NORWOOD'S
TRIGONOMETRIE
1685

Honble Constantine John Phipps.

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9.8935444
10.4401146
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9.9791236
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10.0993948
10.9262112

Trigonometrie:

OR, THE

DOCTRINE

OF

TRIANGLES:

Divided into two Books.

The first ſhewing the Menſuration of right lined Triangles: The ſecond of Spherical, with the Grounds and Demonſtrations thereof.

Both performed by that late and excellent Invention of *Logarithms*, after a more eaſie and compendious manner, than hath been formerly taught.

Whereunto is annexed (chiefly for the uſe of *Seamen*) A Treatiſe of the application thereof, in the three principal kinds of Sailing.

With exact Tables of the *Suns Declination*, newly calculated: and Tables of the right Aſcenſion and Declination of ſome eminent *Fixed Stars*, with the true times of the coming to the *Meridian* at Four of the Clock in the Morning, fitted for the preſent ſeaſon, and may ſerve for many years without any alteration.

S. Hayne

Alſo other neceſſary Tables uſed in NAVIGATION.

By *Richard Norwood*, Reader of the Mathematicks.

This *Eight Edition* being diligently Corrected, in divers difficult Places explained; New Tables of the Stars right aſcenſions and Declinations added, and the whole Work very much enlarged, by the Author himſelf.

LONDON, Printed by *R. W.* for *William Fiſher*, at the *Poſtern* near *Tower-Hill*, *T. Paſſenger*, at the *three Bibles* on *London*-Bridge, and *R. Smith*, at the ſign of the Bible in *Cornhill*. 1685.

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To the Right honourable, *Francis*, Earl of *Bedford*, Lord *Ruſſel*, Baron *Ruſſel* of *Thournhaughe*, Lord Lieutenant of the County of *Devon*, and City of *EXETER*.

Right Honourable,

AS it hath pleaſed the ſovereign Fountain of Light to ſhine upon the World in theſe later Times, by a more clear manifeſtation of thoſe heavenly Myſteries, that concern Eternal life and bleſſedneſs; ſo he hath alſo enlightned the minds of Men with knowledge in humane Arts and Sciences, and diſcovered many profitable Inventions unknown to former Ages. To ſpeak of all, were a ſubject deſerving of it ſelf a peculiar Treatiſe. To ſpeak of thoſe that have reference to the Mathematicks, would require a larger Diſcourſe than becomes this place. Amongſt the reſt, and of the higheſt rank, is that admirable Invention of *Logarithms*, by the famous

John Nepair, late Baron of *Marchiston*: which hath been further perfected by the labours of Mr. *Henry Briggs*. And although the maturity of this Invention was prevented in them both, by their several and most happy changes, from this life to a better: yet they proceeded so far, as to lay a very good foundation for sundry conclusions Mathematical. Upon which foundation chiefly, I have grounded this present Treatise of the *Doctrine of Plain and Spherical Triangles*; annexing an application thereof, in the three principal kinds of Sailing. And howsoever (being rudely composed) it may seem unworthy the protection of one so eminent in place, and of such ripeness and judgement in all kind of Learning: Yet I am bold to present it to your Lordship, in confidence of your favourable acceptance according to that noble respect you are accustomed to manifest towards all good endeavours. The most High God, and Lord of all things, increase and continue unto your Lordship, all his blessings, Temporal and Eternal.

Your Honours most devted,

Richard Norwood.

TO THE READER.

