17096 years, but by Examining the Work, I find it to be 17100, that is four years more. For the Great Wheel fixed is 96, a spindle Wheel of 12 bars turns round it 8 times in 24 hours, that is in 3 hours; after these, there are four Wheels, 20, 73, 24, and 75, wrought by endless screws that are in value but one; therefore $3 \times 20 \times 73 \times 24 \times 75 = 7884000$ hours, which divided by 24 gives 328500 days equal 900 years. Now on the last Wheel 75 is a Pinion of 6 turning a great Wheel that carries the Apogee number 114, and 114 by 6 gives 19, and $900 \times 19 = 17100$.

Rule 7. Of giving particular Motions to any Movement. The number of a Motion, is the Proportion that it bears to one turn of the hour Wheel, or the Pinion of Report, from whithersoever it be taken, which proportion, being broken into two or three Quotients, will shew the Wheels and Pinions, as if you took it for the Beats of the Ballance.

The last Note shall be concerning *Time*; that which is ordinarily termed the *Hour of the Day*: Consider this in the length of days, which are two, distinguished only by the Revolution of the Earth: The first is the *Syderial Day*, where any fixt point or points of the Earth in the same Meridian or Azimuth returns from any Star to the same again; the second the *Solar Day*, where the same Meridian of the Earth returns from the ☉ to the same again, neither

neither of these days are the true Equinoctial day, indeed the *Syderial* is sensibly the same, if it be but for some small space of time, the difference being only some fourths and fifths of a degree slower in a day; but the *Solar* is notably longer than the other, viz. by $3^h, 56^m, 53^s, 19^{th}$, of time in a day, and from hence the length of an hour is generally accounted: Therefore to fit the *Pendulum* of a Watch or Clock to this Solar day and hour: I. By the *Revolution of a fixed Star* to the same point again after one or more *Revolutions* (which you must curiously observe by fixing your eye to a point.) If the *Motion* for one *Revolution* want $3^h, 56^m$ of 24 hours, or for two, $7^h, 45^m$, for three, $40^h, 35^m$, &c. then doth your Watch go true to the Equal or Middle Motion of the ☉, if otherwise, the *Pendulum* must be altered to make it go so. II. By a *Sun Dial*, which though it be made never so exact, and your Motion so too, yet there will be a considerable difference after some days, nay even in one day, all which falls out by reason of the inequality of Natural Days, (which at last is settled and demonstrated by Mr. *William Flamsted*), from whom (if God continue his health) Astronomy hopes for a better Dress; But this Manual will not admit the Table of Equations, which you may find in Monsieur *Huged's* Herology, whereto you are referred.

Lastly, There is added a *Table of the Right Ascension of the ☉*, and a *Table of the Right Ascension of the Stars* of the greater Magnitude, that when any of them come into the Meridian, by subtracting that of the ☉ from that of the Star (adding 24 hours, if need be) leaves the hour of the night.

And there is an *Excellent and useful Table* the last of all, of 22 Stars, which here never
rise

rise or set, and are constantly seen, which Table shews their right Ascensions and their time and Azimuth when they come under the *Pole Star*; therefore if you hang up a Thred and Plummet, and looking through a small hole, (to take away the Stars ray) observe when any of these Stars come with the *Pole Star* to that Perpendicular: If you subtract the ☉ Right Ascension, from the hour of the Stars coming under the North Pole, you have the true time of the Night to a minute. Many other uses may be made of this Table, but there is not room here to set them down.

The *Table of Right Ascensions of the ☉* is very exact to a second, to every degree of the Ecliptick; and because the North-Signs have the same Right Ascension with their respective degrees of the South-Signs 12 hours difference: The Table is contracted, and the common parts do answer two Columns: For finding the *Part Proportional* for the ☉ minutes, the differences are set down to seconds, and may be supplied from the Table of Parts Proportional, if you enter the 10 differences under 6, as you did for the Log. under 10.

The Table of the Right Ascensions and Declinations of one hundred of the Principal fixed Stars are rectified to the year 1680, and are taken from *Ricciolus* his last Book. Entituled, *Astronomia Reformata*, are more exact than any other extant, and have their Differences set by, for every ten years to rectifie them, and were thus done at the desire of that Worthy and Able *Physician*, and incomparable *Mathematician*, Sir Charles Scarborough, for the benefit of the Industrious Seaman.

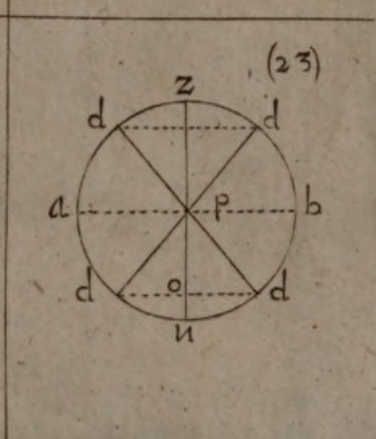
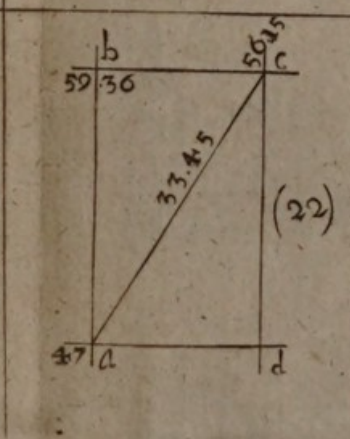
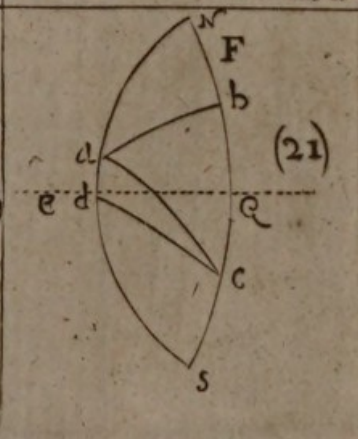
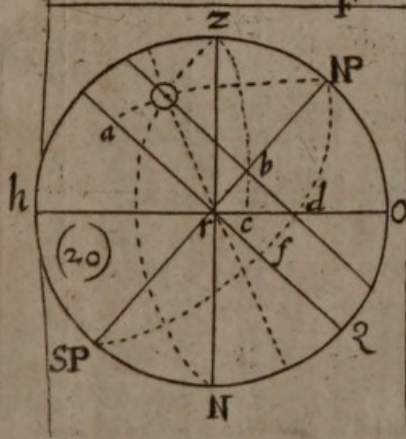
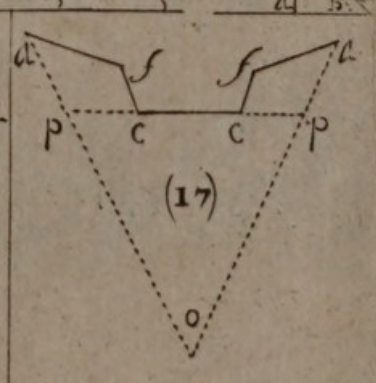
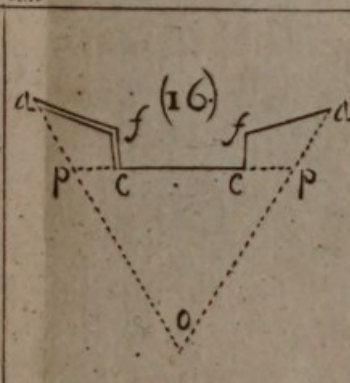
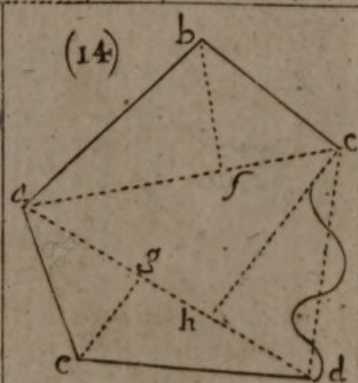
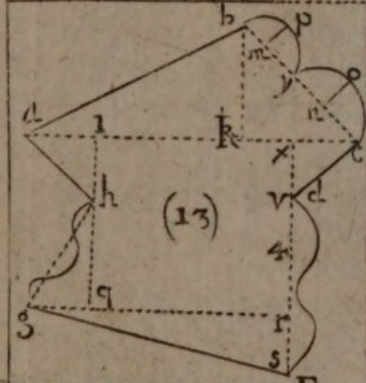
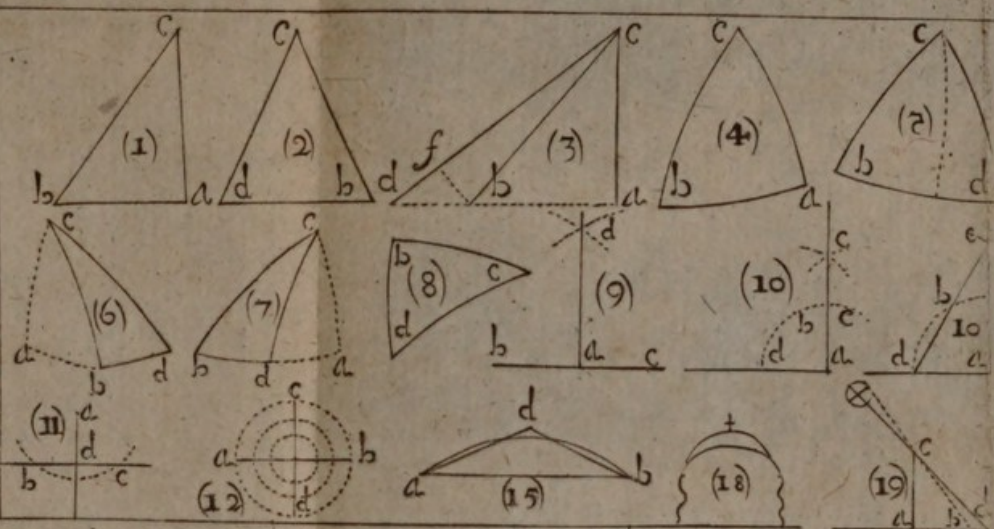
The last Table of the Stars about the North-Pole, are calculated for the Latitude of *London*, and for the year 1680. Any Artist may compute

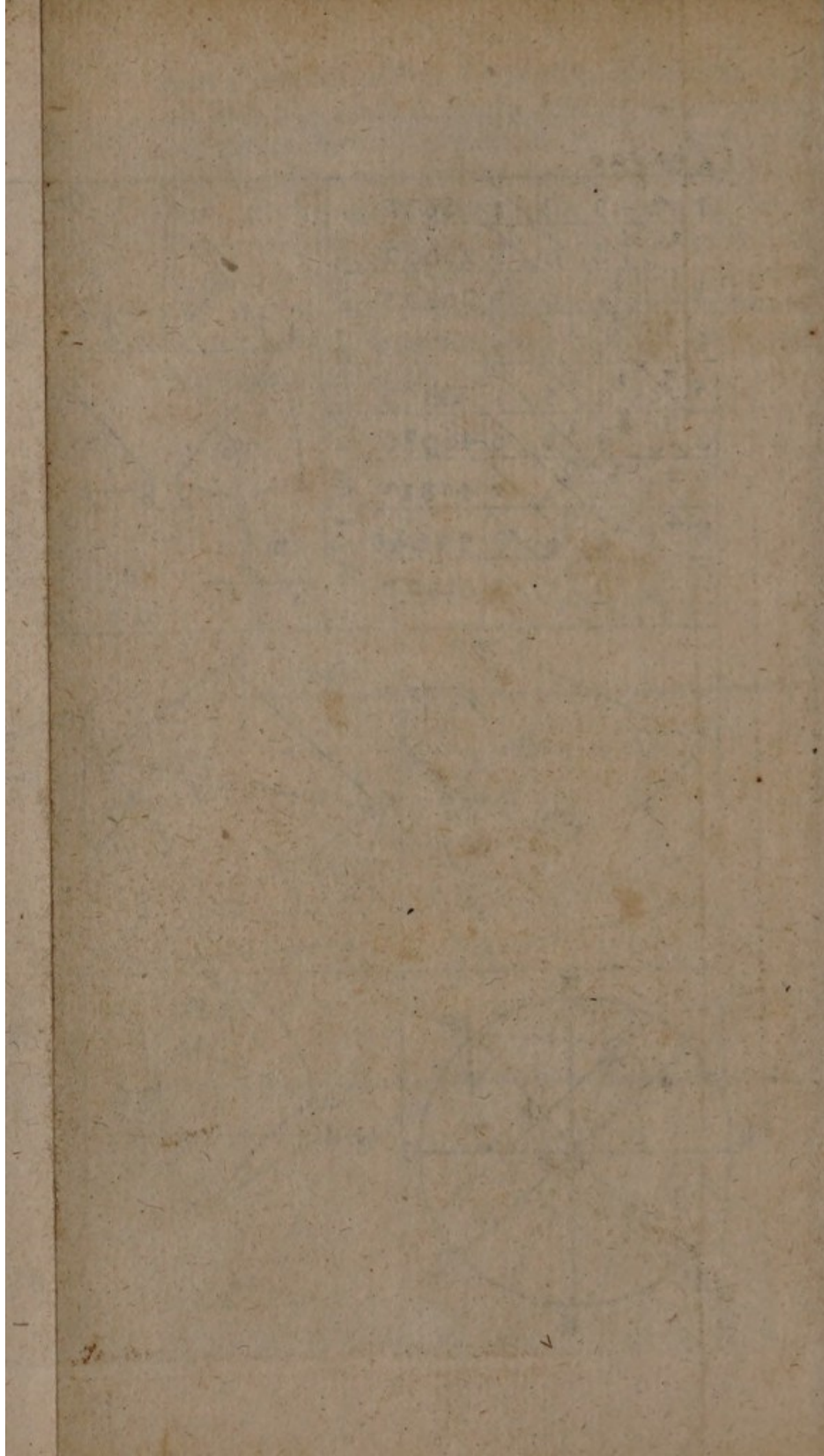
pute them for other Latitudes, observing that all such Stars whose Right Ascensions are above 9° , $14'$, $10''$, and under 8° , $14'$, $10''$, pass the Meridian before they came under the Pole-Star, all the other Semicircles contrary. This Table will be welcome to those that make Observations of the Stars, to know the true time of the night, and to rectifie their *Pendulum* Watches by : To all whom let their Days and Nights be fortunate.

Soli Deo Gloria.

1	6	8	3	1	6831
2	1	2	6	2	13662
3	1	8	2	3	20493
4	2	4	3	4	27324
5	3	0	4	5	34155
6	3	6	4	6	40986
7	4	2	5	7	47817
8	4	8	6	8	54648
9	5	4	7	9	61479

Fig 1 for Repaires Rods.





Brigg's Logarithms.

A Table of Logarithms, from Unity to 10000, by which, and the Table of Proportional Parts annexed, the Logarithms of all Numbers under 100000 may easily be supplied.

N	Log.	N	Log.	N	Log.
1	000000	34	531479	67	826075
2	301030	35	544068	68	832509
3	477121	36	556302	69	838849
4	602060	37	568202	70	845098
5	698970	38	579783	71	851258
6	778151	39	591065	72	857332
7	845098	40	602060	73	863323
8	903090	41	612784	74	869232
9	954242	42	623249	75	875061
10	000000	43	633468	76	880814
11	041393	44	643453	77	886491
12	079181	45	653212	78	892095
13	113943	46	662758	79	897627
14	146128	47	672098	80	903089
15	176091	48	681241	81	908485
16	204120	49	690916	82	913814
17	230449	50	698970	83	919078
18	255272	51	707570	84	924279
19	278753	52	716003	85	929419
20	301030	53	724276	86	934498
21	322219	54	732394	87	939519
22	342422	55	740363	88	944483
23	361728	56	748188	89	949390
24	380211	57	755875	90	954242
25	397940	58	763428	91	959041
26	414973	59	770852	92	963788
27	431364	60	778151	93	968483
28	447158	61	785330	94	973128
29	462398	62	792393	95	977724
30	477121	63	799341	96	982272
31	491361	64	806180	97	986771
32	505150	65	812913	98	991226
33	518514	66	819544	99	995635

Briggs's Logarithms.

N	0	1	2	3	4
100	000000	000434	000868	001301	001734
101	004321	004751	005181	005609	006038
102	008600	009026	009451	009876	010300
103	012837	013259	013679	014100	014520
104	017033	017451	017868	018284	018700
105	021189	021603	022016	022428	022841
106	025306	025715	026124	026533	026942
107	029384	029789	030195	030600	031004
108	033424	033826	034227	034628	035029
109	037426	037825	038223	038620	039017
110	041393	041787	042182	042575	042969
111	045323	045714	046105	046495	046885
112	049218	049605	049993	050308	050766
113	053078	053456	053846	054230	054613
114	056905	057283	057666	058046	058426
115	060698	061075	061452	061829	062206
116	064458	064832	065206	065580	065953
117	068186	068557	068928	069298	069668
118	071882	072250	072617	072985	073352
119	075547	075912	076276	076640	077004
120	079181	079543	079994	080266	080626
121	082785	083144	083503	083861	084219
122	086360	086716	087071	087426	087781
123	089905	090258	090611	090963	091315
124	093422	093772	094122	094471	094820
125	096190	097257	097604	097951	098297
126	100371	100715	101059	101403	101747
127	103804	104145	104487	104828	105169
128	107210	107549	107888	108227	108565
129	110590	110926	111262	111598	111934
130	113943	114277	114611	114944	115278
131	117271	117603	117934	118265	118595
132	120574	120903	121231	121560	121888
133	123852	124178	124504	124830	125156
134	127105	127429	127752	128076	128399

Briggs's Logarithms.

5	6	7	8	9	D
002166	002598	003029	003460	003891	432
006466	006894	007321	007748	008174	428
010724	011147	011570	011993	012415	424
014940	015360	015779	016197	016615	420
019116	019532	019947	020361	020775	416
023252	023664	024075	024486	024896	411
027350	027757	028164	028571	028978	408
031408	031812	032216	032619	033021	404
035430	035830	036229	036629	037028	401
039414	039810	040207	040602	040998	397
043362	043755	044148	044540	044931	393
047275	047664	048053	048442	048830	390
051152	051538	051924	052309	052694	386
054906	055378	055760	056142	056524	383
058805	059185	059562	059942	060320	379
062582	062958	063333	063708	064083	376
066326	066698	067071	067443	067814	373
070038	070407	070776	071145	071514	370
073718	074085	074451	074816	075182	366
077368	077731	078094	078457	078819	364
080987	081347	081707	082067	082426	361
084576	084934	085291	085647	086004	357
088136	088490	088845	089198	089552	355
091667	092018	092369	092721	093071	352
095169	095518	095866	096215	096562	349
098644	098989	099335	099681	100026	347
102091	102434	102777	103119	103462	344
105510	105851	106191	106531	106870	341
108903	109241	109578	109916	110253	338
112270	112605	112940	113275	112609	336
115610	115943	116276	116608	116940	332
118926	119256	119586	119915	120245	330
122215	122543	122871	123198	123525	328
125481	125806	126131	126456	126781	325
128722	129045	129368	129690	130012	323

Briggs's Logarithms.

N	O	I	2	3	4
135	130334	130655	130977	131298	131619
136	133539	133858	134177	134496	134814
137	136721	137037	137354	137671	137987
138	139879	140194	140508	140822	141136
139	143015	143327	143639	143951	144263
140	146128	146438	146748	147058	147367
141	149219	149527	149835	150142	150449
142	152283	152594	152900	153205	153510
143	155336	155640	155943	156246	156549
144	158362	158664	158965	159266	159567
145	161368	161667	161967	162266	162564
146	164353	164650	164947	165244	165541
147	167317	167613	167908	168203	168497
148	170262	170555	170848	171141	171434
149	173186	173478	173769	174060	174351
150	176091	176318	176669	176939	177248
151	178977	179264	179552	179839	180126
152	181844	182129	182415	182699	182985
153	184691	184975	185259	185542	185825
154	187521	187803	188084	188366	189647
155	190332	190612	190892	191171	191451
156	193125	193403	193681	193959	194237
157	195900	196176	196453	196729	197005
158	198657	198932	199206	199481	199755
159	201397	201670	201943	202216	202488
160	204120	204391	204663	204934	205204
161	206826	207096	207365	207634	207904
162	209515	209783	210051	210319	210586
163	212188	212454	212730	212986	213253
164	214844	215109	215373	215638	215902
165	217484	217747	218010	218273	218536
166	220108	220370	220631	220892	221153
167	222716	222976	223236	223496	223755
168	225309	225563	225826	226048	226342
169	227887	228143	228400	228657	228913

Briggs's Logarithms.

5	6	7	8	9	D
131939	132260	132580	132900	133219	321
135133	135451	135768	136086	136403	319
138303	138618	138934	139249	139564	316
141450	141763	142076	142389	142702	314
144574	144885	145196	145507	145818	311
147676	147985	148294	148603	148911	309
150746	151063	151370	151676	151982	307
154815	154119	154424	154723	155032	305
156852	157154	157457	157759	158061	303
159868	160168	160469	160769	161068	301
162863	163161	163459	163758	164055	298
165838	166134	166430	166726	167022	297
168792	169086	169380	169764	169968	295
171726	172019	172311	172603	172895	292
174641	174932	175222	175512	175802	290
177536	177825	178113	178401	178689	289
180413	180699	180986	181272	181558	287
183270	183555	183839	184123	184407	285
186108	186391	186674	186956	187239	283
188928	189210	189490	189771	190051	281
191730	192009	192289	192567	192846	279
195514	194792	195069	195346	195623	278
197231	197556	197832	198107	198382	276
200029	200303	200577	200850	201124	274
202761	203033	203305	203577	203848	272
205475	205746	206016	206286	206556	271
208173	208441	208701	208978	209247	269
219853	211121	211388	211654	211921	267
213518	213783	214049	214314	214579	266
216616	216430	216694	216957	217221	264
218798	219060	219323	219585	219846	262
221414	221675	221936	222196	222456	261
224015	224274	224533	224791	225051	260
226600	226858	227115	227372	227630	258
229170	229426	229682	229938	230194	257

Briggs's Logarithms.

N	0	1	2	3	4
170	230449	230704	230959	231213	231470
171	232996	233250	233504	233757	234011
172	235528	235781	236033	236285	236537
173	238046	238297	238548	238799	239049
174	240549	240799	241048	241297	241546
175	243038	243286	243534	243782	244030
176	245513	245759	246006	246252	246499
177	247973	248219	248464	248709	248954
178	250420	250664	250908	251151	251395
179	252853	253096	253338	253580	253822
180	255272	255514	255755	255996	256236
181	257679	257919	258158	258398	258637
182	260071	260310	260548	260787	261025
183	262451	262688	262925	263162	263399
184	264818	265054	265290	265525	265761
185	264172	267406	267641	267875	268110
186	269513	269746	269980	270213	270446
187	271842	272074	272306	272538	272770
188	274158	274389	274620	274850	275081
189	276462	276691	276921	277151	277380
190	278754	278982	279210	279439	279667
191	281033	281261	281488	281715	281942
192	283301	283527	283753	283979	284205
193	285557	285782	286007	286232	286456
194	287802	288025	288249	288473	288696
195	290035	290257	290480	290702	290925
196	292256	292478	292699	292920	293141
197	294466	294687	294907	295127	295347
198	296665	296884	297104	297323	297542
199	298853	299071	299289	299507	299725
200	301030	301247	301464	301681	301898
201	303196	303412	303628	303844	304059
202	305351	305566	305781	305995	306210
203	307496	307710	307927	308137	308351
204	309630	309843	310056	310260	310481

Briggs's Logarithms.

5	6	7	8	9	D
231724	231979	232233	232488	232742	254
234264	234517	234770	235023	235276	253
236789	237041	237292	237544	237795	252
239299	239550	239800	240050	240300	250
241795	242044	242293	242541	242790	249
244277	244524	244772	245019	245266	247
246745	246991	247236	247482	247728	246
249198	249443	249687	249932	250176	244
251638	251881	252125	252367	252610	243
254064	254306	254548	254790	255031	242
256477	256718	256958	257198	257439	241
258877	259116	259355	259594	259833	239
261263	261501	261738	261976	262214	238
263636	263873	264109	264345	264582	237
265996	266232	266467	266702	266937	235
268344	268578	268812	269046	269279	234
270679	270912	271144	271377	271609	233
273001	273233	273464	273696	273927	231
275311	275542	275772	276002	276232	230
277609	277838	278064	278296	278525	229
279895	280123	280351	280578	280806	228
282169	282395	282622	282849	283075	227
284431	284656	284882	285107	285332	226
286681	286905	287130	287354	287578	225
288920	289143	289366	289589	289812	224
291147	291369	291591	291831	292034	222
293363	293583	293804	294015	294246	221
295567	295787	296007	296226	296446	220
297760	297979	298198	298416	298635	219
299943	300160	300373	300595	300813	218
302114	302331	302547	302764	302980	217
304275	304490	304706	304921	305136	216
306425	306639	306854	307068	307282	215
308564	308778	308991	309204	309417	213
310693	310906	311118	311330	311542	212

Briggs's Logarithms.

N	C	I	2	3	4
205	311754	311966	312177	312389	312600
206	313867	314078	314289	314499	314710
207	315970	316180	316390	316599	316809
208	318063	318272	318481	318689	318898
209	320146	320354	320562	320769	320977
210	322219	322426	322633	322839	323046
211	324282	324488	324694	324899	325105
212	326336	326541	326745	326950	327155
213	328380	328583	328787	328991	329194
214	330414	320617	350819	331022	331224
215	332430	332640	332842	333044	333246
216	333454	334655	334856	335057	335257
217	336460	336660	336860	337060	337260
218	338456	338656	338855	339054	339253
219	330444	340642	340841	341039	341237
220	342423	342620	342817	343014	343212
221	344392	344589	344785	344981	345178
222	346353	346549	346744	346939	347135
223	348305	348500	348694	348889	349083
224	350248	350441	350636	350829	351023
225	352183	352375	352568	352761	352954
226	354108	354301	354493	354685	354876
227	356026	356217	356403	356599	356790
228	357935	358125	358316	358506	358696
229	359835	360025	360215	360404	360593
230	361728	361917	362105	362294	362482
231	363612	363800	363988	364176	364363
232	365488	365675	365862	366049	366236
233	367356	367542	367729	367915	368101
234	369216	369101	369587	369772	369958
235	37109	371253	371437	371622	371806
236	372912	373096	373280	373464	373647
237	374748	374932	375115	375298	375481
238	376577	376759	376942	377124	377306
239	378398	378580	378761	378952	379124

Briggs's Logarithms.

5	6	7	8	9	D
312812	313234	313023	313445	313656	211
314920	315130	315340	315551	315760	210
317018	317227	317436	317646	317854	209
319106	319314	319522	319730	319938	209
321184	321391	321598	321805	322012	207
323252	323458	323665	323871	324077	106
325310	325511	325721	325926	326131	205
327359	327563	327767	327972	328176	204
329398	329601	329805	330008	330211	203
331427	331630	331832	332034	332236	202
333447	333649	333859	335051	334253	202
335458	335658	335859	336059	336260	201
337459	337659	337858	338058	348257	200
339451	339650	339849	340047	340246	199
341435	341632	341830	342028	342225	198
343409	343606	343802	343999	344196	197
345374	345570	345766	345962	346157	196
347330	347525	347720	347915	348110	195
349278	349572	349660	349850	350054	194
351216	351410	351603	351796	351989	193
353147	353339	353532	353724	353916	193
355068	355260	355452	355643	355834	192
356981	357172	357363	357554	357744	191
358886	359076	359266	359456	369646	190
360783	360972	361161	361350	361539	189
362671	362859	363048	363236	363424	188
364551	364739	364926	365113	365301	188
366423	366610	366796	366983	367169	187
368287	368473	368659	368845	369030	186
370143	370328	370513	370698	370883	185
371991	372175	372359	372544	372728	184
373831	374015	374198	374382	374565	184
375664	375846	376029	376212	376394	183
377488	377670	377852	378034	378216	182
379306	379487	379668	379849	380030	181

Briggs's Logarithms.

N	O	I	2	3	4
240	380211	380392	380573	380754	380934
241	382017	382197	382377	382557	382737
242	383815	383995	384174	384353	384533
243	385606	385785	385964	386142	386321
244	387390	387568	387746	387923	388101
245	389166	389343	389520	389697	389875
246	390935	391112	391288	391464	391641
247	392697	392873	393048	393224	393400
248	394452	394627	394802	394977	395152
249	396199	396374	396548	396722	396896
250	397940	398114	398287	398461	398634
251	399674	399847	400020	400192	400365
252	401400	401573	401745	401917	402089
253	403120	403297	403464	403635	403807
254	404834	405005	405176	405346	405517
255	406540	406710	406881	407051	407221
256	408240	408410	408579	408749	408918
257	409933	410102	410271	410440	410608
258	411620	411788	411957	412124	412292
259	413300	413467	413635	413802	413970
260	414973	415140	415307	415474	415641
261	416640	416807	416973	417139	417306
262	418301	418467	418633	418798	418964
263	419956	420121	420286	420451	420616
264	421604	421768	421933	422097	422261
265	423246	423410	423573	423737	423901
266	424882	425045	425208	425371	425534
267	426511	426674	426836	426999	427161
268	428135	428297	428459	428621	428782
269	429752	429914	430075	430236	430398
270	431364	431525	431685	431846	432007
271	432969	433129	433290	433450	433610
272	434569	434728	434888	435048	435207
275	436163	436322	436481	436640	436798
274	437751	437909	438067	438226	438384

Briggs's Logarithms.

5	6	7	8	9	N
381115	381296	381476	381656	381837	181
382917	383097	383277	383456	383636	180
384712	384891	385070	385249	385427	179
386499	386677	386856	387034	387212	178
388279	388456	388634	388811	388982	178
390051	390228	390405	390582	390758	177
391817	391993	392169	392345	392521	176
393575	393751	393926	394101	394176	176
395326	395501	395676	395850	396025	175
397060	397245	397418	397592	397766	174
398808	398981	399654	399327	399501	173
400538	400711	400883	401056	401218	173
402261	402433	402605	402777	402929	172
403978	404149	404320	404492	404663	171
405688	405858	406029	406199	406370	171
407391	407561	407731	407900	408070	170
409087	409257	409426	409595	409764	169
410777	410946	411114	411283	411451	169
412460	412628	412796	412964	413132	168
414137	414305	414472	414639	414806	167
415808	415974	416141	416308	416474	167
417472	417638	417804	417970	418135	166
419129	419295	419460	419625	419791	165
420781	420945	421110	421275	421439	165
422426	422590	422754	422918	423082	164
424064	424228	424392	424555	424718	164
425697	425860	426023	426186	426349	163
427324	427486	427648	427811	427973	162
428944	429106	429268	429429	429591	162
430559	430720	430881	431042	431203	161
432167	432338	432488	432649	432809	160
433770	433930	434090	434249	434409	160
435366	435526	435685	435844	436003	159
436957	437119	437275	437433	437592	159
438542	438700	438859	439017	439175	158

Briggs's Logarithms.

N	O	I	2	3	4
275	439333	439491	439648	439806	439964
276	440909	441066	441224	441381	441538
277	442480	442637	442793	442950	443106
278	444045	444201	444357	444513	444669
279	445604	445760	445915	446071	446226
280	447158	447313	447468	447623	447778
281	448706	448861	449015	449170	449324
282	450249	450403	450557	450711	450865
283	451786	451940	452093	452247	452400
284	453318	453471	453624	453777	453930
285	454845	454997	455149	455302	455454
286	456366	456518	456670	456821	456973
287	457882	458033	458184	458336	458487
288	459392	459543	459694	459845	459995
289	460898	461049	461198	461348	461499
290	462398	462548	462697	462847	462997
291	463893	464042	464191	464340	464489
292	465383	465532	465680	465829	465977
293	466868	467016	467164	467312	467460
294	468347	468495	468643	468790	468938
295	469822	469969	470116	470263	470410
296	471292	471438	471585	471732	471878
297	472756	472903	473049	473195	473341
298	474216	474362	474508	474653	474799
299	475671	475816	475962	476107	476252
300	477121	477266	477411	477555	477700
301	478566	478711	478855	478999	479143
302	480007	480151	480294	480438	480582
303	481443	481586	481729	481872	482016
304	482874	483016	483159	483302	483445
305	484300	484442	484585	484727	484869
306	482721	485863	486005	486147	486289
307	487138	487280	487421	487563	487704
308	488551	488692	488833	488874	489114
309	489958	490099	490239	490380	490520

Briggs's Logarithms.

5	6	7	8	9	N
440122	440279	440437	440594	440752	158
441695	441852	442009	442166	442323	157
443263	443419	443576	443732	443889	157
444825	444981	445137	445293	445449	156
446382	446537	446692	446848	447003	155
447933	448088	448242	448397	448552	155
449478	449633	449787	449941	450095	154
451018	451172	451326	451479	451633	154
452553	452706	452859	453012	453165	153
454082	454235	454387	454540	454692	153
455606	455758	455910	456062	456214	152
457125	457276	457428	457579	457731	152
458638	458789	458940	459091	459242	151
460146	460296	460447	460597	460748	151
461649	461799	461948	462098	462248	150
463146	463296	463445	463594	463744	150
464639	464787	464936	465085	465234	149
466126	466274	466423	466571	466719	149
467608	467756	467904	468052	468200	148
469085	469233	469380	469527	469675	147
470557	470704	470851	470998	471145	147
472025	472171	472318	472464	472610	146
473487	473633	473779	473925	474071	146
474944	475090	475235	475381	475526	146
476397	476542	476687	476832	476976	145
477844	477989	478133	478278	478422	145
479287	479431	479575	479719	479863	144
480725	480896	481012	481156	481299	144
482159	482302	482445	482588	482731	143
483587	483730	483872	484015	484157	143
485011	485153	485295	485437	485579	142
486430	486572	486714	486855	486997	142
487845	487986	488127	488269	488410	141
489255	489396	489537	489677	489818	141
490661	490801	490941	491081	491222	140

Briggs's Logarithms.

N	O	I	2	3	4
310	491362	491502	491642	491782	491922
311	492760	492900	493040	493179	493319
312	494155	494294	494433	494572	494711
313	495544	495683	495822	495960	496099
314	496930	497068	497206	497344	497482
315	498311	498448	498586	498724	498862
316	499687	499834	499962	500099	500236
317	500056	501196	501333	501470	501607
318	502427	502564	502700	502837	502973
319	503791	503927	504063	504199	504335
320	505155	505286	505421	505557	505692
321	506505	506640	506775	506911	507046
322	507852	507991	508125	508260	508395
323	509295	509337	509471	508606	509740
324	510545	510679	510813	510947	511081
325	511883	512017	512150	512284	512417
326	513218	513351	513484	513617	513750
327	514548	514681	514813	514946	515079
328	515874	516006	516139	516271	516403
329	517196	517328	517460	517592	517724
230	518514	518645	518777	518909	519040
331	519828	519959	520090	520221	520352
332	521138	521269	521400	521530	521661
333	522444	522575	522705	522835	522966
334	523746	523876	524006	524136	524266
335	525045	525174	525304	525433	525563
336	526339	526468	526598	526727	526856
337	527630	527759	527888	528016	528145
338	528917	529045	529174	529302	529430
339	530200	530328	530456	530584	530712
340	531479	531607	531734	531862	531989
341	532754	532882	533009	533136	533263
342	534026	534153	534280	534407	534534
343	535294	535421	535547	535674	535800
344	536558	536685	536811	536937	537063

Briggs's Logarithms.

5	6	7	8	9	D
492062	492201	492341	492481	492621	140
493458	493597	493737	493876	494015	139
494850	494989	495128	495267	495406	139
496237	496379	496514	496653	496791	139
497621	497759	497897	498035	498173	138
498999	499137	599275	499412	499550	138
500374	500511	500648	500785	500922	137
501744	501880	502017	502158	502290	137
503109	503246	503382	502154	503654	136
504471	504602	504743	504878	505014	136
505828	505963	506099	506234	506370	136
507181	507316	507451	507586	507721	135
508530	508664	508799	508933	509068	135
509874	510008	510143	510277	510411	134
511215	511348	511482	511616	511750	134
512551	512684	512818	512951	513084	134
513883	514016	514149	514282	514415	133
515211	515344	515476	515609	515741	132
516535	516668	516800	516932	517064	132
517855	517987	518119	518251	518382	131
519171	519303	519434	519566	519697	131
520483	520614	520745	520876	521007	131
521792	521922	522053	522183	522314	131
523096	523226	523356	523486	523616	130
524396	524526	524656	524785	524915	130
525692	525822	525951	526081	526210	129
526985	527114	527243	527372	527501	129
528274	528402	528531	528660	528788	129
529559	529687	529815	529943	530072	128
530840	530968	531095	531223	531351	128
532117	532245	532372	532500	532627	128
533391	533518	533645	533772	533899	128
534661	534787	534914	535041	535167	127
535927	536053	536179	536306	536432	127
537189	537315	537441	537567	537693	127

Briggs's Logarithms.

N	O	I	2	3	4
345	537819	537945	538071	538197	538322
346	539076	539202	539327	539452	539578
347	540329	540455	540580	540705	540830
348	541579	541704	541829	541953	542078
349	542825	542950	543074	543199	543323
350	544068	544192	544316	544440	544564
351	545307	545431	545555	545678	545802
352	546543	546666	546789	546913	547036
353	543775	547898	548021	548144	548267
354	549003	549126	549249	549371	549494
355	550228	550351	550473	550595	550717
356	551450	551572	551694	551816	551938
357	552668	552790	552911	553033	553155
358	553883	554004	554126	554247	554368
359	555094	555215	555336	555457	555578
360	556303	556423	556544	556664	556785
361	557507	557627	557748	557868	557988
362	558709	558829	558948	559068	559188
363	559907	560026	560146	560265	560385
364	561101	561221	561340	561459	561578
365	562293	562412	562531	562650	562769
366	563481	563600	563718	563837	563955
367	564666	564784	564903	565021	565139
368	565848	565966	566084	566202	566320
369	567026	567144	567262	567379	567497
370	568202	568319	568436	568554	568671
371	569374	569491	569608	569725	569842
372	570543	570660	570776	570893	571010
373	571700	571825	571942	572058	572174
374	572872	572988	573104	573220	573336
375	574031	574147	574263	574379	574494
376	575188	575303	575419	575534	575650
377	576341	576457	576572	576687	576802
378	577492	577607	577722	577836	577951
379	578639	578754	578868	578983	579097

Briggs's Logarithms.

5	6	7	8	9	D
538448	538574	538699	538852	538951	126
539703	539829	539954	540079	540204	125
540955	541080	541205	541330	541454	125
542203	542327	542452	542076	542701	125
542447	543571	542696	543820	543944	124
544688	544812	544939	545050	545183	124
545925	546049	546172	546295	546419	124
547159	547282	547405	547529	547652	123
548389	548512	548635	548758	548881	123
549615	549739	549891	549984	550106	123
550840	550962	551084	551206	551328	122
552059	552181	552303	552425	552547	122
553276	553398	553519	553640	553762	121
554489	554610	554731	554852	554973	121
555699	555820	555940	555061	556182	121
556905	557026	557146	557267	557387	120
558108	558228	558349	558469	558589	120
559308	559428	550548	559667	559787	120
560504	560624	560743	560863	560982	119
561698	561817	561936	562055	562174	119
562887	563006	563125	563244	563362	119
564074	564182	564311	564429	564548	119
565257	565376	565494	565612	565730	118
566437	566555	566673	566791	566909	118
567614	567732	567849	567967	568084	118
568788	568905	569023	569140	560257	117
569959	570076	570193	570309	570426	117
571126	571243	571359	571476	571592	117
572291	572407	572523	572639	572755	116
573452	573568	573684	573800	573915	116
574610	574726	574841	574957	575072	116
575765	575880	575996	576111	576226	115
576917	577032	577147	577262	577377	115
578066	578181	578295	578410	578525	115
579212	579326	579441	579555	579669	114

Briggs's Logarithms.

N	C	I	2	3	4
380	579784	579898	580012	580126	580240
381	580925	581039	581153	581267	581381
382	582063	582177	582291	582404	582518
383	583199	583312	583425	583539	583652
384	584331	584444	584557	584670	584783
385	585461	585573	585686	585799	585912
386	586587	586700	586812	586925	587037
387	587711	587823	587935	588047	588160
388	588832	588944	589055	589167	589279
389	589950	590061	590173	590284	590396
390	591065	591176	591287	591398	591510
391	592177	592288	592399	592510	592621
392	593286	593397	593508	593618	593729
393	594392	594503	594613	594724	594834
394	595496	595606	595717	595827	595937
395	596597	596707	596817	596927	597037
396	597695	597805	597914	598024	598134
397	598790	598900	599009	599119	599228
398	599883	599992	600101	600210	600319
399	600973	601082	601190	601299	601408
400	602060	602168	602277	602386	602494
401	603144	603253	603361	603469	603577
402	604226	604334	604442	604550	604658
403	605305	605413	605520	605628	605736
404	606381	606489	606596	606704	606811
405	607455	607562	607669	607777	607884
406	608526	608633	608740	608847	608954
407	609594	609701	609808	609914	600021
408	610600	610707	610813	610919	611026
409	611723	611829	611936	612042	612148
410	612784	612890	612996	613101	613207
411	613842	613947	614053	614159	614264
412	614897	615003	615108	615213	615319
413	615950	616055	616160	616265	616370
414	617000	617105	617210	617315	617420

Brigg's Logarithms.