How necessary, and of what excellent use the Doctrine of Triangles is in Astronomy, Geography, Navigation, Fortification; and other parts of Architecture, in all the kinds of Perspective, in Dialing, and in the practice of other parts of the Mathematicks: is so much the better known unto every Man, by how much he hath been more exercised in these Arts. For which cause there hath been for many former Ages, much time and diligence bestowed by most industrious and learned Men, to reduce it to as great perfection as they could; and much hath been done to this purpose of late years. But all that hath been done these many hundred years, is not comparable to that which hath been effected in our Times by the Honourable Lord John Nepair, Baron of Marchiston; who, by an Invention of Logarithms, takes away those Difficulties that were in the practice thereof. Which Invention hath been illustrated, and much perfected, by the labours of Mr. Henry Briggs. Neither is Mr. Edward Wright to be forgotten, though his Endeavours were soonest prevented. And these were the first that communicated their labours on this Subject to the World, being Men, as of singular Piety and Integrity of Life, so of that excellent knowledge in the Mathematicks, as few Ages afford the like. Of the construction and diverse application of Logarithms, Mr. Briggs hath written a Book called Arithmetica Logarithmica. And since again, began another excellent work of like nature, entituled, Trigonometria Britannica. I have only seen (in the hands of a Friend of his) a printed Copy of so much as he had done, namely the Tables, and some part of the Treatise, touching the construction of those Tables: but whilest he was in hand with the rest, he departed this life. Wherefore having my self some years past (but especially this last Winter) bestowed more than ordinary pains in conforming the Doctrine of Triangles, to the nature of Logarithms now in use; and yet so, as the Rules might likewise be applied to natural Sines, Tangents and Secants, and also to instrumental Operations: and considering the present want of directions, and of ordinary Tables in this kind, I have thought good to publish these. If any man think it

should

ſhould be a hindrance to them who have been at the charge to print that which Mr. Briggs *hath begun to write upon this Subject, he may be pleaſed to take notice, That though we both handle the ſame thing, yet it is in ſuch a different manner, that there is ſcarce any one Propoſition handled by us both; beſides, his in Latin, mine in Engliſh: So that though his were finiſhed, according to his intent and method, the one would little or nothing prejudice the other. I rather hope, as the caſe now ſtands, that this will further the ſale of his; foraſmuch as the Rules here delivered, may very aptly be applied to his Tables, and almoſt to any other. And they are ſuch (eſpecially for Spherical Triangles) as I doubt not will be found more eaſie for memory, and more ready for practice, than thoſe that have been formerly uſed. If in ſome things you find me too brief, or otherwiſe faulty, I hope you will pardon it; ſo much the rather, becauſe all this Summer, whileſt this Work was printing, I was abſent upon neceſſary occaſions, above an Hundred miles. And to make ſome part of amends, I ſhall (God willing) be ready to give further ſatisfaction herein, by word of mouth, or otherwiſe, to thoſe that deſire it. As touching others that are bent to Detraction, and will be glad to ſnatch at every occaſion for that purpoſe; I could wiſh them of a better mind, and to remember, That it is much eaſier to find faults in another Mans Work, than without the light thereof to make the like. I have detracted no Man, but have freely attributed to them whoſe Works I have uſed, that which is due unto them; deſiring ſo to be dealt withal, as I deal by others. It may haply be expected, that I ſhould have ſhewed the application of the* Doctrine of Triangles, *in the Mathematical Arts before mentioned,* &c. *But other neceſſary occaſions withdrawing me, I had rather leave that untouched, than by making an imperfect application in every of them, heap together many titles, with little or no profit to the Reader. Yet I have been perſwaded to annex hereunto certain Problems, touching the three principal kinds of Sailing. Which, with the reſt, I commend to your friendly acceptance. Farewell.*

Tower-hill, An. 1631.
Novemb. 1.

THE

THE DOCTRINE OF PLAIN TRIANGLES.

CHAP. I.

Of the Line used in measuring Plain and Spherical Triangles.

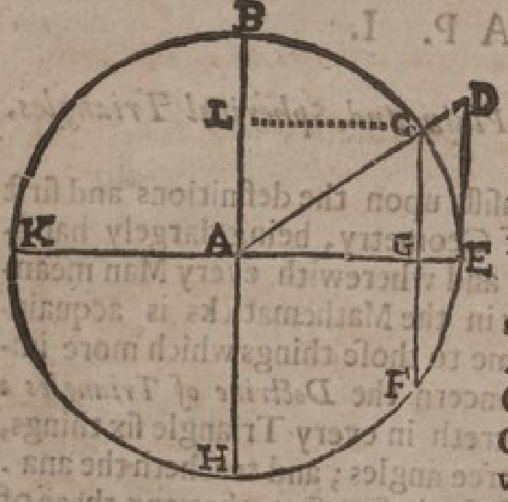
WE will not insist upon the definitions and first principles of Geometry, being largely handled by many, and wherewith every Man meanly conversant in the Mathematicks is acquainted; but come to those things which more immediately concern the *Doctrine of Triangles*: which considereth in every Triangle six things, namely, the three sides, and the three angles; and teacheth the analogy and proportionality of these six, in such sort, that any three of them being known, the other three may by the rule of proportion be discovered: But seeing the sides of a Spherical Triangle are arches of a Circle, and the angles both of plain and Spherical Triangles are measured by arches of a Circle, therefore the proportions of all these parts