5	6	7	8	9	D
580355	580469	580583	580697	580811	114
581494	581608	581722	581836	581950	114
582631	582745	582859	582972	583085	113
583765	583879	583992	584105	584218	113
584895	585007	585122	585235	585348	113
586024	586137	586250	586362	586475	112
587149	587262	587374	587486	587599	112
588272	588384	588496	588608	588720	112
589391	589503	589615	589726	589838	112
590507	590619	590730	590842	590953	111
591621	591732	591843	591955	592066	111
592732	592843	592954	593064	593175	111
593840	593950	594061	594171	594282	111
594945	595055	595166	595276	595386	111
596047	596157	596267	596377	596487	110
597146	597256	597366	597476	597586	110
598243	598353	598462	598572	598681	110
599337	599446	599556	599665	599774	109
600428	600537	600646	600755	600864	109
601517	601625	601734	601843	601951	109
602603	602711	602819	602928	603036	109
603685	603794	603902	604010	604118	108
604766	604874	604982	605089	605197	108
605843	605951	606059	606166	606274	107
606918	607026	607133	607240	607348	107
607991	608098	608205	608312	608419	107
609060	609167	609274	609381	609488	107
610128	610234	610341	610447	610554	107
611192	611298	611405	611511	611617	106
612254	612360	612466	612572	612678	106
613313	613419	613525	613630	613736	106
614370	614475	614681	614786	614892	106
615424	615529	615634	615740	615845	105
616475	616580	616685	616790	616895	105
617524	617629	617734	617839	617943	105

Briggs's Logarithms.

N	O	I	2	3	4
415	618048	618153	618257	618362	618466
416	619093	619198	619302	619406	619511
417	620136	620240	620344	620448	620552
418	621176	621280	621384	621488	621592
419	622214	622318	622421	622525	622628
420	623249	623353	623456	623559	623663
421	624282	624385	624488	624591	624695
422	625312	625415	625518	625621	625724
423	626340	626443	626546	626648	626751
424	627366	627468	627571	627673	627775
425	628389	628491	628593	628695	628797
426	629410	629511	629613	629715	629817
427	630428	630530	630631	630733	630835
428	631444	631545	631647	631748	631849
429	632457	632559	632660	632761	632862
430	633468	633569	633670	633771	633872
431	634477	634578	634679	634779	634880
432	635484	635584	635685	635785	635886
433	636488	636588	636688	636789	636889
434	637490	637590	637690	637790	637890
435	638489	638589	638689	638789	638888
436	639486	639586	639686	639785	639885
437	640481	640581	640680	640779	640879
438	641475	641573	641672	641771	641871
439	642465	642563	642662	642761	642860
440	643453	643551	643650	643749	643847
441	644439	644537	644636	644734	644832
442	645422	645521	645619	645717	645815
443	646404	646502	646600	646698	646796
444	647383	647481	647579	647676	647774
445	648360	648458	648555	648653	648750
446	649335	649432	649530	649627	649724
447	650308	650405	650502	650599	650696
448	651273	651375	651472	651569	651666
449	652246	652343	652440	652536	652633

Briggs's Logarithms.

5	6	7	8	9	D
618571	618676	618780	618884	618989	105
619615	619719	619824	619928	620032	104
620656	620760	620864	620968	621072	104
621695	621799	621902	622007	622110	104
622732	622835	622939	623042	623146	104
623766	623869	623973	624076	624179	103
624798	624901	624004	625107	625209	103
625827	625929	626032	626135	626238	103
626853	626959	627058	627161	627263	103
627878	627980	628082	628185	628287	102
628900	629002	629104	629206	629308	102
629919	630021	630123	630224	630326	102
630936	631038	631139	631241	631342	102
631951	632052	632153	632255	632356	101
632963	633064	633165	633266	633367	101
633973	634074	634175	634276	634376	100
634981	635081	635182	635283	635383	100
635986	636087	636187	636288	636388	100
636989	637089	637189	637289	637390	100
637990	638090	638190	638289	638389	99
638988	639088	639188	639287	638387	99
639984	640084	640183	640283	640382	99
640978	641077	641177	641276	641375	99
641970	642069	642168	642267	642366	99
642959	643058	643156	643255	643354	99
643946	644044	644143	644242	644340	98
644931	645029	645127	645226	645324	98
645913	646011	646109	646208	646306	98
646894	646992	647089	647187	647285	98
647872	647969	648067	648165	648762	98
648848	648945	649043	649140	649237	97
649821	649919	650016	650113	650210	97
650794	650890	650987	651084	651181	97
651760	651859	651956	652053	652152	97
652630	652826	652923	653019	653116	97

Briggs's Logarithms.

N	O	I	2	3	4
450	653212	653309	653404	653502	653598
451	654176	654273	654369	654465	654562
452	655138	655234	655331	655427	655523
453	656098	656194	656290	656386	656481
454	657054	657151	657247	657343	657438
455	658011	658107	658202	658298	658393
456	658965	659060	659155	659250	659346
457	659916	660011	660106	660201	660296
458	660865	660960	661055	661150	661245
459	661813	661907	662002	662096	662191
460	662758	662852	662947	663041	663135
461	663701	663795	663889	663983	664078
462	664642	664736	664830	664924	665018
463	665581	665675	665768	665862	665956
464	666518	666612	666705	666799	666892
465	667453	667546	667640	667733	667827
466	668386	668479	668572	668665	668758
467	669317	669410	669503	669595	669689
468	670246	670339	670431	670524	670617
469	671173	671265	671358	671451	671543
470	672098	672190	672283	672375	672467
471	673021	673113	673205	673297	673390
472	673942	674034	674126	674218	674310
473	674861	674953	675045	675136	675228
474	675778	675870	675961	676053	676145
475	676694	676785	676876	676968	677059
476	677607	677698	677789	677881	677973
477	678518	678609	678700	678791	678882
478	679428	679519	679610	679700	679791
479	680335	680426	680517	680607	680698
480	681241	681332	681422	681513	681603
481	682145	682235	682326	682416	682506
482	683047	683137	683227	684217	683407
483	683947	684037	684127	682317	684307
484	684845	684935	685025	685114	685204

Briggs's Logarithms.

5	6	7	8	9	D
653695	653791	653888	653984	654080	97
654658	654754	654850	654946	655042	96
655619	655714	655810	655906	656002	96
656577	656673	656769	656860	656950	96
657534	657629	657725	657820	657916	96
658488	658584	658679	658774	658870	95
659441	659536	659631	659726	659821	95
660391	660486	660581	660676	660771	95
661339	661434	661529	661623	661718	94
662285	662380	662474	662569	662663	94
663230	663324	663418	663512	663607	94
664172	664266	664360	664454	664548	94
665112	665206	665399	665393	665487	94
666050	666143	666237	666331	666424	94
666986	667079	667173	667266	667359	94
667920	668013	668106	668199	668293	94
668852	668945	669038	669131	669224	94
669782	669874	669967	670060	670153	93
670710	670802	670895	670988	671080	93
671636	671728	671821	671913	672005	93
672560	672652	672744	672836	672929	93
673482	673574	673666	673758	673850	92
674402	674494	674586	674677	674769	92
675320	675412	675503	675595	675687	92
676236	676328	676419	676511	676602	91
677150	677242	677333	677424	677516	91
678063	678154	678245	678336	678427	91
678973	679064	679155	679246	679337	91
679882	679973	680063	680154	680245	91
680789	680879	680970	681060	681151	91
681693	681784	681874	681964	682055	90
682596	682686	682777	682867	682957	90
683497	683587	683677	683767	683857	90
684396	684486	684576	684666	684756	90
685294	685383	685473	685563	685652	90

Briggs's Logarithms.

N	O	I	2	3	4
485	685742	685831	685921	686010	686100
486	686636	686726	686815	686904	686994
487	687529	687618	687707	687796	687885
488	688420	688509	688598	688687	688776
489	689309	689398	689486	689575	689664
490	690196	690285	690373	690462	690550
491	691081	691170	691258	691342	691435
492	691965	692053	692142	692237	692318
493	692847	692935	693023	693111	693199
494	693727	693815	693903	693941	694078
495	694605	694693	694781	694868	694956
496	695482	695569	695657	695744	695832
497	696356	696445	696531	696618	696706
498	697229	697317	697404	697491	697578
499	698101	698188	698275	698362	698449
500	698970	699057	699144	799231	699317
501	699835	699924	700011	700098	700184
502	700704	700790	700877	700963	701049
503	70168	701654	701741	701827	701913
504	702430	702517	702603	702689	702775
505	703291	703377	703463	703231	703635
506	704151	704236	704322	704408	704494
507	705008	705094	705179	705265	705350
508	705864	705949	706035	706120	706206
509	706718	706803	706888	706974	707059
510	707570	707655	707740	707826	707911
511	708421	708506	708591	708676	708761
512	709270	709455	709440	709524	709609
513	710117	710202	710287	710371	710456
514	710963	711048	711132	711217	711501
515	711807	711892	711976	712060	712144
516	712650	712734	712818	712902	712986
517	713491	713575	713659	713742	713826
518	714330	714414	714497	714581	714665
519	715167	715251	715335	715415	715501

Briggs's Logarithms.

5	6	7	8	9	D
685189	685279	685358	685458	685547	89
687083	687172	687261	687351	687440	89
687975	688064	688153	688242	688331	89
688865	688953	689042	689131	689220	89
689753	689841	689930	690019	690107	89
690539	690727	690816	690905	690993	89
691524	691612	691700	691789	691877	88
692405	692494	692583	692671	692759	88
693287	693375	693463	693551	693639	88
694165	694254	694342	694430	694517	88
695044	695131	695219	695307	695394	88
695919	696007	696094	696182	696270	87
696793	696880	696968	697055	697142	87
697655	697752	697839	697926	698014	87
698535	698622	698709	698796	698883	87
699404	699491	699578	699664	699751	87
700271	700358	700444	700531	700617	87
701136	701222	701309	701395	701482	86
701999	702086	702172	702258	702344	86
702861	702947	703033	703119	703205	86
703721	703807	703893	703979	704065	86
704579	704665	704751	704837	704922	86
705436	705522	705607	705693	705778	86
706291	706376	706462	706547	706632	85
707144	707229	707315	707400	707485	85
707996	708081	708166	708251	708336	85
708846	708931	709015	709100	709185	85
709694	709779	709863	709948	710033	85
710540	710625	710710	710794	710879	85
711385	711469	711554	711639	711722	84
712229	712313	712397	712481	712566	84
713070	713154	713238	713323	713407	84
713910	713994	714078	714162	714246	84
714749	714833	714916	715000	715084	84
715586	715669	715753	715836	715920	84

Briggs's Logarithms.

N	O	I	2	3	4
520	716003	716087	716170	716254	716337
521	716838	716921	717004	717088	717171
522	717671	717754	717837	717920	718003
523	718502	718585	718668	718751	718834
524	719331	719414	719497	719580	719663
525	720159	720242	720325	720407	720490
526	720986	721068	721151	721233	721316
527	721811	721893	721975	722058	722140
528	722633	722716	722798	722881	722963
529	723406	723538	723620	723700	723784
530	724276	724358	724440	724522	724603
531	725094	725176	725258	725340	725422
532	725912	725993	726075	726156	726238
533	726727	726809	726890	726972	727053
534	727541	727623	727704	727785	727866
535	728354	728435	728516	728597	728673
536	729165	729246	729327	729408	729481
537	729974	730055	730136	730217	730298
538	730782	730863	730944	731024	731105
539	731589	731669	731750	731830	731911
540	732394	732474	732555	732635	732715
541	733197	733278	733358	733438	733518
542	733999	734079	734159	734240	734320
543	734800	734880	734960	735040	735120
544	735599	735679	735759	735838	735918
545	736397	736476	736556	736635	736715
546	737193	737272	737352	737431	737511
547	737987	738067	738146	738225	738305
548	738781	738860	738939	739018	739097
549	739572	739651	739731	739810	739889
550	740363	740442	740521	740599	740678
551	741152	741230	741309	741388	741467
552	741939	742018	742096	742175	742254
553	742725	742804	742882	742961	743039
554	743510	743588	743667	743745	743823

Briggs's Logarithms.

5	6	7	8	9	D
716421	716504	716588	716671	716754	83
717254	717338	717421	717504	717587	83
718086	718169	718253	718336	718419	83
718917	719000	719083	716165	719248	83
719745	719828	719911	719994	720078	83
720573	720655	720738	720821	720903	83
721393	721481	721563	721646	721728	82
722222	722305	722387	722469	722552	82
723045	723127	723209	723291	723374	82
723866	723948	724030	724112	724194	82
724685	724767	724849	724931	725013	82
725503	725584	725667	725748	725830	82
726320	726401	726483	726564	726646	82
727134	727216	727297	727379	727460	81
727948	728029	728110	728191	728273	81
728759	728841	728922	729003	729034	81
729570	729651	729732	729813	729893	81
730378	730459	730540	730621	730702	81
731186	731266	731347	731428	731508	81
731991	732072	732152	732233	732313	81
732789	732876	732956	733037	733117	80
733598	733679	733759	733839	733919	80
734400	734480	734560	734640	734720	80
735199	735279	735359	735439	735519	80
735998	736078	736157	736237	736317	80
736795	736874	736954	737034	737113	80
737590	737670	737749	737829	737908	79
738384	738463	738543	738622	738701	79
739177	739256	739335	739414	739493	79
739968	740047	740126	740205	740284	79
740757	740836	740915	740994	741073	79
741546	741624	741703	741782	741860	79
742332	742411	742489	742568	742647	79
743118	743196	743275	743353	743431	78
743902	743980	744058	744136	744215	78

Briggs's Logarithms.

N	O	I	2	3	4
555	744293	744371	744449	744528	744606
556	745075	745153	745231	745309	745387
557	745855	745933	746011	746089	746167
558	746634	746712	746790	746868	746945
559	747412	747489	747567	747645	747722
560	748818	748266	748343	748421	748498
561	748963	749040	749118	749195	749272
562	749736	749814	749891	749968	750045
563	750508	750585	750663	750740	750817
564	751279	751356	751433	751510	751587
565	752048	752125	752202	752279	752356
566	752816	752893	752970	753047	753123
567	753583	753660	753736	753813	753889
568	754348	754425	754501	754578	754654
569	755112	755189	755265	755341	755417
570	755875	755951	756027	756103	756179
571	756636	756712	756788	756864	756940
572	757396	757472	757548	757624	757700
573	758155	758230	758306	758382	758458
574	758912	758988	759063	759139	759214
575	759668	759743	759819	759894	759970
576	760422	760498	760573	760649	760724
577	761176	761251	761326	761402	761477
578	761928	762003	762078	762153	762228
579	762679	762754	762829	762904	762978
580	763428	763503	763578	763653	763727
581	764176	764251	764326	764400	764475
582	764923	764998	765072	765147	765221
583	765669	765743	765818	765892	765966
584	766413	766487	766561	766636	766710
585	767156	767230	767304	767379	767453
586	767898	767972	768046	768120	768194
587	768638	768712	768786	768860	768934
588	769377	769451	769525	769599	769673
589	770115	770189	770263	770336	770410

Briggs's Logarithms.

5	6	7	8	9	D
744684	744762	744840	744919	744997	78
745465	745543	745621	745699	745777	78
746245	746323	746401	746479	746556	78
747023	747101	747179	747256	747334	78
747800	747877	747955	748033	748110	78
748576	748653	748731	748808	748885	77
749350	749427	749504	749582	749659	77
750123	750200	750277	750354	750431	77
750894	750971	751048	751125	751202	77
751664	751741	751818	751895	751972	77
752433	752509	752586	752663	752740	77
753200	753277	753353	753430	753506	77
753966	754042	754119	754195	754272	77
754730	754807	754883	754960	755036	76
755494	755570	755646	755722	755799	76
756255	756332	756408	756484	756560	76
757016	757092	757168	757244	757320	76
757775	757851	757927	758003	758079	76
758533	758609	758685	758761	758836	76
759290	759366	759441	759517	759592	76
760045	760121	760196	760272	760347	75
760799	760875	760950	761025	761101	75
761552	761627	761702	761778	761853	75
762303	762378	762453	762529	762604	75
763053	763128	763203	763278	763353	75
763802	763877	763952	764027	764101	75
764550	764624	764699	764774	764848	75
765296	765370	765445	765519	765594	75
766041	766115	766190	766264	766338	74
766784	766859	766933	767007	767082	74
767527	767601	767675	767749	767823	74
768268	768342	768416	768490	768564	74
769008	769082	769156	769230	769303	74
769745	769820	769894	769968	770042	74
770484	770557	770631	770705	770778	74

Briggs's Logarithms.

N	O	I	2	3	4
590	770825	770926	770999	771073	771146
591	771587	771661	771734	771808	771881
592	772322	772395	772468	772542	772615
593	773055	773128	773201	773274	773348
594	773786	773860	773933	774006	775079
595	774517	774590	774663	774736	774809
596	775246	775319	775392	775265	775338
597	775974	776047	776120	776193	776265
598	776701	776774	776846	776919	776992
599	777427	777499	777572	777944	777717
600	778451	778224	778296	778368	778441
601	778874	778947	779019	779091	779163
602	779596	779669	779741	779813	779885
603	780317	780389	780461	780533	780905
604	781037	781109	781181	781253	781324
605	781755	781827	781899	781971	782042
606	782473	782544	782616	782688	782759
607	783189	783260	783332	783403	783475
608	783904	783975	784046	784118	784139
609	784617	784689	784760	784831	784902
610	785330	785401	785472	785543	785615
611	786041	786112	786183	786254	786325
612	786751	786822	786893	786964	787035
613	787460	787531	787602	787673	787744
614	788168	788239	788310	788381	788451
615	788875	788946	789016	789087	789157
616	789581	789651	789722	789792	789863
617	790285	790356	790426	790496	790567
618	790988	791059	791129	791199	791269
619	791691	791761	791831	791901	791971
620	792392	792462	792532	792602	792672
621	793092	793162	793231	793301	793371
622	793790	793860	793930	794000	794070
623	794488	794558	794627	794697	794767
624	795185	795254	795324	795393	795463

Briggs's Logarithms.

5	6	7	8	9	N
771220	771293	771367	771440	771514	74
771955	772028	772102	772175	772248	73
772688	772762	772835	772908	772981	73
773421	773494	773567	773640	773713	73
774152	774225	774298	774371	774444	73
774882	774955	775028	775100	775173	73
775610	775683	775756	775829	775902	73
776338	776411	776483	776556	776629	73
777064	777137	777209	777282	777354	73
777739	777862	777934	778006	778079	72
778513	778585	778658	778720	778802	72
779236	779308	779380	779452	779524	72
779957	780029	780101	780173	780245	72
780977	780749	780821	780893	780965	72
781306	781468	781540	781612	781684	72
782114	782186	782258	782329	782401	72
782831	782902	782974	783046	783117	72
783546	783618	783689	783761	783832	71
784261	784332	784403	784475	784546	71
784974	785045	785116	785187	785259	71
785686	785757	785828	785899	785970	71
786396	786467	786538	786609	786680	71
787106	787177	787248	787319	787390	71
787815	787885	787956	788027	788098	71
788522	788593	788663	788734	788804	71
789228	789299	789369	789440	789510	71
789933	790004	790074	790144	790215	70
790637	790707	790777	790848	790918	70
791340	791410	791480	791550	791620	70
792041	792111	792181	792252	792322	70
792742	792812	792882	792953	793022	70
793441	794511	793581	793651	793721	70
794139	794209	794279	794349	794418	70
794833	794906	794976	795045	795118	70
795532	795602	795672	795741	795810	70

Briggs's Logarithms.

N	C	1	2	3	4
625	795880	795949	796019	796088	796158
626	796574	796644	796713	796782	796852
627	797268	797337	797406	797475	797545
628	797950	798029	798098	798167	798236
629	798651	798720	798789	798858	798927
630	799341	799409	799478	799547	799616
631	800029	800098	800167	800236	800305
632	800717	800786	800854	800923	800992
633	801404	801472	801541	801608	801678
634	802089	802158	802226	802295	802363
635	802774	802842	802910	802979	803047
636	803457	803525	803594	803662	803730
637	804139	804208	804276	804344	804412
638	804821	804889	804957	805025	805093
639	805501	805569	805637	805705	805773
640	806180	806248	806316	806384	806451
641	806858	806926	806993	807061	807129
642	807535	807603	807670	807738	807805
643	808211	808279	808346	808414	808481
644	808886	808953	809021	809088	809156
645	809560	809627	809694	809762	809829
646	810233	810301	810367	810434	810501
647	810904	810971	811039	811106	811173
648	811575	811642	811709	811776	811843
649	812245	812312	812379	812445	812512
650	812913	812980	813047	813114	813181
651	813581	813648	813714	813781	813848
652	814248	814314	814381	814447	814514
653	814913	814980	815046	815113	815179
654	815578	815644	815711	815777	815843
655	816241	816308	816374	816440	816506
656	816904	816970	817036	817102	817169
657	817565	817631	817698	817764	817830
658	818226	818292	818358	818424	818490
659	818885	818951	819017	819083	819149

Briggs's Logarithms.

5	6	7	8	9	D
796227	796297	796366	796436	796505	69
796921	796990	797060	797129	797198	69
797614	797683	797752	797821	797890	69
798305	798374	798443	798513	798582	69
798996	799065	799134	799203	799272	69
799685	799754	799823	799892	799961	69
800373	800442	800511	800580	800648	69
801061	801129	801198	801265	801335	69
801747	801815	801884	801852	802021	69
802432	802500	802568	802637	802705	68
803116	803184	803252	803321	803389	68
803798	803867	803935	804003	804071	68
804480	804548	804616	804685	804753	68
805161	805229	805297	805365	805433	68
805840	805908	805976	806044	806112	68
806519	806587	806655	806722	806790	68
807197	807264	807332	807400	807467	68
807873	807941	808008	808076	808143	68
808548	808616	808684	808751	808818	67
809223	809290	809358	809425	809492	67
809896	809964	810031	810098	810165	67
810569	810636	810703	810770	810837	67
811240	811307	811374	811441	811508	67
811910	811977	812044	812111	812178	67
812577	812646	812713	812780	812847	67
813247	813314	813381	813448	813514	66
813914	813981	814048	814114	814181	66
814581	814647	814714	814780	814847	66
815246	815312	815379	815445	815511	66
815910	815976	816042	816109	816175	66
816573	816639	816705	816771	816838	66
817235	817301	817367	817433	817499	66
817896	817962	818028	818094	818160	66
818556	818622	818688	818754	818819	66
819215	819281	819347	819412	819478	66

Briggs's Logarithms.

N	O	I	2	3	4
660	819544	819610	819676	819741	819807
661	820202	820267	820333	820399	820464
662	820858	820924	820989	821055	821120
663	821514	821579	821645	821710	821776
664	822168	822233	822299	822364	822430
665	822822	822887	822952	823018	823083
666	823474	823539	823605	823670	823735
667	824126	824101	824256	824321	824386
668	824777	824842	824907	824972	825036
669	825426	825491	825556	825621	825686
670	826075	826140	826204	826269	826334
671	826723	826787	826852	826917	826981
672	827369	827434	827499	827563	827608
673	828015	828080	828144	828209	828273
674	828660	828724	828789	828853	828918
675	829334	829368	829432	829497	829561
676	829947	830011	830075	830139	830204
677	830589	830653	830717	830781	830845
678	831230	831294	831358	831422	831486
679	831870	831934	831998	832062	832126
680	832509	832573	832636	832700	832764
681	833147	833211	833275	833338	833402
682	833784	833848	833912	833975	834039
683	834401	834484	834548	834611	834675
684	835056	835120	835183	835247	835310
685	835691	835754	835817	835881	835944
686	836324	836386	836451	836514	836577
687	836957	837020	837083	837146	837209
688	837588	837652	837715	837778	837841
689	838219	838282	838345	838408	838471
690	838849	838912	838975	839038	839101
691	839478	839541	839604	839667	839729
692	840106	840169	840232	840295	840357
693	840733	840795	840859	840921	840984
694	841359	841422	841485	841547	841610

5	6	7	8	9	D
819873	819939	820004	820070	820136	66
820530	820596	820661	820727	820792	66
821186	821251	821317	821382	821448	66
821841	821906	821972	822037	822103	65
822495	822560	822626	822691	822756	65
823148	823213	823279	823344	823409	65
823800	823865	823930	823996	824061	65
824451	824516	824581	824646	824771	65
825501	825166	825231	825296	825361	65
825751	825815	825880	825945	826009	65
826399	826464	826528	826593	826658	65
827046	827111	827175	827240	827305	65
827692	827757	827821	827886	827951	65
828338	828402	828867	823531	828596	64
828982	829046	829111	829175	829240	64
829625	829690	829754	829818	829882	64
830268	830332	830396	830460	830525	64
830909	830973	831037	831102	831166	64
831550	831614	831678	831742	831806	64
832189	832253	832317	832381	832445	64
832828	832892	832956	833019	833083	64
833466	833530	833593	833657	833721	64
834103	834166	834230	834294	834357	64
834739	834702	834866	834929	834993	64
835373	835437	835500	835564	835627	63
836007	836071	836134	836197	836261	63
836641	836704	836767	836830	836894	63
837273	837336	837399	837461	837525	63
837904	837969	838030	838093	838156	63
838534	838597	838660	838723	838786	63
839164	839237	839289	839352	839415	63
839792	839855	839918	839981	840043	63
840420	840482	840545	840608	840671	63
841046	841109	841172	841234	841297	63
841672	841735	841797	841860	841922	63

Brigg's Logarithms.

N	O	I	2	3	4
695	841985	842047	842110	842172	842235
696	842609	842672	842734	842796	842859
697	843233	843295	843357	843420	843482
698	843855	843918	843980	844042	844104
699	844477	844539	844601	844664	844726
700	845098	845160	845222	845284	845346
701	845718	845780	845842	845904	845966
702	846337	846399	846461	846523	846585
703	846955	847017	847079	847141	847202
704	847573	847634	847696	847758	847819
705	848189	848251	848312	848374	848435
706	848805	848866	848928	848989	849051
707	849419	849481	849542	849604	849665
708	850033	850095	850156	850217	850279
709	850646	850707	850769	850830	850891
710	851258	851319	851381	851442	851503
711	851869	851931	851992	852053	852114
712	852480	852541	852602	852663	852724
713	853089	853150	853211	853272	853333
714	853698	853759	853820	853881	853941
715	854306	854367	854428	854488	854549
716	854913	854974	855034	855095	855156
717	855519	855580	855640	855701	855761
718	856124	856185	856245	856306	856366
719	856729	856789	856850	856910	856970
720	857333	857393	857453	857513	857574
721	857935	857995	858056	858116	858176
722	858537	858597	858657	858718	858778
723	859138	859198	859258	859318	859278
724	859739	859799	859859	859918	859978
725	860338	860398	860458	860518	860578
726	860937	860996	861056	861116	861176
727	861534	861594	861654	861714	861773
728	862131	862191	862251	862310	862370
729	862727	862787	862847	862906	862966

Briggs's Logarithms.

5	6	7	8	9	N
842297	842360	842422	842484	842547	62
842921	842983	843046	843108	843170	62
843544	843606	843669	843731	843793	62
844166	844229	844291	844353	844415	62
844788	844850	844912	844974	845036	62
845408	845470	845532	845594	845656	62
846028	846090	846151	846213	846275	62
846646	846708	846770	846832	846894	62
847263	847325	847388	847449	847511	62
847881	847943	848004	848066	848127	62
848497	848559	848620	848682	848743	62
849112	849174	849235	849297	849358	61
849725	849788	849849	849911	849972	61
850340	850401	850462	850524	850585	61
850952	851014	851075	851136	851197	61
851564	851625	851686	851747	851809	61
852175	852236	852297	852358	852419	61
852785	852846	852907	852968	853029	61
853394	853455	853516	853576	853637	61
854002	854063	854124	854184	854245	61
854610	854670	854731	854792	854852	61
855216	855277	855337	855398	855459	61
855822	855882	855943	856003	856064	61
856427	856487	856548	856608	856668	60
857031	857091	857151	857212	857272	60
857634	857694	857754	857815	857875	60
858236	858296	858357	858417	858477	60
858838	858898	858958	859018	859078	60
859439	859499	859559	859619	859679	60
850038	850098	850158	850218	850278	60
860637	860697	860757	860817	860877	60
861236	861295	861355	861415	861475	60
861833	861893	861952	862012	862072	60
862430	862489	862549	862608	862668	60
863025	863085	863144	863204	863263	60

N	O	I	2	3	4
730	863323	863382	863442	863501	863561
731	863917	863977	864036	864099	864155
732	864511	864570	864630	864689	864748
733	865104	865163	865222	865282	865341
734	865696	865755	865815	865873	865933
735	866287	866346	866405	866465	866524
736	866878	866937	866996	867055	867114
737	867467	867526	867585	867644	867703
738	868058	868115	868174	868233	868292
739	868644	868703	868762	868821	868879
740	869232	869290	869349	869408	869466
741	869818	869877	869935	869994	870053
742	870404	870462	870521	870579	870638
743	870989	871047	871106	871164	871223
744	871573	871631	871690	871748	871806
745	872156	872215	872273	872332	872389
746	872739	872797	872855	872913	872972
747	873321	873379	873437	873495	873553
748	873902	873960	874018	874076	874134
749	874482	874540	874598	874656	874714
750	875061	875119	875177	875235	875293
751	875640	875698	875756	875813	875871
752	876218	876276	876333	876391	876449
753	876795	876853	876910	876968	877026
754	877371	877429	877488	877544	877602
755	877947	878004	878062	878119	878177
756	878522	878579	878637	878694	878751
757	879095	879153	879211	879268	879325
758	879669	879726	879784	879841	879898
759	880242	880299	880356	880413	880471
760	880814	880871	880928	880985	881042
761	881385	881442	881499	881556	881613
762	881955	882012	882069	882126	882183
763	882524	882581	882638	882695	882752
764	883093	883150	883207	883266	883321

5	6	7	8	9	D
863620	863680	863739	863798	863858	59
864214	864274	864333	864392	864452	59
864808	864867	864926	864985	865045	59
865400	865459	865518	865578	865637	59
865692	866051	866110	866169	866228	59
866585	866642	866701	866760	866819	59
867173	867232	867291	867350	867409	59
867762	867821	867880	867939	867997	59
868350	868409	868469	868527	868586	59
868938	868997	869056	869114	869173	59
869525	869584	869642	869701	869760	59
870111	870170	870228	870287	870345	59
870696	870795	870813	870872	870930	58
871281	871339	871398	871456	871515	58
871865	871923	871981	872040	872098	58
872448	872506	872564	872622	872681	58
873030	873088	873146	873294	873262	58
873611	873669	873727	873785	873843	58
874192	874250	874308	874366	874424	58
874772	874830	874887	874945	875003	58
875351	875409	875466	875524	875582	58
875929	875987	876044	876102	876160	58
876506	876564	876622	876680	876737	58
877083	877141	877198	877256	877314	58
877659	877717	877774	877832	877889	58
878234	878292	878349	878407	878464	57
878809	878866	878924	878981	879038	57
879383	879439	879497	879555	879612	57
879956	880013	880070	880127	880185	57
880528	880585	880642	880699	880756	57
881099	881156	881213	881270	881328	57
881670	881727	881784	881841	881898	57
882240	882297	882354	882411	882468	57
882809	882866	882923	882980	883036	57
883377	883434	883491	883548	883605	57

Briggs's Logarithms.

N	O	I	2	3	4
765	883661	883718	883775	883832	883888
766	884229	884285	884342	884399	884455
767	884795	884852	884909	884965	885022
768	885361	885418	885474	885531	885587
769	885925	885983	886039	886097	886155
770	886491	886547	886604	886660	886716
771	887054	887111	887167	887223	887280
772	887617	887673	887730	887786	887842
773	888179	888236	888292	888348	888404
774	888741	888797	888853	888909	888964
775	889302	889358	889414	889470	889526
776	889862	889918	889974	890030	890086
777	890421	890477	890533	890589	890644
778	890980	891035	891091	891147	891203
779	891537	891593	891649	891705	891760
780	892095	892150	892206	892262	892317
781	892651	892707	892762	892818	892873
782	893207	893262	893318	893373	893429
783	893762	893817	893873	893928	893984
784	894316	894371	894427	894482	894538
785	894870	894925	894980	895036	895091
786	895422	895478	895533	895588	895643
787	895975	896030	896085	896140	896195
788	896526	896581	896636	896691	896747
789	897077	897132	897187	897243	897297
790	897627	897682	897737	897792	897847
791	898176	898231	898286	898341	898396
792	898725	898780	898835	898890	898944
793	899273	899328	899383	899437	899492
794	899820	899875	899930	899985	900039
795	900367	900422	900476	900531	900586
796	900913	900968	901022	901077	901131
797	901458	901513	901567	901622	901676
798	902003	902057	902112	902166	902220
799	902547	902601	902655	902710	902764

Brigg's Logarithms.

5	6	7	8	9	D
883945	884002	884059	884115	884172	57
884512	884569	884625	884682	884739	57
885078	885135	885191	885248	885305	57
885644	885700	885757	885813	885869	57
886209	886265	886321	886378	886434	56
886773	886829	886885	886941	886998	56
887336	887392	887449	887505	887561	56
887898	887955	888011	888067	888123	56
888460	888516	888573	888629	888685	56
889021	889077	889133	889190	889246	56
889582	889638	889694	889750	889806	56
890141	890197	890253	890309	890365	56
890700	890756	890812	890868	890924	56
891259	891314	891370	891426	891482	56
891816	891872	891928	891983	892039	56
892373	892428	892484	892540	892595	56
892929	892985	893040	893096	893151	56
893484	893540	893595	893651	893706	56
894039	894094	894150	894205	894261	55
894593	894648	894704	894759	894814	55
895146	895201	895257	895312	895367	55
895699	895754	895809	895864	895919	55
896251	896306	896361	896416	896471	55
896802	896857	896912	896967	897022	55
897352	897407	897461	897517	897572	55
897902	897957	898011	898067	898122	55
898451	898506	898561	898615	898670	55
898999	899054	899109	899164	899218	55
899547	899602	899656	899711	899766	55
900094	900149	900203	900258	900312	55
900640	900695	900749	900804	900859	55
901186	901240	901295	901349	901404	55
901731	901785	901840	901894	901948	54
902275	902329	902384	902438	902492	54
902818	902873	902927	902981	903036	54

Briggs's Logarithms.

N	C	I	2	3	4
800	903090	903144	903198	903253	903307
801	903632	903687	903741	903795	903849
802	904174	904228	904283	904337	904391
803	904715	904770	904824	904878	904932
804	905276	905310	905364	905418	905472
805	905706	905850	905904	905958	906012
806	906335	906389	906443	906497	906550
807	906873	906927	907081	907035	907089
808	907411	907465	907519	907573	907626
809	907948	908002	908056	908109	908163
810	908485	908539	908592	908646	908699
811	909021	909074	909128	906181	909235
812	909556	909609	909663	909716	909770
813	910090	910144	910197	910251	910304
814	910624	910678	910731	910784	910838
815	911158	911211	911264	911317	911391
816	911690	911743	911797	911850	911903
817	912222	912275	912323	912381	912435
818	912753	912806	912859	912912	912966
819	913283	913337	913390	913443	913496
820	913814	913867	913920	913973	914026
821	914343	914396	914449	914502	914555
822	914872	914925	914977	915030	915583
823	915400	915453	915505	915558	915611
824	915927	915980	916033	916085	916138
825	916454	916507	916559	916612	916664
826	916980	917033	917085	917138	917190
827	917505	917558	917611	917663	917715
828	918030	918083	918135	918188	918240
829	918554	918607	918659	918712	918764
830	919078	919130	919183	919235	919287
831	919601	919653	919700	919758	919810
832	920123	920175	920228	920280	920332
833	920645	920697	920742	920801	920853
834	921166	921218	921270	921322	921374

Briggs's Logarithms.

5	6	7	8	9	D
903361	903416	903470	903524	903578	54
903903	903958	904012	904066	904120	54
904445	904499	904553	904607	904661	54
904986	905040	905094	905148	905202	54
905526	905580	905634	905688	905742	54
906065	906119	906173	906227	906281	54
906604	906658	906712	906766	906820	54
907142	907196	907250	907304	907358	54
907680	907734	907787	907841	907895	54
908217	908270	908424	908378	908431	54
908753	908807	908800	908914	908967	54
909288	909342	909395	909449	909502	54
909823	909877	909930	909984	910037	53
910358	910411	910464	910518	910571	53
910891	910944	910998	911051	911104	53
911424	911477	911530	911584	911637	53
911956	912009	912062	912116	912166	53
912488	912541	912594	912647	912700	53
913019	913072	913125	913178	913231	53
913549	913602	913655	913708	913761	53
914079	914132	914184	914237	914290	53
914603	914660	914713	914766	914819	53
915136	915189	915214	915294	915347	53
915664	915716	915769	915822	915874	53
916191	916243	916296	916349	916401	53
916717	916770	916822	916875	916927	53
917243	917295	917348	917400	917453	53
917768	917820	917873	917925	917978	53
918292	918345	918397	918459	918502	53
918816	918869	918921	918973	919026	53
919340	919392	919444	919496	919549	52
919862	919914	919967	920019	920071	52
920384	920436	920489	920541	920593	52
920906	920958	921010	921062	921114	52
92146	921478	921530	921582	921634	52

Briggs's Logarithms.

N	0	1	2	3	4
835	921686	921738	921790	921842	921894
836	922205	922253	922310	922362	922414
837	922725	922777	922829	922881	922933
838	923244	923296	923348	923399	923451
839	923762	923814	923865	923917	923969
840	924279	924331	924383	924434	924486
841	924795	924848	924899	924951	925002
842	925312	925364	925415	925467	925518
843	925828	925879	925931	925982	926034
844	926342	926394	926445	926497	926548
845	926875	926903	926959	927011	927062
846	927370	927422	927473	927524	927576
847	927883	927935	927986	928037	928088
848	928396	928447	928498	928549	928601
849	928903	928959	929010	929061	929112
850	929419	929470	929521	929572	929623
851	929930	929981	930032	930083	930134
852	930440	930491	930541	930592	930643
853	930949	931000	931051	931102	931152
854	931458	931509	931560	931610	931661
855	931966	932017	932068	932118	932169
856	932474	932524	932575	932626	932677
857	932981	933031	933082	933131	933183
858	933487	933538	933588	933639	933690
859	933993	934044	934094	934145	934195
860	934498	934549	934599	934650	934700
861	935003	935054	935104	935154	935205
862	935507	935558	935608	935658	935709
863	936011	936061	936111	936162	936212
864	936514	936564	936614	936665	936715
865	937016	937066	937116	937167	937217
866	937518	937568	937618	937668	937718
867	938019	938069	938119	938169	938219
868	938520	938570	938620	938670	938720
869	939020	939070	939120	939170	939220

Briggs's Logarithms.

5	6	7	8	9	D
921946	921998	922050	9221 2	922154	52
922466	922518	922570	922622	922674	52
922985	923037	923088	923140	923192	52
923503	923555	923607	923658	923710	52
924022	924070	924124	924176	924228	52
924538	924589	924641	924693	924744	52
925054	925106	925157	9252 9	925261	52
925570	925621	925673	925725	925776	52
926085	926137	926188	926239	926291	51
926600	926651	926702	926754	926805	51
927114	927165	927216	927268	927319	51
927627	927678	927730	927781	927832	51
928140	928191	928242	928293	928345	51
928652	928703	928754	928805	928856	51
929163	929214	929266	929317	929368	51
929674	929725	929776	929827	929878	51
930185	930236	930287	93 338	930389	51
930694	930745	930796	930847	930898	51
931203	931254	931305	931356	931407	51
931712	931763	931814	931864	931915	51
932220	932271	932322	932372	932423	51
932727	932778	932829	932879	932930	51
933234	933285	933335	933386	933437	51
933740	933791	933841	933892	933943	51
934246	934296	934347	934397	934448	51
934751	934801	934852	934902	934953	50
935255	935306	935356	935406	935457	50
935759	935809	935860	935910	935960	50
936262	936313	936363	936413	936463	50
936765	936815	936865	936916	936966	50
937267	937317	937367	937418	937468	50
937769	937819	937869	937919	937969	50
938269	938319	938370	938420	938469	50
938770	938820	938870	938920	938970	50
939270	939320	939370	939420	939470	50

Briggs's Logarithms.