parts one to another cannot be declared, unless these arches be after a sort reduced to right lines; because the proportions of arches one to another, and of an arch to a right line, is not to this day found out.

These arches of a Circle are after a sort reduced to right lines, by defining the quantity which the right lines to them applied have, in respect of Radius, or the Semidiameter of the Circle. And it is to be understood, that every arch of a Circle is measured by degrees, minutes, seconds, thirds &c. a degree being such a part of a Circle as the whole circumference, whether great or little, contains 360. A degree is measured by minutes, and every degree is supposed to contain 60 minutes. In like sort, every minute contains 60 seconds, and every second 60 thirds, &c.

And although the measure of every arch cannot be exactly expressed by these parts, yet may it be so nearly expressed, that all sensible Error in ordinary use and application shall be avoided, which is esteemed sufficient.

1. *The right lines applied to a Circle are Chords, Sines, Tangents, and Secants.*



2. *A Chord is a right line drawn in a Circle, from one part of the circumference to another.* Thus C F is the Chord of the arches C E F, and C K F, also B H the diameter, is the Chord of the semicircles B E H, and B K H.

3. *The right Sine of an arch, is half the Chord of twice that arch.* As C G being half the Chord, C F is the right Sine of the arch C E, also of the arch C B K: which arch C E is the half of C E F.

Whence first it is manifest, that the right Sine of an arch less than a Quadrant, is also the right Sine of an arch as much greater than a Quadrant: for as the arch C E is less than a Quadrant by the arch B C, so the arch C K doth as much exceed a Quadrant, C G being the right Sine to them both.

So

So that properly the sine complement of an arch is the sine of the complement of a lesser arch unto a quadrant. As the complement of the lesser arch C E, unto a quadrant, is the arch C B, the sine whereof is C L, wherefore C L is properly said to be the sine of the complement of the arch C E.

Secondly, that the right sine of any arch, is a line falling from one end of that arch perpendicularly upon the diameter drawn to the other end of that arch. As C G, is perpendicular to K E.

Thirdly, that the right sine of the Complement of an arch, is equal to that part of the diameter, which lieth between the right sine of that arch and the center. As C L, the sine of the complement of C E, is equal to A G.

4. *The versed sine of an arch, is that part of the Diameter which lyeth between the right sine of that arch, and the circumference.* Thus G E is the versed sine of the arch C E: and G K the versed sine of the arch C B K.

5. *If unto one end of an arch there be drawn a diameter, and to the other end a right line from the center cutting the circle; and if from the end of the diameter be raised a perpendicular till it concur with the line cutting the circle, that perpendicular is the tangent of that arch.* As D E is the tangent of the arch C E.

6. *The foresaid right line cutting the circle, is the secant of that arch.* Thus A D is the secant of the arch C E.

7. *Now to define or express in numbers, the quantity that these right lines have in respect of the semidiameter of the circle, is the constructions of the tables of natural sines, tangents and secants.*

Thus supposing the semidiameter of the circle A E to be 1000000 parts, and the arch C E to be 30 degrees, the right sine of that arch C G will be 500000 parts, the tangent E D 577350 parts, and the secant A D 1154701 such parts. The quantities of versed sines, and of the chords of arches, are not usually expressed in the Tables, because they are easily found by the right sines: As the versed sine of the arch C E, namely G E, is found by substracting the sine complement of C E, namely A G from the semidiameter A E: also the versed sine of the arch K B C, is found by adding the same A G, to the semidiameter A K. Also the chord of the arch C E F namely C F, is found by doubling the sine of half that arch, namely, by doubling

B CG.