N	0	1	2	3	4
870	939519	939569	939619	939668	939719
871	940018	940068	940118	940168	940218
872	940516	940566	940616	940666	940716
873	941014	941064	941114	941163	941213
874	941511	941561	941611	941660	941710
875	942008	942058	942107	942157	942206
876	942504	942554	942603	942653	942702
877	943000	943049	943099	943148	943198
878	943494	943544	943593	943643	943692
879	943989	944038	944088	944137	944186
880	944483	944532	944581	944631	944680
881	944976	945025	945074	945124	945173
882	945469	945518	945567	945616	945665
883	945916	946010	946059	946108	946157
884	946452	946501	946551	946600	946649
885	946943	946992	947041	947090	947139
886	947434	947483	947532	947581	947630
887	947924	947973	948022	948070	948119
888	948413	948462	948511	948560	948609
889	948902	948951	948999	949048	949097
890	949390	949439	949488	949536	949585
891	949878	949926	949975	950024	950073
892	950365	950414	950462	950511	950560
893	950851	950900	950949	950997	951046
894	951337	951386	951435	951483	951532
895	951823	951872	951920	951969	952017
896	952308	952356	952405	952453	952502
897	952792	952841	952889	952938	952986
898	953276	953325	953373	953421	953470
899	953706	953808	953856	953905	953953
900	954242	954291	954339	954387	954435
901	954725	954773	954821	954869	954918
902	955207	955255	955303	955351	955399
903	955688	955736	955784	955832	955880
904	956168	956216	956264	956313	956361

Briggs's Logarithms.

5	6	7	8	9	D
939769	939818	939868	939918	939968	50
940267	940317	940367	940417	940467	50
940765	940815	940865	940915	940964	50
941263	941313	941362	941412	941462	50
941760	941809	941859	941909	941958	50
942256	942306	942355	942405	942454	50
942752	942801	942851	942900	942950	50
943247	943297	943346	943396	943445	49
943742	943791	943841	943890	943939	49
944236	944285	944335	944384	944433	49
944729	944779	944828	944877	944927	49
945222	945272	945321	945370	945419	49
945715	945764	945813	945862	945911	49
946207	946256	946305	946354	946403	49
946698	946747	946796	946845	946894	49
947189	947238	947278	947336	947385	49
947679	947728	947777	947826	947875	49
949168	948217	948266	948315	948364	49
948657	948706	948755	948804	948853	49
949146	949195	949245	949292	949341	49
949534	949583	949731	949780	949829	49
950121	950170	950219	950267	950316	49
950608	950657	950706	950754	950803	49
951095	951143	951192	951240	951289	49
951580	951629	951677	951729	951775	49
952066	952114	952163	952211	952259	49
952550	952599	952647	952696	952744	48
953034	953083	953131	953180	953228	48
953518	953566	953615	953663	953711	48
954001	954049	954098	954146	954194	48
954484	954532	954580	954628	954977	48
954966	955214	955062	955110	955158	48
955447	955495	955543	955591	955640	48
955928	955976	956024	956072	956120	48
956409	956457	956505	956553	956601	48

Briggs's Logarithms.

N	0	1	2	3	4
905	956649	956597	956745	956793	956840
906	957123	957176	957224	957272	957320
907	957607	957655	957703	957751	957799
908	958086	958134	958181	958229	958277
909	958564	958612	958659	958707	958755
910	959041	959089	959137	959184	959232
911	959518	959566	959614	959661	959709
912	959995	960042	960090	960138	960185
913	960471	960518	960566	960613	960661
914	960946	960994	961041	961089	961136
915	961421	961468	961516	961563	961611
916	961895	961934	961990	962038	962085
917	962369	962417	962464	962511	962559
918	962843	962890	962937	962985	963032
919	963315	963363	963410	963457	963504
920	963783	963835	963882	963929	963977
921	964260	964307	964354	964401	964448
922	964731	964778	964821	964872	964919
923	965202	965249	965295	965343	965390
924	965672	965719	965766	965813	965860
925	966142	966189	966236	966283	966329
926	966611	966658	966705	966752	966798
927	967080	967127	967173	967220	967267
928	967548	967595	967642	967688	967735
929	968016	968062	968109	968156	968202
930	968483	968530	968576	968623	968670
931	968950	968996	969043	969090	969136
932	969416	969463	969509	969556	969602
933	969882	969928	969975	970021	970068
934	970347	970393	970440	970486	970533
935	970812	970858	970904	970951	970997
936	971276	971322	971369	971415	971461
937	971740	971786	971832	971879	971925
938	972203	972249	972295	972342	972388
939	972666	972712	972758	972804	972851

Briggs's Logarithms.

5	6	7	8	9	D
956885	956936	956984	957032	957080	48
957368	957416	957464	957512	957559	48
957847	957894	957942	957990	958038	48
958325	958373	958421	958468	958516	48
958803	958850	958898	958946	958994	48
959280	959328	959375	959423	959471	48
959757	959804	959852	959900	959947	48
960235	960283	960328	960376	960423	48
960709	960756	960804	960851	960899	48
961184	961231	961279	961326	961374	47
961658	961706	961753	961801	961848	47
962132	962180	962227	962275	962322	47
962606	962653	962701	962748	962795	47
963079	963126	963174	963221	963268	47
963552	963599	963646	963693	963741	47
964024	964071	964118	964165	964212	47
964495	964542	964590	964637	964684	47
964966	965013	965061	965108	965155	47
965437	965484	965531	965578	965624	47
965907	965954	966001	966048	966095	47
966376	966423	966470	966517	966564	47
966845	966892	966939	966986	967033	47
967314	967361	967408	967454	967501	47
967782	967829	967875	967922	967969	47
968249	968296	968343	968389	968436	47
968716	968763	968810	968856	968903	47
969183	969229	969276	969323	969369	47
969649	969695	969742	969789	969835	47
970114	970161	970207	970254	970300	47
970579	970626	970672	970719	970765	46
971044	971090	971137	971183	971229	46
971508	971554	971601	971647	971693	46
971971	972018	972064	972110	972157	46
972434	972481	972527	972573	972619	46
972897	972943	972989	973035	973082	46

Briggs's Logarithms.

N	O	I	2	3	4
940	973128	973174	973220	973266	973313
941	973550	973636	973682	973728	973774
942	974051	974097	974143	974189	974235
943	974512	974558	974604	974650	974696
944	974972	975018	975064	975110	975156
945	975432	975478	975524	975570	975616
946	975891	975937	975983	976029	976075
947	976350	976396	976442	976488	976533
948	976828	976874	976920	976966	977012
949	977266	977312	977358	977403	977449
950	977724	977769	977815	977861	977906
951	978181	978226	978272	978317	978363
952	978637	978683	978728	978774	978819
953	979093	979138	979184	979230	979275
954	979548	979594	979639	979685	979730
955	980003	980049	980094	980140	980185
956	980458	980503	980539	980594	980640
957	980912	980957	981003	981048	981093
958	981366	981411	981456	981501	981547
959	981819	981864	981909	981954	982000
960	982271	982316	982361	982407	982452
961	982723	982769	982814	982859	982904
962	983175	983220	983265	983310	983356
963	983626	983671	983716	983762	983807
964	984077	984122	984167	984212	984257
965	984527	984572	984617	984662	984707
966	984977	985022	985067	985112	985157
967	985426	985471	985516	985561	985606
968	985875	985920	985965	986010	986055
969	986324	986369	986413	986458	986503
970	986772	986816	986861	986906	986951
971	987219	987264	987309	987353	987398
972	987666	987711	987756	987800	987845
973	988113	988157	988202	988247	988291
974	988559	988604	988648	988693	988737

Briggs's Logarithms.

5	6	7	8	9	D
973359	973405	973451	973497	973543	46
973820	973866	973913	973959	974005	46
974281	974327	974374	974420	974466	46
974742	974788	974834	974880	974926	46
975202	975248	975294	975340	975386	46
975662	975707	975753	975799	975845	46
976121	976167	976212	976258	976304	46
976579	976625	976671	976717	976763	46
977037	977083	977129	977175	977220	46
977495	977541	977586	977632	977678	46
977952	977998	978043	978089	978135	46
978409	978454	978500	978546	978591	46
978865	978911	978956	979002	979047	46
979321	979366	979412	979457	979503	46
979776	979821	979867	979912	979958	46
980231	980276	980322	980367	980412	45
980685	980730	980776	980821	980867	45
981139	981184	981229	981275	981320	45
981592	981637	981683	981728	981773	45
982045	982090	982135	982181	982226	45
982467	982513	982558	982603	982648	45
982919	982964	983010	983055	983100	45
983371	983416	983461	983506	983551	45
983822	983867	983912	983957	984002	45
984272	984317	984362	984407	984452	45
984722	984767	984812	984857	984902	45
985172	985217	985262	985307	985352	45
985622	985667	985712	985757	985802	45
986072	986117	986162	986207	986252	45
986522	986567	986612	986657	986702	45
986972	987017	987062	987107	987152	45
987422	987467	987512	987557	987602	45
987872	987917	987962	988007	988052	45
988322	988367	988412	988457	988502	45
988772	988817	988862	988907	988952	45

Briggs's Logarithms.

N	0	1	2	3	4
975	989005	989049	989094	989138	989183
976	989450	989494	989539	989583	989628
977	989895	989939	989983	990023	990072
978	990339	990383	990428	990472	990516
979	990783	990827	990871	990916	990960
980	991226	991270	991315	991359	991403
981	991669	991713	991757	991802	991845
982	992111	992156	992200	992244	992288
983	992554	992598	992642	992686	992730
984	992995	993039	993083	993127	993172
985	993436	993480	993524	993568	993613
986	993877	993921	993965	994009	994053
987	994317	994361	994405	994449	994493
988	994757	994801	994845	994889	994933
989	995196	995240	995284	995328	995372
990	995635	995679	995723	995767	995811
991	996074	996117	996161	996205	996249
992	996522	996565	996609	996653	996697
993	996949	996993	997037	997080	997124
994	997386	997430	997474	997517	997561
995	997823	997867	997910	997954	997998
996	998259	998303	998346	998390	998434
997	998695	998739	998782	998826	998869
998	999130	999174	999218	999261	999305
999	999565	999609	999652	999696	999739

End of the Table

Briggs's Logarithms.

5	6	7	8	9	D
989227	989372	989316	989301	989405	45
989572	989717	989761	989806	989850	44
990117	990161	990206	990250	990294	44
990561	990605	990650	990694	990738	44
991004	991509	991093	991137	991182	44
991448	991492	991536	991580	991625	44
991890	991934	991979	992023	992067	44
992333	992377	992421	992465	992509	44
992774	992819	992863	992907	992951	44
993216	993260	993304	993348	993392	44
993657	993701	993745	993789	993833	44
993097	994141	994185	994229	994273	44
994537	994581	994625	994669	994713	44
994977	995021	995065	995108	995152	44
995416	995460	995504	995547	995591	44
995854	995898	995942	995986	996030	44
996293	996337	996380	996424	996468	44
996731	996774	996818	996862	996906	44
997168	997212	997255	997299	997043	44
997695	997648	997692	997736	997779	44
998041	998085	998129	998172	998216	44
998477	998521	998564	998608	998652	44
998913	998956	999000	999043	999087	44
999438	999392	999435	999479	999522	44
999783	999826	999870	999913	999956	44

Of Logarithms.

Here followeth

A TABLE

OF

PARTS PROPORTIONAL,

FOR

The finding the Logarithms of all
Numbers, betwixt 10000 and
100000.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
43	4	8	12	17	21	25	30	34	38
44	4	8	13	17	22	26	30	35	39
45	4	9	13	18	22	27	31	36	40
46	4	9	13	18	23	27	32	36	41
47	4	9	14	18	23	28	32	37	42
48	4	9	14	19	24	28	33	38	43
49	4	9	14	19	24	29	34	39	44
50	5	10	15	20	25	30	35	40	45
51	5	10	15	20	25	30	35	40	45
52	5	10	15	20	26	31	36	41	46
53	5	10	15	21	26	31	37	42	47
54	5	10	16	21	27	32	37	43	48
55	5	11	16	22	27	33	38	44	49
56	5	11	16	22	28	33	39	44	50
57	5	11	17	22	28	34	39	45	51
58	5	11	17	23	29	34	40	46	52
59	5	11	17	23	29	35	41	47	53
60	6	12	18	24	30	36	42	48	54
61	6	12	18	24	30	36	42	48	54
62	6	12	18	24	31	37	43	49	55
63	6	12	18	25	31	37	44	50	56
64	6	12	19	25	32	38	44	51	57
65	6	13	19	26	32	39	45	52	58
66	6	13	19	26	33	39	46	52	59
67	6	13	20	26	33	40	46	53	60
68	6	13	20	27	34	40	47	54	61
69	6	13	20	27	34	41	48	55	62
70	7	14	21	28	35	42	49	56	63
71	7	14	21	28	35	42	49	56	63
72	7	14	21	28	36	43	50	57	64
73	7	14	21	29	36	43	51	58	65
74	7	14	22	29	37	44	51	59	66
75	7	15	22	30	37	45	52	60	67
76	7	15	22	30	38	45	53	60	68

Briggs's Logarithms.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
77	7	15	23	30	38	46	53	61	69
78	7	15	23	31	39	46	54	62	70
79	7	15	23	31	39	47	55	63	71
80	8	16	24	32	40	48	56	64	72
81	8	16	24	32	40	48	56	64	72
82	8	16	24	32	41	49	57	65	73
83	8	16	24	33	41	49	58	66	74
84	8	16	25	33	42	50	58	67	75
85	8	17	25	34	42	51	59	68	76
86	8	17	25	34	43	51	59	68	77
87	8	17	26	34	43	52	60	69	78
88	8	17	26	35	44	52	61	70	79
89	8	17	26	35	44	53	62	71	80
90	9	18	27	36	45	54	63	72	81
91	9	18	27	36	45	54	63	72	81
92	9	18	27	36	46	55	64	73	82
93	9	18	27	37	46	55	65	74	83
94	9	18	28	37	47	56	65	75	84
95	9	19	28	38	47	57	66	76	85
96	9	19	28	38	48	57	67	76	86
97	9	19	29	38	48	58	67	77	87
98	9	19	29	39	49	58	68	78	88
99	9	19	29	39	49	59	69	79	89
100	10	20	30	40	50	60	70	80	90
101	10	20	30	40	50	60	70	80	90
102	10	20	30	40	51	61	71	81	91
103	10	20	30	41	51	61	72	82	92
104	10	20	31	41	52	62	72	83	93
105	10	21	31	42	52	63	73	84	94
106	10	21	31	42	53	63	74	84	95
107	10	21	32	42	53	64	74	85	96
108	10	21	32	43	54	64	75	86	97
109	10	21	32	43	54	65	76	87	98
110	11	22	33	44	55	66	77	88	99

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
111	11	22	33	44	55	66	77	88	99
112	11	22	33	44	56	67	78	89	100
113	11	22	33	45	57	67	78	90	101
114	11	22	34	45	57	68	79	91	102
115	11	23	34	46	57	69	80	92	103
116	11	23	34	46	58	69	81	92	104
117	11	23	35	46	58	70	81	93	105
118	11	23	35	47	59	70	82	94	106
119	11	23	35	47	59	71	83	95	107
120	12	24	35	48	60	72	84	96	108
121	12	24	36	48	60	72	84	96	108
122	12	24	36	48	61	73	85	97	109
123	12	24	36	48	61	73	86	98	110
124	12	24	37	49	62	74	86	99	111
125	12	25	37	50	62	75	87	100	112
126	12	25	37	50	63	75	88	100	113
127	12	25	38	50	63	76	88	101	114
128	12	25	38	51	64	76	89	102	115
129	12	25	38	51	64	77	90	103	116
130	13	26	39	52	65	78	91	104	117
131	13	26	39	52	65	78	91	104	117
132	13	26	39	52	66	79	92	105	118
133	13	26	39	53	66	79	93	106	119
134	13	26	40	53	67	80	93	107	120
135	13	27	40	54	67	81	94	108	121
136	13	27	40	54	68	81	95	108	122
137	13	27	41	54	68	82	95	109	123
138	13	27	41	55	69	82	96	110	124
139	13	27	41	55	69	83	97	111	125
140	14	28	42	56	70	84	98	112	126
141	14	28	42	56	70	84	98	112	126
142	14	28	42	56	71	85	99	113	127
143	14	28	42	57	71	85	100	114	128
144	14	28	43	57	72	86	100	115	129

Briggs's Logarithms.

Parts Proportional.

D.	1	2	3	4	5	6	7	8	9
145	14	28	43	58	72	87	101	116	130
146	14	29	43	58	73	87	102	116	131
147	14	29	44	58	73	88	102	117	132
148	14	29	44	59	74	88	103	118	133
149	14	29	44	59	74	89	104	119	134
150	15	30	45	60	75	90	105	120	135
151	15	30	45	60	75	90	105	120	135
152	15	30	45	60	76	91	106	121	136
153	15	30	45	60	76	91	107	122	137
154	15	30	46	61	77	92	107	123	138
155	15	31	46	62	77	93	108	124	138
156	15	31	46	62	78	93	109	124	140
157	15	31	47	62	78	94	109	125	141
158	15	31	47	63	79	94	110	126	142
159	15	31	47	63	79	95	111	127	143
160	16	32	48	64	80	96	112	128	144
161	16	32	48	64	80	96	112	128	144
162	16	32	48	65	81	97	113	129	145
163	16	32	48	65	82	98	114	130	146
164	16	32	49	66	82	98	114	131	147
165	16	33	49	66	82	99	115	132	148
166	16	33	49	66	83	99	116	132	149
167	16	33	50	66	83	100	116	133	150
168	16	33	50	67	84	100	117	134	151
169	16	33	50	67	84	101	118	135	152
170	17	34	51	68	85	102	119	136	153
171	17	34	51	68	85	102	119	136	153
172	17	34	51	68	86	103	120	137	154
173	17	34	51	69	86	103	121	138	155
174	17	34	52	69	87	104	121	139	156
175	17	35	52	70	87	105	122	140	157
176	17	35	52	70	88	105	123	140	158
177	17	35	53	70	88	106	123	141	159
178	17	35	53	71	89	106	124	142	160

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
179	17	35	53	71	89	107	125	143	161
180	18	36	54	72	90	108	126	144	162
181	18	36	54	72	90	108	126	144	162
182	18	36	54	72	91	109	127	145	163
183	18	36	54	73	91	109	128	146	164
184	18	36	55	73	92	110	128	147	165
185	18	37	55	74	92	111	129	148	166
186	18	37	55	74	93	111	130	148	167
187	18	37	56	74	93	112	130	149	168
188	18	37	56	75	94	112	131	150	169
189	18	37	56	75	94	113	132	151	170
190	19	38	57	76	95	114	133	152	171
191	19	38	57	76	95	114	133	152	171
192	19	38	57	76	96	115	134	153	172
193	19	38	57	77	96	115	235	154	173
194	19	38	58	77	97	116	135	155	174
195	19	39	58	78	97	117	136	156	175
196	19	39	59	78	98	117	136	156	176
197	19	39	59	78	98	118	137	157	177
198	19	39	59	79	99	118	138	158	178
199	19	39	59	79	99	119	139	159	179
200	20	40	60	80	100	120	140	160	180
201	20	40	60	80	100	120	140	160	180
202	20	40	60	80	101	121	141	161	181
203	20	40	60	81	101	121	142	162	182
204	20	40	61	81	102	122	142	163	183
205	20	41	61	82	102	123	143	164	184
206	20	41	61	82	103	123	144	164	185
207	20	41	62	82	103	124	144	165	186
208	20	41	62	83	104	124	145	166	187
209	20	41	62	83	104	125	146	167	188
210	21	42	63	84	105	126	147	168	189
211	21	42	63	84	105	126	147	168	189
212	21	42	63	84	106	127	148	169	190

Briggs's Logarithms.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
213	21	42	63	85	106	127	149	170	191
214	21	42	64	85	107	128	149	171	192
215	21	43	64	86	107	129	150	172	193
216	21	43	64	86	108	129	151	172	194
217	21	43	65	86	108	130	151	173	195
218	21	43	65	87	109	130	152	174	196
219	21	43	65	87	109	131	153	175	197
220	22	44	66	88	110	132	154	176	198
221	22	44	66	88	110	132	154	176	198
222	22	44	66	88	111	133	155	177	199
223	22	44	66	89	111	133	156	178	200
224	22	44	67	89	112	134	156	179	201
225	22	45	67	90	112	135	157	180	202
226	22	45	67	90	113	135	158	180	203
227	22	45	68	90	113	136	158	181	204
228	22	45	68	91	114	136	159	182	205
229	23	45	68	91	114	137	160	183	206
230	23	46	69	92	115	138	161	184	207
231	23	46	69	92	115	138	161	184	207
232	23	46	69	92	116	139	162	185	208
233	23	46	69	93	116	139	163	186	209
234	23	46	70	93	117	140	163	187	210
235	23	47	70	94	117	141	164	188	211
236	23	47	70	94	118	141	165	188	212
237	23	47	71	94	118	142	165	189	213
238	23	47	71	95	119	142	166	190	214
239	24	47	71	95	119	143	167	191	215
240	24	48	72	95	120	144	168	192	216
241	24	48	72	96	120	144	168	192	216
242	24	48	72	96	121	145	169	193	217
243	24	48	72	97	121	145	170	194	218
244	24	48	73	97	122	146	170	195	219
245	24	49	73	98	122	147	171	196	220
246	24	49	73	98	123	147	172	196	221

Bigg's Logarithms.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
247	24	49	74	93	123	148	172	197	222
248	24	49	74	99	124	148	173	198	223
249	24	49	74	99	124	149	174	199	224
250	25	50	75	100	125	150	175	200	225
251	25	50	75	100	125	150	175	200	225
252	25	50	75	100	126	151	176	201	226
253	25	50	75	101	126	151	177	202	227
254	25	50	76	101	127	152	177	203	228
255	25	50	76	102	127	153	178	204	229
256	25	51	76	102	128	153	179	204	230
257	25	51	77	102	128	154	179	205	231
258	25	51	77	103	129	154	180	205	232
259	25	51	77	103	129	155	181	207	233
260	26	52	78	104	130	156	182	208	234
261	26	52	78	104	130	156	182	208	234
262	26	52	78	104	131	156	183	209	235
263	26	52	78	105	131	157	184	210	236
264	26	52	79	105	132	158	184	211	237
265	26	53	79	106	132	159	185	212	238
266	26	53	79	106	133	159	185	212	239
267	26	53	80	106	133	160	186	213	240
268	26	53	80	107	134	160	187	214	241
269	26	53	80	107	134	161	188	215	242
270	27	54	81	108	135	162	189	216	243
271	27	54	81	108	135	162	189	216	243
272	27	54	81	108	136	163	190	217	244
273	27	54	81	109	136	163	191	218	245
274	27	54	82	109	137	164	191	219	246
275	27	55	82	110	137	165	192	220	247
276	27	55	82	110	138	165	193	220	248
277	27	55	83	110	138	166	193	221	249
278	27	55	83	111	139	166	194	222	250
279	27	55	83	111	139	167	195	223	251
280	28	56	84	112	140	168	196	224	252

Briggs's Logarithms.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
281	28	56	84	112	140	168	196	224	252
282	28	56	84	112	141	169	197	225	253
283	28	56	84	113	141	169	198	226	254
284	28	56	85	113	142	170	168	227	255
285	28	57	85	114	142	171	199	228	256
286	28	57	85	114	143	171	200	228	257
287	28	57	86	114	143	172	200	229	258
288	28	57	86	115	144	172	201	230	259
289	28	57	86	115	144	173	202	231	260
290	29	58	87	116	145	174	203	232	261
291	29	58	87	116	145	174	203	232	261
292	29	58	87	116	146	175	204	233	262
293	29	58	87	117	146	175	205	234	263
294	29	58	88	117	147	176	205	235	264
295	29	59	88	118	147	177	206	236	265
296	29	59	88	118	148	177	607	236	266
297	29	59	88	118	148	178	207	237	267
298	29	59	89	119	149	178	208	238	268
299	29	59	89	119	149	179	209	239	269
300	30	60	90	120	150	180	210	240	270
301	30	60	90	120	150	180	210	240	270
302	30	60	90	120	151	181	211	241	271
303	30	60	90	121	151	181	212	242	272
304	30	60	91	121	152	182	212	243	273
305	30	61	91	122	152	183	213	244	274
306	30	61	91	122	153	183	214	244	275
307	30	61	92	122	153	184	214	245	276
308	30	61	92	123	154	184	215	246	277
309	30	61	92	123	154	185	216	247	278
310	31	62	93	124	155	186	217	248	279
311	31	62	93	124	155	186	217	248	279
312	31	62	93	124	156	187	218	249	280
313	31	62	93	125	156	187	219	250	281
314	31	62	94	125	157	188	219	251	282

Briggs's Logarithms.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
315	31	63	94	126	157	189	220	252	283
316	31	63	94	126	158	189	221	252	284
317	31	63	95	126	158	190	221	253	285
318	31	63	95	127	159	190	222	254	286
319	31	63	95	127	159	191	223	255	287
320	32	64	95	128	160	192	224	256	288
321	32	64	96	128	160	192	224	256	288
322	32	64	96	128	161	193	225	257	289
323	32	64	96	129	161	193	226	258	290
324	32	64	97	129	162	194	226	259	291
325	32	65	97	130	162	195	227	260	292
326	32	65	97	130	163	195	228	260	293
327	32	65	98	130	163	196	228	261	294
328	32	65	98	131	163	196	229	262	295
329	32	65	98	131	164	197	230	263	296
330	33	66	99	132	165	198	221	264	297
131	33	66	99	132	165	198	231	264	297
332	33	66	99	132	165	199	232	265	298
333	33	66	99	133	166	199	233	266	299
334	33	66	100	133	167	200	233	267	300
335	33	67	100	134	167	201	234	268	301
336	33	67	100	134	168	201	235	268	302
337	33	67	101	134	168	202	235	269	303
338	33	67	101	135	169	202	236	270	304
339	33	67	101	135	169	203	237	271	305
340	34	68	102	136	170	304	238	272	306
341	34	68	102	136	170	204	238	272	306
342	34	68	102	136	171	205	239	273	307
343	34	68	102	637	171	205	240	274	308
344	34	68	103	137	172	206	240	275	309
345	34	69	103	138	172	207	241	276	310
346	34	69	103	138	173	207	242	276	311
347	34	69	104	138	273	208	242	277	312
348	34	69	104	139	174	208	243	278	313

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
349	34	69	104	139	174	209	244	279	314
350	34	70	105	140	175	210	245	280	315
351	35	70	105	140	175	210	245	280	315
352	35	70	105	140	176	211	246	281	316
353	35	70	105	141	176	211	247	282	317
354	35	70	106	141	177	212	247	283	318
355	35	71	106	142	177	213	248	284	319
356	35	71	106	142	178	213	249	284	320
357	35	71	107	142	178	214	249	285	321
358	35	71	107	143	179	214	250	286	322
359	35	71	107	143	179	215	251	287	323
360	35	72	108	144	180	216	251	288	324
361	36	72	108	144	180	216	252	288	325
362	36	72	108	144	181	217	252	289	325
363	36	72	108	145	181	217	253	290	326
364	36	72	109	145	182	218	254	291	327
365	36	73	109	146	182	219	254	292	328
366	36	73	109	146	182	219	255	292	329
367	36	73	110	146	183	220	256	293	330
368	36	73	110	147	184	220	256	294	331
369	36	73	110	147	184	221	257	295	332
370	36	74	111	148	185	222	258	296	333
371	37	74	111	148	185	222	259	296	333
372	37	74	111	148	186	223	260	297	334
373	37	74	111	149	186	223	261	298	335
374	37	74	112	149	187	224	261	299	336
375	37	75	112	150	187	225	262	300	337
376	37	75	112	150	188	225	262	300	338
377	37	75	113	150	188	226	263	301	339
378	37	75	113	151	189	226	264	302	340
379	37	75	113	151	189	227	265	303	341
380	37	76	114	152	190	228	266	304	342
381	38	76	114	152	190	228	266	304	342
382	38	76	114	152	191	229	267	305	343

Briggs's Logarithms.

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
383	38	76	114	153	191	229	268	306	344
384	38	76	115	153	192	230	268	307	345
385	38	77	115	154	192	231	269	308	346
386	38	77	115	154	193	231	270	308	347
387	38	77	116	154	193	232	270	309	348
388	38	77	116	155	194	232	271	310	349
389	38	77	116	155	194	233	272	311	350
390	39	78	117	156	195	233	273	312	351
391	39	78	117	156	195	233	273	312	351
392	39	78	117	156	196	234	274	313	352
393	39	78	117	157	196	235	275	314	353
394	39	78	118	157	197	236	275	315	354
395	39	79	118	158	197	237	276	316	355
396	39	79	118	158	198	237	277	316	356
397	39	79	119	158	198	238	277	317	357
398	39	79	119	159	199	238	278	318	358
399	39	79	119	159	199	239	279	319	359
400	40	80	120	160	200	240	280	320	360
401	40	80	120	160	200	240	280	320	360
402	40	80	120	160	201	241	281	321	361
403	40	80	120	161	201	241	282	322	362
404	40	80	121	161	202	242	282	323	363
405	40	81	121	162	202	243	283	324	364
406	40	81	21	162	203	243	284	324	365
407	40	81	122	162	203	244	284	325	366
408	40	81	122	163	204	244	285	326	367
409	40	81	122	163	204	245	286	327	368
410	41	82	123	164	205	246	287	328	369
411	41	82	123	164	205	246	287	328	369
412	41	82	123	164	206	247	288	329	370
413	41	82	123	165	206	247	289	330	371
414	41	82	124	165	207	248	289	331	372
415	41	82	124	166	207	249	290	332	373
416	41	83	124	166	208	249	291	332	374

Parts Proportional.

D	1	2	3	4	5	6	7	8	9
417	41	83	125	166	208	250	291	333	375
418	41	83	125	167	209	250	292	334	376
419	41	83	125	167	209	251	293	335	377
420	42	84	126	168	210	252	294	336	378
421	42	84	126	168	210	252	294	336	378
422	42	84	126	168	211	253	295	337	379
423	42	84	126	169	211	253	296	338	380
424	42	84	127	169	212	254	296	339	381
425	42	85	127	170	212	255	297	340	382
426	42	85	127	170	213	255	298	340	383
427	42	85	128	170	213	256	298	341	384
428	42	85	128	171	214	256	299	342	385
429	42	85	128	171	214	257	300	343	386
430	43	86	129	172	215	258	301	344	387
431	43	86	129	172	215	258	301	344	387
432	43	86	129	172	216	259	302	345	388
433	43	86	129	173	216	259	303	346	389
434	43	86	130	173	217	260	304	347	390
435	43	87	130	174	217	261	304	348	391

A
TABLE
OF
Artificial Sines
AND
TANGENTS,
For every
Degree and Minute
OF THE
QUADRANT,
Fitted to the Size
OF THE
LOGARITHMS.

Degree 0.

M	Sine	Co sine	Tangent	Co-Tang.	
0	0.000000	10.000000	0.000000	Infinita.	60
1	6.463726	9.999999	6.463725	13.536274	59
2	6.764756	9.999999	6.764756	13.235244	58
3	6.940847	9.999999	6.940847	13.059153	57
4	7.065786	9.999999	7.065786	12.934214	56
5	7.162696	9.999999	7.163696	12.836304	55
6	7.341877	9.999999	7.241878	12.758122	54
7	7.308824	9.999999	7.308825	12.691175	53
8	7.366816	9.999999	7.366817	12.623183	52
9	7.417968	9.999999	7.417970	12.582030	51
10	7.463726	9.999998	7.463727	12.536273	50
11	7.505118	9.999998	7.505120	12.494880	49
12	7.542906	9.999997	7.542909	12.457091	48
13	7.577668	9.999997	7.577272	12.422323	47
14	7.609853	9.999996	7.609857	12.390143	46
15	7.639816	9.999996	7.639826	12.360180	45
16	7.667844	9.999995	7.667849	12.332151	44
17	7.694173	9.999995	7.694179	12.305821	43
18	7.718977	9.999994	7.719003	12.281997	42
19	7.742477	9.999993	7.742484	12.257516	41
20	7.764754	9.999993	7.764751	12.235239	40
21	7.785943	9.999992	7.785951	12.214049	39
22	7.806146	9.999991	7.806145	12.193845	38
23	7.825451	9.999990	7.825460	12.174540	37
24	7.843934	9.999989	7.843944	12.156056	36
25	7.861662	9.999989	7.861674	12.138326	35
26	7.878695	9.999988	7.878708	12.121292	34
27	7.895085	9.999987	7.895099	12.104901	33
28	7.910879	9.999986	7.910894	12.089106	32
29	7.926219	9.999985	7.926134	12.073866	31
30	7.940842	9.999983	7.940858	12.059142	30
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 89.

Degree. o.

M	Sine	Co-sine	Tangent	Co Tang.	
30	7.940842	9.999983	7.940858	12.059142	30
31	7.955082	9.999982	7.955100	12.044900	29
32	7.968870	9.999981	7.968889	12.031111	28
33	7.982233	9.999980	7.982253	12.017747	27
34	7.995198	9.999978	7.995215	12.004781	26
35	8.007787	9.999978	7.007810	11.992191	25
36	8.020021	9.999976	8.020044	11.979956	24
37	8.031919	9.999975	8.031945	11.968055	23
38	8.043501	9.999973	8.043527	11.956473	22
39	8.054781	9.999972	8.054809	11.945181	21
40	8.065776	9.999971	8.065806	11.934194	20
41	8.076500	9.999969	8.076531	11.923469	19
42	8.086965	9.999968	8.086997	11.913003	18
43	8.097183	9.999966	8.097217	11.902783	17
44	8.107167	9.999964	8.107203	11.892797	16
45	8.116926	9.999963	8.116963	11.883037	15
46	8.126471	9.999961	8.126510	11.873490	14
47	8.135810	9.999959	8.135851	11.864149	13
48	8.144953	9.999958	8.144996	11.855004	12
49	8.153907	9.999956	8.153952	11.846048	11
50	8.162681	9.999954	8.162737	11.837273	10
51	8.172180	9.999952	8.171328	11.828672	9
52	8.179713	9.999950	8.179763	11.820237	8
53	8.187985	9.999948	8.188036	11.811964	7
54	8.196102	9.999946	8.196156	11.803844	6
55	8.204070	9.999944	8.204126	11.795874	5
56	8.211895	9.999942	8.211953	11.788047	4
57	8.219581	9.999940	8.219641	11.780359	3
58	8.227134	9.999938	8.227195	11.772805	2
59	8.234557	9.999936	8.234621	11.765379	1
60	8.241855	9.999934	8.241921	11.758079	0
	Co-sine	Sine	Co.Tang.	Tangent.	M

Degree 89.

Briggs's Logarithms.

Degree 1.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	8.241855	9.999934	8.241921	11.758079	60
1	8.249033	9.999932	8.249102	11.750898	59
2	8.256094	9.999929	8.256165	11.743835	58
3	8.263012	9.999927	8.263115	11.736885	57
4	8.269881	9.999925	8.269956	11.73044	56
5	8.276614	9.999922	8.276691	11.723309	55
6	8.283243	9.999920	8.283323	11.716677	54
7	8.289773	9.999918	8.289856	11.710144	53
8	8.296207	9.999915	8.296292	11.703708	52
9	8.202546	9.999913	8.302634	11.697366	51
10	8.308794	9.999910	8.308884	11.691116	50
11	8.314954	9.999907	8.315046	11.684954	49
12	8.321027	9.999905	8.321122	11.678878	48
13	8.327016	9.999902	8.327114	11.672886	47
14	8.332924	9.999899	8.333025	11.666975	46
15	8.338753	9.999897	8.338856	11.661144	45
16	8.344504	9.999894	8.344610	11.655390	44
17	8.350180	9.999891	8.350289	11.649711	43
18	8.355783	9.999888	8.355895	11.644105	42
19	8.361315	9.999885	8.361430	11.638570	41
20	8.366777	9.999882	8.366895	11.633105	40
21	8.372171	9.999879	8.372292	11.627708	39
22	8.377499	9.999876	8.377622	11.622378	38
23	8.382762	9.999873	8.382889	11.617111	37
24	8.387962	9.999870	8.388092	11.611908	36
25	8.393101	9.999867	8.393234	11.606766	35
26	8.398179	9.999864	8.398315	11.601685	34
27	8.403199	9.999861	8.403338	11.596662	33
28	8.408161	9.999858	8.408304	11.591696	32
29	8.413068	9.999854	8.413213	11.586787	31
30	8.417919	9.999851	8.418068	11.581932	30
	Co sine	Sine	Co-Tang.	Tangent	M

Degree 88.

Briggs's Logarithms.

Degree 1.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	8.417919	9.999851	8.418068	11.581932	30
31	8.422717	9.999848	8.422869	11.577131	29
32	8.427462	9.999844	8.427618	11.572382	28
33	8.432156	9.999841	8.432315	11.567685	27
34	8.436800	9.999838	8.436962	11.563038	26
35	8.441394	9.999834	8.441560	11.558440	25
36	8.445941	9.999831	8.446110	11.553990	24
37	8.450440	9.999827	8.450613	11.549387	23
38	8.454891	9.999824	8.455070	11.544930	22
39	8.459301	9.999820	8.459481	11.540519	21
40	8.463665	9.999816	8.463849	11.536151	20
41	8.467985	9.999812	8.468172	11.531828	19
42	8.472263	9.999809	8.472454	11.527546	18
43	8.476498	9.999805	8.476693	11.523307	17
44	8.480693	9.999801	8.480892	11.519108	16
45	8.484843	9.999797	8.485053	11.514950	15
46	8.488963	9.999794	8.489170	11.510830	14
47	8.493040	9.999790	8.493250	11.506750	13
48	8.497078	9.999786	8.497293	11.502707	12
49	8.501080	9.999782	8.501298	11.498702	11
50	8.505045	9.999778	8.505267	11.494733	10
51	8.508974	9.999774	8.509200	11.490800	9
52	8.512867	9.999769	8.513098	11.486902	8
53	8.516726	9.999765	8.516961	11.483039	7
54	8.520551	9.999761	8.520790	11.479210	6
55	8.524343	9.999756	8.524586	11.475414	5
56	8.528102	9.999753	8.528349	11.471651	4
57	8.531828	9.999748	8.532080	11.467920	3
58	8.535523	9.999744	8.535779	11.464221	2
59	8.539186	9.999740	8.539147	11.460553	1
60	8.552819	9.999735	8.543084	11.456910	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 88.

Degree 2.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	8.542819	9.999375	8.543084	11.456916	60
1	8.546422	9.999731	8.546691	11.453309	59
2	8.549995	9.999725	8.550268	11.449732	58
3	8.553558	9.999722	8.553817	11.446183	57
4	8.557054	9.999717	8.557335	11.442664	56
5	8.560540	9.999713	8.560827	11.449172	55
6	8.563999	9.999708	8.564291	11.435709	54
7	8.567431	9.999703	8.567727	11.432272	53
8	8.570836	9.999699	8.571137	11.428863	52
9	8.574214	9.999694	8.574520	11.425480	51
10	8.577566	9.999689	8.577877	11.422123	50
11	8.580092	9.999685	8.581208	11.418792	49
12	8.584193	9.999680	8.584514	11.415486	48
13	8.587469	9.999675	8.587795	11.412205	47
14	8.590721	9.999670	8.591051	11.408949	46
15	8.593948	9.999665	8.594283	11.405717	45
16	8.597152	9.999660	8.597492	11.402508	44
17	8.600332	9.999655	8.600667	11.399323	43
18	8.603488	9.999650	8.603838	11.396161	42
19	8.606622	9.999645	8.606978	11.393022	41
20	8.609734	9.999640	8.610094	11.389906	40
21	8.612823	9.999635	8.613189	11.386811	39
22	8.615891	9.999629	8.616262	11.383738	38
23	8.618937	9.999624	8.619313	11.380687	37
24	8.621967	9.999619	8.622343	11.377657	36
25	8.624965	9.999614	8.625352	11.374648	35
26	8.627948	9.999608	8.628340	11.371660	34
27	8.630911	9.999603	8.631308	11.368692	33
28	8.633854	9.999597	8.634456	11.365744	32
29	8.636776	9.999592	8.637184	11.362816	31
30	8.639679	9.999586	8.640093	11.359907	30
	Co sine	Sine	Co-Tang.	Tangent	M

Degree 87.

Degree 2.

M	Sine	Co sine	Tangent	Co-Tang.	
30	8.639579	9.999586	8.640093	11.359907	30
31	8.642563	9.999581	8.642982	11.257017	29
32	8.645428	9.999575	8.645853	11.354147	28
33	8.648274	9.999570	8.648704	11.351296	27
34	8.651102	9.999564	8.651538	11.348463	26
35	8.653911	9.999558	8.654352	11.345648	25
36	8.656702	9.999553	8.657149	11.342851	24
37	8.659475	9.999547	8.659928	11.340072	23
38	8.662230	9.999541	8.662689	11.337311	22
39	8.664968	9.999535	8.665433	11.334567	21
40	8.667639	9.999529	8.668160	11.331840	20
41	8.670393	9.999523	8.670869	11.329130	19
42	8.673080	9.999518	8.673563	11.326437	18
43	8.675751	9.999512	8.676239	11.323761	17
44	8.678405	9.999506	8.678866	11.321100	16
45	8.681043	9.999499	8.681544	11.318456	15
46	8.683665	9.999493	8.684172	11.315828	14
47	8.686272	9.999487	8.686784	11.313216	13
48	8.688892	9.999481	8.689381	11.310619	12
49	8.691438	9.999475	8.691963	11.308037	11
50	8.693998	9.999469	8.694529	11.305471	10
51	8.696543	9.999462	8.697081	11.302919	9
52	8.699073	9.999456	8.699617	11.300383	8
53	8.701589	9.999450	8.702139	11.297861	7
54	8.704090	9.999443	8.704646	11.295354	6
55	8.706576	9.999437	8.707139	11.292860	5
56	8.709049	9.999431	8.709618	11.290381	4
57	8.711507	9.999424	8.712083	11.287917	3
58	8.713952	9.999418	8.714543	11.285466	2
59	8.716383	9.999411	8.716972	11.283028	1
60	8.718800	9.999404	8.719396	11.280604	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 87.

Degree. 3.

M	Sine	Co sine	Tangent	Co-Tang.	
0	8.718800	9.999404	8.719396	11.280604	60
1	8.721204	9.999398	8.721806	11.278194	59
2	8.723595	9.999391	8.724254	11.275796	58
3	8.725972	9.999384	8.726588	11.273412	57
4	8.728336	9.999378	8.728959	11.271041	56
5	8.730688	9.999371	8.731317	11.268653	55
6	8.733027	9.999364	8.733663	11.266337	54
7	8.735354	9.999357	8.735996	11.264034	53
8	8.737667	9.999350	8.738317	11.261683	52
9	8.739969	9.999343	8.740626	11.259374	51
10	8.742259	9.999336	8.742922	11.257078	50
11	8.744536	9.999329	8.745207	11.254793	49
12	8.746801	9.999322	8.747479	11.252521	48
13	8.745955	9.999315	8.749740	11.250240	47
14	8.751297	9.999308	8.751989	11.248011	46
15	8.753528	9.999301	8.754227	11.245773	45
16	8.755747	9.999294	8.756453	11.243547	44
17	8.757955	9.999286	8.758668	11.241332	43
18	8.760151	9.999279	8.760872	11.239128	42
19	8.762337	9.999272	8.763065	11.236935	41
20	8.764511	9.999265	8.765246	11.234754	40
21	8.766675	9.999257	8.767417	11.232583	39
22	8.768828	9.999250	8.769578	11.230422	38
23	8.770970	9.999242	8.771727	11.228273	37
24	8.773101	9.999235	8.773866	11.229134	36
25	8.775223	9.999227	8.775995	11.224005	35
26	8.777333	9.999220	8.778114	11.221886	34
27	8.779434	9.999212	8.783222	11.219778	33
28	8.781524	9.999204	8.782320	11.217680	32
29	8.783605	9.999197	8.784404	11.215592	31
30	8.785675	9.999189	8.786486	11.213514	30
	Co-sine	Sine	Co-Tang	Tang.	M

Degree 86.

Degree 3.

M	Sine	Co sine	Tangent	Co Tang.	
30	8.785675	9.999187	8.786486	11.213541	30
31	8.787736	9.999181	8.788554	11.211446	29
32	8.789787	9.999174	8.790613	11.209387	28
33	8.781828	9.999166	8.792662	11.207338	27
34	8.793859	9.999158	8.794701	11.205299	26
35	8.795881	9.999150	8.796731	11.203269	25
36	8.797894	9.999142	8.798752	11.201248	24
37	8.799897	9.999134	8.800763	11.199237	23
38	8.801891	9.999126	8.802765	11.197235	22
39	8.803876	9.999118	8.804758	11.195242	21
40	8.805852	9.999110	8.806742	11.193253	20
41	8.807819	9.999102	8.808717	11.191285	19
42	8.809777	9.999094	8.812683	11.189317	18
43	8.811726	9.999086	8.812641	11.187359	17
44	8.813667	9.999077	8.814589	11.185411	16
45	8.815598	9.999069	8.816529	11.183471	15
46	8.817522	9.999061	8.818461	11.181539	14
47	8.819436	9.999052	8.820384	11.179616	13
48	8.821342	9.999044	8.822298	11.177702	12
49	8.823240	9.999036	8.824205	11.175795	11
50	8.825130	9.999027	8.826103	11.173897	10
51	8.827011	9.999019	8.827992	11.172008	9
52	8.828884	9.999010	8.829874	11.170126	8
53	8.830749	9.999002	8.831748	11.168252	7
54	8.8326106	9.998993	8.833613	11.166387	6
55	8.834456	9.998984	8.835471	11.164529	5
56	8.836297	9.998976	8.837321	11.162679	4
57	8.838130	9.998967	8.839163	11.160837	3
58	8.839956	9.998958	8.840998	11.159002	2
59	8.841774	9.998940	8.842825	11.157175	1
60	8.843585	9.998941	8.844644	11.155356	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 86.

Degree 4.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	8.843584	9.998941	8.844649	11.155356	60
1	8.845387	9.998931	8.846455	11.153545	59
2	8.847183	9.998923	8.848240	11.151740	58
3	8.848971	9.998914	8.850057	11.149943	57
4	8.850751	9.998905	8.851846	11.148154	56
5	8.852525	9.998896	8.853628	11.146372	55
6	8.854291	9.998887	8.855403	11.144597	54
7	8.856049	9.998878	8.857171	11.142829	53
8	8.857801	9.998869	8.858922	11.141068	52
9	8.859546	9.998860	8.860686	11.139314	51
10	8.861283	9.998851	8.862433	11.137507	50
11	8.863014	9.998841	8.864173	11.135827	49
12	8.864738	9.998832	8.865906	11.134094	48
13	8.866454	9.998823	8.867632	11.132368	47
14	8.868165	9.998813	8.869351	11.130649	46
15	8.869868	9.998804	8.871064	11.128936	45
16	8.871565	9.998795	8.872750	11.127230	44
17	8.873255	9.998785	8.874469	11.125531	43
18	8.874938	9.998776	8.876162	11.123838	42
19	8.876615	9.998766	8.877849	11.122151	41
20	8.878285	9.998757	8.879529	11.120471	40
21	8.879949	9.998747	8.881202	11.118798	39
22	8.881607	9.998738	8.882869	11.117131	38
23	8.883258	9.998728	8.884530	11.115470	37
24	8.884903	9.998718	8.886185	11.113815	36
25	8.886542	9.998708	8.887838	11.112167	35
26	8.888174	9.998699	8.889476	11.110524	34
27	8.889801	9.998689	8.891112	11.108883	33
28	8.891421	9.998679	8.892742	11.107258	32
29	8.893035	9.998669	8.894366	11.105634	31
30	8.894643	9.998659	8.895984	11.104016	30
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 85.

Degree 4.

M	Sine	Co-sine	Tangent	Co Tang.	
30	8.891643	9.998659	8.895910	11.104016	30
31	8.895246	9.998649	8.897596	11.102404	29
32	8.897842	9.998639	8.899202	11.100797	28
33	8.899432	9.998629	8.900803	11.099197	27
34	8.901017	9.998619	8.902398	11.097602	26
35	8.902596	9.998609	8.903987	11.096013	25
36	8.904169	9.998599	8.905570	11.094430	24
37	8.905736	9.998589	8.907147	11.093853	23
38	8.907297	9.998578	8.908719	11.092281	22
39	8.908853	9.998568	8.910285	11.090715	21
40	8.910404	6.998558	8.911846	11.089154	20
41	8.911949	9.998548	8.913401	11.086599	19
42	8.913488	9.998537	8.914951	11.085049	18
43	8.915022	9.998527	8.916495	11.083505	17
44	8.916550	9.998516	8.918034	11.081960	16
45	8.918073	9.998506	8.919568	11.080432	15
46	8.919591	9.998495	8.921096	11.078921	14
47	8.921103	9.998485	8.922519	11.077381	13
48	8.922610	9.998474	8.924136	11.075864	12
49	8.924112	9.998464	8.925649	11.074351	11
50	8.925607	9.998453	8.927156	11.072844	10
51	8.927100	9.998442	8.928658	11.071344	9
52	8.928587	9.998431	8.930155	11.069845	8
53	8.930068	9.998421	8.931647	11.068353	7
54	8.931544	9.998410	8.933134	11.066866	6
55	8.933015	9.998399	8.934616	11.065384	5
56	8.931481	9.998388	8.936093	11.063907	4
57	8.935942	9.998377	8.937565	11.062435	3
58	8.937398	9.998366	8.939032	11.060968	2
59	8.938850	9.998355	8.940494	11.059506	1
60	8.940296	9.998344	8.941952	11.058048	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 85.

Degree 5.

M	Sine	Co sine	Tangent	Co-Tang.	
0	8.940296	9.998344	8.941952	11.058048	60
1	8.941738	9.998333	8.943404	11.056596	59
2	8.943174	9.998322	8.944852	11.055148	58
3	8.944606	9.998311	8.946295	11.053705	57
4	8.946034	9.998300	8.947734	11.052266	56
5	8.957456	9.998289	8.949168	11.050832	55
6	8.958814	9.998277	8.950597	11.049403	54
7	8.950287	9.998256	8.952021	11.047979	33
8	8.951696	9.998255	8.953441	11.046559	52
9	8.953099	9.998243	8.954856	11.045144	51
10	8.954499	9.998232	8.956267	11.043703	50
11	8.955894	9.998220	8.957674	11.042326	49
12	8.957284	9.998209	8.959075	11.040925	48
13	8.958670	9.998197	8.960473	11.039527	47
14	8.960052	9.998186	8.961866	11.038134	46
15	8.961429	9.998174	8.963254	11.036746	45
16	8.962801	9.998163	8.964639	11.035361	44
17	8.964170	9.998151	8.966019	11.033981	43
18	8.965534	9.998139	8.967394	11.032605	42
19	8.966893	9.998128	8.968766	11.031234	41
20	8.968349	9.998106	8.970133	11.039867	40
21	8.969600	9.998104	8.971495	11.028505	39
22	8.970947	9.998092	8.972855	11.027145	38
23	8.972289	9.998080	8.974209	11.025791	37
24	8.973626	9.998068	8.975560	11.024440	36
25	8.974962	9.998056	8.976906	11.023094	35
26	8.976293	9.998044	8.978248	11.0217 2	34
27	8.977619	9.998032	8.979585	11.020414	33
28	8.978941	9.998020	8.980921	11.019079	32
29	8.980259	9.998008	8.982251	11.017749	31
30	8.981573	9.997996	8.983577	11.016423	30
	Co sine	Sine	Co Tang.	Tangent	M

Degree 84.

Degree 5.

M	Sine	Co-sine	Tangent	Co Tang.	
30	8.981573	9.997996	8.983577	11.010423	30
31	8.982883	9.997984	8.984899	11.015101	29
32	8.984189	9.997971	8.986217	11.013783	28
33	8.985491	9.997959	8.987532	11.012468	27
34	8.986782	9.997947	8.988842	11.011153	26
35	8.988083	9.997935	8.990149	11.009851	25
36	8.989374	9.997922	8.991451	11.008549	24
37	8.990660	9.997910	8.992750	11.007250	23
38	8.991943	9.997897	8.994045	11.005955	22
39	8.993223	9.997885	8.995337	11.004653	21
40	8.994497	9.997873	8.996624	11.003376	20
41	8.995768	9.997860	8.997908	11.002092	19
42	8.997036	9.997847	8.999188	11.000812	18
43	8.998291	9.997835	9.000465	10.999535	17
44	8.999560	9.997822	9.001738	10.998262	16
45	8.990816	9.997809	9.003007	10.996991	15
46	9.002069	9.997797	9.004272	10.995728	14
47	9.003318	9.997784	9.005534	10.994466	13
48	9.004563	9.997771	9.006792	10.993208	12
49	9.005805	9.997758	9.008047	11.991953	11
50	9.007044	9.997742	9.009298	10.990702	10
51	9.008278	9.997732	9.010546	10.989454	9
52	9.009510	9.997719	9.011790	10.988210	8
53	9.010737	9.997706	9.013031	10.986969	7
54	9.011962	9.997693	9.014268	10.985732	6
55	9.013182	9.997680	9.015502	10.984498	5
56	9.014399	9.997667	9.016732	10.983268	4
57	9.015613	9.997654	9.017959	10.982041	3
58	9.016824	9.997641	9.019183	10.980817	2
59	9.018031	9.997628	9.020403	10.979597	1
60	9.019235	9.997614	9.021620	10.978380	0
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 84.

Degree. 6.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.019235	9.997614	9.021620	10.978380	60
1	9.020435	9.997601	9.022834	10.977166	59
2	9.021632	9.997588	9.024044	10.975956	58
3	9.022825	9.997574	9.025251	10.974749	57
4	9.024016	9.997562	9.026455	10.973545	56
5	9.025203	9.997548	9.027655	10.972345	55
6	9.026306	9.997534	9.028852	10.971148	54
7	9.027567	9.997520	9.030046	10.969954	53
8	9.028744	9.997507	9.031237	10.968763	52
9	9.029918	9.997493	9.032425	10.967575	51
10	9.031089	9.997480	9.033609	10.966391	50
11	9.032257	9.997466	9.034791	10.965209	49
12	9.033421	9.997452	9.035969	10.964031	48
13	9.034582	9.997439	9.037144	10.962856	47
14	9.035741	9.997425	9.038316	10.961684	46
15	9.036896	9.997411	9.039485	10.960505	45
16	9.038048	9.997397	9.040651	10.959349	44
17	9.039197	9.997383	9.041813	10.958187	43
18	9.040342	9.997369	9.042973	10.957027	42
19	9.041485	9.997355	9.044130	10.955870	41
20	9.042625	9.997341	9.045284	10.954716	40
21	9.043762	9.997327	9.046434	10.953566	39
22	9.044895	9.997313	9.047582	10.952418	38
23	9.046026	9.997299	9.048727	10.951273	37
24	9.047154	9.997285	9.049869	10.950131	36
25	9.048279	9.997271	9.051008	10.948992	35
26	9.049400	9.997256	9.052144	10.947856	34
27	9.050519	9.997242	9.053277	10.946723	33
28	9.051635	9.997228	9.054408	10.945592	32
29	9.052749	9.997214	9.055535	10.944485	31
30	9.053859	9.997200	9.056640	10.943340	30
	Co-sine	Sine	Co-Tang.	Tang.	M

Degree 83.

Degree 6.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.053859	9.997199	9.056630	10.943340	30
31	9.054966	9.997185	9.057781	10.942219	29
32	9.056071	9.997170	9.058500	10.941100	28
33	9.057172	9.997156	9.060016	10.939984	27
34	9.058271	9.997141	9.061130	10.938870	26
35	9.059367	9.997127	9.062240	10.937760	25
36	9.060460	9.997112	9.063348	10.936652	24
37	9.061551	9.997098	9.064453	10.935547	23
38	9.062638	9.997083	9.065556	10.934444	22
39	9.063723	9.997068	9.066655	10.933345	21
40	9.064806	9.997053	9.067752	10.932248	20
41	9.065885	9.997039	9.068847	10.931153	19
42	9.066962	9.997024	9.069938	10.930062	18
43	9.068036	9.997009	9.071027	10.928973	17
44	9.069107	9.996994	9.072113	10.927887	16
45	9.070176	9.996979	9.073197	10.925803	15
46	9.071242	9.996964	9.074278	10.925722	14
47	9.072306	9.996949	9.075356	10.924644	13
48	9.073366	9.996934	9.076432	10.923568	12
49	9.074424	9.996919	9.077505	10.922495	11
50	9.075480	9.996904	9.078576	10.921424	10
51	9.076533	9.996889	9.079644	10.920356	9
52	9.077583	9.996874	9.080710	10.919290	8
53	9.078631	9.996858	9.081773	10.918227	7
54	9.079676	9.996843	9.082833	10.917167	6
55	9.080719	9.996828	9.083891	10.916109	5
56	9.081759	9.996812	9.084947	10.915053	4
57	9.082797	9.996797	9.085999	10.914000	3
58	9.083832	9.996782	9.087050	10.912950	2
59	9.084864	9.996766	9.088098	10.911902	1
60	9.085894	9.996751	9.089144	10.910856	0
	Co sine	Sine	Co-Tang	Tangent.	M

Degree 83.

Degree 7.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.085894	9.996751	9.089144	10.910856	60
1	9.086922	9.996735	9.090187	10.909813	59
2	9.087947	9.996720	9.091228	10.908772	58
5	9.088970	9.996704	9.092266	10.907734	57
4	9.089990	9.996688	9.093302	10.906698	56
5	9.091088	9.996673	9.094335	10.905664	55
6	9.092024	9.996657	9.095367	10.904633	54
7	9.093037	9.996641	9.096395	10.903604	53
8	9.094047	9.996625	9.097422	10.902578	52
9	9.095056	9.996610	9.098446	10.901554	51
10	9.096062	9.996594	9.099468	10.900532	50
11	9.097065	9.996578	9.100487	10.899513	49
12	9.098066	9.996562	9.101504	10.898496	48
13	9.099065	9.996546	9.102519	10.897481	47
14	9.100062	9.996530	9.103532	10.896468	46
15	9.101056	9.996514	9.104542	10.895458	45
16	9.102048	9.996498	9.105550	10.894450	44
17	9.103037	9.996482	9.106556	10.893444	43
18	9.104025	9.996465	9.107559	10.892441	42
19	9.105010	9.996449	9.108560	10.891440	41
20	9.105992	9.996433	9.109559	10.890441	40
21	9.106973	9.996417	9.110556	10.889444	39
22	9.107951	9.996400	9.111551	10.888449	38
23	9.108927	9.996384	9.112543	10.887457	37
24	9.109901	9.996368	9.113533	10.886467	36
25	9.100873	9.996351	9.114521	10.885478	35
26	9.111842	9.996335	9.115507	10.884493	34
27	9.112809	9.996318	9.116491	10.883509	33
28	9.113774	9.996302	9.117472	10.882528	32
29	9.114737	9.996285	9.118452	10.881548	31
30	9.115698	9.996269	9.119429	10.880571	30
	Co sine	Sine	Co-Tang	Tangent	M

Degree 82.

Degree 7.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.115698	9.996269	9.119427	10.880571	30
31	9.116656	9.996252	9.120404	10.879595	29
32	9.117612	9.996235	9.121377	10.878623	28
33	9.118567	9.996218	9.122348	10.877652	27
34	9.119519	9.996202	9.123317	10.876683	26
35	9.120469	9.996185	9.124284	10.875716	25
36	9.121417	9.996168	9.125248	10.874751	24
37	9.122362	9.996152	9.126211	10.873789	23
38	9.123306	9.996134	9.127172	10.872828	22
39	9.124248	9.996117	9.128130	10.871870	21
40	9.125187	9.996100	9.129087	10.870913	20
41	9.126125	9.996083	9.130041	10.869959	19
42	9.127060	9.996066	9.130994	10.869006	18
43	9.127993	9.996049	9.131944	10.868056	17
44	9.128925	9.996032	9.132893	10.867107	16
45	9.129854	9.996015	9.133839	10.866161	15
46	9.130781	9.995998	9.134784	10.865216	14
47	9.131706	9.995980	9.135725	10.864274	13
48	9.132630	9.995963	9.136666	10.863334	12
49	9.133551	9.995946	9.137605	10.862395	11
50	9.134470	9.995928	9.138542	10.861458	10
51	9.135387	9.995911	9.139476	10.860524	9
52	9.136303	9.995894	9.140409	10.859591	8
53	9.137216	9.995876	9.141340	10.858660	7
54	9.138127	9.995859	9.142269	10.857731	6
55	9.139037	9.995841	9.143196	10.856804	5
56	9.139944	9.995825	9.144121	10.855879	4
57	9.140850	9.995806	9.145044	10.854956	3
58	9.141754	9.995788	9.145965	10.854035	2
59	9.142655	9.995770	9.146885	10.853115	1
60	9.143555	9.995753	9.147803	10.852197	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 82.

Degree 8.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.143555	9.995753	9.147803	10.852197	60
1	9.144453	9.995735	9.148718	10.851282	59
2	9.145349	9.995717	9.149632	10.850363	58
3	9.146243	9.995699	9.150544	10.849456	57
4	9.147136	9.995681	9.151454	10.848546	56
5	9.148026	9.995664	9.152363	10.847637	55
6	9.148915	9.995646	9.153269	10.846731	54
7	9.149801	9.995620	9.154174	10.845825	53
8	9.150686	9.995610	9.155077	10.844923	52
9	9.151569	9.995591	9.155978	10.844022	51
10	9.152451	9.995573	9.156877	10.843123	50
11	9.153330	9.995555	9.157775	10.842225	49
12	9.154208	9.995537	9.158671	10.841329	48
13	9.155082	9.995519	9.159565	10.840435	47
14	9.155957	9.995501	9.160457	10.839543	46
15	9.156830	9.995584	9.161347	10.838633	45
16	9.157700	9.995464	9.162235	10.837764	44
17	9.158569	9.995446	9.163123	10.836877	43
18	9.159436	9.995427	9.164008	10.835992	42
19	9.160301	9.995409	9.164892	10.835108	41
20	9.161164	9.995390	9.165773	10.834225	40
21	9.162052	9.995372	9.166654	10.833346	39
22	9.162885	9.995353	9.167532	10.832468	38
23	9.163743	9.995334	9.168409	10.831591	37
24	9.164600	9.995316	9.169284	10.830716	36
25	9.165454	9.995297	9.170157	10.829843	35
26	9.166307	9.995278	9.171029	10.828971	34
27	9.167158	9.995260	9.171899	10.828101	33
28	9.168008	9.995241	9.172767	10.827233	32
29	9.168856	9.995222	9.173634	10.826366	31
30	9.169702	9.995203	9.174499	10.825501	30
	Co sine	Sine	Co-Tang.	Tangent	M

Degree 81.

Degree 8.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.169702	9.995203	9.174499	10.825501	30
31	9.170546	9.995184	9.175362	10.824638	29
32	9.171389	9.995165	9.176224	10.823776	28
33	9.172230	9.995146	9.177084	10.822916	27
34	9.173070	9.995127	9.177942	10.822057	26
35	9.173908	9.995108	9.178799	10.821201	25
36	9.174744	9.995089	9.179655	10.820345	24
37	9.175578	9.995070	9.180508	10.819492	23
38	9.176411	9.995061	9.181360	10.818640	22
39	9.177242	9.995032	9.182211	10.817789	21
40	9.178072	9.995012	9.183060	10.816940	20
41	9.178900	9.994993	9.183907	10.816093	19
42	9.179726	9.994974	9.184752	10.815248	18
43	9.180551	9.994955	9.185597	10.814403	17
44	9.181374	9.994935	9.186439	10.813561	16
45	9.182195	9.994916	9.187280	10.812720	15
46	9.183016	9.994896	9.188120	10.811880	14
47	9.183834	9.994876	9.188957	10.811042	13
48	9.184651	9.994857	9.189794	10.810206	12
49	9.185466	9.994838	9.190629	10.809371	11
50	9.186280	9.994818	9.191462	10.808538	10
51	9.187192	9.994798	9.192294	10.807706	9
52	9.187903	9.994779	9.193124	10.806876	8
53	9.188712	9.994759	9.193953	10.806047	7
54	9.189519	9.994739	9.194780	10.805220	6
55	9.190325	9.994719	9.195606	10.804394	5
56	9.191130	9.994699	9.196440	10.803569	4
57	9.191933	9.994680	9.197253	10.802747	3
58	9.192734	9.994660	9.198067	10.801926	2
59	9.193534	9.994640	9.198894	10.801106	1
60	9.194332	9.994620	9.199712	10.800287	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 81.

Degree 9.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.194332	9.994620	9.199712	10.80887	60
1	9.195129	9.994600	9.200529	10.799470	59
2	9.195925	9.994580	9.201345	10.799955	58
3	9.196718	9.994560	9.202159	10.797841	57
4	9.197511	9.994540	9.202971	10.797029	56
5	9.198302	9.994519	9.203782	10.796218	55
6	9.199091	9.994499	9.204592	10.795408	54
7	9.199879	9.994479	9.205400	10.794600	53
8	9.200666	9.994459	9.206207	10.793793	52
9	9.201451	9.994438	9.207013	10.792987	51
10	9.202234	9.994418	9.207817	10.792183	50
11	9.203017	9.994368	9.208619	10.791381	49
12	9.203797	9.994377	9.209420	10.790580	48
13	9.204577	9.994357	9.212220	10.789780	47
14	9.205354	9.994336	9.211018	10.788982	46
15	9.206131	9.994316	9.211815	10.788185	45
16	9.206905	9.994295	9.212611	10.787389	44
17	9.207679	9.994274	9.213405	10.786595	43
18	9.208452	9.994254	9.214198	10.785802	42
19	9.209222	9.994233	9.214989	10.785011	41
20	9.209992	9.994212	9.215780	10.784220	40
21	9.210760	9.994191	9.216568	10.783432	39
22	9.211526	9.994171	9.217356	10.782644	38
23	9.212291	9.994150	9.218142	10.781858	37
24	9.213055	9.994129	9.218926	10.781074	36
25	9.213818	9.994108	9.219710	10.780290	35
26	9.214579	9.994087	9.220491	10.779508	34
27	9.215338	9.994066	9.221272	10.778729	33
28	9.216097	9.994044	9.222052	10.777948	32
29	9.216854	9.994022	9.222830	10.777170	31
30	9.21769	9.994003	9.223607	10.766393	30
	Co sine	Sine	Co Tang.	Tangent	M

Degree 80.

Degree 9.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.217609	9.994003	9.223607	10.775393	30
31	9.218363	9.993982	9.224382	10.775618	29
32	9.219116	9.993960	9.225156	10.774844	28
33	9.219868	9.993939	9.225929	10.774071	27
34	9.220518	9.993918	9.226704	10.773300	26
35	9.221367	9.993897	9.227471	10.772529	25
36	9.222115	9.993875	9.228240	10.771760	24
37	9.222861	9.993854	9.229007	10.770993	23
38	9.223505	9.993832	9.229774	10.770226	22
39	9.224349	9.993811	9.230539	10.769461	21
40	9.225092	9.993789	9.231302	10.768698	20
41	9.225833	9.993768	9.232055	10.767935	19
42	9.225573	9.993746	9.232826	10.767174	18
43	9.227311	9.993725	9.233586	10.766414	17
44	9.228048	9.993703	9.234345	10.765655	16
45	9.228784	9.993681	9.235103	10.764897	15
46	9.229518	9.993650	9.235859	10.764141	14
47	9.230252	9.993638	9.236614	10.763386	13
48	9.230984	9.993616	9.237368	10.762632	12
49	9.231715	9.993594	9.238120	10.761880	11
50	9.232444	9.993572	9.238872	10.761128	10
51	9.233172	9.993550	9.239622	10.760378	9
52	9.233899	9.993528	9.240371	10.759629	8
53	9.234625	9.993506	9.241118	10.758882	7
54	9.235349	9.993484	9.241865	10.758135	6
55	9.236073	9.993462	9.242510	10.757390	5
56	9.236795	9.993440	9.243354	10.756646	4
57	9.237515	9.993418	9.244097	10.755903	3
58	9.238835	9.993396	9.244839	10.755161	2
59	9.238952	9.993374	9.245579	10.754421	1
60	9.239670	9.993351	9.246319	10.753681	0
	Co sine	Sine	Co Tang	Tangent.	M

Degree 80.

Degree 10.

M	Sine	Co. sine	Tangent	Co. Tang.	
0	9.239670	9.993351	9.246310	10.753681	60
1	9.240386	9.993329	9.247057	10.752943	59
2	9.241101	9.993307	9.247794	10.752206	58
3	9.241814	9.993284	9.248530	10.751470	57
4	9.242526	9.993262	9.249264	10.750736	56
5	9.243237	9.993240	9.249998	10.750002	55
6	9.243947	9.993117	9.250730	10.749270	54
7	9.244656	9.993195	9.251461	10.748539	53
8	9.245363	9.993172	9.252191	10.747809	52
9	9.246070	9.993149	9.252920	10.747080	51
10	9.246775	9.993127	9.253648	10.746352	50
11	9.247478	9.993104	9.254374	10.745626	49
12	9.248181	9.993081	9.255200	10.744900	48
13	9.248883	9.993059	9.255824	10.744176	47
14	9.249583	9.993036	9.256547	10.743453	46
15	9.250282	9.993013	9.257269	10.742731	45
16	9.250980	9.992990	9.257990	10.742010	44
17	9.251677	9.992967	9.258710	10.741290	43
18	9.252373	9.992944	9.259429	10.740571	42
19	9.253057	9.992921	9.260146	10.749854	41
20	9.253761	9.992898	9.260863	10.749137	40
21	9.254453	9.992875	9.261578	10.738422	39
22	9.255144	9.992852	9.262292	10.737708	38
23	9.255834	9.992829	9.263005	10.736995	37
24	9.256523	9.992806	9.263717	10.736283	36
25	9.257211	9.992783	9.264428	10.735572	35
26	9.257898	9.992759	9.265138	10.734862	34
27	9.258583	9.992736	9.265847	10.734153	33
28	9.259268	9.992613	9.266555	10.733445	32
29	9.259951	9.992690	9.267261	10.732739	31
30	9.260633	9.992666	9.267967	10.732033	30
	Co. sine	Sine	Co. Tang	Tangent.	M

Degree 79.

Degree 10.

M	Sine	Co. sine	Tangent.	Co-Tang.	
30	9.260633	9.992666	9.267957	10.732033	30
31	9.261314	9.992643	9.268671	10.731329	29
32	9.261994	9.992619	9.269375	10.730525	28
33	9.262573	9.992595	9.270778	10.729923	27
34	9.263351	9.992572	9.271479	10.729221	26
35	9.264027	9.992549	9.271470	10.728521	25
36	9.264703	9.992525	9.272178	10.727822	24
37	9.265378	9.992501	9.272876	10.727124	23
38	9.266051	9.992478	9.273573	10.726427	22
39	9.266723	9.992454	9.974269	10.725731	21
40	9.267395	9.992430	9.274964	10.725036	20
41	9.268065	9.992406	9.275658	10.724342	19
42	9.268734	9.992382	9.276351	10.723649	18
43	9.269402	9.992362	9.277043	10.722957	17
44	9.270069	9.992335	9.277734	10.722267	16
45	9.270735	9.992311	9.278424	10.721567	15
46	9.271400	9.992287	9.279113	10.720887	14
47	9.272063	9.992263	9.279801	10.720199	13
48	9.272726	9.992239	9.280488	10.719512	12
49	9.273388	9.992214	9.281174	10.718826	11
50	9.274049	9.992190	9.281858	10.718142	10
51	9.274708	9.992166	9.282542	10.717458	9
52	9.275367	9.992142	9.283225	10.716775	8
53	9.276025	9.992118	9.283907	10.716093	7
54	9.276681	9.992093	9.284588	10.715412	6
55	9.277337	9.992069	9.285268	10.714732	5
56	9.277991	9.992045	9.285946	10.714053	4
57	9.278635	9.992020	9.286624	10.713376	3
58	9.279297	9.991995	9.287301	10.712690	2
59	9.279948	9.991971	9.287977	10.712023	1
60	9.280599	9.991947	9.288652	10.711348	0
	Co. sine	Sine	Co-Tang.	Tangent.	M

Degree 79.

Degree 11.

M	Sine	Co fine	Tangent	Co-Tang.	
0	9.280599	9.991917	9.288652	10.711348	60
1	9.281229	9.991922	9.289326	10.710574	59
2	9.281897	9.991897	9.289999	10.710001	58
3	9.282544	9.991873	9.290671	10.709329	57
5	9.283190	9.991848	9.291342	10.708658	56
5	9.283835	9.991823	9.292013	10.707987	55
6	9.284480	9.991799	9.292682	10.707318	54
7	9.285121	9.991774	9.293350	10.706650	53
8	9.285766	9.991749	9.29517	10.705983	52
9	9.286408	9.991724	9.294684	10.705316	51
10	9.287048	9.991699	9.295349	10.704651	50
11	9.287683	9.991674	9.296013	10.703987	49
12	9.288326	9.991649	9.296677	10.703323	48
13	9.288964	9.991624	9.297339	10.702661	47
14	9.289600	9.991599	9.298001	10.701999	46
15	9.290235	9.991574	9.298662	10.701338	45
16	9.290870	9.991549	9.299322	10.700678	44
17	9.291504	9.991524	9.299980	10.700020	43
18	9.292137	9.991498	9.300638	10.699362	42
19	9.292768	9.991473	9.301295	10.698705	41
20	9.293399	9.991448	9.301951	10.698049	40
21	9.294029	9.991422	9.302607	10.697393	39
22	9.294658	9.991397	9.303261	10.696739	38
23	9.295286	9.991372	9.303914	10.696086	37
24	9.295913	9.991346	9.304567	10.695433	36
25	9.296539	9.991321	9.305218	10.694782	35
26	9.297164	9.991295	9.305867	10.694131	34
27	9.297788	9.991270	9.306519	10.693481	33
28	9.298412	9.991241	9.307168	10.692832	32
29	9.299034	9.991218	9.307816	10.692184	31
30	9.299655	9.991193	9.308463	10.691537	30
	Co fine	Sine	Co Tang	Tangent	M

Degree 73.

Degree 11.

M	Sine	Co. sine	Tangent	Co Tang.	
30	9.295655	9.991193	9.3084'3	10.69'537	30
31	9.300276	9.991167	9.309109	10.690891	29
32	9.300895	9.991141	9.309754	10.690245	28
33	9.301514	9.991115	9.310399	10.689601	27
34	9.302132	9.991090	9.311042	10.688958	26
35	9.302749	9.991064	9.311685	10.688315	25
36	9.303364	9.991038	9.312327	10.687673	24
37	9.303979	9.991012	9.312968	10.687032	23
38	9.304593	9.990986	9.313608	10.686392	22
39	9.305207	9.990950	9.314247	10.685753	21
40	9.305819	9.990934	9.314885	10.685115	20
41	9.306430	9.990908	9.315523	10.684477	19
42	9.307041	9.990882	9.316159	10.683841	18
43	9.307650	9.990855	9.316795	10.683205	17
44	9.308259	9.990829	9.317430	10.682570	16
45	9.308867	9.990803	9.318064	10.681936	15
46	9.309474	9.990777	9.318697	10.681303	14
47	9.310080	9.990750	9.319330	10.680670	13
48	9.310685	9.990724	9.319961	10.680039	12
49	9.311289	9.990697	9.320592	10.679408	11
50	9.311899	9.990671	9.321222	10.678778	10
51	9.312495	9.990645	9.321851	10.678149	9
52	9.313097	9.990618	9.322479	10.677521	8
53	9.313698	9.990591	9.323106	10.676894	7
54	9.314297	9.990565	9.323733	10.676257	6
55	9.314897	9.990538	9.324358	10.675642	5
56	9.315495	9.990512	9.324983	10.675017	4
57	9.316092	9.990485	9.325607	10.674393	3
58	9.316689	9.990458	9.326231	10.673769	2
59	9.317284	9.990431	9.326853	10.673147	1
60	9.317879	9.990404	9.327475	10.672525	0
	Co sine	Sine	Co.Tang.	Tangent.	M

Degree 78.

Degree 12.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.317879	9.990404	9.327475	10.672525	60
1	9.318473	9.990377	9.328095	10.671905	59
2	9.319066	9.990351	9.328715	10.671285	58
3	9.319658	9.990324	9.329334	10.670666	57
4	9.322250	9.990297	9.329953	10.670047	56
5	9.320840	9.990270	9.320570	10.669430	55
6	9.321430	9.990242	9.331187	10.668813	54
7	9.322019	9.990215	9.331803	10.668197	53
8	9.322607	9.990188	9.332418	10.667582	52
9	9.323194	9.990161	9.332033	10.666967	51
10	9.323786	9.990134	9.333646	10.666354	50
11	9.324366	9.990107	9.334259	10.665741	49
12	9.324950	9.990075	9.334871	10.665129	48
13	9.325534	9.990052	9.335482	10.664518	47
14	9.326117	9.990025	9.336093	10.663907	46
15	9.326699	9.989997	9.336702	10.663298	45
16	9.327281	9.989970	9.337311	10.662689	44
17	9.327862	9.989942	9.337919	10.662081	43
18	9.328441	9.989915	9.338527	10.661473	42
19	9.329020	9.989887	9.339133	10.660867	41
20	9.329599	9.989860	9.339739	10.660261	40
21	9.330176	9.989832	9.340344	10.659656	39
22	9.330753	9.989804	9.340948	10.659052	38
23	9.331323	9.989777	9.341552	10.658448	37
24	9.331903	9.989749	9.342155	10.657845	36
25	9.332478	9.989721	9.342757	10.657243	35
26	9.333051	9.989693	9.343358	10.656642	34
27	9.333624	9.989665	9.343958	10.656042	33
28	9.334195	9.989637	9.344558	10.655442	32
29	9.334766	9.989609	9.345157	10.654843	31
30	9.335337	9.989581	9.345755	10.654245	30
	Co-sine	Sine	Co Tang	Tangent.	M

Degree 77.

Degree 12.

M	Sine	Co sine	Tangent	Co Tang.	
30	9.335337	9.989581	9.345755	10.654245	30
31	9.335906	9.989553	9.346353	10.653647	29
32	9.336475	9.989525	9.346949	10.653051	28
33	9.337043	9.989597	9.347545	10.652455	27
34	9.337610	9.989469	9.348141	10.651859	26
35	9.338176	9.989441	9.343735	10.651265	25
36	9.338742	9.989413	9.349329	10.650671	24
37	9.339306	9.989384	9.349922	10.650078	23
38	9.339870	9.989356	9.350514	10.649486	22
39	9.340434	9.989328	9.351106	10.648894	21
40	9.340996	9.989299	9.351697	10.648303	20
41	9.341558	9.989271	9.352287	10.647713	19
42	9.342119	9.989243	9.352876	10.647124	18
43	9.342679	9.989214	9.353465	10.646535	17
44	9.343229	9.989185	9.354053	10.645947	16
45	9.343797	9.989157	9.354644	10.645350	15
46	9.344355	9.989128	9.355227	10.644773	14
47	9.344912	9.989100	9.355812	10.644187	13
48	9.345469	9.989071	9.356393	10.643602	12
49	9.346024	9.989042	9.356982	10.643018	11
50	9.346579	9.989014	9.357566	10.642434	10
51	9.347134	9.988985	9.358149	10.641851	9
52	9.347687	9.988956	9.358731	10.641259	8
53	9.348240	9.988927	9.359313	10.640687	7
54	9.348792	9.988898	9.359893	10.640107	6
55	9.349343	9.988869	9.360474	10.639525	5
56	9.349893	9.988840	9.361053	10.638947	4
57	9.350443	9.988811	9.361632	10.638369	3
58	9.350992	9.988782	9.362210	10.637790	2
59	9.351540	9.988754	9.362787	10.637213	1
60	9.352083	9.988724	9.363364	10.636635	0
	Co sine	Sine	Co Tang.	Tangent.	M

Degree 77.