CG. So that in the tables, there are only expreſſed the right Sines Tangents, and Secants of every arch of a circle not exceeding a quadrant. Which how to find is largely ſhewed by *Lansbergius*, *Petiſcus*, Mr. *Henry Briggs*, (which I have not yet read) and by others, therefore we paſs over that. And intending to ſhew the reſolution of plain and ſpherical triangles, after a more eaſie and compendious way, by Logarithms lately invented by the Honourable Lord *John Nepair*, Baron of *Marchiſton*, and ſince further perfected by the late learned Mathematician Mr. *Henry Briggs*, (both of ever worthy memory (we come in the next place to ſpeak ſomething of the nature and affections of thoſe numbers, wherein I ſhall (as occaſion requireth) follow Mr. *Briggs* in his *Arithmetica Logarithmica*.

CHAP. II.

Of the nature and affections of Logarithms.

Logarithms are numbers, ſo fitted to proportional numbers, that themſelves retain equal differences:

As let there be a rank of numbers how many ſoever in continual proportion, namely, 1. 2. 4. 8. 16. 32. 64. 128. 256. and let there be as many other numbers in any progreſſion arithmetical, as 3. 5. 7. 9. 11. 13. 15. 17. 19. then foraſmuch as theſe later are equi-different (for every one differs from his next by 2) therefore they are logarithms to the former, each to his correſpondent. As 3 being the Logarithm of 1, and 5 of 2 : 7 is the Logarithm of 4, and 9. of 8: and the like is to be underſtood of the reſt.

Numb. proport.	Log	Log	Log
1	0	3	0
2	1	5	3
4	2	7	6
8	3	9	9
16	4	11	12
32	5	13	15
64	6	15	18
128	7	17	21
256	8	19	24

So likewiſe 0. 1. 2. 3. 4. 5. 6. 7. 8. are Logarithms to the ſame numbers, and ſo are 0. 3. 6. 9. 12. 15. 18. 21. 24. And ſo infinite others

others might be found, obſerving that where numbers are in like proportion, the differences of their logarithms muſt be equal.

And as any of theſe three rows may be logarithms to the firſt, ſo they may be logarith. to any other numbers in continual proportion.

2. *If of four numbers, the firſt exceed the ſecond as much as the third exceeds the fourth: then the ſum of the firſt and fourth is equal to the ſum of the ſecond and third, and the contrary.*

As 8, 5, 6, 3, here 8 exceeds 5, as much as 6 exceeds 3, therefore the ſum of the firſt and fourth, namely, of 8 and 3 is equal to the ſum of the ſecond and third, namely, of 5 and 6. And ſo 9, 18, 15, 24, where the ſum of the extreams is 33, and ſo of the two middle ones. *Bachetus in Diophantum.*

3. *If four numbers be proportional, the Logarithm of the firſt ſubſtracted from the ſum of the Logarithms of the ſecond and third, leaves the Logarithms of the fourth.*

As if the proportion be. As 256 to 32: ſo 64 to a fourth number: here adding 5 and 6 the logarithms of the ſecond and third, the ſum is 11, from which ſubſtracting 8, the logarithm of the firſt, the remainder is 3. the logarithm of the fourth proportional 8.

Abſolute Numbers.	Lagarith.
256	8
32	5
64	6
	11
8	3

For ſeeing (by ſuppoſition) the firſt number is in proportion to the ſecond, as the third is to the fourth, therefore (by the firſt definition of this ſecond chapter) the logarithms of the firſt and ſecond differ as much as the logarithms of the third and fourth, therefore (by the ſecond propoſition) the ſum of the logarithms of the firſt and fourth, is equal to the ſum of the logarithms of the ſecond and third; therefore if from the ſum of the logarithms of the ſecond and third, be taken, the logarithm of the firſt, there remains the logarithm of the fourth.