Degree 13.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.352088	9.98824	9.36336	10.66636	60
1	9.352635	9.988695	9.363940	10.636060	59
2	9.353181	9.988666	9.364515	10.635485	58
3	9.353726	9.988636	9.365090	10.634910	57
4	9.354271	9.988607	9.365664	10.634336	56
5	9.354815	9.988578	9.366237	10.633763	55
6	9.355358	9.988548	9.366810	10.633190	54
7	9.355901	9.988519	9.367382	10.632618	53
8	9.356443	9.988489	9.367953	10.632047	52
9	9.356984	9.988460	9.368524	10.631475	51
10	9.357524	9.988430	9.369094	10.630906	50
11	9.358064	9.988401	9.369663	10.630337	49
12	9.358603	9.988371	9.370232	10.629768	48
13	9.359141	9.988341	9.370799	10.629201	47
14	9.359679	9.988312	9.371367	10.628633	46
15	9.350215	9.988282	9.371933	10.628067	45
16	9.360752	9.988252	9.372499	10.627501	44
17	9.361287	9.988223	9.373064	10.626936	43
18	9.361822	9.988193	9.373629	10.626371	42
19	9.362356	9.988163	9.374193	10.625807	41
20	9.362889	9.988133	9.374756	10.625244	40
21	9.363422	9.988103	9.375319	10.624681	39
22	9.363954	9.988073	9.375881	10.624119	38
23	9.364485	9.988043	9.376442	10.623558	37
24	9.365015	9.988013	9.377003	10.622997	36
25	9.365546	9.987983	9.377562	10.622437	35
26	9.366075	9.987953	9.378122	10.621878	34
27	9.366604	9.987922	9.378681	10.621319	33
28	9.367132	9.987892	9.379239	10.620761	32
29	9.367659	9.987862	9.379797	10.620203	31
30	9.368185	9.987882	9.380354	10.619646	30
	Co-sine	Sine	Co-Tang	Tangent.	M

Degree 76.

Degree 13.

M	Sine	Co sine	Tangent.	Co-Tang.	
30	9.368185	9.987832	9.380354	10.619546	30
31	9.368711	9.987801	9.380910	10.619090	29
32	9.369236	9.987771	9.381405	10.618544	28
33	9.369761	9.987740	9.382021	10.617980	27
34	9.370285	9.987710	9.382575	10.617425	26
35	9.370808	9.987679	9.383129	10.616871	25
36	9.371330	9.987649	9.383682	10.616318	24
37	9.371852	9.987618	9.384234	10.615766	23
38	9.372373	9.987588	9.384786	10.615214	22
39	9.372894	9.987557	9.385337	10.614663	21
40	9.373414	9.987526	9.385888	10.614112	20
41	9.373933	9.987495	9.386438	10.613562	19
42	9.374452	9.987465	9.386987	10.613013	18
43	9.374970	9.987434	9.387536	10.612464	17
44	9.375487	9.987403	9.388084	10.611916	16
45	9.376003	9.987372	9.388531	10.611369	15
46	9.376519	9.987341	9.389178	10.610822	14
47	9.377035	9.987310	9.389724	10.610276	13
48	9.377549	9.987279	9.390270	10.609730	12
49	9.378063	9.987248	9.390815	10.609185	11
50	9.378577	9.987217	9.391360	10.608640	10
51	9.379089	9.987186	9.391907	10.608097	9
52	9.379601	9.987155	9.392467	10.607553	8
53	9.380113	9.987124	9.392989	10.607011	7
54	9.380624	9.987092	9.393531	10.606469	6
55	9.381134	9.987061	9.394074	10.605927	5
56	9.381643	9.987030	9.394614	10.605385	4
57	9.382152	9.986998	9.395154	10.604846	3
58	9.382661	9.986967	9.395694	10.604306	2
59	9.383168	9.986936	9.396233	10.603767	1
60	9.383675	9.986904	9.396771	10.603229	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 76.

Degree 14.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.383675	9.986904	9.395771	10.603229	60
1	9.384181	9.986873	9.397309	10.602594	59
2	9.384687	9.986841	9.397846	10.602154	58
5	9.385192	9.986809	9.399383	10.601617	57
4	9.385697	9.986778	9.398919	10.601081	56
5	9.386201	9.986746	9.399455	10.600545	55
6	9.386704	9.986714	9.399990	10.600010	54
7	9.387207	9.986683	9.400524	10.599476	53
8	9.387709	9.986651	9.401058	10.598942	52
9	9.388210	9.986619	9.401591	10.598409	51
10	9.388711	9.986587	9.402124	10.597876	50
11	9.389211	9.986555	9.402656	10.597344	49
12	9.389711	9.986523	9.403187	10.596813	48
13	9.390210	9.986491	9.403718	10.596282	47
14	9.390708	9.986459	9.404249	10.595751	46
15	9.391206	9.986427	9.404778	10.595222	45
16	9.391703	9.986395	9.405306	10.594693	44
17	9.392199	9.986363	9.405836	10.594164	43
18	9.392695	9.986338	9.406364	10.593636	42
19	9.393190	9.986299	9.406892	10.593608	41
20	9.393685	9.986266	9.407419	10.592581	40
21	9.394179	9.986234	9.407945	10.592055	39
22	9.394673	9.986201	9.408471	10.591529	38
23	9.395166	9.986169	9.408995	10.591001	37
24	9.395654	9.986137	9.409521	10.590479	36
25	9.396150	9.986124	9.410045	10.589954	35
26	9.396641	9.986072	9.410569	10.582431	34
27	9.397131	9.986039	9.411092	10.588908	33
28	9.397621	9.986007	9.411615	10.588385	32
29	9.398111	9.985974	9.412137	10.587863	31
30	9.398600	9.985942	9.412658	10.587342	30
	Co sine	Sine	Co Tang	Tangent	M

Degree 75.

Degree 14.

M	Sine	Co-fine	Tangent	Co-Tang.	
30	9.398600	9.985942	9.412658	10.587342	30
31	9.399087	9.985939	9.413179	10.586821	29
32	9.399575	9.985876	9.413699	10.586301	28
33	9.400062	9.985843	9.414219	10.585781	27
34	9.400549	9.985811	9.414738	10.585262	26
35	9.401035	9.985778	9.415257	10.585742	25
36	9.401520	9.985745	9.415775	10.584225	24
37	9.402005	9.985712	9.416293	10.583707	23
38	9.402489	9.985679	9.416810	10.583190	22
39	9.402972	9.985646	9.417326	10.582674	21
40	9.403455	9.985613	9.417842	10.582157	20
41	9.403938	9.985580	9.418357	10.581642	19
42	9.404420	9.985547	9.418873	10.581127	18
43	9.404901	9.985513	9.419387	10.580613	17
44	9.405382	9.985480	9.419901	10.580099	16
45	9.405862	9.985447	9.420415	10.589585	15
46	9.406341	9.985414	9.420927	10.579072	14
47	9.406820	9.985380	9.421440	10.578560	13
48	9.407299	9.985347	9.421951	10.578048	12
49	9.407776	9.985314	9.422463	10.577537	11
50	9.408254	9.985280	9.422973	10.577026	10
51	9.408731	9.985247	9.423484	10.576516	9
52	9.409207	9.985213	9.423993	10.576007	8
53	9.409682	9.985180	9.424503	10.575497	7
54	9.410157	9.985146	6.425011	10.574989	6
55	9.410632	9.985112	9.425518	10.574480	5
56	9.411106	9.985079	9.426027	10.573973	4
57	9.411579	9.985045	9.426534	10.573466	3
58	9.412052	9.985011	9.427041	10.572959	2
59	9.412524	9.984977	9.427547	10.572453	1
60	9.412996	9.984943	9.428052	10.571947	0
	Co fine	Sine	Co Tang	Tangent.	M

Degree 75.

Degree 15.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.412996	9.984944	9.428052	10.571947	60
1	9.413467	9.984910	9.428557	10.571442	59
2	9.413938	9.984876	9.429067	10.570938	58
3	9.414408	9.984842	9.429566	10.570434	57
4	9.414878	9.984808	9.430070	10.569930	56
5	9.415347	9.984774	9.430573	10.569427	55
6	9.415815	9.984740	9.431075	10.568925	54
7	9.416283	9.984706	9.431577	10.568423	53
8	9.416850	9.984672	9.432079	10.567921	52
9	9.417217	9.984637	9.432580	10.567420	51
10	9.417684	9.984603	9.433080	10.566920	50
11	9.418149	9.984569	9.433580	10.566419	49
12	9.418615	9.984535	9.434080	10.565920	48
13	9.419079	9.984500	9.434579	10.565421	47
14	9.419544	9.984466	9.435078	10.564922	46
15	9.420007	9.984431	9.435576	10.564424	45
16	9.420470	9.984397	9.436073	10.563927	44
17	9.420933	9.984363	9.436570	10.563430	43
18	9.421395	9.984328	9.437067	10.562933	42
19	9.421856	9.984293	9.437563	10.562437	41
20	9.422317	9.984259	9.438059	10.561941	40
21	9.422778	9.984224	9.438554	10.561446	39
22	9.423238	9.984189	9.439048	10.560952	38
23	9.423697	9.984155	9.439543	10.560457	37
24	9.424156	9.984120	9.440036	10.559964	36
25	9.424615	9.984085	9.440529	10.559471	35
26	9.425072	9.984050	9.441022	10.558978	34
27	9.425530	9.984015	9.441514	10.558486	33
28	9.425987	9.983980	9.442006	10.557994	32
29	9.426443	9.983945	9.442497	10.557503	31
30	9.426899	9.983910	9.442988	10.557911	30
	Co sine	Sine	Co-Tang.	Tangent	M

Degree 74.

Degree 15.

M	Sine	Co-fine	Tangent	Co-Tang.	
30	9.416899	9.983910	9.442988	10.557011	30
31	9.427354	9.983875	9.443479	10.556521	29
32	9.427809	9.983840	9.443968	10.556031	28
33	9.428264	9.983805	9.444458	10.555542	27
34	9.428717	9.983770	9.444947	10.555053	26
35	9.429170	9.983735	9.445435	10.554565	25
36	9.439623	9.983699	9.445923	10.554077	24
37	9.430075	9.983664	9.446411	10.553589	23
38	9.430507	9.983629	9.446898	10.553102	22
39	9.430978	9.983593	9.447384	10.552616	21
40	9.431429	9.983558	9.447870	10.552129	20
41	9.431879	9.983523	9.448356	10.551644	19
42	9.432328	9.983487	9.448841	10.551159	18
43	9.432778	9.983451	9.449326	10.550674	17
44	9.433206	9.983416	9.449870	10.550181	16
45	9.433674	9.983380	9.440294	10.549706	15
46	9.434122	9.983345	9.450777	10.549223	14
47	9.434569	9.983309	9.451260	10.548740	13
48	9.435016	9.983273	9.451743	10.548257	12
49	9.435462	9.983238	9.452225	10.547775	11
50	9.435918	9.983202	9.452706	10.547295	10
51	9.436353	9.983166	9.453187	10.546813	9
52	9.436798	9.983130	9.453668	10.546332	8
53	9.437242	9.983094	9.454148	10.545852	7
54	9.437686	9.983058	6.454629	10.545372	6
55	9.438129	9.983022	9.455107	10.544893	5
56	9.438572	9.982986	9.455586	10.544414	4
57	9.439014	9.982950	9.456064	10.543936	3
58	9.439456	9.982914	9.456542	10.543458	2
59	9.439897	9.982878	9.457019	10.542980	1
60	9.430338	9.982842	9.457496	10.542503	0
	Co fine	Sine	Co Tang	Tangent.	M

Degree 74.

Degree 16.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.440338	9.982842	9.457496	10.542503	60
1	9.440778	9.982805	9.457973	10.542027	59
2	9.441218	9.982769	9.458449	10.541551	58
3	9.441658	9.982733	9.458925	10.541075	57
4	9.442096	9.982696	9.459400	10.540600	56
5	9.442535	9.982660	9.459875	10.540125	55
6	9.442972	9.982623	9.460349	10.539651	54
7	9.443416	9.982587	9.460829	10.539177	53
8	9.443848	9.982550	9.461297	10.538703	52
9	9.444284	9.982514	9.461770	10.538230	51
10	9.444720	9.982477	9.462242	10.537758	50
11	9.445155	9.982441	9.462714	10.537285	49
12	9.445590	9.982404	9.463186	10.536814	48
13	9.446025	9.982367	9.463658	10.536342	47
14	9.446459	9.982330	9.464129	10.535871	46
15	9.446893	9.982294	9.464599	10.535401	45
16	9.447326	9.982257	9.465069	10.534931	44
17	9.447759	9.982220	9.465539	10.534461	43
18	9.448191	9.982183	9.466009	10.533992	42
19	9.448623	9.982146	9.466476	10.533523	41
20	9.449054	9.982109	9.466945	10.533055	40
21	9.449485	9.982072	9.467413	10.532587	39
22	9.449915	9.982035	9.467880	10.532120	38
23	9.450345	9.981998	9.468347	10.531653	37
24	9.450775	9.981961	9.468814	10.531186	36
25	9.451203	9.981923	9.469280	10.530720	35
26	9.451632	9.981886	9.469746	10.530254	34
27	9.452060	9.981849	9.470211	10.529789	33
28	9.452488	9.981812	9.470676	10.529324	32
29	9.452915	9.981774	9.471141	10.528859	31
30	9.453342	9.981737	9.471605	10.528395	30
	Co-sine	Sine	Co-Tang	Tangent.	M

Degree 73.

Degree 16.

M	Sine	Co sine	Tangent	Co-Tang.	
30	9.453342	9.981737	9.471605	10.528395	30
31	9.453768	9.981699	9.472068	10.527931	29
32	9.454194	9.981662	9.472532	10.527468	28
33	9.454619	9.981624	9.472995	10.527005	27
34	9.455044	9.981587	9.473457	10.526543	26
35	9.455469	9.981549	9.473919	10.526081	25
36	9.455892	9.981512	9.474381	10.525619	24
37	9.456316	9.981474	9.474842	10.525158	23
38	9.456739	9.981436	9.475303	10.524695	22
39	9.457162	9.981398	9.475763	10.524237	21
40	9.457584	9.981361	9.476223	10.523777	20
41	9.458006	9.981323	9.476683	10.523317	19
42	9.458427	9.981285	9.477142	10.522858	18
43	9.458848	9.981247	9.477601	10.522399	17
44	9.459263	9.981209	9.478059	10.521941	16
45	9.459684	9.981171	9.478517	10.521483	15
46	9.460108	9.981133	9.478975	10.521025	14
47	9.460527	9.981095	9.479432	10.520568	13
48	9.460946	9.981057	9.479889	10.520111	12
49	9.461364	9.981019	9.480345	10.519655	11
50	9.461782	9.980980	9.480801	10.519197	10
51	9.462199	9.980942	9.481257	10.518743	9
52	9.462516	9.980904	9.481712	10.518288	8
53	9.463032	9.980866	9.482167	10.517833	7
54	9.463448	9.980827	9.482621	10.517379	6
55	9.463864	9.980789	9.483075	10.516925	5
56	9.464279	9.980750	9.483528	10.516471	4
57	9.464694	9.980712	9.483982	10.516018	3
58	9.465108	9.980672	9.484434	10.515565	2
59	9.465522	9.980635	9.484887	10.515113	1
60	9.465953	9.980596	9.485339	10.514661	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 73.

Degree 17.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.465935	9.980596	9.485339	10.514661	60
1	9.466348	9.980558	9.485791	10.514209	59
2	9.466761	9.980519	9.486242	10.513758	58
3	9.467173	9.980480	9.486693	10.513307	57
4	9.467585	9.980441	9.487143	10.512857	56
5	9.467996	9.980403	9.487593	10.512407	55
6	9.468407	9.980364	9.488043	10.511957	54
7	9.468817	9.980325	9.488493	10.511507	53
8	9.469227	9.980286	9.488941	10.511059	52
9	9.469637	9.980247	9.489390	10.510610	51
10	9.460446	9.980208	9.489838	10.510162	50
11	9.470155	9.980169	9.490286	10.509714	49
12	9.471863	9.980130	9.490733	10.509267	48
13	9.471071	9.980091	9.491180	10.508820	47
14	9.471678	9.980052	9.491627	10.508373	46
15	9.472086	9.980012	9.492073	10.507928	45
16	9.472492	9.979973	9.492519	10.507481	44
17	9.472898	9.979934	9.492964	10.507035	43
18	9.473304	9.979894	9.493410	10.506590	42
19	9.473710	9.979855	9.493854	10.506145	41
20	9.474115	9.979816	9.494299	10.505701	40
21	9.474519	9.979776	9.494743	10.505257	39
22	9.474923	9.979737	9.495186	10.504813	38
23	9.475327	9.979697	9.495630	10.504370	37
24	9.475730	9.979658	9.496073	10.503928	36
25	9.476133	9.979618	9.496515	10.503485	35
26	9.476536	9.979578	9.496957	10.503043	34
27	9.476938	9.979539	9.497399	10.502601	33
28	9.477340	9.979499	9.497840	10.502160	32
29	9.477741	9.979459	9.498282	10.501718	31
30	9.478142	9.979419	9.498722	10.501278	30
	Co-sine	Sine	Co-Tang	Tangent.	M

Degree 72.

Degree 17.

M	Sine	Co sine	Tangent	Co Tang.	
30	9.478142	9.979419	9.498722	10.501278	30
31	9.478542	9.979380	9.499163	10.500837	29
32	9.478942	9.979340	9.499602	10.500398	28
33	9.479342	9.979300	9.500042	10.499958	27
34	9.479741	9.979260	9.500481	10.499519	26
35	9.480140	9.979220	9.500920	10.499080	25
36	9.480538	9.979180	9.501359	10.498641	24
37	9.480936	9.979140	9.501797	10.498203	23
38	9.481334	9.979099	9.502234	10.497765	22
39	9.481731	9.979059	9.502672	10.497328	21
40	9.482128	9.979019	9.503107	10.496891	20
41	9.482525	9.978980	9.503546	10.496454	19
42	9.482921	9.978939	9.503982	10.496018	18
43	9.483316	9.978898	9.504418	10.495582	17
44	9.483711	9.978858	9.504854	10.495146	16
45	9.484106	9.978817	9.505289	10.494711	15
46	9.484501	9.978777	9.505724	10.494276	14
47	9.484895	9.978736	9.506158	10.493841	13
48	9.485289	9.978695	9.506593	10.493407	12
49	9.485682	9.978655	9.507026	10.492973	11
50	9.486075	9.978615	9.507459	10.492540	10
51	9.486467	9.978574	9.507892	10.492107	9
52	9.486859	9.978533	9.508326	10.491674	8
53	9.487251	9.978493	9.508759	10.491241	7
54	9.487642	9.978452	9.509181	10.490809	6
55	9.488033	9.978411	9.509622	10.490377	5
56	9.488424	9.978370	9.510044	10.489946	4
57	9.488814	9.978329	9.510480	10.489515	3
58	9.489204	9.978288	9.510916	10.489084	2
59	9.489593	9.978247	9.511346	10.488654	1
60	9.489982	9.978206	9.511776	10.488225	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 72.

Degree 18.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.489982	9.978205	9.511776	10.488224	60
1	9.490371	9.978165	9.512205	10.487794	59
2	9.490759	9.978124	9.512635	10.487265	58
3	9.491147	9.978083	9.513064	10.486936	57
4	9.491534	9.978042	9.513493	10.486507	56
5	9.491922	9.978000	9.513921	10.486079	55
6	9.492308	9.977956	9.514349	10.485651	54
7	9.492695	9.977918	9.514777	10.485223	53
8	9.493080	9.977877	9.515204	10.484795	52
9	9.493466	9.977835	9.515631	10.484369	51
10	9.493851	9.977794	9.516057	10.483942	50
11	9.494236	9.977752	9.516484	10.483516	49
12	9.494620	9.977711	9.516910	10.483090	48
13	9.495005	9.977669	9.517335	10.482665	47
14	9.495388	9.977628	9.517761	10.482239	46
15	9.495771	9.977586	9.518185	10.481814	45
16	9.496154	9.977544	9.518610	10.481390	44
17	9.496537	9.977503	9.519034	10.480966	43
18	9.496919	9.977461	9.519458	10.480542	42
19	9.497301	9.977419	9.519882	10.480118	41
20	9.497682	9.977377	9.520305	10.479695	40
21	9.498063	9.977335	9.520728	10.479272	39
22	9.498444	9.977293	9.521151	10.478849	38
23	9.498824	9.977251	9.521573	10.478427	37
24	9.499204	9.977209	9.521995	10.478005	36
25	9.499584	9.977167	9.522417	10.477583	35
26	9.499963	9.977125	9.522838	10.477162	34
27	9.500342	9.977083	9.523259	10.476741	33
28	9.500720	9.977041	9.523679	10.476320	32
29	9.501099	9.976999	9.524109	10.475900	31
30	9.501476	9.976956	9.524520	10.475480	30
	Co sine	Sine	Co-Tang	Tangent	M

Degree 71.

Degree 18.

M	Sine	Co. sine	Tangent.	Co-Tang.	
30	9.501476	9.977956	9.524520	10.475080	30
31	9.501854	9.976914	9.524939	10.475060	29
32	9.502231	9.976872	9.525359	10.474641	28
33	9.502607	9.976830	9.525778	10.474222	27
34	9.502984	9.976787	9.526197	10.473803	26
35	9.503360	9.976745	9.526615	10.473385	25
36	9.503735	9.976702	9.527033	10.472967	24
37	9.504110	9.976660	9.527451	10.472549	23
38	9.504485	9.976617	9.527868	10.472132	22
39	9.504840	9.976574	9.528285	10.471715	21
40	9.505234	9.976532	9.528702	10.471298	20
41	9.505608	9.976489	9.529118	10.470881	19
42	9.505981	9.976446	9.529535	10.470465	18
43	9.506354	9.976404	9.529950	10.470049	17
44	9.506727	9.976361	9.530366	10.469634	16
45	9.507099	9.976318	9.530781	10.469219	15
46	9.507471	9.976275	9.531169	10.468804	14
47	9.507843	9.976232	9.531611	10.468389	13
48	9.508214	9.976185	9.532025	10.467975	12
49	9.508585	9.976146	9.532436	10.467561	11
50	9.508955	9.976103	9.532852	10.467147	10
51	9.509326	9.976060	9.533266	10.466784	9
52	9.509696	9.976017	9.533679	10.466321	8
53	9.510065	9.975973	9.534092	10.465908	7
54	9.510434	9.975930	9.534504	10.465496	6
55	9.510803	9.975887	9.534916	10.465084	5
56	9.511171	9.975844	9.535328	10.464672	4
57	9.511540	9.975800	9.535739	10.464261	3
58	9.511907	9.975757	9.536150	10.463849	2
59	9.512275	9.975713	9.536561	10.463439	1
60	9.512642	9.975670	9.536972	10.463028	0
	Co sine	Sine	Co-Tang.	Tangent.	M

Degree 71.

Degree 19.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.512642	9.975670	9.536972	10.463028	60
1	9.513009	9.975626	9.537382	10.462618	59
2	9.513375	9.975583	9.537792	10.462208	58
3	9.513741	9.975539	9.538202	10.461798	57
4	9.514107	9.975496	9.538610	10.461389	56
5	9.514472	9.975452	9.539020	10.460980	55
6	9.514837	9.975408	9.539429	10.460571	54
7	9.515202	9.975364	9.539837	10.460163	53
8	9.515566	9.975321	9.540245	10.459755	52
9	9.515930	9.975277	9.540653	10.459347	51
10	9.516294	9.975233	9.541061	10.458939	50
11	9.516657	9.975186	9.541468	10.458532	49
12	9.517020	9.975145	9.541875	10.458125	48
13	9.517382	9.975101	9.542281	10.457719	47
14	9.517745	9.975057	9.542688	10.457312	46
15	9.518107	9.975013	9.543094	10.456906	45
16	9.518468	9.974969	9.543499	10.456501	44
17	9.518829	9.974925	9.543905	10.456095	43
18	9.519190	9.974880	9.544310	10.455690	42
19	9.519551	9.974836	9.544715	10.455285	41
20	9.519911	9.974792	9.545119	10.454881	40
21	9.520271	9.974747	9.545524	10.454476	39
22	9.520631	9.974703	9.545927	10.454072	38
23	9.520990	9.974659	9.546331	10.453669	37
24	9.521349	9.974614	9.546735	10.453265	36
25	9.521707	9.974570	9.547138	10.452862	35
26	9.522065	9.974525	9.547540	10.452459	34
27	9.522423	9.974480	9.547943	10.452057	33
28	9.522781	9.974436	9.548345	10.451655	32
29	9.523138	9.974391	9.548747	10.451253	31
30	9.523495	9.974340	9.549149	10.450851	30
	Co sine	Sine	Co-Tang	Tangent	M

Degree 70.

Degree 19.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.523495	9.974316	9.549149	10.450851	30
31	9.523851	9.974302	9.549550	10.450450	29
32	9.524208	9.974257	9.549951	10.450049	28
33	9.524564	9.974212	9.550352	10.449648	27
34	9.524920	9.974167	9.550752	10.449048	26
35	9.525275	9.974122	9.551152	10.448848	25
36	9.525630	9.974077	9.551552	10.448448	24
37	9.525984	9.974032	9.551952	10.448048	23
38	9.526339	9.973987	9.552351	10.447649	22
39	9.526693	9.973942	9.552750	10.447250	21
40	9.527046	9.973897	9.553149	10.446851	20
41	9.527400	9.973852	9.553548	10.446452	19
42	9.527753	9.973807	9.553946	10.446054	18
43	9.528105	9.973761	9.554344	10.445656	17
44	9.528458	9.973716	9.554741	10.445259	16
45	9.528810	9.973671	9.555139	10.444861	15
46	9.529161	9.973625	9.555536	10.444464	14
47	9.529513	9.973580	9.555932	10.444068	13
48	9.529864	9.973535	9.556329	10.443671	12
49	9.530214	9.973489	9.556725	10.443257	11
50	9.530565	9.973443	9.557121	10.442876	10
51	9.530915	9.973398	9.557517	10.442483	9
52	9.531265	9.973352	9.557912	10.442088	8
53	9.531614	9.973307	9.558308	10.441693	7
54	9.531963	9.973261	9.558702	10.441298	6
55	9.532312	9.973215	9.559097	10.440903	5
56	9.532661	9.973169	9.559491	10.440509	4
57	9.533099	9.973123	9.559885	10.440115	3
58	9.533357	9.973078	9.560279	10.439721	2
59	9.533704	9.973032	9.560673	10.439327	1
60	9.534052	9.973986	9.561066	10.438934	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 70.

Degree 20.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.534052	9.972986	9.561066	10.438934	60
1	9.534399	9.972940	9.561459	10.438541	59
2	9.534746	9.972894	9.561851	10.438148	58
3	9.535091	9.972848	9.562244	10.437756	57
4	9.535437	9.972801	9.562636	10.437364	56
5	9.535782	9.972755	9.563028	10.436972	55
6	9.536129	9.972709	9.563419	10.436580	54
7	9.536474	9.972663	9.563811	10.436189	53
8	9.536818	9.972617	9.564202	10.435798	52
9	9.537163	9.972570	9.564592	10.435407	51
10	9.537507	9.972524	9.564983	10.435017	50
11	9.537851	9.972477	9.565373	10.434627	49
12	9.538194	9.972431	9.565763	10.434237	48
13	9.538537	9.972384	9.566153	10.433847	47
14	9.538880	9.972338	9.566542	10.433457	46
15	9.539222	9.972291	9.566932	10.433068	45
16	9.539566	9.972245	9.567320	10.432679	44
17	9.539907	9.972198	9.567709	10.432291	43
18	9.540249	9.972151	9.568097	10.431902	42
19	9.540590	9.972105	9.568486	10.431514	41
20	9.540931	9.972058	9.568873	10.431126	40
21	9.541272	9.972011	9.569261	10.430739	39
22	9.541612	9.971964	9.569648	10.430351	38
23	9.541953	9.971917	9.560035	10.429964	37
24	9.542292	9.971870	9.560402	10.429578	36
25	9.542632	9.971823	9.560809	10.429191	35
26	9.542971	9.971776	9.571195	10.428805	34
27	9.543310	9.971729	9.571581	10.428419	33
28	9.543649	9.971682	9.571967	10.428033	32
29	9.543987	9.971635	9.572352	10.427643	31
30	9.544325	9.971588	9.572738	10.427262	30
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 69.

Degree. 20.

M	Sine	Co-sine	Tangent	Co Tang.	
30	9.544325	9.971588	9.572738	10.427262	30
31	9.544663	9.971540	9.573123	10.426877	29
32	9.545000	9.971492	9.573507	10.426492	28
33	9.545338	9.971446	9.573892	10.426108	27
34	9.545674	9.971398	9.574276	10.425724	26
35	9.546011	9.971351	9.574660	10.425340	25
36	9.546347	9.971303	9.575044	10.424956	24
37	9.546683	9.971256	9.575427	10.424573	23
38	9.547019	9.971208	9.575810	10.424189	22
39	9.547354	9.971161	9.576193	10.423807	21
40	9.547689	9.971112	9.576576	10.423424	20
41	9.548024	9.971065	9.576958	10.423041	19
42	9.548358	9.971018	9.577341	10.422659	18
43	9.548693	9.970970	9.577723	10.422277	17
44	9.549026	9.970923	9.578104	10.421896	16
45	9.549360	9.970874	9.578486	10.421514	15
46	9.549693	9.970826	9.578867	10.421133	14
47	9.550026	9.970779	9.579248	10.420752	13
48	9.550359	9.970731	9.579628	10.420371	12
49	9.550692	9.970683	9.580009	10.419991	11
50	9.551024	9.970634	9.580389	10.419611	10
51	9.551355	9.970586	9.580769	10.419231	9
52	9.551687	9.970538	9.581149	10.418851	8
53	9.552018	9.970490	9.581528	10.418472	7
54	9.552349	9.970442	9.581907	10.418092	6
55	9.552680	9.970394	9.582286	10.417713	5
56	9.553010	9.970345	9.582665	10.417335	4
57	9.553340	9.970297	9.583043	10.416956	3
58	9.553670	9.970249	9.583422	10.416578	2
59	9.554000	9.970200	9.583800	10.416200	1
60	9.554329	9.970152	9.584177	10.415823	0
	Co-sine	Sine	Co.Tang	Tangent	M

Degree 69.

Degree. 21.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.554329	9.970155	9.584177	10.415822	60
1	9.554558	9.970105	9.584555	10.415415	59
2	9.554987	9.970055	9.584932	10.415068	58
3	9.555315	9.970006	9.585308	10.414691	57
4	9.555643	9.969957	9.585685	10.414314	56
5	9.555971	9.969909	9.586062	10.413938	55
6	9.556299	9.969860	9.586439	10.413561	54
7	9.556626	9.969811	9.586815	10.413185	53
8	9.556953	9.969762	9.587190	10.412800	52
9	9.557279	9.969715	9.587566	10.412434	51
10	9.557606	9.969665	9.587941	10.412059	50
11	9.557932	9.969616	9.588316	10.411684	49
12	9.558258	9.969567	9.588691	10.411309	48
13	9.558583	9.969518	9.589066	10.410934	47
14	9.558909	9.969469	9.589440	10.410560	46
15	9.559234	9.969419	9.589814	10.410185	45
16	9.559558	9.969370	9.590188	10.409812	44
17	9.559883	9.969321	9.590561	10.409438	43
18	9.560207	9.969272	9.590935	10.409065	42
19	9.560531	9.969223	9.591308	10.408692	41
20	9.560855	9.969173	9.591681	10.408319	40
21	9.561178	9.969124	9.592054	10.407946	39
22	9.561501	9.969075	9.592426	10.407574	38
23	9.561824	9.969025	9.592798	10.407201	37
24	9.562146	9.968976	9.593170	10.406829	36
25	9.562468	9.968926	9.593542	10.406457	35
26	9.562790	9.968877	9.593914	10.406086	34
27	9.563112	9.968827	9.594285	10.405715	33
28	9.563433	9.968777	9.594656	10.405344	32
29	9.563754	9.968728	9.595027	10.404973	31
30	9.564075	9.968678	9.595397	10.404602	30
	Co-sine	Sine	Co-Tang.	Tang.	M

Degree 68.

Degree 21.

M	Sine	Co-sine	Tangent.	Co-Tang.	
30	9.564075	9.968678	9.595397	10.404602	30
31	9.564396	9.968628	9.595768	10.404232	29
32	9.564716	9.968578	9.596138	10.403862	28
33	9.565036	9.968528	9.596508	10.403492	27
34	9.565356	9.968478	9.596878	10.403122	26
35	9.565675	9.968428	9.597247	10.402753	25
36	9.565995	9.968378	9.597616	10.402384	24
37	9.566314	9.968328	9.597985	10.402015	23
38	9.566632	9.968278	9.598354	10.401646	22
39	9.566951	9.968228	9.598722	10.401277	21
40	9.567269	9.968178	9.599091	10.400909	20
41	9.567587	9.968128	9.599459	10.400541	19
42	9.567904	9.968078	9.599827	10.400173	18
43	9.568222	9.968027	9.600194	10.399806	17
44	9.568539	9.967977	9.600562	10.399438	16
45	9.568855	9.967927	9.600929	10.399071	15
46	9.569172	9.967876	9.601296	10.398704	14
47	9.569488	9.967826	9.601662	10.398337	13
48	9.569804	9.967775	9.602029	10.397971	12
49	9.570120	9.967725	9.602395	10.397605	11
50	9.570435	9.967674	9.602761	10.397239	10
51	9.570751	9.967623	9.603127	10.396873	9
52	9.571065	9.967573	9.603493	10.396507	8
53	9.571380	9.967522	9.603858	10.396142	7
54	9.571695	9.967471	9.604223	10.395777	6
55	9.572009	9.967420	9.604588	10.395412	5
56	9.572322	9.967370	9.604953	10.395047	4
57	9.572636	9.967319	9.605317	10.394683	3
58	9.572949	9.967268	9.605681	10.394318	2
59	9.573263	9.967217	9.606046	10.393954	1
60	9.573575	9.967166	9.606409	10.393592	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 68.

Degree 22.

M	Sine	Co. fine	Tangent	Co-Tang.	
0	9.573575	6.967166	9.606409	10.393590	60
1	9.573888	9.967115	9.606773	10.393227	59
2	9.574200	9.967064	9.607136	10.392863	58
3	9.574512	9.967012	9.607500	10.392500	57
4	9.574824	9.966961	9.607862	10.392137	56
5	9.575135	9.966910	9.608225	10.391774	55
6	9.575447	9.966859	9.608588	10.391412	54
7	9.575758	9.966807	9.608950	10.391050	53
8	9.576058	9.966756	9.609312	10.390688	52
9	9.576379	9.966705	9.609674	10.390326	51
10	9.576689	9.966653	9.610036	10.389964	50
11	9.576999	9.966602	9.610397	10.389603	49
12	9.577309	9.966550	9.610758	10.389241	48
13	9.577618	9.966499	9.611119	10.388880	47
14	9.577927	9.966447	9.611480	10.388520	46
15	9.578236	9.966395	9.611841	10.388159	45
16	9.578545	9.966344	9.612201	10.387799	44
17	9.578853	9.966292	9.612561	10.387438	43
18	9.579161	9.966240	9.612921	10.387078	42
19	9.579469	9.966188	9.613281	10.386719	41
20	9.579777	9.966136	9.613641	10.386359	40
21	9.580084	9.966084	9.614000	10.386000	39
22	9.580392	9.966032	9.614359	10.385641	38
23	9.580698	9.965980	9.614718	10.385282	37
24	9.581005	9.965928	9.615077	10.384923	36
25	9.581311	9.965876	9.615435	10.384565	35
26	9.581618	9.965824	9.615793	10.384207	34
27	9.581923	9.965772	9.616151	10.383848	33
28	9.582229	9.965720	9.616509	10.383491	32
29	9.582534	9.965668	9.616867	10.383133	31
30	9.582840	9.965615	9.617224	10.382776	30
	Co fine	Sine	Co Tang.	Tangent	M

Degree 67.

Degree 22.

M	Sine	Co-sine	Tangent	Co.Tang.	
30	9.582840	9.955515	9.617224	10.382776	30
31	9.583144	9.955553	9.617581	10.382418	29
32	9.583449	9.955511	9.617938	10.382061	28
33	9.583753	9.955458	9.618295	10.381705	27
34	9.584058	9.955405	9.618652	10.381348	26
35	9.584361	9.955353	9.619008	10.380992	25
36	9.584665	9.955301	9.619364	10.380635	24
37	9.584968	9.955248	9.619720	10.380279	23
38	9.585271	9.955195	9.620076	10.379924	22
39	9.585574	9.955143	9.620432	10.379568	21
40	9.585877	9.955090	9.620787	10.379213	20
41	9.586179	9.955037	9.621142	10.378858	19
42	9.586481	9.954984	9.621497	10.378503	18
43	9.586783	9.954931	9.622352	10.378148	17
44	9.587085	9.954878	9.622205	10.377793	16
45	9.587386	9.954825	9.622551	10.377439	15
46	9.587687	9.954772	9.622915	10.377085	14
47	9.587988	9.954719	9.623269	10.376731	13
48	9.588239	9.954665	9.623623	10.376377	12
49	9.588589	9.954613	9.623976	10.376024	11
50	9.588890	9.954560	9.624330	10.375670	10
51	9.589190	9.954507	9.624683	10.375317	9
52	9.589489	9.954454	9.625035	10.374964	8
53	9.589789	9.954400	9.625388	10.374612	7
54	9.590088	9.954347	9.625741	10.374259	6
55	9.590387	9.954291	9.626093	10.373907	5
56	9.590685	9.954240	9.626445	10.373555	4
57	9.590984	9.954187	9.626797	10.373203	3
58	9.591282	9.954133	9.627149	10.372850	2
59	9.591580	9.954080	9.627501	10.372499	1
60	9.591878	9.954026	9.627852	10.372148	0
	Co sine	Sine	Co.Tang.	Tangenc.	M

Degree 67.

Degree 23.

M	Sine	Co sine	Tangent	Co-Tang	
0	9.591878	9.964026	9.627852	10.372148	60
1	9.592175	9.963972	9.628203	10.371797	59
2	9.592473	9.963919	9.628554	10.371244	58
3	9.592770	9.963865	9.628905	10.371095	57
4	9.593067	9.963811	9.629255	10.370744	56
5	9.593363	9.963757	9.629606	10.370394	55
6	9.593659	9.963703	9.629956	10.370044	54
7	9.593955	9.963650	9.630306	10.369594	53
8	9.594251	9.963596	9.630655	10.369344	52
9	9.594547	9.963542	9.631005	10.368995	51
10	9.594842	9.963488	9.631354	10.368645	50
11	9.595137	9.963433	9.631704	10.368296	49
12	9.595432	9.963379	9.632053	10.367947	48
13	9.595727	9.963325	9.632401	10.367598	47
14	9.596021	9.963271	9.632750	10.367250	46
15	9.596315	9.963217	9.633098	10.366901	45
16	9.596610	9.963162	9.633447	10.366553	44
17	9.596903	9.963108	9.633795	10.366205	43
18	9.597196	9.963054	9.634043	10.365857	42
19	9.597490	9.962999	9.634490	10.365510	41
20	9.597783	9.962945	9.634838	10.365162	40
21	9.598075	9.962892	9.635185	10.364815	39
22	9.598368	9.962836	9.635530	10.364468	38
23	9.598660	9.962781	9.635879	10.364121	37
24	9.598952	9.962726	9.636226	10.363774	36
25	9.599244	9.962672	9.636572	10.363428	35
26	9.599536	9.962617	9.636918	10.363081	34
27	9.599827	9.962562	9.637205	10.362735	33
28	9.600118	9.962507	9.637611	10.362389	32
29	9.600409	9.962453	9.637956	10.362044	31
30	9.600700	9.962398	9.638302	10.361698	30
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 26.

Degree 23.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.600700	9.962398	9.638302	10.361698	30
31	9.600950	9.962345	9.638647	10.361353	29
32	9.601280	9.962288	9.638992	10.361007	28
33	9.601570	9.962233	9.639337	10.360662	27
34	9.601860	9.962178	9.639685	10.360318	26
35	9.602149	9.962122	9.640927	10.359973	25
36	9.602439	9.962057	9.640371	10.359629	24
37	9.602728	9.962012	9.640716	10.359284	23
38	9.603017	9.961957	9.641060	10.358940	22
39	9.603305	9.961902	9.641404	10.358596	21
40	9.603594	9.961816	9.641747	10.358258	20
41	9.603882	9.961791	9.642091	10.357909	19
42	9.604170	9.961735	9.642434	10.357566	18
43	9.604457	9.961630	9.642777	10.357223	17
44	9.604745	9.961624	9.643120	10.356980	16
45	9.605032	9.961569	9.643463	10.356537	15
46	9.605319	9.961513	9.643806	10.356194	14
47	9.605606	9.961458	9.644148	10.355852	13
48	9.605892	9.961402	9.644490	10.355510	12
49	9.606179	9.961346	9.644832	10.355168	11
50	9.606465	9.961290	9.645174	10.354826	10
51	9.606750	9.961235	9.645516	10.354484	9
52	9.607039	9.961179	9.645857	10.354142	8
53	9.607322	9.961123	9.646199	10.353801	7
54	9.607607	9.961067	9.646540	10.353460	6
55	9.607892	9.961011	9.646881	10.353119	5
56	9.608176	9.960955	9.647222	10.352778	4
57	9.608461	9.960899	9.647562	10.352438	3
58	9.608745	9.960842	9.647903	10.352097	2
59	9.609029	9.960786	9.648243	10.351757	1
60	9.609313	9.960730	9.648583	10.351417	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 66.

Degree 24.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.609313	9.950730	9.648585	10.351417	60
1	9.609597	9.960674	9.648923	10.351077	59
2	9.609880	9.960617	9.649253	10.350737	58
3	9.610163	9.960561	9.649602	10.350308	57
4	9.610446	9.960505	9.649942	10.350058	56
5	9.610729	9.960448	9.650281	10.349719	55
6	9.611012	9.960392	9.650520	10.349380	54
7	9.611294	9.960335	9.650959	10.349041	53
8	9.611576	9.960279	9.651297	10.348703	52
9	9.611858	9.960222	9.651636	10.348364	51
10	9.612140	9.960165	9.651974	10.348025	50
11	9.612421	9.960109	9.652312	10.347688	49
12	9.612702	9.960052	9.652550	10.347350	48
13	9.612983	9.959995	9.652788	10.347012	47
14	9.613264	9.959938	9.653325	10.346674	46
15	9.613545	9.959881	9.653663	10.346337	45
16	9.614825	9.959824	9.654000	10.345999	44
17	9.614105	9.959768	9.654337	10.345662	43
18	9.614385	9.959710	9.654674	10.345325	42
19	9.614665	9.959653	9.655011	10.344989	41
20	9.614944	9.959596	9.655348	10.344652	40
21	9.615223	9.959539	9.655584	10.344316	39
22	9.615502	9.959482	9.656020	10.343980	38
23	9.615781	9.959425	9.656356	10.343643	37
24	9.616050	9.959367	9.656692	10.343308	36
25	9.616338	9.959310	9.657028	10.342972	35
26	9.616616	9.959253	9.657363	10.342636	34
27	9.616894	9.959195	9.657699	10.342301	33
28	9.617172	9.959138	9.658034	10.341966	32
29	9.617450	9.959080	9.658369	10.341531	31
30	9.617727	9.959023	9.658704	10.341296	30
	Co sine	Sine	Co Tang	Tangent.	M

Degree 65.

Degree 24.

M	Sine	Co-sine	Tangent	Co Tang.	
30	9.617727	9.959023	9.658704	10.341296	30
31	9.618004	9.958965	9.659039	10.340926	29
32	9.618581	9.958908	9.659373	10.340627	28
33	9.618558	9.958850	9.659708	10.340292	27
34	9.618834	9.958792	9.660042	10.339958	26
35	9.619110	9.958734	9.660276	10.339624	25
36	9.619386	9.958677	9.660710	10.339290	24
37	9.619662	9.958619	9.661043	10.338957	23
38	9.619938	9.958561	9.661377	10.338623	22
39	9.620213	9.958503	9.661710	10.338290	21
40	9.620488	9.958445	9.662043	10.337956	20
41	9.620763	9.958387	9.662376	10.337623	19
42	9.621038	9.958329	9.662709	10.337291	18
43	9.621313	9.958271	9.663042	10.336958	17
44	9.621587	9.958212	9.663374	10.336625	16
45	9.621861	9.958154	9.663707	10.336293	15
46	9.622135	9.958096	9.664039	10.335961	14
47	9.622409	9.958038	9.664371	10.335629	13
48	9.622682	9.957979	9.664703	10.335297	12
49	9.622956	9.957921	9.665035	10.334965	11
50	9.623229	9.957862	9.665366	10.334634	10
51	9.623502	9.957804	9.665697	10.334302	9
52	9.623775	9.957745	9.666029	10.333971	8
53	9.624047	9.957687	9.666360	10.333640	7
54	9.624319	9.957628	9.666691	10.333309	6
55	9.624591	9.957570	9.667021	10.332979	5
56	9.624863	9.957511	9.667352	10.332648	4
57	9.625134	9.957452	9.667682	10.332318	3
58	9.625406	9.957393	9.668012	10.331987	2
59	9.625677	9.957334	9.668343	10.331657	1
60	9.625948	9.957276	9.668672	10.331327	0
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 65.

Degree 25.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.625948	9.957276	9.668672	10.331327	60
1	9.621219	9.957217	9.669002	10.330998	59
2	9.626490	9.957158	9.669332	10.330668	58
3	9.626569	9.957099	9.669661	10.330339	57
4	9.627030	9.957040	9.669990	10.330009	56
5	9.627300	9.956981	9.670320	10.329680	55
6	9.627570	9.956922	9.670649	10.329351	54
7	9.627840	9.956862	9.670977	10.329022	53
8	9.628109	9.956803	9.671305	10.328694	52
9	9.628378	9.956744	9.671634	10.328365	51
10	9.628647	9.956684	9.671963	10.328035	50
11	9.628916	9.956625	9.672291	10.327609	49
12	9.629184	9.956565	9.672619	10.327381	48
13	9.629453	9.956506	9.672947	10.327053	47
14	9.629721	9.956446	9.673274	10.326725	46
15	9.629989	9.956387	9.673603	10.326398	45
16	9.630257	9.956327	9.673929	10.326070	44
17	9.630524	9.956267	9.674259	10.325743	43
18	9.630792	9.956208	9.674584	10.325416	42
19	9.631059	9.956148	9.674910	10.325089	41
20	9.631326	9.956088	9.675237	10.324763	40
21	9.631592	9.956029	9.675564	10.324436	39
22	9.631859	9.955969	9.675890	10.324110	38
23	9.632125	9.955909	9.676216	10.323783	37
24	9.632392	9.955849	9.676543	10.323457	36
25	9.632657	9.955789	9.676869	10.323131	35
26	9.632923	9.955739	9.677194	10.322805	34
27	9.633189	9.955669	9.677520	10.322480	33
28	9.633454	9.955609	9.677845	10.322154	32
29	9.633719	9.955548	9.678171	10.321829	31
30	9.633984	9.955488	9.678496	10.321504	30
	Co-sine	Sine	Co-Tang	Tangent.	M

Degree 64.

Degree 25.

M	Sine	Co-sine	Tangent	Co.Tang.	
30	9.633984	9.955488	9.678496	10.321504	30
31	9.634249	9.955428	9.678821	10.321179	29
32	9.634514	9.955867	9.679146	10.320854	23
33	9.634778	9.955307	9.679471	10.320529	27
34	9.635042	9.955246	9.679795	10.320205	26
35	9.635306	9.955286	9.680120	10.319880	25
36	9.635570	9.955125	9.680444	10.319556	24
37	9.635833	9.955065	9.680768	10.319232	23
38	9.636097	9.955004	9.681092	10.318908	22
39	9.636360	9.954944	9.681416	10.318584	21
40	9.636623	9.954883	9.681740	10.318260	20
41	9.636886	9.954823	9.682063	10.317937	19
42	9.637148	9.954762	9.682385	10.317613	18
43	9.637411	9.954701	9.682710	10.317290	17
44	9.637673	9.954640	9.683033	10.316967	16
45	9.637935	9.954579	9.683356	10.316644	15
46	9.638197	9.954518	9.683678	10.316321	14
47	9.638458	9.954457	9.684001	10.315999	13
48	9.638720	9.954396	9.684324	10.315676	12
49	9.638981	9.954335	9.684646	10.315354	11
50	9.639242	9.954274	9.684968	10.315032	10
51	9.639503	9.954213	9.685290	10.314710	9
52	9.639764	9.954152	9.685612	10.314388	8
53	9.640024	9.954090	9.685934	10.314066	7
54	9.640284	9.954029	9.686255	10.313745	6
55	9.640544	9.954968	9.686577	10.313423	5
56	9.640804	9.953906	9.686898	10.313102	4
57	9.641064	9.953845	9.687219	10.312781	3
58	9.641323	9.953783	9.687540	10.312460	2
59	9.641583	9.953722	9.687861	10.312138	1
60	9.641842	9.953660	9.688182	10.311818	0
	Co-sine	Sine	Co.Tang.	Tangent.	M

Degree 64.

Degree 26.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.541842	9.953660	9.688182	10.311818	60
1	9.642101	9.953598	9.688502	10.311493	59
2	9.642360	9.953537	9.688823	10.311177	58
3	9.642618	9.953475	9.689143	10.310857	57
4	9.642876	9.953413	9.689493	10.310537	56
5	9.643135	9.953351	9.689783	10.310217	55
6	9.643393	9.953290	9.690103	10.309897	54
7	9.643650	9.953228	9.690423	10.309577	53
8	9.643908	9.953166	9.690742	10.309258	52
9	9.644165	9.953104	9.691063	10.308938	51
10	9.644423	9.953042	9.691381	10.308619	50
11	9.644680	9.952980	9.691700	10.308300	49
12	9.644936	9.952917	9.692019	10.307981	48
13	9.645193	9.952855	9.692338	10.307662	47
14	9.645449	9.952793	9.692656	10.307343	46
15	9.645706	9.952731	9.692975	10.307025	45
16	9.645962	9.952668	9.693293	10.306706	44
17	9.646218	9.952606	9.693612	10.306388	43
18	9.646473	9.952544	9.693930	10.306070	42
19	9.646729	9.952481	9.694248	10.305752	41
20	9.646984	9.952419	9.694566	10.305434	40
21	9.647239	9.952356	9.694883	10.305117	39
22	9.647494	9.952294	9.695201	10.304799	38
23	9.647749	9.952231	9.695518	10.304482	37
24	9.648004	9.952168	9.695835	10.304164	36
25	9.648258	9.952105	9.696153	10.303847	35
26	9.648512	9.952043	9.696470	10.303530	34
27	9.648766	9.951980	9.696786	10.303213	33
28	9.648020	9.951917	9.697103	10.302897	32
29	9.649274	9.951854	9.697420	10.302580	31
30	9.649527	9.951791	9.697738	10.302264	30
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 36.

Degree 26.

M	Sine	Co-sine	Tangent	Co-Tang	
30	9.649527	9.951791	9.697738	10.302264	30
31	9.649781	9.951728	9.698052	10.301947	29
32	9.650034	9.951665	9.698369	10.301631	28
33	9.650287	9.951602	9.698685	10.301315	27
34	9.650519	9.951539	9.699001	10.300999	26
35	9.650798	9.951476	9.699316	10.300684	25
36	9.651044	9.951412	9.699632	10.300368	24
37	9.651296	9.951349	9.699947	10.300052	23
38	9.651648	9.951286	9.700263	10.299737	22
39	9.6518 0	9.951222	9.700578	10.299422	21
40	9.652052	9.951159	9.700893	10.299107	20
41	9.652303	9.951095	9.701208	10.298792	19
42	9.652556	9.951032	9.701522	10.298477	18
43	9.652806	9.950968	9.701837	10.298163	17
44	9.653057	9.950905	9.702152	10.297848	16
45	9.653307	9.950841	9.702466	10.297534	15
46	9.653558	9.950777	9.702780	10.297219	14
47	9.653808	9.950714	9.703095	10.296905	13
48	9.654059	9.950650	9.703409	10.296591	12
49	9.654309	9.950586	9.703722	10.296277	11
50	9.654558	9.950522	9.704036	10.295964	10
51	9.654808	9.950458	9.704350	10.295650	9
52	9.655057	9.950394	9.704663	10.295337	8
53	9.655307	9.950330	9.704976	10.295023	7
54	9.655556	9.950266	9.705290	10.294710	6
55	9.655805	9.950202	9.705603	10.294397	5
56	9.656053	9.950138	9.705915	10.294081	4
57	9.656302	9.950074	9.706225	10.293771	3
58	9.656550	9.950009	9.706541	10.293459	2
59	9.656799	9.949945	9.706853	10.293146	1
60	9.656447	9.949881	9.707166	10.292834	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 63.

Degree 27.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.657047	9.949380	9.707166	10.292334	60
1	9.657295	9.949816	9.707478	10.292523	59
2	9.657542	9.949752	9.707790	10.292210	58
3	9.657790	9.949687	9.708102	10.291897	57
4	9.658037	9.949623	9.708414	10.291586	56
5	9.658284	9.949593	9.708726	10.291274	55
6	9.658531	9.949494	9.709037	10.290962	54
7	9.658777	9.949429	9.709349	10.290651	53
8	9.659024	9.949364	9.709660	10.290340	52
9	9.659271	9.949300	9.709971	10.290029	51
10	9.659517	9.949238	9.710282	10.289718	50
11	9.659763	9.949174	9.710593	10.289407	49
12	9.660009	9.949105	9.710904	10.289096	48
13	9.660255	9.949040	9.711214	10.288785	47
14	9.660500	9.948976	9.711525	10.288475	46
15	9.660746	9.948910	9.711836	10.288164	45
16	9.660991	9.948845	9.712146	10.287854	44
17	9.661236	9.948760	9.712456	10.287544	43
18	9.661481	9.948713	9.712766	10.287234	42
19	9.661726	9.948650	9.713076	10.286924	41
20	9.661970	9.948584	9.713285	10.286614	40
21	9.662214	9.948519	9.713695	10.286305	39
22	9.662459	9.948453	9.714005	10.285995	38
23	9.662702	9.948388	9.714314	10.285686	37
24	9.662947	9.948323	9.714624	10.285376	36
25	9.663190	9.948257	9.714933	10.285067	35
26	9.663433	9.948191	9.715241	10.284758	34
27	9.663677	9.948126	9.715550	10.284449	33
28	9.663920	9.948060	9.715859	10.284140	32
29	9.664164	9.947995	9.716168	10.283832	31
30	9.664406	9.947929	9.716477	10.283523	30
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 62.

Degree 27.

M	Sine	Co. sine	Tangent	Co Tang.	
30	9.664406	9.947929	9.716477	10.283523	30
31	9.664618	9.947863	9.716785	10.283215	29
32	9.664891	9.947797	9.717093	10.282907	28
33	9.665133	9.947731	9.717401	10.282598	27
34	9.665375	9.947665	9.717709	10.282290	26
35	9.665617	9.947599	9.718017	10.281983	25
36	9.665858	9.947533	9.718325	10.281675	24
37	9.666100	9.947467	9.718633	10.281367	23
38	9.666341	9.947401	9.718940	10.281060	22
39	9.666583	9.947335	9.719248	10.280752	21
40	9.666824	6.947269	9.719555	10.280445	20
41	9.667065	9.947203	9.719862	10.280138	19
42	9.667305	9.947136	9.720169	10.279831	18
43	9.667545	9.947070	9.720476	10.279524	17
44	9.667786	9.947004	9.720783	10.279217	16
45	9.668026	9.946937	9.721089	10.278911	15
46	9.668265	9.946871	9.721395	10.278604	14
47	9.668505	9.946804	9.721702	10.278298	13
48	9.668746	9.946738	9.722008	10.277991	12
49	9.668986	9.946671	9.722315	10.277685	11
50	9.669225	9.946604	9.722621	10.277379	10
51	9.669464	9.946537	9.722927	10.277073	9
52	9.669703	9.946471	9.723232	10.276768	8
53	9.669942	9.946404	9.723538	10.276462	7
54	9.670181	9.946337	9.723843	10.276156	6
55	9.670419	9.946270	9.724149	10.275851	5
56	9.670657	9.946203	9.724454	10.275546	4
57	9.670896	9.946136	9.724759	10.275240	3
58	9.671134	9.946069	9.725065	10.274935	2
59	9.671372	9.946002	9.725369	10.274630	1
60	9.671609	9.946935	9.725674	10.274325	0
	Co. sine	Sine	Co Tang.	Tangent	M

Degree 62.

Degree 28.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.671609	9.945935	9.725674	10.274326	60
1	9.671847	9.945868	9.725979	10.274021	59
2	9.672084	9.945800	9.726284	10.273816	58
3	9.672321	9.945733	9.726588	10.273412	57
4	9.672558	9.945666	9.726892	10.273107	56
5	9.672795	9.945598	9.727197	10.272803	55
6	9.673032	9.945531	9.727501	10.272499	54
7	9.673268	9.945463	9.727805	10.272195	53
8	9.673505	9.945396	9.728109	10.271891	52
9	9.673741	9.945328	9.728412	10.271587	51
10	9.673977	9.945261	9.728716	10.271284	50
11	9.674213	9.945193	9.729020	10.270980	49
12	9.674448	9.945125	9.729323	10.270677	48
13	9.674684	9.945058	9.729626	10.270374	47
14	9.674919	9.944990	9.729929	10.270070	46
15	9.675154	9.944922	9.730232	10.269767	45
16	9.675389	9.944854	9.730535	10.269464	44
17	9.675623	9.944786	9.730838	10.269162	43
18	9.675859	9.944718	9.731141	10.268859	42
19	9.676094	9.944650	9.731443	10.268556	41
20	9.676328	9.944582	9.731746	10.268254	40
21	9.676562	9.944514	9.732048	10.267952	39
22	9.676796	9.944446	9.732351	10.267649	38
23	9.677030	9.944377	9.732653	10.267347	37
24	9.677264	9.944309	9.732955	10.267045	36
25	9.677497	9.944241	9.733257	10.266743	35
26	9.677731	9.944172	9.733558	10.266441	34
27	9.677964	9.944104	9.733860	10.266140	33
28	9.678197	9.944016	9.734162	10.265838	32
29	9.678430	9.943967	9.734463	10.265537	31
30	9.678663	9.943898	9.734764	10.265236	30
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 61.

Degree 28.

M	Sine	Co. Sine	Tangent	Co. Tang.	
30	9.578563	9.943893	9.734764	10.265236	30
31	9.578895	9.943830	9.735666	10.264934	29
32	9.579123	9.943761	9.735362	10.264633	28
33	9.579360	9.943692	9.735668	10.264332	27
34	9.579592	9.943624	9.735968	10.264031	26
35	9.579824	9.943555	9.736269	10.263731	25
36	9.580056	9.943485	9.736570	10.263430	24
37	9.580288	9.943417	9.736870	10.263130	23
38	9.580519	9.943348	9.737171	10.262829	22
39	9.580750	9.943279	9.737471	10.262529	21
40	9.580982	9.943210	9.737771	10.262229	20
41	9.581213	9.943141	9.738071	10.261929	19
42	9.581443	9.943071	9.738371	10.261629	18
43	9.581674	9.943003	9.738671	10.261329	17
44	9.581904	9.942933	9.738971	10.261029	16
45	9.582135	9.942864	9.739271	10.260729	15
46	9.582365	9.942795	9.739570	10.260430	14
47	9.582597	9.942725	9.739870	10.260130	13
48	9.582825	9.942656	9.740169	10.259831	12
49	9.583055	9.942587	9.740468	10.259532	11
50	9.583284	9.942517	9.740767	10.259233	10
51	9.583514	9.942448	9.741066	10.258934	9
52	9.583743	9.942378	9.741365	10.258635	8
53	9.583972	9.942308	9.741664	10.258336	7
54	9.584201	9.942239	9.741962	10.258038	6
55	9.584430	9.942169	9.742261	10.257739	5
56	9.584658	9.942099	9.742559	10.257441	4
57	9.584887	9.942029	9.742858	10.257142	3
58	9.585115	9.941959	9.743155	10.256844	2
59	9.585343	9.941889	9.743454	10.256546	1
60	9.585571	9.941819	9.743751	10.256248	0
	Co Sine	Sine	Co Tang	Tangent.	M

Degree 61.

Degree 29.

M	Sine	Co. sine	Tangent	Co-Tang.	
0	9.685571	9.941819	9.743752	10.256248	60
1	9.685799	9.941749	9.744050	10.255950	59
2	9.686027	9.941679	9.744348	10.255652	58
3	9.686254	9.941609	9.744645	10.255355	57
4	9.686482	9.941539	9.744943	10.255057	56
5	9.686709	9.941468	9.745240	10.254760	55
6	9.686936	9.941398	9.745538	10.254462	54
7	9.687163	9.941328	9.745835	10.254165	53
8	9.687389	9.941257	9.746132	10.253868	52
9	9.687616	9.941187	9.746429	10.253571	51
10	9.687842	9.941116	9.746726	10.253274	50
11	9.688069	9.941046	9.747023	10.252977	49
12	9.688295	9.940975	9.747319	10.252680	48
13	9.688523	9.940905	9.747616	10.252384	47
14	9.688747	9.940834	9.747912	10.252087	46
15	9.688972	9.940763	9.748209	10.251791	45
16	9.689198	9.940693	9.748505	10.251495	44
17	9.689421	9.940622	9.748801	10.251199	43
18	9.689648	9.940551	9.749097	10.250902	42
19	9.689873	9.940480	9.749393	10.250607	41
20	9.690098	9.940409	9.749689	10.250311	40
21	9.690323	9.940338	9.749985	10.250015	39
22	9.690548	9.940267	9.750281	10.249719	38
23	9.690772	9.940196	9.750576	10.249424	37
24	9.690996	9.940125	9.750872	10.249128	36
25	9.691220	9.940053	9.751167	10.248833	35
26	9.691444	9.939982	9.751462	10.248538	34
27	9.691668	9.939911	9.751757	10.248243	33
28	9.691892	9.939840	9.752052	10.247948	32
29	9.692115	9.939768	9.752347	10.247653	31
30	9.692339	9.939697	9.752642	10.247358	30
	Co. sine	Sine	Co-Tang	Tangent.	M

Degree 60.

Degree 29.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.592339	9.970697	9.752542	10.247358	30
31	9.592562	9.939525	9.751937	10.247063	29
32	9.592758	9.930554	9.751231	10.246769	28
33	9.593003	9.939482	9.753525	10.246474	27
34	9.593231	9.939412	9.753820	10.246180	26
35	9.593453	9.939339	9.754115	10.245885	25
36	9.593676	9.939267	9.754409	10.245591	24
37	9.593898	9.939195	9.754703	10.245297	23
38	9.594120	9.939125	9.754997	10.245003	22
39	9.594342	9.939051	9.755291	10.244709	21
40	9.594564	9.938980	9.755584	10.244415	20
41	9.594786	9.938908	9.755878	10.244122	19
42	9.595007	9.938835	9.756172	10.243828	18
43	9.595229	9.938763	9.756465	10.243535	17
44	9.595450	9.938691	9.756759	10.243241	16
45	9.595671	9.938619	9.757052	10.242948	15
46	9.595892	9.938547	9.757345	10.242655	14
47	9.596113	9.938475	9.757638	10.242362	13
48	9.596334	9.938402	9.757931	10.242069	12
49	9.596554	9.938330	9.758224	10.241776	11
50	9.596774	9.938257	9.758517	10.241483	10
51	9.596995	9.938185	9.758810	10.241190	9
52	9.597215	9.938112	9.759102	10.240898	8
53	9.597435	9.938040	9.759395	10.240605	7
54	9.597654	9.937967	9.759687	10.240313	6
55	9.597874	9.937895	9.759979	10.240021	5
56	9.598093	9.937822	9.760271	10.239728	4
57	9.598313	9.937740	9.760564	10.239436	3
58	9.598532	9.937671	9.760856	10.239144	2
59	9.598751	9.937501	9.761147	10.238862	1
60	9.598970	9.937531	9.761439	10.238561	0
	Co sine	Sine	Co Tang	Tangent.	M

Degree 60.

Degree 30.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.698970	9.937531	9.761439	10.238561	60
1	9.699189	9.937458	9.761731	10.238269	59
2	9.699407	9.937385	9.762034	10.237977	58
3	9.699626	9.937312	9.762314	10.237686	57
4	9.699844	9.937238	9.762606	10.237394	56
5	9.700062	9.937165	9.762897	10.237103	55
6	9.700280	9.937092	9.763188	10.236812	54
7	9.700498	9.937019	9.763479	10.236521	53
8	9.700716	9.936945	9.763770	10.236230	52
9	9.700933	9.936872	9.764061	10.235939	51
10	9.701151	9.936799	9.764352	10.235648	50
11	9.701368	9.936725	9.764643	10.235357	49
12	9.701585	9.936652	9.764933	10.235067	48
13	9.701802	9.936578	9.765224	10.234776	47
14	9.702019	9.936505	9.765514	10.234486	46
15	9.702236	9.936431	9.765805	10.234195	45
16	9.702452	9.936357	9.766095	10.233905	44
17	9.702669	9.936284	9.766385	10.233615	43
18	9.702885	9.936210	9.766675	10.233325	42
19	9.703101	9.936136	9.766965	10.233035	41
20	9.703317	9.936062	9.767255	10.232745	40
21	9.703533	9.935980	9.767545	10.232455	39
22	9.703748	9.935914	9.767834	10.232166	38
23	9.703964	9.935840	9.768124	10.231876	37
24	9.704179	9.935766	9.768413	10.231587	36
25	9.704395	9.935692	9.768703	10.231297	35
26	9.704610	9.935618	9.768992	10.231008	34
27	9.704825	9.935543	9.769281	10.230719	33
28	9.705040	9.935469	9.769570	10.230430	32
29	9.705254	9.935395	9.769859	10.230141	31
30	9.705469	9.935320	9.770148	10.229852	30
	Co-sine	Sine	Co Tang	Tangent	M

Degree 59.

Degree 30.

M	Sine	Co. sine	Tangent.	Co-Tang.	
30	9.705469	9.935320	9.770148	10.229852	30
31	9.705683	9.935246	9.770437	10.229363	29
32	9.705867	9.935171	9.770726	10.229274	28
33	9.706112	9.935097	9.771015	10.228985	27
34	9.706326	9.935022	9.771303	10.228697	26
35	9.706529	9.934948	9.771592	10.228408	25
36	9.706753	9.934873	9.771800	10.228120	24
37	9.706967	9.934798	9.772168	10.227833	23
38	9.707180	9.934723	9.772456	10.227543	22
39	9.707393	9.934649	9.772745	10.227255	21
40	9.707606	9.934574	9.773033	10.226967	20
41	9.707819	9.934499	9.773321	10.226679	19
42	9.708032	9.934424	9.773608	10.226391	18
43	9.708245	9.934349	9.773896	10.226104	17
44	9.708457	9.934274	9.774184	10.225816	16
45	9.708670	9.934199	9.774471	10.225519	15
46	9.708882	9.934123	9.774759	10.225241	14
47	9.709094	9.934048	9.775046	10.224954	13
48	9.709306	9.933973	6.775323	10.224666	12
49	9.709518	9.933897	9.775621	10.224379	11
50	9.709730	9.933822	9.775908	10.224092	10
51	9.709941	9.933747	9.776195	10.223805	9
52	9.710153	9.933671	9.776482	10.223518	8
53	9.710364	9.933596	9.776768	10.223232	7
54	9.710575	9.933520	9.777005	10.222945	6
55	9.710786	9.933444	9.777342	10.222658	5
56	9.710997	9.933369	9.777628	10.222372	4
57	9.711208	9.933293	9.777915	10.222085	3
58	9.711418	9.933217	9.778201	10.221799	2
59	9.711629	9.933141	9.778487	10.221513	1
60	9.711839	9.933066	9.778774	10.221226	0
	Co. sine	Sine	Co-Tang.	Tangent.	M

Degree 59.

Degree 31.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.711839	9.933066	9.778774	10.221225	60
1	9.712049	9.932990	9.779060	10.220940	59
2	9.712239	9.932914	9.779346	10.220654	58
3	9.712469	9.932838	9.779632	10.220368	57
4	9.712679	9.932761	9.779918	10.220082	56
5	9.712889	9.932685	9.780203	10.219796	55
6	9.713098	9.932609	9.780489	10.219511	54
7	9.713308	9.932533	9.780775	10.219225	53
8	9.713517	9.932457	9.781060	10.218940	52
9	9.713726	9.932380	9.782346	10.318654	51
10	9.713935	9.932304	9.782631	10.218369	50
11	9.714144	9.932447	9.781916	10.218084	49
12	9.714352	9.932151	9.782202	10.217799	48
13	9.714561	9.932074	9.782485	10.217514	47
14	9.714769	9.931990	9.782771	10.217229	46
15	9.714977	9.931921	9.783056	10.216944	45
16	9.715186	9.931845	9.783341	10.216659	44
17	9.715394	9.931768	9.783626	10.216374	43
18	9.715601	9.931691	9.783910	10.216090	42
19	9.715809	9.931614	9.784195	10.215805	41
20	9.716017	9.931537	9.784479	10.215520	40
21	9.716124	9.931460	9.784764	10.215236	39
22	9.716431	9.931383	9.785048	10.214942	38
23	9.716639	9.931306	9.785332	10.214668	37
24	9.716846	9.931229	9.785616	10.214384	36
25	9.717053	9.931152	9.785900	10.214099	35
26	9.717259	9.931079	9.786184	10.213816	34
27	9.717456	9.930998	9.786463	10.213532	33
28	9.717672	9.930920	9.786752	10.213248	32
29	9.717869	9.930843	9.787036	10.212964	31
30	9.718085	9.930766	9.787319	10.212681	30
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 58.

Degree 31.

M	Sine	Co-sine	Tangent.	Co-Tang.	
30	9.713083	9.930766	9.787319	10.212681	30
31	9.718291	9.930638	9.787603	10.212397	29
32	9.718497	9.930611	9.787886	10.212114	28
33	9.718703	9.930533	9.788170	10.211830	27
34	9.718909	9.930456	9.788453	10.211547	26
35	9.719114	9.930378	9.788736	10.211264	25
36	9.719320	9.930300	9.789019	10.210981	24
37	9.719525	9.930223	9.789302	10.210698	23
38	9.719730	9.930145	9.789585	10.210415	22
39	9.719935	9.930067	9.789868	10.210132	21
40	9.720140	9.929989	9.790151	10.209849	20
41	9.720345	9.929911	9.790433	10.209566	19
42	9.720549	9.929833	9.790716	10.209284	18
43	9.720754	9.929755	9.790999	10.209001	17
44	9.720958	9.929677	9.791281	10.208719	16
45	9.721162	9.929599	9.791563	10.208436	15
46	9.721366	9.929521	9.791846	10.208154	14
47	9.721570	9.929442	9.792128	10.207872	13
48	9.721774	9.929364	6.792410	10.207590	12
49	9.721978	9.929283	9.792592	10.207308	11
50	9.722181	9.929207	9.792974	10.207024	10
51	9.722383	9.929129	9.793256	10.206744	9
52	9.722588	9.929050	9.793538	10.206462	8
53	9.722791	9.928972	9.793819	10.206180	7
54	9.722994	9.928893	9.794101	10.205899	6
55	9.723197	9.928814	9.794383	10.205627	5
56	9.723400	9.928736	9.794664	10.205346	4
57	9.723603	9.928656	9.794945	10.205054	3
58	9.723805	9.928578	9.795227	10.204773	2
59	9.724007	9.928499	9.795508	10.204493	1
60	9.724219	9.928420	9.795789	10.204211	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 58.

Degree 32.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.724210	9.928420	9.795789	10.204211	60
1	9.724412	9.928341	9.796070	10.203930	59
2	9.724614	9.928262	9.796351	10.203649	58
3	9.724816	9.928183	9.796632	10.203368	57
4	9.725017	9.928104	9.796913	10.203087	56
5	9.725219	9.928025	9.797194	10.202806	55
6	9.725620	9.927946	9.797474	10.202522	54
7	9.725622	9.927867	9.797755	10.202245	33
8	9.725823	9.927787	9.798036	10.201964	52
9	9.726024	9.927708	9.798316	10.201684	51
10	9.726225	9.927628	9.798596	10.201404	50
11	9.726426	9.927549	9.798877	10.201123	49
12	9.726626	9.927469	9.799157	10.200843	48
13	9.726827	9.927390	9.799437	10.200563	47
14	9.727027	9.927310	9.799717	10.200283	46
15	9.727228	9.927231	9.799997	10.200003	45
16	9.727428	9.927151	9.800277	10.199723	44
17	9.727628	9.927071	9.800557	10.199443	43
18	9.727828	9.926991	9.800836	10.199163	42
19	9.728027	9.926911	9.801116	10.198884	41
20	9.728227	9.926831	9.801396	10.198604	40
21	9.728427	9.926751	9.801675	10.198325	39
22	9.728626	9.926671	9.801955	10.198045	38
23	9.728825	9.926591	9.802234	10.197766	37
24	9.729024	9.926511	9.802513	10.197487	36
25	9.729223	9.926431	9.802792	10.197207	35
26	9.729422	9.926351	9.803072	10.196928	34
27	9.729621	9.926270	9.803351	10.196649	33
28	9.729820	9.926190	9.803630	10.196370	32
29	9.730018	9.926110	9.803908	10.196091	31
30	9.730216	9.926029	9.804187	10.195813	30
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 57.

Degree 32.

M	Sine	Co sine	Tangent	Co-Tang.	
30	9.730216	9.926079	9.804187	10.195813	30
31	9.730415	9.925949	9.804466	10.195534	29
32	9.730613	9.925868	9.804745	10.195255	28
33	9.730811	9.925787	9.805023	10.194977	27
34	9.731009	9.925707	9.805302	10.194693	26
35	9.731206	9.925626	9.805590	10.194420	25
36	9.731404	9.925545	9.805859	10.194141	24
37	9.731601	9.925464	9.806137	10.193863	23
38	9.731799	9.925384	9.806415	10.193585	22
39	9.731995	9.925303	9.806693	10.193309	21
40	9.732193	9.925222	9.806971	10.192028	20
41	9.732390	9.925141	9.807249	10.192751	19
42	9.732587	9.925060	9.807527	10.192433	18
43	9.732784	9.924978	9.807805	10.192195	17
44	9.732980	9.924897	9.808083	10.191917	16
45	9.733177	9.924816	9.808361	10.191639	15
46	9.733373	9.924735	9.808638	10.191362	14
47	9.733569	9.924653	9.808916	10.191084	13
48	9.733765	9.924572	9.809193	10.190807	12
49	9.733961	9.924491	9.809471	10.190529	11
50	9.734157	9.924409	9.809748	10.190252	10
51	9.734353	9.924328	9.810025	10.189975	9
52	9.734548	9.924246	9.810302	10.189697	8
53	9.734744	9.924164	9.810580	10.189420	7
54	9.734939	9.924083	9.810857	10.189143	6
55	9.735134	9.924001	9.811134	10.188866	5
56	9.735330	9.923919	9.811410	10.188589	4
57	9.735525	9.923837	9.811687	10.188313	3
58	9.735719	9.923755	9.811964	10.188036	2
59	9.735914	9.923673	9.812241	10.187759	1
60	9.736109	9.923591	9.812517	10.187483	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 57.

Degree 33.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.736109	9.923591	9.812517	10.187483	60
1	9.736309	9.923509	9.812794	10.187206	59
2	9.736497	9.923427	9.813070	10.186930	58
3	9.736692	9.923340	9.813347	10.186653	57
4	9.736885	9.923203	9.813623	10.186377	56
5	9.737080	9.923180	9.813899	10.186101	55
6	9.737274	9.923098	9.814175	10.185824	54
7	9.737467	9.923016	9.814452	10.185548	53
8	9.737661	9.922930	9.814728	10.185272	52
9	9.737854	9.922851	9.815004	10.184996	51
10	9.738048	9.922768	9.815279	10.184720	50
11	9.738241	9.922680	9.815555	10.184445	49
12	9.738434	9.922605	9.815831	10.184169	48
13	9.738627	9.922520	9.816107	10.183893	47
14	9.738820	9.922438	9.816382	10.183617	46
15	9.739013	9.922355	9.816658	10.183342	45
16	9.739205	9.922272	9.816933	10.183066	44
17	9.739393	9.922189	9.817209	10.182791	43
18	9.739590	9.922105	9.817484	10.182516	42
19	9.739783	9.922023	9.817759	10.182240	41
20	9.739975	9.921940	9.818035	10.181965	40
21	9.740107	9.921857	9.818310	10.181690	39
22	9.740359	9.921770	9.818585	10.181415	38
23	9.740550	9.921690	9.818860	10.181140	37
24	9.740742	9.921907	9.819135	10.180865	36
25	9.740934	9.921534	9.819410	10.180590	35
26	9.741125	9.921441	9.819684	10.180315	34
27	9.741316	9.921357	9.819959	10.180041	33
28	9.741507	9.921274	9.820234	10.179766	32
29	9.741698	9.921190	9.820562	10.179492	31
30	9.741889	9.921100	9.820783	10.179217	30
	Co sine	Sine	Co-Tang	Tangent	M

Degree 56.

Degree 33.

M	Sine	Co sine	Tangent	Co Tang.	
30	9.742889	9.922107	9.820783	10.179217	30
31	9.742030	9.921623	9.821057	10.178943	29
32	9.742271	9.920939	9.821332	10.178668	28
33	9.742461	9.920855	9.821606	10.178394	27
34	9.742650	9.920772	9.821880	10.178120	26
35	9.742842	9.920688	9.822154	10.177846	25
36	9.743032	9.920604	9.822429	10.177571	24
37	9.743223	9.920520	9.822703	10.177297	23
38	9.743412	9.920436	9.822977	10.177023	22
39	9.743602	9.920352	9.823250	10.176739	21
40	9.743792	9.920268	9.823524	10.176476	20
41	9.743982	9.920184	9.823798	10.176202	19
42	9.744171	9.920093	9.824072	10.175928	18
43	9.744361	9.920015	9.824345	10.175655	17
44	9.744550	9.919931	9.824619	10.175381	16
45	9.744739	9.919846	9.824892	10.175108	15
46	9.745928	9.919762	9.825166	10.174834	14
47	9.745117	9.919677	9.825439	10.174560	13
48	9.745306	9.919593	9.825713	10.174287	12
49	9.745494	9.919508	9.825986	10.174014	11
50	9.745683	9.919424	9.826259	10.173741	10
51	9.745871	9.919339	9.826532	10.173468	9
52	9.746059	9.919254	9.826805	10.173195	8
53	9.746248	9.919169	9.827078	10.172922	7
54	9.746436	9.919083	9.827351	10.172649	6
55	9.746624	9.918999	9.827624	10.172376	5
56	9.746811	9.918915	9.827897	10.172103	4
57	9.746999	9.918830	9.828170	10.171830	3
58	9.747187	9.918744	9.828442	10.171558	2
59	9.747374	9.918656	9.828715	10.171285	1
60	9.747562	9.918574	9.828987	10.171012	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 56.

Degree 34.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.747562	9.918574	9.828937	10.171012	60
1	9.747749	9.918489	9.829260	10.170740	59
2	9.747936	9.918404	9.829532	10.170468	58
3	9.748123	9.918318	9.829805	10.170195	57
4	9.748310	9.918233	9.830077	10.169923	56
5	9.748497	9.918147	9.830349	10.169651	55
6	9.748683	9.918062	9.830621	10.169379	54
7	9.748870	9.917976	9.830893	10.169156	53
8	9.749056	9.917891	9.831165	10.168834	52
9	9.749242	9.917805	9.831437	10.168503	51
10	9.749429	9.917719	9.831705	10.168291	50
11	9.749615	9.917634	9.831981	10.168019	49
12	9.749801	9.917548	9.832253	10.167747	48
13	9.749986	9.917462	9.832525	10.167475	47
14	9.750172	9.917376	9.832796	10.167204	46
15	9.750358	9.917290	9.833068	10.166932	45
16	9.750543	9.917204	9.833339	10.166660	44
17	9.750729	9.917118	9.833611	10.166389	43
18	9.750914	9.917032	9.833882	10.166118	42
19	9.751099	9.916945	9.834154	10.165846	41
20	9.751284	9.916859	9.834425	10.165575	40
21	9.751469	9.916773	9.834696	10.165304	39
22	9.751654	9.916686	9.834967	10.165033	38
23	9.751838	9.916600	9.835238	10.164762	37
24	9.752023	9.916514	9.835509	10.164491	36
25	9.752207	9.916427	9.835780	10.164220	35
26	9.752392	9.916240	9.836051	10.163949	34
27	9.752576	9.916254	9.836322	10.163678	33
28	9.752760	9.916167	9.836593	10.163407	32
29	9.752944	9.916080	9.836864	10.163136	31
30	9.753128	9.915994	9.837134	10.162866	30
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 55.

Degree 34.

M	Sine	Co. sine	Tangent	Co. Tang.	
30	9.753123	9.915091	9.837134	10.162856	30
31	9.753312	9.915907	9.837405	10.162595	29
32	9.753495	9.915820	9.837675	10.162325	28
33	9.753679	9.915733	9.837946	10.162054	27
34	9.753862	9.915646	9.838216	10.161784	26
35	9.754046	9.915559	9.838487	10.161513	25
36	9.754229	9.915472	9.838757	10.161243	24
37	9.754412	9.915385	9.839027	10.160973	23
38	9.754595	9.915297	9.839297	10.160702	22
39	9.754778	9.915210	9.839568	10.160432	21
40	9.754960	9.915123	9.839838	10.160162	20
41	9.755143	9.915035	9.840108	10.159892	19
42	9.755325	9.914948	9.840378	10.159622	18
43	9.755508	9.914860	9.840647	10.159352	17
44	9.755690	9.914773	9.840917	10.159083	16
45	9.755872	9.914685	9.841187	10.158813	15
46	9.756054	9.914597	9.841457	10.158543	14
47	9.756236	9.914510	9.841725	10.158273	13
48	9.756418	9.914422	9.841995	10.158004	12
49	9.756600	9.914334	9.842266	10.157734	11
50	9.756781	9.914246	9.842535	10.157465	10
51	9.756963	9.914158	9.842804	10.157195	9
52	9.757144	9.914070	9.843074	10.156926	8
53	9.757305	9.913982	9.843343	10.156657	7
54	9.757507	9.913894	9.843602	10.156387	6
55	9.757688	9.913806	9.843832	10.156118	5
56	9.757869	9.913718	9.844131	10.155849	4
57	9.758049	9.913630	9.844420	10.155580	3
58	9.758230	9.913542	9.844689	10.155311	2
59	9.758411	9.913453	9.844958	10.155042	1
60	9.758591	9.913364	9.845227	10.154774	0
	Co sine	Sine	Co. Tang.	Tangent.	M

Degree 55.

Degree 35.

M	Sine	Co. sine	Tangent	Co. Tang.	
0	9.758591	9.913364	9.845227	10.154774	60
1	9.758772	9.913276	9.845496	10.154504	59
2	9.758952	9.913187	9.845764	10.154235	58
3	9.759132	9.913091	9.846033	10.153967	57
4	9.759312	9.913010	9.846302	10.153698	56
5	9.759492	9.912972	9.846570	10.153429	55
6	9.759672	9.912833	9.846839	10.153161	54
7	9.759851	9.912744	9.847107	10.152892	53
8	9.760031	9.912655	9.847376	10.152624	52
9	9.760210	9.912566	9.847644	10.152356	51
10	9.760390	9.912477	9.847913	10.152087	50
11	9.760569	9.912388	9.848181	10.151819	49
12	9.760748	9.912299	9.848449	10.151551	48
13	9.760927	9.912210	9.848717	10.151283	47
14	9.761106	9.912121	9.848985	10.151015	46
15	9.761285	9.912031	9.849254	10.150746	45
16	9.761464	9.911942	9.849522	10.150478	44
17	9.761642	9.911853	9.849789	10.150215	43
18	9.761821	9.911763	9.850057	10.149943	42
19	9.761999	9.911674	9.850325	10.149675	41
20	9.762177	9.911584	9.850593	10.149408	40
21	9.762355	9.911495	9.850861	10.149139	39
22	9.762534	9.911405	9.851128	10.148872	38
23	9.762712	9.911315	9.851396	10.148604	37
24	9.762889	9.911225	9.851664	10.148336	36
25	9.763067	9.911136	9.851931	10.148069	35
26	9.763245	9.911046	9.852199	10.147801	34
27	9.763422	9.910956	9.852466	10.147534	33
28	9.763599	9.910866	9.852701	10.147267	32
29	9.763777	9.910776	9.853001	10.146999	31
30	9.763954	9.910686	9.853268	10.146732	30
	Co. sine	Sine	Co Tang.	Tangent	M

Degree 34.

Degree 25.

M	Sine	Co sine	Tangent	Co Tang.	
30	9.763955	9.910686	9.853268	10.146732	30
31	9.764131	9.910595	9.853535	10.146465	29
32	9.764306	9.910506	9.853802	10.146198	28
33	9.764486	9.910415	9.854059	10.145931	27
34	9.764662	9.910325	9.854336	10.145664	26
35	9.764838	9.910235	9.854603	10.145397	25
36	9.765015	9.910144	9.854870	10.145130	24
37	9.765191	9.910054	9.855137	10.146863	23
38	9.765367	9.909963	9.855404	10.146596	22
39	9.765544	9.909873	9.855671	10.145329	21
40	9.765720	9.909782	9.855937	10.145063	20
41	9.765896	9.900144	9.856204	10.143796	19
42	9.766071	9.900054	9.856471	10.143529	18
43	9.766247	9.909963	9.856737	10.143263	17
44	9.766423	9.909873	9.857004	10.142996	16
45	9.766598	9.909782	9.857270	10.142730	15
46	9.766774	9.909237	9.857537	10.142463	14
47	9.766949	9.909145	9.857803	10.142197	13
48	9.767124	9.909055	9.858069	10.141931	12
49	9.767299	9.908964	9.858336	10.141664	11
50	9.767474	9.908873	9.858602	10.141398	10
51	9.767649	9.908781	9.858868	10.141132	9
52	9.767824	9.908690	9.859134	10.141166	8
53	9.767997	9.908599	9.859400	10.140600	7
54	9.768173	9.908509	9.859666	10.145334	6
55	9.768348	9.908416	9.859932	10.140068	5
56	9.768522	9.908324	9.860198	10.139802	4
57	9.768696	9.908233	9.860464	10.139536	3
58	9.768871	9.908141	9.860730	10.139270	2
59	9.769045	9.908049	9.860995	10.139005	1
60	9.769219	9.907958	9.861261	10.138739	0
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 54.

Degree 36.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.769219	9.907958	9.861251	10.138739	60
1	9.769392	9.907856	9.861527	10.138473	59
2	9.769565	9.907774	9.861792	10.138208	58
3	9.769740	9.907682	9.862058	10.137942	57
4	9.769913	9.907590	9.862323	10.137677	56
5	9.770087	9.907493	9.862589	10.137411	55
6	9.770260	9.907406	9.862854	10.137145	54
7	9.770433	9.907314	9.863119	10.136880	53
8	9.770606	9.907221	9.863385	10.136615	52
9	9.770779	9.907129	9.863650	10.136350	51
10	9.770952	9.907027	9.863915	10.136085	50
11	9.771125	9.906945	9.864180	10.135820	49
12	9.771298	9.906852	9.864445	10.135554	48
13	9.771270	9.906760	9.864710	10.135289	47
14	9.771643	9.906667	9.864975	10.135024	46
15	9.771815	9.906574	9.865240	10.134759	45
16	9.771987	9.906482	9.865505	10.134495	44
17	9.772159	9.906389	9.865770	10.134230	43
18	9.772331	9.906296	9.866035	10.133965	42
19	9.772503	9.906203	9.866300	10.133700	41
20	9.772675	9.906111	9.866564	10.133436	40
21	9.772847	9.906018	9.866829	10.133171	39
22	9.773018	9.905925	9.867094	10.132906	38
23	9.773190	9.905832	9.867358	10.132642	37
24	9.773361	9.905738	9.867623	10.132377	36
25	9.773533	9.905645	9.867887	10.132113	35
26	9.773704	9.905552	9.868152	10.131848	34
27	9.773875	9.905459	9.868416	10.131584	33
28	9.774046	9.905365	9.868680	10.131320	32
29	9.774217	9.905272	9.868945	10.131055	31
30	9.774388	9.905179	9.869209	10.130791	30
	Co sine	Sine	Co-Tang.	Tangent	M

Degree 53.

Degree 26.

M	Sine	Co sine	Tangent	Co Tang.	
30	9.774388	9.905179	9.869209	10.130791	30
31	9.774558	9.905085	9.869773	10.130527	29
32	9.774729	9.904992	9.869337	10.130263	28
33	9.774899	9.904898	9.870001	10.129999	27
34	9.775070	9.904804	9.870265	10.129735	26
35	9.775240	9.904711	9.870529	10.129471	25
36	9.775410	9.904617	9.870793	10.129207	24
37	9.775580	9.904523	9.871057	10.128943	23
38	9.775750	9.904429	9.871321	10.128679	22
39	9.775920	9.904335	9.871585	10.128415	21
40	9.776090	9.904241	9.871849	10.128151	20
41	9.776259	9.904147	9.872112	10.127888	19
42	9.776429	9.904053	9.872316	10.127624	18
43	9.776598	9.903959	9.872640	10.127360	17
44	9.776763	9.903864	9.872903	10.127097	16
45	9.776837	9.903770	9.873167	10.126835	15
46	9.777106	9.903676	9.873450	10.126570	14
47	9.777275	9.903581	9.873694	10.126306	13
48	9.777444	9.903486	9.873957	10.126043	12
49	9.777613	9.903392	9.874220	10.125780	11
50	9.777781	9.903298	9.874481	10.125516	10
51	9.777950	9.903203	9.874747	10.125253	9
52	9.778119	9.903108	9.875010	10.124990	8
53	9.778287	9.903013	9.875273	10.124727	7
54	9.778455	9.902919	9.875536	10.124464	6
55	9.778623	9.902824	9.875799	10.124201	5
56	9.778792	9.902729	9.876063	10.123937	4
57	9.778960	9.902634	9.876326	10.123674	3
58	9.779129	9.902539	9.876589	10.123411	2
59	9.779295	9.902444	9.876851	10.123149	1
60	9.779463	9.902349	9.877114	10.122885	0
	Co-sine	Sine	Co Tang	Tangent	M

Degree 53.

Degree 37.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.779463	9.902349	9.87711	10.122885	60
1	9.779631	9.902254	9.877377	10.122623	59
2	9.779798	9.902158	9.877640	10.122360	58
3	9.779965	9.902063	9.877903	10.122097	57
4	9.780133	9.901967	9.878165	10.121834	56
5	9.780300	9.901872	9.878428	10.121572	55
6	9.780467	9.901776	9.878691	10.121309	54
7	9.780634	9.901681	9.878953	10.121047	53
8	9.780801	9.901585	9.879216	10.120784	52
9	9.780968	9.901488	9.879478	10.120522	51
10	9.781134	9.901391	9.879741	10.120259	50
11	9.781301	9.901293	9.880003	10.119997	49
12	9.781467	9.901202	9.880265	10.119734	48
13	9.781634	9.901106	9.880528	10.119472	47
14	9.781800	9.901010	9.880790	10.119210	46
15	9.781966	9.900914	9.881052	10.118948	45
16	9.782132	9.900828	9.881314	10.118686	44
17	9.782298	9.900722	9.881576	10.118424	43
18	9.782464	9.900626	9.881839	10.118161	42
19	9.782630	9.900529	9.882101	10.117899	41
20	9.782796	9.900433	9.882363	10.117637	40
21	9.782961	9.900337	9.882625	10.117375	39
22	9.783127	9.900240	9.882886	10.117114	38
23	9.783292	9.900144	9.883148	10.116852	37
24	9.783457	9.900047	9.883410	10.116590	36
25	9.783623	9.899951	9.883672	10.116328	35
26	9.783788	9.899854	9.883934	10.116066	34
27	9.783953	9.899757	9.884195	10.115805	33
28	9.784118	9.899660	9.884457	10.115543	32
29	9.784282	9.899563	9.884719	10.115281	31
30	9.784447	9.899467	9.884980	10.115020	30
	Co-sine	Sine	Co-Tang	Tangent.	M

Degree 52.

Degree 37.

M	Sine	Co-sine	Tangent	Co Tang.	
30	9.784447	9.899467	9.884980	10.115020	30
31	9.784616	9.899370	9.885242	10.114758	29
32	9.784776	9.899273	9.885503	10.114497	28
33	9.784941	9.899175	9.885765	10.114235	27
34	9.785105	9.899078	9.886026	10.113974	26
35	9.785269	9.898931	9.886288	10.113712	25
36	9.785433	9.898834	9.886549	10.113451	24
37	9.785591	9.898787	9.886810	10.11319	23
38	9.785761	9.898689	9.887072	10.112028	22
39	9.785925	9.898592	9.887333	10.112667	21
40	9.786088	9.898494	9.887594	10.112406	20
41	9.786252	9.898397	9.887855	10.112145	19
42	9.786416	9.898299	9.888116	10.111834	18
43	9.786579	9.898201	9.888377	10.111623	17
44	9.786742	9.898104	9.888638	10.111362	16
45	9.786909	9.898006	9.888899	10.111101	15
46	9.787069	9.897908	9.889160	10.110840	14
47	9.787232	9.897810	9.889421	10.110579	13
48	9.787395	9.897712	9.889682	10.110318	12
49	9.787557	9.897614	9.889943	10.110057	11
50	9.787720	9.897516	9.890204	10.109796	10
51	9.787883	9.897418	9.890465	10.109535	9
52	9.788045	9.897320	9.890725	10.109275	8
53	9.788208	9.897222	9.890986	10.109014	7
54	9.788370	9.897123	9.891247	10.108753	6
55	9.788532	9.897025	9.891507	10.108493	5
56	9.788694	9.896926	9.891768	10.108232	4
57	9.788856	9.896828	9.892028	10.107972	3
58	9.789018	9.896729	9.892289	10.107711	2
59	9.789180	9.896631	9.892549	10.107451	1
60	9.789342	9.896532	9.892810	10.107190	0
	Co sine	Sine	Co. Tang.	Tangent.	M

Degree 52.

Degree 38.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.789342	9.896532	9.892810	10.107190	60
1	9.789504	9.896433	9.893070	10.106930	59
2	9.789665	9.896335	9.893330	10.106659	58
3	9.789827	9.896236	9.893591	10.106409	57
4	9.789988	9.896137	9.893851	10.106149	56
5	9.790149	9.896038	9.894111	10.105889	55
6	9.790310	9.895939	9.894371	10.105623	54
7	9.790471	9.895840	9.894632	10.105368	53
8	9.790632	9.895741	9.894892	10.105108	52
9	9.790793	9.895641	9.895152	10.104848	51
10	9.790954	9.895542	9.895412	10.104583	50
11	9.791115	9.895443	9.895672	10.104328	49
12	9.791275	9.895343	9.895932	10.104068	48
13	9.791436	9.895244	9.896192	10.103808	47
14	9.791596	9.895144	9.896452	10.103548	46
15	9.791756	9.895045	9.896712	10.103283	45
16	9.791917	9.894945	9.896971	10.103023	44
17	9.792077	9.894846	9.897231	10.102769	43
18	9.792237	9.894746	9.897491	10.102509	42
19	9.792397	9.894646	9.897751	10.102249	41
20	9.792557	9.894546	9.898010	10.101990	40
21	9.792716	9.894446	9.898270	10.101730	39
22	9.792876	9.894346	9.898530	10.101470	38
23	9.793035	9.894246	9.898789	10.101211	37
24	9.793195	9.894146	9.899049	10.100951	36
25	9.793354	9.884046	9.899303	10.100692	35
26	9.793513	9.893946	9.899568	10.100432	34
27	9.793673	9.893845	9.899827	10.100173	33
28	9.793832	9.893745	9.900086	10.099913	32
29	9.793991	9.893645	9.900346	10.099654	31
30	9.794149	9.893544	9.900605	10.099395	30
	Co-sine	Sine	Co-Tang	Tangent.	M

Degree 51.

Degree 38.

M	Sine	Co sine	Tangent	Co-Tang.	
30	9.794149	9.893544	9.900605	10.099395	30
31	9.794308	9.893444	9.900864	10.099135	29
32	9.794467	9.893343	9.901124	10.098876	28
33	9.794626	9.893243	9.901383	10.098617	27
34	9.794784	9.893142	9.901642	10.098358	26
35	9.794942	9.893041	9.901901	10.098099	25
36	9.795101	9.892940	9.902160	10.097839	24
37	9.795259	9.892839	9.902419	10.097580	23
38	9.795417	9.892738	9.902678	10.097321	22
39	9.795575	9.892637	9.902937	10.097062	21
40	9.795733	9.892536	9.903196	10.096803	20
41	9.795891	9.892435	9.903455	10.096544	19
42	9.796049	9.892334	9.903714	10.096285	18
43	9.796206	9.892233	9.903973	10.096027	17
44	9.796364	9.892132	9.904232	10.095768	16
45	9.796521	9.892031	9.904491	10.095509	15
46	9.796678	9.891929	9.904750	10.095250	14
47	9.796836	9.891827	9.905008	10.094991	13
48	9.796993	9.891726	9.905267	10.094733	12
49	9.797150	9.891624	9.905526	10.094474	11
50	9.797307	9.891522	9.905784	10.094215	10
51	9.797464	9.891421	6.906043	10.093957	9
52	9.797621	9.891310	9.906302	10.093698	8
53	9.797777	9.891217	9.906560	10.093440	7
54	9.797934	9.891115	9.906819	10.093181	6
55	9.798091	9.891013	9.907077	10.092923	5
56	9.798247	9.890911	9.907336	10.092664	4
57	9.798403	9.890809	9.907594	10.092406	3
58	9.798560	9.890707	9.907852	10.092147	2
59	9.798716	9.890605	9.908111	10.091889	1
60	9.798872	9.890503	9.908369	10.091631	0
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 51.

Degree 39.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.798872	9.890503	9.908369	10.091631	60
1	9.799028	9.890400	9.908627	10.091373	59
2	9.799184	9.890298	9.908885	10.091114	58
3	9.799339	9.890195	9.909144	10.090856	57
4	9.799495	9.890093	9.909402	10.090598	56
5	9.799651	9.889990	9.909600	10.090340	55
6	9.799806	9.889888	9.909918	10.090081	54
7	9.799961	9.889785	9.910176	10.089823	53
8	9.800117	9.889682	9.910435	10.089565	52
9	9.800272	9.889579	9.910593	10.089307	51
10	9.800427	9.889476	9.910951	10.089049	50
11	9.800582	9.889374	9.911209	10.088791	49
12	9.800737	9.889271	9.911467	10.088533	48
13	9.800892	9.889167	9.911724	10.088275	47
14	9.801047	9.889064	9.911982	10.088017	46
15	9.801201	9.888961	9.912240	10.087760	45
16	9.801356	9.888858	9.912498	10.087502	44
17	9.801510	9.888755	9.912756	10.087244	43
18	9.801665	9.888651	9.913014	10.086986	42
19	9.801819	9.888548	9.913271	10.086729	41
20	9.801973	9.888444	9.913529	10.086471	40
21	9.802127	9.888341	9.913787	10.086213	39
22	9.802282	9.888237	9.914044	10.085956	38
23	9.802435	9.888133	9.914302	10.085698	37
24	9.802589	9.888030	9.914560	10.085440	36
25	9.802743	9.887926	9.914817	10.085183	35
26	9.802897	9.887822	9.915075	10.084925	34
27	9.803050	9.887718	9.915332	10.084668	33
28	9.803204	9.887614	9.915590	10.084410	32
29	9.803457	9.887510	9.915847	10.084153	31
30	9.803510	9.887406	9.916104	10.083895	30
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 50.

Degree 39.

M	Sine	Co-sine	Tangent	Co.Tang.	
30	9.803510	9.837406	9.916104	10.083895	30
31	9.803664	9.837302	9.916362	10.083638	29
32	9.803817	9.837198	9.916619	10.083381	28
33	9.803970	9.837093	9.916876	10.083123	27
34	9.804123	9.836989	9.917134	10.082866	26
35	9.804276	9.836884	9.917391	10.082609	25
36	9.804428	9.836780	9.917648	10.082352	24
37	9.804581	9.836675	9.917905	10.082094	23
38	9.804734	9.836571	9.918162	10.081837	22
39	9.804886	9.836466	9.918420	10.081580	21
40	9.805038	9.836361	9.918677	10.081323	20
41	9.805191	9.836257	9.918934	10.081066	19
42	9.805343	9.836152	9.919191	10.080809	18
43	9.805495	9.836047	9.919448	10.080552	17
44	9.805647	9.835942	9.919705	10.080295	16
45	9.805799	9.835837	9.919962	10.080038	15
46	9.805951	9.835732	9.920219	10.079781	14
47	9.806103	9.835627	9.920476	10.079524	13
48	9.806254	9.835521	9.920733	10.079267	12
49	9.806405	9.835416	9.920990	10.079010	11
50	9.806557	9.835311	9.921247	10.078753	10
51	9.806709	9.835205	9.921503	10.078496	9
52	9.806860	9.835100	9.921760	10.078240	8
53	9.807011	9.834994	9.922017	10.077983	7
54	9.807162	9.834889	9.922274	10.077726	6
55	9.807313	9.834783	9.922530	10.077469	5
56	9.807464	9.834677	9.922787	10.077213	4
57	9.807615	9.834572	9.923044	10.076956	3
58	9.807766	9.834466	9.923300	10.076699	2
59	9.807917	9.834360	9.923557	10.076443	1
60	9.808067	9.834254	9.923813	10.076186	0
	Co sine	Sine	Co.Tang.	Tangent.	M

Degree 50.

Degree 40.

M.	Sine	Co. sine	Tangent	Co. Tang.	
0	9.808067	9.884254	9.923813	10.076186	60
1	9.808218	9.884148	9.924070	10.075930	59
2	9.808368	9.884042	9.924327	10.075673	58
3	9.808519	9.883936	9.924583	10.075417	57
4	9.808669	9.883829	9.924839	10.075160	56
5	9.808819	9.883723	9.925095	10.074904	55
6	9.808969	9.883617	9.925352	10.074647	54
7	9.809119	9.883510	9.925609	10.074391	53
8	9.809269	9.883404	9.925855	10.074135	52
9	9.809419	9.883297	9.926121	10.073878	51
10	9.809569	9.883191	9.926378	10.073622	50
11	9.809718	9.883084	9.926634	10.073366	49
12	9.809868	9.882977	9.926890	10.073110	48
13	9.810017	9.882871	9.927147	10.072853	47
14	9.810166	9.882764	9.927403	10.072597	46
15	9.810316	9.882657	9.927659	10.072341	45
16	9.810465	9.882550	9.927915	10.072085	44
17	9.810614	9.882443	9.928171	10.071829	43
18	9.810763	9.882336	9.928427	10.071573	42
19	9.810912	9.882228	9.928683	10.071316	41
20	9.811061	9.882121	9.928940	10.071060	40
21	9.811210	9.882014	9.929196	10.070804	39
22	9.811358	9.881907	9.929452	10.070548	38
23	9.811506	9.881799	9.929708	10.070292	37
24	9.811655	9.881692	9.929964	10.070036	36
25	9.811804	9.881584	9.930219	10.069781	35
26	9.811952	9.881477	9.930475	10.069525	34
27	9.812100	9.881369	9.930731	10.069269	33
28	9.812248	9.881261	9.930987	10.069013	32
29	9.812396	9.881153	9.931243	10.068757	31
30	9.812544	9.881045	9.931499	10.068501	30
	Co. sine	Sine	Co. Tang.	Tangent.	M

Degree 49.

Degree 40.

M	Sine	Co-sine	Tangent	Co Tang.	
30	9.812544	9.881045	9.931499	10.058501	30
31	9.812692	9.880939	9.931755	10.058245	29
32	9.812840	9.880827	9.932010	10.067979	28
33	9.812988	9.880722	9.932266	10.067734	27
34	9.813135	9.880613	9.932522	10.067478	26
35	9.813283	9.880505	9.932778	10.067222	25
36	9.813430	9.880397	9.933033	10.066967	24
37	9.813578	9.880289	9.933289	10.066711	23
38	9.813725	9.880180	9.933545	10.066455	22
39	9.813872	9.880072	9.933800	10.066200	21
40	9.814019	9.889963	9.934050	10.065944	20
41	9.814166	9.879855	9.934311	10.065688	19
42	9.814313	9.879746	9.934567	10.065433	18
43	9.814460	9.879637	9.934822	10.065177	17
44	9.814607	9.879529	9.935078	10.064922	16
45	9.814753	9.879420	9.935333	10.064666	15
46	9.814900	9.879310	9.935589	10.064411	14
47	9.815046	9.879202	9.935844	10.064156	13
48	9.815193	9.879093	9.936100	10.063900	12
49	9.815339	9.878984	9.936355	10.063645	11
50	9.815485	9.878875	9.936610	10.063389	10
51	9.815631	9.878766	9.936866	10.063134	9
52	9.815777	9.878656	9.937121	10.062879	8
53	9.815923	9.878547	9.937376	10.062623	7
54	9.816069	9.878438	9.937632	10.062368	6
55	9.816215	9.878328	9.937887	10.062113	5
56	9.816361	9.878219	9.938142	10.061858	4
57	9.816506	9.878129	9.938397	10.061602	3
58	9.816652	9.877990	9.938653	10.061347	2
59	9.816797	9.877880	9.938908	10.061092	1
60	9.816943	9.877780	9.939163	10.060837	0
	Co-sine	Sine	Co-Tang.	Tangent	M

Degree 41.

Degree 41.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.816943	9.877780	9.939163	10.060837	60.
1	9.817088	9.877670	9.939418	10.060582	59
2	9.817233	9.877560	9.939673	10.060327	58.
3	9.817378	9.877450	9.939928	10.060072	57
4	9.817523	9.877340	9.940183	10.059816	56
5	9.817668	9.877230	9.940438	10.059562	55.
6	9.817813	9.877120	9.940693	10.059307	54
7	9.817958	9.877009	9.940948	10.059052	53
8	9.818103	9.876899	9.941203	10.058797	52
9	9.818247	9.876789	9.941458	10.058542	51
10	9.818492	9.876678	9.941713	10.058287	50
11	9.818536	9.876568	9.941968	10.058032	49
12	9.818681	9.876457	9.942223	10.057777	48
13	9.818825	9.876347	9.942478	10.057522	47
14	9.818969	9.876236	9.942733	10.057267	46
15	9.819113	9.876125	9.942988	10.057012	45
16	9.819257	9.876014	9.943243	10.056757	44
17	9.819451	9.875904	9.943498	10.056502	43
18	9.819545	9.875793	9.943752	10.056248	42
19	9.819689	9.875682	9.944097	10.055993	41
20	9.819832	9.875571	9.944262	10.055738	40
21	9.819976	9.875459	9.944517	10.055483	39
22	9.820119	9.875348	9.944771	10.055229	38
23	9.820263	9.875237	9.945026	10.054974	37
24	9.820406	9.875125	9.945281	10.054719	36
25	9.820549	9.875004	9.945535	10.054464	35
26	9.820693	9.874903	9.945790	10.054210	34
27	9.820836	9.874791	9.946045	10.053955	33
28	9.820979	9.874679	9.946299	10.053701	32
29	9.821122	9.874568	9.946554	10.053446	31
30	9.821264	9.874450	9.946808	10.053192	30
	Co-sine	Sine	Co-Tang.	Tangent	M.

Degree 48.

Degree 41.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.821254	9.874456	9.946808	10.053192	30
31	9.821407	9.874367	9.947063	10.052937	29
32	9.821550	9.874210	9.947317	10.052682	28
33	9.821692	9.874172	9.947572	10.092428	27
34	9.821835	9.874008	9.947826	10.052173	26
35	9.821977	9.873895	9.948081	10.051919	25
36	9.822120	9.873784	9.948335	10.051664	24
37	9.822262	9.873672	9.948590	10.051410	23
38	9.822404	9.873560	9.948844	10.051156	22
39	9.822546	9.873447	9.949099	10.050901	21
40	9.822583	9.873335	9.949353	10.050647	20
41	9.822830	9.873223	9.949607	10.050393	19
42	9.822972	9.873110	9.949862	10.050139	18
43	9.823114	9.872998	9.950116	10.049884	17
44	9.823255	9.872885	9.950370	10.049630	16
45	9.823397	9.872772	9.950625	10.049375	15
46	9.823538	9.872659	9.950879	10.049121	14
47	9.823680	9.872546	9.951233	10.048867	13
48	9.823821	9.872434	9.951338	10.048612	12
49	9.823962	9.872321	9.951642	10.048358	11
50	9.824104	9.872203	9.951895	10.048104	10
51	9.824245	9.872094	9.952150	10.047850	9
52	9.824386	9.871981	9.952404	10.047575	8
53	9.824527	9.871868	9.952659	10.047341	7
54	9.824667	9.871755	9.952915	10.047387	6
55	9.824808	9.871641	9.953167	10.046833	5
56	9.824949	9.871538	9.953421	10.046579	4
57	9.825090	9.871414	9.953675	10.046325	3
58	9.825230	9.871301	9.953929	10.046071	2
59	9.825370	9.871187	9.954183	10.045817	1
60	9.825511	9.871070	9.954437	10.045562	0
	Co-sine	Sine	Co Tang.	Tangent	M

Degree 48.

Degree 42.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.825511	9.871073	9.954437	10.045562	60
1	9.825651	9.870960	9.954691	10.045308	59
2	9.825791	9.870846	9.954945	10.045054	58
3	9.825931	9.870732	9.955199	10.044800	57
4	9.826071	9.870918	9.955453	10.044546	56
5	9.826211	9.870504	9.955707	10.044292	55
6	9.826351	9.870390	9.955961	10.044038	54
7	9.826491	9.870175	9.956215	10.043784	53
8	9.826631	9.870161	9.956469	10.043531	52
9	9.826770	9.870047	9.956723	10.043276	51
10	9.826930	9.869933	9.956977	10.043023	50
11	9.827049	9.869818	9.957231	10.042769	49
12	9.827189	9.869704	9.957485	10.042515	48
13	9.827328	9.869589	9.957739	10.042261	47
14	9.827467	9.869474	9.957993	10.042007	46
15	9.827605	9.869360	9.958246	10.041753	45
16	9.827745	9.869245	9.958500	10.041500	44
17	9.827884	9.869130	9.958754	10.041246	43
18	9.828 23	9.869015	9.959008	10.040992	42
19	9.828162	9.868900	9.959262	10.040738	41
20	9.828301	9.868785	9.959515	10.040485	40
21	9.828439	9.868670	9.959769	10.040231	39
22	9.828578	9.868555	9.960023	10.039977	38
23	9.828716	9.868429	9.960277	10.039723	37
24	9.828855	9.868324	9.960530	10.039469	36
25	9.828993	9.868209	9.960784	10.039216	35
26	9.829131	9.868092	9.961038	10.038962	34
27	9.829269	9.867978	9.961291	10.038708	33
28	9.829407	9.867862	9.961545	10.038455	32
29	9.829545	9.867747	9.961799	10.038201	31
30	9.829683	9.867631	9.962052	10.037947	30
	Co sine	Sine	Co-Tang.	Tangent	M

Degree 47.

Degree 42.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.829683	9.867631	9.962052	10.037947	30
31	9.829821	9.867515	9.962305	10.037694	29
32	9.829959	9.867399	9.962560	10.037140	28
33	9.830096	9.867283	9.962813	10.037187	27
34	9.830234	9.867167	9.963067	10.036933	26
35	9.830372	9.867051	9.963320	10.036680	25
36	9.830509	9.866935	9.963574	10.036426	24
37	9.830646	9.866819	9.963827	10.036173	23
38	9.830784	9.866703	9.964081	10.035910	22
39	9.830921	9.866586	9.964335	10.035665	21
40	9.831058	9.866470	9.964588	10.035412	20
41	9.831195	9.866353	9.964842	10.035158	19
42	9.831332	9.866237	9.965095	10.034905	18
43	9.831469	9.866120	9.965348	10.034652	17
44	9.831605	9.866004	9.965602	10.034398	16
45	9.831742	9.865887	9.965855	10.034144	15
46	9.831879	9.865770	9.966109	10.033891	14
47	9.832015	9.865653	9.966362	10.033638	13
48	9.832152	9.865536	9.966616	10.033384	12
49	9.832288	9.865419	9.966869	10.033131	11
50	9.832425	9.865302	9.967122	10.032878	10
51	9.832561	9.865185	9.967376	10.032624	9
52	9.832697	9.865068	9.967629	10.032371	8
53	9.832833	9.864950	9.967883	10.032117	7
54	9.832969	9.864833	9.968136	10.031864	6
55	9.833105	9.864716	9.968389	10.031611	5
56	9.833241	9.864598	9.968643	10.031357	4
57	9.833376	9.864480	9.968896	10.031104	3
58	9.833512	9.864363	9.969149	10.030851	2
59	9.833648	9.864240	9.969403	10.030597	1
60	9.833783	9.864127	9.969656	10.030344	0
	Co sine	Sine	Co Tang.	Tangent.	M

Degree 47.

Degree 43.

M	Sine	Co-sine	Tangent	Co-Tang.	
0	9.823783	9.864127	9.959556	10.030344	60
1	9.833919	9.864010	9.959909	10.030091	59
2	9.834054	9.863892	9.970162	10.02838	58
3	9.834189	9.863774	9.970416	10.029584	57
4	9.834324	9.863656	9.970669	10.029331	56
5	9.834460	9.863537	9.970922	10.029078	55
6	9.834595	9.863419	9.971175	10.028825	54
7	9.834730	9.863301	9.971428	10.028572	53
8	9.834865	9.863183	9.971682	10.028318	52
9	9.834999	9.863064	9.971935	10.028065	51
10	9.835134	9.862946	9.972188	10.027812	50
11	9.835269	9.862827	9.972441	10.027559	49
12	9.835403	9.862709	9.972694	10.027306	48
13	9.835538	9.862590	9.972948	10.027052	47
14	9.835672	9.862471	9.973201	10.026799	46
15	9.835806	9.862353	9.973454	10.026546	45
16	9.835941	9.862234	9.973707	10.026293	44
17	9.836075	9.862115	9.973960	10.026040	43
18	9.836209	9.861996	9.974213	10.025787	42
19	9.836343	9.861877	9.974466	10.025533	41
20	9.836477	9.861757	9.974719	10.025280	40
21	9.836611	9.861638	9.974973	10.025027	39
22	9.836745	9.861519	9.975226	10.024774	38
23	9.836878	9.861399	9.975479	10.024521	37
24	9.837012	9.861280	9.975732	10.024268	36
25	9.837146	9.861161	9.975985	10.024015	35
26	9.837279	9.861041	9.976238	10.023762	34
27	9.837412	9.860921	9.976491	10.023509	33
28	9.837546	9.860802	9.976744	10.023256	32
29	9.837679	9.860682	9.976997	10.023003	31
30	9.837812	9.860562	9.977250	10.022750	30
	Co sine	Sine	Co-Tang	Tangent.	M

Degree 46.

Degree 43.

M	Sine	Co sine	Tangent	Co Tang.	
30	9.837812	9.860562	9.977250	10.022750	30
31	9.837945	9.860422	9.977503	10.022497	29
32	9.838078	9.860322	9.977756	10.022244	28
33	9.838211	9.860202	9.978009	10.021991	27
34	9.838344	9.860082	9.978262	10.021738	26
35	9.838477	9.859962	9.978515	10.021485	25
36	9.838609	9.859842	9.978768	10.021232	24
37	9.838742	9.859721	9.979021	10.020979	23
38	9.838875	9.859601	9.979274	10.020726	22
39	9.839007	9.859480	9.979527	10.020473	21
40	9.839140	9.859360	9.979780	10.020220	20
41	9.839272	9.859239	9.980033	10.019967	19
42	9.839404	9.859118	9.980285	10.019714	18
43	9.839536	9.858998	9.980538	10.019461	17
44	9.839668	9.858877	9.980791	10.019209	16
45	9.839800	9.858756	9.981044	10.018956	15
46	9.839932	9.858635	9.981297	10.018703	14
47	9.840064	9.858514	9.981550	10.018450	13
48	9.840196	9.858393	9.981803	10.018197	12
49	9.840328	9.858272	9.982056	10.017944	11
50	9.840459	9.858150	9.982309	10.017691	10
51	9.840591	9.858029	9.982562	10.017438	9
52	9.840722	9.857908	9.982814	10.017185	8
53	9.840854	9.857786	9.983067	10.016933	7
54	9.840985	9.857665	9.983320	10.016680	6
55	9.841116	9.857543	9.983573	10.016427	5
56	9.841247	9.857421	9.983826	10.016174	4
57	9.841378	9.857300	9.984079	10.015921	3
58	9.841509	9.857178	9.984331	10.015668	2
59	9.841640	9.857056	9.984584	10.015416	1
60	9.841771	9.856934	9.984837	10.015163	0
	Co-sine	Sine	Co-Tang	Tangent	

Degree 46.

Degree 44.

M	Sine	Co sine	Tangent	Co-Tang.	
0	9.841771	9.856934	9.984837	10.015162	60
1	9.841902	9.856812	9.985090	10.014910	59
2	9.842033	9.856690	9.985343	10.014657	58
3	9.842163	9.856568	9.985596	10.015404	57
4	9.842294	9.856445	9.985848	10.014151	56
5	9.842924	9.856323	9.986101	10.013899	55
6	9.842555	9.856201	9.986354	10.013646	54
7	9.842685	9.856078	9.986607	10.013393	53
8	9.84 815	9.855956	9.986859	10.013140	52
9	9.842945	9.855833	9.987112	10.012888	51
10	9.843076	9.855710	9.987365	10.012635	50
11	9.843206	9.855588	9.987618	10.012382	49
12	9.843336	9.855465	9.987871	10.012129	48
13	9.843465	9.855342	9.988123	10.011877	47
14	9.843595	9.855219	9.988376	10.011624	46
15	9.843725	9.855096	9.988629	10.011371	45
16	9.843855	9.854973	9.988882	10.011118	44
17	9.843984	9.854850	9.989 34	10.010866	43
18	9.844114	9.854727	9.989387	10.010613	42
19	9.844243	9.854603	9.989640	10.010360	41
20	9.844372	9.854480	9.989893	10.010107	40
21	9.844502	9.854356	9.990145	10.009855	39
22	9.844631	9.854233	9.990398	10.009602	38
23	9.844760	9.854109	9.990651	10.009349	37
24	9.844889	9.853986	9.990903	10.009096	36
25	9.845018	9.853862	9.991156	10.008844	35
26	9.845147	9.853738	9.991409	10.008591	34
27	9.845276	9.853614	9.991662	10.008338	33
28	9.845404	9.853490	9.991914	10.008086	32
29	9.845533	9.853366	9.992167	10.007833	31
30	9.845662	9.853242	9.992420	10.007580	30
	Co-sine	Sine	Co-Tang.	Tangent.	M

Degree 45.

Degree 44.

M	Sine	Co-sine	Tangent	Co-Tang.	
30	9.845662	9.853242	9.99242	10.007580	30
31	9.845790	9.853113	9.992572	10.007328	29
32	9.845919	9.852994	9.992925	10.007075	28
33	9.846047	9.852869	9.993178	10.006822	27
34	9.846175	9.852745	9.993430	10.006569	26
35	9.846304	9.852620	9.993683	10.006317	25
36	9.846432	9.852496	9.993936	10.006064	24
37	9.846560	9.852371	9.994189	10.005811	23
38	9.846688	9.852246	9.994442	10.005559	22
39	9.846816	9.852122	9.994694	10.005306	21
40	9.846944	9.851997	9.994947	10.005053	20
41	9.847071	9.851872	9.995199	10.004801	19
42	9.847199	9.851747	9.995452	10.004548	18
43	9.847327	9.851622	9.995705	10.004295	17
44	9.847454	9.851497	9.995957	10.004043	16
45	9.847582	9.851372	9.996210	10.003790	15
46	9.847709	9.851246	9.996463	10.003537	14
47	9.847836	9.851121	9.996715	10.003285	13
48	9.847964	9.850996	9.996968	10.003032	12
49	9.848091	9.850870	9.997220	10.002779	11
50	9.848218	9.850745	9.997473	10.002527	10
51	9.848345	9.850619	9.997726	10.002274	9
52	9.848472	9.850493	9.997979	10.002021	8
53	9.848599	9.850367	9.998231	10.001769	7
54	9.848726	9.850242	9.998484	10.001516	6
55	9.848852	9.850116	9.998737	10.001263	5
56	9.848979	9.849990	9.998989	10.001011	4
57	9.849106	9.849864	9.999242	10.000758	3
58	9.849132	9.849737	9.999495	10.000505	2
59	9.849359	9.849611	9.999747	10.000253	1
60	9.849485	9.849485	10.000000	10.000000	0
	Co sine	Sine	Co Tang	Tangent	M

Degree 45.

*A most useful Table, whereby the true time of the Night may be known to a minute, without knowing the Meridian, Height, or Distance of the *.*

Stars names that never set, and will be under the Pole Star.	right asc. in time under the Pole *	d. in t. bet. the pole * & pol:	Azimuth under Pole *	From Meri.	Magnitude
	h m s	m s	o m s		
1 Cassiopeias hip-	12.38.01	00.07	00.01.00	E	3
2 -- her knee --	13.08.33	03.25	00.30.30	E	3
3 In Perseus side -	15.15.39	14.40	02.21.30	E	2
4 Great Bears lip	20.13.11	09.19	01.43.20	E	4
5 In his left knee	21.16.04	11.59	01.51.30	E	3
6 Lower leader -	22.53.21	11.08	01.33.40	E	2
7 Upper i'th' wain	22.55.42	12.07	01.29.30	E	2
8 The lower in □	23.42.52	06.26	00.57.00	E	2
9 The upper --	00.10.33	02.05	00.35.20	E	2
10 Rump or Alias	00.39.18	00.18	00.02.30	W	2
11 Last but one tayl	01.07.09	03.40	00.25.00	W	2
12 Last of the tayl	01.29.05	05.40	00.55.00	W	2
13 Last turn of Dr.	01.48.12	10.52	01.14.40	W	2
14 Upper guard l. B.	02.24.32	26.06	02.01.50	W	2
15 Lower of lit. B	02.58.42	26.38	02.22.10	W	3
16 Br. * Drag. hea.	05.25.26	43.17	03.42.44	W	2
17 Upp. turn of D.	06.38.11	34.54	03.51.20	W	3
18 Cepheus left sho.	08.43.06	27.20	03.10.20	W	2
19 In his Girdle -	08.55.04	24.43	03.04.40	W	3
20 Right knee --	11.10.02	17.30	01.21.40	W	3
21 Cassiopeas chair	11.41.37	10.21	00.48.20	W	3
22 In her breast --	12.20.56	01.32	00.15.20	W	3

A Table of the Suns Right Ascension in Time.

	γ H	α H	Com. parts	diff. "		δ H	η H	Com. parts	diff. "
1	0	11	3.40	222	1	13	55.25	230	
2	0	12	7.20	220	1	13	59.15	231	
3	0	12	11.10	220	2	14	3.06	231	
4	0	12	14.40	220	2	14	6.57	232	
5	0	12	18.20	220	2	14	10.49	233	
6	0	12	22.00	220	2	14	14.42	233	
7	0	12	25.41	221	2	14	88.35	234	
8	0	12	29.22	221	2	14	22.29	234	
9	0	12	33.03	221	2	14	26.23	235	
10	0	12	36.44	221	2	14	30.18	236	
11	0	12	40.25	222	2	14	34.14	237	
12	0	12	44.07	222	2	14	38.11	237	
13	0	12	47.49	222	2	14	42.08	238	
14	0	12	51.31	222	2	14	46.06	239	
15	0	12	55.13	223	2	14	50.05	239	
16	0	12	58.56	223	2	14	54.04	241	
17	1	13	2.39	223	2	14	58.05	241	
18	1	13	6.22	224	3	15	2.06	241	
19	1	13	10.06	224	3	15	6.07	241	
20	1	13	13.50	224	3	15	10.10	243	
21	1	13	17.34	224	3	15	14.13	243	
22	1	13	21.19	225	3	15	18.17	244	
23	1	13	25.04	225	3	15	22.21	244	
24	1	13	28.50	226	3	15	26.26	245	
25	1	13	32.36	226	3	15	30.32	246	
26	1	13	36.23	227	3	15	34.39	247	
27	1	13	40.10	227	3	15	38.47	248	
28	1	13	43.58	228	3	15	42.55	248	
29	1	13	47.47	229	3	15	47.04	249	
30	1	13	51.36	229	3	15	51.13	249	

A Table of the Suns Right Ascension in Time.

	II		Com	d ff.		☉	VS	Com	diff.
	H	H	parts					parts	
1	3	15	55.24	251	6	18	4.22	262	
2	3	15	59.35	252	6	18	8.43	262	
3	4	16	3.46	250	6	18	13.05	252	
4	4	16	7.58	253	6	18	17.27	261	
5	4	16	12.11	253	6	18	21.48	261	
6	4	16	16.25	254	6	18	26.09	251	
7	4	16	20.39	255	6	18	30.30	251	
8	4	16	24.53	255	6	18	34.51	260	
9	4	16	29.09	256	6	18	39.11	260	
10	4	16	33.24	256	6	18	43.31	260	
11	4	16	37.41	257	6	18	47.51	260	
12	4	16	41.57	257	6	18	52. 1	260	
13	4	16	46.15	258	6	18	56.31	259	
14	4	16	50.32	258	7	19	0.50	259	
15	4	16	54.51	259	7	19	5.09	258	
16	4	16	59.09	259	7	19	9.27	258	
17	5	17	3 28	250	7	19	13.45	257	
18	5	17	7 48	260	7	19	18.02	257	
19	5	17	12.08	260	7	19	22.19	256	
20	5	17	16.28	260	7	19	26.35	256	
21	5	17	20.48	250	7	19	30.51	255	
22	5	17	25.09	261	7	19	35.06	255	
23	5	17	29.30	261	7	19	39.21	254	
24	5	17	33.51	261	7	19	43.35	253	
25	5	17	38.12	261	7	19	47.48	253	
26	5	17	42.33	262	7	19	52.01	252	
27	5	17	46.55	262	8	20	00.25	251	
28	5	17	51.17	262	8	20	4.36	250	
29	5	17	55.38	262	8	20	8.45		
30	6	18	0.00	262					

A Table of the Suns Right Ascension in Time.

	♈	♉	Com.	diff.		♊	♋	Com.	diff.
	H	H	parts	"		H	H	parts	"
1	8	20	12.55	249	10	22	12.13	228	
2	8	20	17.04	248	10	22	16.01	228	
3	8	20	21.12	248	10	22	19.49	227	
4	8	20	25.20	247	10	22	23.36	227	
5	8	20	29.27	246	10	22	27.23	226	
6	8	20	33.33	245	10	22	31.09	226	
7	8	20	37.38	244	10	22	34.55	225	
8	8	20	41.42	244	10	22	38.40	225	
9	8	20	45.46	244	10	22	42.25	225	
10	8	20	49.50	243	10	22	46.10	224	
11	8	20	53.53	242	10	22	49.54	224	
12	8	20	57.55	240	10	22	53.38	223	
13	9	21	1.55	240	10	22	57.21	223	
14	9	21	5.55	239	11	23	1.24	223	
15	9	21	9.54	239	11	23	4.47	222	
16	9	21	13.53	238	11	23	8.29	222	
17	9	21	17.51	237	11	23	12.11	222	
18	9	21	21.48	237	11	23	15.13	221	
19	9	21	25.45	236	11	23	19.34	221	
20	9	21	29.41	235	11	23	23.15	221	
21	9	21	33.36	234	11	23	26.56	221	
22	9	21	37.30	234	11	23	30.37	221	
23	9	21	41.24	233	11	23	34.18	221	
24	9	21	45.17	233	11	23	37.59	220	
25	9	21	49.10	232	11	23	41.39	220	
26	9	21	53.02	231	11	23	45.19	220	
27	9	21	56.53	231	11	23	48.59	220	
28	10	22	0.44	231	11	23	52.39	220	
29	10	22	4.34	230	11	23	56.20	220	
30	10	22	8.24	230	12	24	00.00	220	

A Table of the Longitudes, Latitudes, Right Ascension, Declination of 100 of the most Notable Stars for Anno 1680, with the Difference for every Ten Years.

BEV	Names of the Stars	Longitude			Latitude		
		o	'	"	o	'	"
2	In the head of Andr.	Υ	09.52.09		25.42.10	N	
2	In her Girdle - - -	Υ	25.54.06		25.58.30	N	
2	In her Souther foot	Ο	09.44.50		27.47.10	N	
1	In Aquar. Fornahont		29.19.49		20.59.40	S	
3	In his right shoulder	♊	28.55.03		10.42.15	N	
3	In his left shoulder -	♊	18.56.33		08.42.15	N	
5	In his left hand - -	♊	11.56.33		04.50.15	N	
2	Bright * in Aquil. vul.	Υ	27.15.23		29.20.40	N	
4	1. Horn Υ - - - -	Υ	28.42.33		07.08.00	N	
4	2. Horn of Υ - - -	Υ	29.23.33		08.28.30	N	
3	Bright * in Aries -	Ο	03.11.32		09.56.30	N	
1	Capella - - - - -	Π	17.23.08		22.51.45	N	
2	In his right shoulder	Π	25.28.28		21.25.40	N	
1	Boores Arcturus - -	♊	19.47.32		31.00.40	N	
3	In his left shoulder	♊	14.13.33		49.51.40	N	
nb	Cancer, Praesepe - -	♊	02.51.29		01.14.30	N	
4	Canc. the Nor. Asell.	♊	03.01.59		03.08.30	N	
4	The Southren Asell.	♊	04.12.59		00.03.30	N	
1	The G. doz & Sirius	♊	09.47.53		39.32.05	S	
2	The L. doz * Precion	♊	21.23.23		15.57.10	S	
3	Capric. the fore horn	Υ	29.27.32		07.03.11	N	
3	the lower horn	Υ	29.40.33		04.42.10	N	
3	former in the tayl	♊	17.23.33		02.24.50	S	
3	latter in the tayl	♊	19.09.33		02.27.50	S	
3	Cas. br. * i'th' chair	Ο	00.38.53		51.17.50	N	
3	Br g. * in her Breast	Ο	03.22.33		46.36.50	N	
3	In the beard of her hip	Ο	09.02.33		48.47.50	N	
3	In her knee - - - -	Ο	13.26.03		46.23.50	N	
3	Cepheus in his Girdle	Ο	01.19.33		71.08.30	N	
2	Cete the Whale's jaw	Ο	09.52.23		12.36.50	S	
3	In the belly North -	Υ	17.31.21		20.17.20	S	
3	The Nor. in the Tayl	✳	26.29.53		09.58.10	S	
2	The Southren - - -	✳	28.02.53		30.43.40	S	
2	Nor. Cr. the bright *	♊	07.45.36		44.25.60	N	

<i>a.s.c. in d</i>	<i>r.as. in ti</i>	<i>Declinati.</i>	<i>di.r.a.</i>	<i>di.d. 10y</i>
° ' "	h ' "	° ' "	h' "	' "
57.58.44	23.51.55	27.20.38 N	0.31	03.24 A
12.54.44	0.51.39	33.56. 4 N	0.33	03.18 A
26.01.03	1.44.16	40.46. 0 N	0.35	03.18 A
39.54.00	22.39.36	31.14.10 S	0.34	03.00 S
27.20.55	21.49.21	1.49.32 S	0.22	02.54 S
18.39.42	21.14.39	6.53.58 S	0.32	01.36 S
07.30.42	20.30.03	10.37.32 S	0.30	01.51 S
93.47.23	19.35. 9	8. 3.56 N	0.14	01.18 A
24.00.36	1.36. 2	17.42.12 N	0.33	03.07 A
24.13.39	1.36.55	19.12.42 N	0.33	02.51 A
27.18.58	1.49.16	21.55.30 N	0.34	03.00 A
73.09.08	4.52.36	45.38.00 N	0.33	01.00 A
84.06.06	5.36.24	44.50.40 N	0.47	00.25 A
10.18.50	14. 1.15	20.53.55 N	0.28	02.57 S
14.50.09	14.19.21	39.10.36 N	0.25	02.41 S
25.28.26	8.21.54	20.46.52 N	03.5	01.54 S
26.08.00	8.24.32	22.35.00 N	0.36	02.00 S
26.36.32	8.26.26	19.19.00 N	0.35	01.00 S
97.43.42	6.30.55	16.17.18 S	0.27	00.24 A
10.38.32	7.22.34	6. 1.36 N	0.32	01.12 S
00.07.34	20. 0.30	13.25.18 S	0.34	01.36 S
00.50.05	20. 3.20	15.41.26 S	0.35	01.42 S
20.39.17	21.22.37	17.59.33 S	0.34	02.36 S
22.26.30	21.29.46	17.27.46 S	0.34	02.42 S
57.59.33	23.51.58	57.25.28 N	0.30	03.24 A
5.39.36	0.22.38	54.48.28 N	0.33	03.24 A
9.28.24	0.37.54	59. 0.48 N	0.34	03.24 A
16.17.00	1.05. 8	58.33.46 N	0.38	02.18 A
21. 2.06	21.24. 8	69.11.56 N	0.39	02.36 A
41.23.07	2.45.32	2.48.50 N	0.30	02.30 A
23.57.00	1.35.48	11.51.02 S	0.30	03.06 S
0.48.36	0. 3.14	10.31.50 S	0.31	03.30 S
6.59.44	0.27.59	19.42.32 S	0.31	03.24 S
30.26.00	15.21.44	27.49.32 N	1.26	02.06 S

A Table of the Longitudes, Latitudes, Right Ascension, Declination of 100 of the most Notable Stars for Anno 1680, with the Difference for every Ten Years.

Mag.	Names of the Star.	Longitude	Latitude
		° ' "	° ' "
3	In the Swans bill -	♊ 26.48.37	49.03.00
3	In her Breast —	♊ 20.28.37	57.10.20
3	In her tayl —	♋ 00.58.18	59.57.20
3	In her upp'r wing -	♊ 11.57.53	64.25.50
3	In her l w r —	♊ 23.14.22	49.27.00
3	Bright * in Draco	♊ 23.29.13	75.02.10
2	Gemin's head of Ca	♊ 15.44.53	10.02.50
2	Gem. head of Pollux	♊ 18.47.59	06.38.30
2	In the bright foot	♊ 04.34.53	06.48.00
3	Hercules his head -	♊ 11.41.13	37.22.15
3	In his right shoulde	♊ 26.37.43	42.47.15
3	In his left shoulde	♊ 10.20.13	47.46.15
1	Hydra's Heart —	♊ 22.49.43	22.23.50
1	Lyons Heart —	♊ 25.31.48	00.26.20
1	Lyons Tyal —	♋ 17.09.53	12.16.20
2	Ly. br.* in his craf	♊ 25.01.25	08.45.40
2	Ly. br.* in his loin	♊ 06.50.38	14.18.30
3	Ly. i'th' top of's neck	♊ 22.59.53	11.48.40
3	Ly. below in his ne. k	♊ 23.22.23	04.50.40
3	In the back o'th bare	♊ 15.12.13	43.55.50
2	No'theren Ballance-	♊ 14.55.23	08.33.30
2	Sout'ern Ballance--	♊ 10.39.33	00.25.10
1	Bright * i'th' harp	♊ 10.49.33	61.47.00
3	I'th' head of Ophiu	♊ 18.00.13	35.56.15
3	In his left hand —	♊ 27.54.43	17.18.20
3	In his right knee —	♊ 13.34.13	07.17.20
3	In his left knee—	♊ 04.49.13	11.29.20
3	In his right shoulder	♊ 20.55.13	28.00.20
4	Ori. i'th' top of his h	♊ 19.17.53	13.25.30
2	Orions right shoul	♊ 24.19.41	16.06.15
2	In his left shoulder-	♊ 16.29.53	16.52.30
1	Orions Foot Rigid -	♊ 12.19.03	31.10.10
2	First of his belt —	♊ 17.52.33	23.36.40
2	Second of his belt--	♊ 18.56.48	24.34.10

asc. in d.	r. asc. in t.	Declinati.	di. r. a.	d. d. 107.
h	h	h	h	h
19.27.36	19.17.50	27.20.28 N	0.24	01.06 A
22.45.10	20.11.01	39.16.36 N	0.21	01.48 A
07.37.06	20.30.28	44.10.46 N	0.20	02.03 A
23.51.26	19.35.26	44.23.33 N	0.29	01.24 A
08.17.10	20.33.09	32.47.12 N	0.24	02.06 A
57.18.20	17.49.13	51.29.25 N	0.14	00.12 S
03.29.58	07.14.00	32.32.38 N	0.41	01.06 S
11.25.18	07.25.41	28.45.26 N	0.38	01.12 S
94.45.56	06.19.04	16.37.56 N	0.35	00.12 S
55.01.52	17.00.07	14.48.44 N	0.27	00.18 S
44.06.35	16.16.26	22.15.40 N	0.25	01.03 S
55.26.19	17.01.45	25.17.24 N	0.21	00.48 S
37.57.22	09.11.49	07.16.30 S	0.30	02.30 A
47.47.45	09.51.11	13.30.58 N	0.33	02.51 S
73.09.46	11.32.39	16.20.52 N	0.31	03.24 S
50.31.41	10.02.07	21.26.48 N	0.34	02.54 S
64.14.55	10.57.00	22.14.32 N	0.35	03.24 S
49.41.16	09.58.45	24.59.42 N	0.35	02.54 S
47.30.16	09.50.01	18.19.09 N	0.35	02.48 S
078.38.80	05.14.34	21.00.13 S	0.26	00.42 S
224.59.02	14.59.56	08.09.58 S	0.32	00.24 A
218.21.44	14.33.27	14.39.54 S	0.33	00.42 A
276.29.32	18.25.58	38.31.28 N	0.20	00.24 A
260.01.26	17.20.06	12.51.46 N	0.28	00.42 S
239.31.01	15.58.04	02.19.16 S	0.33	01.48 A
252.55.46	16.51.43	15.14.30 S	0.30	01.30 A
244.55.01	16.19.40	19.50.30 S	0.33	01.00 A
261.54.02	17.27.36	04.43.46 N	0.33	00.30 S
079.24.45	05.17.39	09.42.14 N	0.33	00.42 A
084.25.40	05.37.47	07.17.32 N	0.33	00.24 A
077.00.52	05.08.06	06.01.26 N	0.31	00.45 A
074.47.44	04.59.18	08.35.36 S	0.30	00.57 S
078.54.24	05.15.38	08.34.14 S	0.31	00.42 S
079.57.27	05.19.51	01.26.58 S	1.31	00.36 S

*A Table of the Longitudes, Latitudes, Right Ascension, Declination of 100 of the most
Notable Stars for Anno 1680, with the Difference for every Ten Year.*

	Names of the Stars	Longitude	Latitude
		° ' "	° ' "
2	The 3 ^d in Orions belt	♐ 20.06.03	25:21:10 S
3	Pegasus in his mouth.	♐ 27.28.17	22 06 20 N
2	In his thigh, sheat—	♐ 24.57.13	31 08 20 N
2	Bright * in the wing	♐ 19.02.43	19 24 50 N
2	Br. * i th lower w.	♐ 04.43.13	21:37:10 N
2	Perseus in his side---	♐ 27.17.01	30 05 50 N
3	Caput Medusæ—	♐ 21.49.03	22 22 40 N
4	Southern fish occiput	♐ 16.56.05	07:17:00 N
3	Bright * betwixt *	♐ 13.53.05	09 04 03 S
4	Sagittar. in his head	♐ 09.05.33	01 45:10 N
1	Scorpions's heart—	♐ 05.18.33	04 26:30 S
2	In his forehead north	♐ 28.40.03	01 06:55 N
3	In his forehe. middle	♐ 28.03.13	01.52.40 S
3	In his forehead South	♐ 18.28.53	05.20.40 S
2	Serpents neck br. *	♐ 17.33.53	25.33.50 N
1	Bulls eye South —	♐ 05.18.36	05.30.50 S
2	Bulls Northern eye—	♐ 03.59.06	02.36.10 S
3	The low- of Hiades	♐ 01.17.03	05.46.20 S
2	His Northern horn—	♐ 18.05.53	05.20.40 S
3	His Southern horn—	♐ 20.18.53	02.13.30 S
3	Brightest of the 7 *	♐ 20.37.42	03.59.30 N
1	Virgin Spike —	♐ 19.22.53	01.59.30 S
3	Br. * in her Girdle	♐ 07.01.53	08.40.30 N
3	Vindimatrix —	♐ 05.28.23	16.15.00 N
2	Great Bears shoulder	♐ 10.41.32	49.40.10 N
2	Next under it—	♐ 14.51.03	45.05.40 N
2	Br. * hinder thigh	♐ 25.57.33	47.08.40 N
3	Br. * on his back	♐ 25.33.03	51.37.10 N
2	In his Rump Aliot—	♐ 04.19.33	54.17.45 N
2	Middle in the Tayl—	♐ 11.04.59	56.21.10 N
2	Last in the Tayl—	♐ 22.20.13	54.24.10 N
2	The Pole Star—	♐ 24.09.53	65.59.50 N
2	Little Bears shoulder	♐ 08.28.12	72.48.40 N

<i>r.asc.in d.</i>	<i>r.as in t.</i>	<i>Declinati.</i>	<i>di.r.a.</i>	<i>d.d 10y.</i>
° ' "	h ' "	° ' "	h ' "	' ' "
081.03.12	05.24.13	02.09.20 S	0.30	00.30 S
222.12.00	21.28.48	03.27.02 N	0.31	02.36 A
342.06.12	22.48.25	25.22.09 N	0.29	03.09 A
342.12.03	22.48.52	13.29.29 N	0.30	03.09 A
350.12.12	23.56.49	13.25.03 N	0.20	03.24 A
045.04.42	03.00.19	48.39.42 N	0.35	02.35 A
041.53.18	02.47.33	39.41.30 N	0.39	02.30 A
345.08.40	23.00.35	01.33.26 N	0.39	03.18 A
026.22.38	01.45.30	01.13.00 N	0.32	03 00 A
276.47.37	18.39.10	22.24.24 S	0.47	00.48 S
242.29.04	16.09.56	25.36.42 S	0.37	01.36 A
236.40.51	15.46.43	18.49.48 S	0.35	01.54 A
235.19.35	15.43.06	21.37.40 S	0.35	02.00 A
223.48.31	15.39.54	25.05.42 S	0.39	02.06 A
320.90.00	15.28.36	07.20.24 N	0.30	02.06 S
064.24.16	04.17.37	15.50.10 N	0.34	01.30 A
062.26.48	04.09.37	18.33.52 N	0.34	01.42 A
060.22.35	04.01.30	14.49.02 N	0.34	01.42 A
076.31.54	05.06.07	28.20.38 N	0.39	00.48 A
079.37.18	05.18.29	20.57.22 N	0.36	00.12 A
052.09.49	03.28.39	23.03.36 N	0.35	02.05 A
197.05.57	13.08.28	09.27.00 S	0.31	03.15 A
189.54.46	12.39.39	05.09.42 N	0.31	05.24 S
191.36.56	12.46.27	12.41.34 N	0.31	03.18 S
160.56.52	10.43.47	63.28.26 N	0.40	03.12 S
160.32.55	10.42.11	58.05.25 N	0.39	03.12 S
174.06.58	11.36.27	55.30.06 N	0.33	03.12 S
179.12.01	11.39.28	58.47.06 N	0.32	05.12 S
189.54.08	12.39.36	57.43.24 N	0.27	03.18 S
197.42.26	13.10.50	56.37.16 N	0.25	03.12 S
203.41.25	13.34.46	50.57.08 N	0.24	03.06 S
009.14.10	00.36.57	87.36.03 N	0.46	02.24 A
222.40.05	14.50.40	75.38.00 N	0.01	00.15 A

A Table of Accounts.

	1 farthing	2 farthings	3 farthings
	li. sh. d. q.	li. sh. d. q.	li. sh. d. q.
1	1	2	3
2	2	1.0	1.2
3	3	1.2	2.1
4	1.0	2.0	3.0
5	1.1	2.2	3.3
6	1.2	3.0	4.2
7	1.3	3.2	5.1
8	2.0	4.0	6.0
9	2.1	4.2	6.3
10	2.2	5.0	7.2
20	5.0	10.0	1. 3.0
30	7.2	1. 3.0	1.10. 2
40	10.0	1. 8.0	2. 6.0
50	1. 0.2	2. 1.0	3. 1.2
60	1. 0.3	2. 6.0	3. 9.0
70	1. 5.2	2.11.0	4. 4.2
80	1. 8.0	3. 4.0	5. 0.0
90	1.10.2	3. 9.0	5. 7.2
100	2. 1.0	4. 2.0	6. 3.0
200	4. 2.0	8. 4.0	12. 6.0
300	6. 3.0	12. 6.0	18. 9.0
400	8. 4.0	16. 8.0	1. 5. 0.0
500	10. 5.0	1. 0.10.0	1.11. 3.0
600	12. 6.0	1. 5. 0.0	1.17. 6.0
700	14. 7.0	1. 9. 2.0	2. 3. 9.0
800	16. 8.0	1.13. 4.0	2.10. 0.0
900	18. 9.0	1.17. 6.0	2.16. 3.0
1000	1. 0.10.0	2. 1. 8.0	3. 2. 6.0
2000	2. 1. 8.0	4. 3. 4.0	6. 5. 0.0
5000	5. 4. 2.0	10. 8. 4.0	15.12. 6.0
10000	10. 8. 4.0	20.16. 8.0	31. 5. 0.0

A Table of Accounts.

	1 penny	2 pence	3 pence	4 pence
	li. sh. d.	li. sh. d.	li. sh. d.	li. sh. d.
1	1	2	3	4
2	2	4	6	1 8
3	3	6	9	1. 0
4	4	8	1. 0	1. 4
5	5	10	1. 3	1. 8
6	6	1. 0	1. 6	2. 0
7	7	1. 2	1. 9	2. 4
8	8	1. 4	2. 0	2. 8
9	9	1. 6	2. 3	3. 0
10	10	1. 8	2. 6	3. 4
20	1. 8	3. 4	5. 0	6. 8
30	2. 6	5. 0	7. 6	10. 0
40	3. 4	6. 8	10. 0	13. 4
50	4. 2	8. 4	12. 6	16. 8
60	5. 0	10. 0	15. 0	1. 0. 0
70	5. 10	11. 8	17. 6	1. 3. 4
80	6. 8	13. 4	1. 0. 0	1. 6. 8
90	7. 6	15. 0	1. 2. 6	1. 10. 0
100	8. 4	16. 8	1. 5. 0	1. 13. 4
200	16. 8	1. 13. 4	2. 10. 0	3. 6. 8
300	1. 5. 0	2. 10. 0	3. 15. 0	5. 0. 0
400	1. 13. 4	3. 6. 8	5. 0. 0	6. 13. 4
500	2. 1. 8	4. 3. 4	6. 5. 0	8. 6. 8
600	2. 10. 0	5. 0. 0	7. 10. 0	10. 0. 0
700	2. 18. 4	5. 16. 8	8. 15. 0	11. 13. 4
800	3. 6. 8	6. 13. 4	10. 0. 0	13. 6. 8
900	3. 15. 0	7. 10. 0	11. 5. 0	15. 0. 0
1000	4. 3. 4	8. 6. 8	12. 0. 0	16. 13. 4
2000	8. 6. 8	16. 13. 4	25. 0. 0	33. 6. 8
5000	20. 16. 8	41. 13. 4	62. 10. 0	83. 6. 8
10000	41. 13. 4	83. 6. 8	125. 0. 0	166. 13. 4

A Table of Accounts.

	5 pence	6 pence	7 pence	8 pence
	li. sh. d.	li. sh. d.	li. sh. d.	li. sh. d.
1	5	6	7	8
2	10	1. 0	1. 2	1. 4
3	1. 3	1. 6	1. 9	2. 0
4	1. 8	2. 0	2. 4	2. 8
5	2. 1	2. 6	2. 11	3. 4
6	2. 6	3. 0	3. 6	4. 0
7	2. 11	3. 6	4. 1	4. 8
8	3. 4	4. 0	4. 8	5. 4
9	3. 9	4. 6	5. 3	6. 0
10	4. 2	5. 0	5. 10	6. 8
20	8. 4	10. 0	11. 8	13. 4
30	12. 6	15. 0	17. 6	1. 0. 0
40	16. 8	1. 0. 0	1. 3. 4	1. 6. 8
50	1. 0. 0	1. 5. 0	1. 9. 2	1. 13. 4
60	1. 5. 0	1. 10. 0	1. 12. 0	2. 0. 0
70	1. 9. 2	1. 15. 0	2. 0. 10	2. 6. 8
80	1. 13. 4	2. 0. 0	2. 6. 8	2. 13. 4
90	1. 17. 6	2. 5. 0	2. 12. 6	3. 0. 0
100	2. 1. 8	2. 10. 0	2. 18. 4	3. 6. 8
200	4. 3. 4	5. 0. 0	5. 16. 8	6. 13. 4
300	6. 5. 0	7. 10. 0	8. 15. 0	10. 0. 0
400	8. 6. 8	10. 0. 0	11. 13. 4	13. 6. 8
500	10. 8. 4	12. 10. 0	14. 11. 8	16. 13. 4
600	12. 10. 0	15. 0. 0	17. 10. 0	20. 0. 0
700	14. 11. 8	17. 10. 0	20. 8. 4	23. 6. 8
800	16. 13. 4	20. 0. 0	23. 6. 8	26. 13. 4
900	18. 15. 0	22. 10. 0	26. 5. 0	30. 00. 0
1000	25. 16. 8	25. 0. 0	29. 3. 4	33. 6. 8
2000	41. 12. 4	50. 0. 0	58. 6. 8	66. 13. 4
5000	104. 3. 4	125. 0. 0	145. 16. 8	166. 13. 4
10000	208. 6. 8	250. 0. 0	291. 13. 4	333. 6. 8

A Table of Accounts.

	9 pence	10. pence	11. pence	12. pence
	li. sh. d.	li. sh. d.	li. sh. d.	li. sh. d.
1	9	10	11	1. 0
2	1. 6	1. 8	1. 10	2. 0
3	2. 3	2. 6	2. 9	3. 0
4	3. 0	3. 4	3. 8	4. 0
5	3. 9	4. 2	4. 7	5. 0
6	4. 6	5. 0	5. 8	6. 0
7	5. 3	5. 10	6. 5	7. 0
8	6. 0	6. 8	7. 4	8. 0
9	6. 9	7. 6	8. 3	9. 0
10	7. 6	8. 4	9. 2	10. 0
20	15. 0	16. 8	18. 4	1. 0. 0
30	1. 2. 6	1. 5. 0	1. 7. 6	1. 10. 0
40	1. 10. 0	1. 13. 4	1. 16. 8	2. 0. 0
50	1. 17. 6	2. 1. 8	2. 5. 10	2. 10. 0
60	2. 5. 0	2. 10. 0	2. 15. 0	3. 0. 0
70	2. 12. 6	2. 18. 4	4. 4. 2	3. 10. 0
80	3. 0. 0	3. 6. 8	3. 13. 4	4. 0. 0
90	3. 7. 6	3. 15. 0	4. 2. 6	4. 10. 0
100	3. 15. 0	4. 3. 4	4. 11. 8	5. 0. 0
200	7. 10. 0	8. 6. 8	9. 3. 4	10. 0. 0
300	11. 5. 0	12. 10. 0	13. 15. 0	15. 0. 0
400	15. 0. 0	16. 13. 4	18. 6. 8	20. 0. 0
500	18. 15. 0	20. 16. 8	22. 18. 4	25. 0. 0
600	22. 10. 0	25. 0. 0	17. 10. 0	30. 0. 0
700	26. 5. 0	29. 3. 4	32. 1. 8	35. 0. 0
800	30. 0. 0	33. 6. 8	36. 13. 4	40. 0. 0
900	33. 15. 0	37. 10. 0	41. 5. 0	45. 0. 0
1000	37. 10. 0	41. 13. 4	45. 16. 8	50. 0. 0
2000	75. 0. 0	82. 6. 8	91. 13. 4	100. 0. 0
5000	187. 10. 0	208. 6. 8	229. 3. 4	250. 0. 0
10000	375. 0. 0	416. 13. 4	458. 6. 8	500. 0. 0

Forreign Weights and Measures, Carefully compared with the English.

	English Foot, in- to 1000 equal Parts.	English Foot, in- to Inc. and tenth parts of an Inch.	The Pound A- verdupois into 100 parts.
London Foot —————	1000	0.12.0	100
<i>France.</i>			
Paris, the Royal Foot —	1.068	1.00.8	0.93
Lyon Ell —————	8.976	3.11.7	1.09
Boloyne Ell —————	2. 76	2.00.8	0.89
<i>The 17 Provinces.</i>			
Amsterdam Foot ———	.942	0.11.3	0.93
Ell ———	2.269	2.03.2	
Antwerp Foot ———	.946	0.11.3	0.98
Ell ———	2.273	2.03.3	
Brill Foot ———	1.103	1.01.2	
Dort Foot ———	1.184	1.02.2	
Rynland or Leyden Foot—	1.033	1.00.4	0.96
Ell ———	2.260	2.03.1	
Lorain Foot ———	.958	.11.4	0.98
Mechalin Foot ———	.919	.11.0	0.98
Middleburg Foot ———	.991	.11.9	0.98

Germany.

	Thous parts.	F.I.p.	Aver. 100.p.
Strasbourg Foot _____	.920	0.11.0	0.93
Bremen Foot _____	.964	0.11.6	0.94
Cologn Foot _____	.954	0.11.4	0.97
Frankford ad Menam } Foot _____	.948	.11.4	5.93
Ell _____	1.826		
Hambrough Ell _____	1.905	1. 9.9	
Lipfig Ell _____	2.260	1.10.8	0.95
Lubick Ell _____	1.903	2. 3.1	1.17
Noremberg _____	1.006	1. 9.8	
Ell _____	2.227	1.00.1	0.94
Bavaria _____	.954	2. 3.3	
Vienna _____	1.053	0.11.4	
		1.00.6	3.83

Spain and Portu.

Spanish Palm, or the } Palm of Castile.	.751	0.09.0	0.99
The Spanish Ware or } Rod, (four Palms)	3.004	3.00.0	
Their Foot is of } the Ware _____	1.001	1.00.0	
Lisbon Ware _____	2.750	2.09.0	1.06
Gibraltar Ware _____	2.760	2.09.1	1.03
Toledo Foot _____	.899	0.10.7	1.00
Vare _____	2.685	2.08.2	

Italy.

Roman Foot, on the } Monum. of Cossutius	.967	0.11.6	1.23
Of Statilius _____	.972	0.11.7	
Roman Palm, for build- } ing, whereof 10 make } the Cauna _____	.732	0.08.8	

	Thou. parts.	F. In. p.	Aver. 100 p.
Bononia Foot	1.204	1.20.4	1.27
Ell	2.147	2.01.7	
Perch, whereof 500 to a Mile	12.040	12.00.5	
Florence Brace or Ell	1.913	1.11.0	1.23
Naples Palm	.861	0.09.6	1.43
Brace	2.100	2. 1.2	
Canna	6.880	6.10.5	
Genua Palm	.830	.09.6	1.42
Mantova Foot	1.569	1.06.8	1.43
Milan Calamus	6.544	6.06.5	1.40
Parma Cubit	1.866	1.10.4	1.43
Venice Foot	1.162	1.01.9	1.53
<i>Other Places.</i>			
Dantzick Foot	.944	0.11.3	1.19
Ell	1.903	1.10.8	
Copenhagen Foot	.965	.11.6	0.94
Prague (in Bohemia) Foot	1.026	1.00.3	1.06
Riga Foot	1.831	1.09.9	
China Cubit	1.016	1.00.2	
Turin Foot	1.052	1.00.7	
Cairo Cubit	1.824	1.09.9	1.61
Persian Arash	3.197	3.02.3	
Turkish Pike, at Con- stantin, the greater	2.200	1.02.4	0.86
The Greek Foot	1.007	1.00.1	
The Universal measure.	3.267	3. 3.2	

*A Pendulum of the just length whereof will vibrate
60 times in a Minute.*

To Guage a Cask which is not full.

*A Table for Guaging of Wine Casks
which are not full.*

G.	parts	G.	parts	G.	parts	G.	parts	G.	parts
0	000	13	2630	26	4330	39	5913	52	7072
1	295		2703		4400		5976		7718
2	470	14	2775	27	4462	40	6040	53	7829
1	602		2847		4542		6094		7909
2	720	15	2918	28	4585	41	6158	54	7990
	830		2986		4646		6223		8072
3	935	16	3056	29	4726	42	6288	55	8154
	1038		3123		4766		6353		8236
4	1138	17	3189	30	4826	43	6418	56	8319
	1235		3255		4885		6483		8404
5	1339	18	3321	31	4948	44	6548	57	8491
	1420		3387		5000		6613		8580
6	1502	19	3452	32	5057	45	6679	58	8661
	1596		3517		5115		6745		8765
7	1681	20	3582	33	5174	46	6811	59	8862
	1764		3647		5234		6877		8962
8	1846	21	3712	34	5294	47	6944	60	9065
	1928		3777		5354		7012		9170
9	2010	22	3842	35	5415	48	7082	61	9280
	2091		3906		5476		7153		9398
10	2171	23	3960	36	5535	49	7225	62	9530
	2242		4024		5600		7297		9705
11	2328	24	4087	37	5662	50	7370	63	10000
	2405		4150		5724		7444		
12	2481	25	4213	38	5787	51	7519		
	2556		4270		5850		7595		

Deg. | 0 | 10 | 20 | 30 | 40 | 50 | D

Latit.

A Table of Meridional Parts.

0	0	16	38	50	66	88	16.5
1	103	116	133	150	166	183	16.5
2	200	216	233	250	267	283	16.5
3	300	317	333	350	367	383	1.7
4	400	417	433	450	467	484	1.7
5	500	517	534	551	567	584	1.7
6	601	618	634	651	668	685	1.7
7	701	718	735	752	769	785	1.7
8	802	819	836	853	870	887	1.7
9	903	920	937	954	971	988	1.7
10	1005	1022	1039	1056	1082	1090	1.7
11	1107	1124	1141	1158	1185	1192	1.7
12	1209	1226	1243	1260	1287	1294	1.7
13	1311	1328	1345	1367	1380	1397	1.7
14	1414	1431	1448	1468	1483	1500	1.7
15	1517	1534	1552	1569	1586	1604	1.7
16	1621	1638	1656	1673	1690	1708	17.5
17	1725	1743	1760	1778	1795	1813	17.5
18	1830	1848	1865	1883	1900	1918	17.5
19	1936	1953	1971	1988	2006	2024	17.5
20	2042	2059	2077	2098	2113	2131	17.5
21	2148	2166	2184	2202	2220	2238	1.8
22	2256	2274	2292	2310	2328	2346	1.8
23	2364	2382	2400	2419	2437	2455	1.8
24	2473	2491	2510	2528	2545	2565	1.8
25	2583	2601	2620	2638	2657	2675	1.8
26	2694	2712	2731	2750	2768	2787	1.8
27	2806	2824	2843	2862	2880	2899	1.8
28	2918	2937	2956	2975	2994	3013	1.9
29	3032	3051	3070	3089	3108	3128	1.9

Deg

0 | 10 | 20 | 30 | 40 | 50 | D

Latit.

A Table of Meridional Parts.

30	3147	3106	3185	3205	3224	3244	19
31	3263	3282	3302	3322	3341	3361	19
32	3380	3400	3420	3439	3459	3469	20
33	3499	3519	3539	3550	3579	3599	20
34	3619	3639	3659	3679	3700	3720	20
35	3740	3760	3781	3801	3822	3842	20
36	3863	3884	3904	3925	3946	3967	21
37	3987	4000	4029	4050	4071	4092	21
38	4114	4135	4156	4177	4198	4220	21
39	4241	4265	4284	4306	4327	4349	22
40	4371	4393	4414	4436	4458	4480	22
41	4502	4524	4546	4569	4591	4613	22
42	4636	4658	4681	4703	4726	4749	22
43	4771	4794	4817	4840	4863	4886	23
44	4909	4932	4956	4970	4002	4026	23
45	5050	5073	5097	5120	5144	5168	23
46	5192	5216	5040	5265	5289	5313	24
47	5337	5362	5386	5411	5436	5461	25
48	5485	5510	5585	5560	5586	5611	25
49	5636	5662	5687	5713	5739	5764	26
50	5790	5816	5842	5868	5895	5921	26
51	5948	5974	6001	6027	6054	6081	26
52	6108	6135	6162	6190	6217	6245	27
53	6272	6300	6328	6356	6384	6412	28
54	6440	6469	6497	6526	6555	6584	29
55	6613	6642	6671	6700	6730	6760	29
59	6790	6820	6850	6879	6910	6940	30
57	6970	7002	7031	7060	7094	7125	31
58	7156	7188	7220	7252	7184	7316	32
59	7348	7380	7413	7446	7479	2512	33

Deg | 0 | 10 | 20 | 30 | 40 | 50 | D

Latit.

A Table of Meridional Parts.

60	7545	7579	7612	7646	7650	7714	34
61	7748	7793	7817	7852	7887	7923	35
62	7958	7994	8029	8065	8102	8138	36
63	8175	8211	8248	8286	8323	8361	37
64	8399	8437	8475	8514	8553	8592	38
65	8631	8671	8710	8750	8791	8831	39
66	8872	8913	8960	8996	9038	9080	41
67	9123	9166	9224	9252	9296	9340	43
68	9384	9429	9474	9517	9565	9611	45
69	9557	9704	9751	9798	9846	9899	47
70	9943	9993	10041	10091	10141	10192	49
71	10242	10294	10346	10398	10450	10504	52
72	10558	10612	10666	10722	10777	10834	54
73	10890	10948	11005	11064	11123	11182	57
74	11242	11303	11365	11427	11489	11553	61
75	11617	11682	11747	11814	11881	11948	67
76	12016	12086	12156	12227	12299	12371	70
77	12445	12519	12595	12672	12749	12828	74
78	12907	12988	13070	13153	13237	13322	81
79	13409	13497	13586	13677	13765	13863	88
80	13958	14055	14153	14253	14355	14459	97
81	14565	14672	14782	14893	15007	15123	107
82	15242	15363	15487	15613	15742	15874	121
83	16009	16148	16289	16435	16584	16737	139
84	16894	17056	17222	17394	17570	17752	162
85	17940	18135	18336	18548	18761	18986	
86	19220	19464	19719	19986	20266	20560	
87	20870	21197	21545	21915	22310	22985	
88	23193	23692	24238	24842	25517	26282	
89	27165	28210	29483	31137	33460	37431	
90	Infin.						

FINIS.