Corollary. *Hence it is evident, that if four numbers be proportional, the ſum of the Logarithms of the firſt and fourth is equal to the ſum of the Logarithms of the ſecond and third. And if the ſum of the Logarithms of the firſt and fourth, be equal to the ſum of the Logarithms of the ſecond and third, then is the firſt in proportion to the ſecond, as the third is to the fourth.*

Let the proportion be

As	256	Logar.	8
to	32		5
ſo	64		6
to	8		3

Here the ſum of the Logarithms of the firſt and fourth, namely, 8 + 3 that is 11, is equal to the ſum of the Logarithms of the ſecond and third, namely, of 5 + 6 that is 11.

4. *If inſtead of ſubſtracting the foreſaid Logarithms of the firſt, we add his complement arithmetical to any number: the total abating that number, is as much as the remainer would have been.*

The complement arithmetical of one number to another (as here we take it:) is that, which makes that firſt number equal to the other; thus the complement arithmetical of 8 to 10 is 2, becauſe 8 and 2 are 10. And ſo the complement arith. of 9, 76144 to 20, 00000 is 10, 23856, becauſe 10, 23856 and 9,76144 added together, are 20, 00000.

Now then whereas (in the example of the third propoſition before going) ſubſtracting 8 from 11, there remained 3; if inſtead of ſubſtracting 8, we add his complement arithmetical to 10, which is 2, the total is 13, from which abating 10, there remains 3 as before, and the like is to be underſtood of any other.

The reaſon is manifeſt, for whereas we ſhould have abated 8 out of 11 we did not only not abate it, but added moreover his complement to 10, which is 2, wherefore the total is more than it ſhould be by 8 and 2, that is by 10; wherefore abating 10 from it, we have the Logarithm deſired.

Which rule although it be general, yet we ſhall ſeldom have occaſion to uſe any other complements, than ſuch as are complements of the Logarithms given, either to 10,0000000, or to 20,0000000, as ſhall hereafter appear in due place.

And thus much of Logarithms in general, whereof (as is before noted) there might be fitted divers kinds, but we intend to uſe only that kind which were framed by Mr. *Henry Briggs*, at the requeſt of the Baron of *Marchiſton*; where a cypher is made the Logarithm of Unite or 1, and an Unite with many Cyphers the Logarithm of 10, and the reſt fitted accordingly: theſe being the beſt kind, and the ground of all the beſt Tables of Logarithms hitherto put forth by any.

And of this kind are the Tables to this Book annexed, which want-

ing

ing leaſure to calculate my ſelf, I conferred together ſuch as were formerly extant, and out of them have drawn theſe. It is true, that the *firſt* of theſe differs in form from all others, but I have ordered it thus, eſteeming it moſt convenient and ready for ordinary uſe. The *later* ſheweth the Logarithms of abſolute numbers from 1 to 10000, and may be uſed for numbers far greater; the *firſt* ſheweth the Logarithms of the Sines and Tangents of every degree and minute of the Quadrant, and alſo the Complements Arithmetical of the Logarithm of every Sine, which may ſerve as a Table of Secants. Which Logarithms of abſolute numbers, Sines and Tangents, we may call Logarithmetical numbers, Sines and Tangents, or (with their firſt Inventour) Artificial Sines and Tangents, as being uſed for and inſtead of the natural. And thus if you enter the *later* of theſe Tables with any abſolute number, you find againſt it his Logarithm, if you enter the *firſt* with any number of degrees and minutes, you find againſt it his artificial Sine & Tangent, each under his proper title. As entring the Table with an arch of 30 degrees 00 minutes, I find the artificial Sine thereto anſwering to be 9, 6989700, and the tangent 9, 7614394, which are the Logarithms of the natural ſine 500000, and of the natural tangent, 577350. And contrariwiſe a Logarithm being given, you may find the arch thereto anſwering.

Of artificial ſecants we make little uſe, but if you deſire the artificial ſecant of an arch, ſubſtract the artificial ſine of the complement of that arch from twice radius, or 20, 0000000, the remainer is the ſecant required. As if I deſire the ſecant of 22 deg. 37′: I find the ſine of his complement to be 9,9652480, which ſubſtracted from 20, 0000000, there remains 10,0347520, the ſecant of 22 deg. 37′: the reaſon whereof is evident by the Corollary of the firſt Theoreme of Variety hereafter following, Chap. 4. inſtead of theſe ſecants we have ſet in the two laſt columns of the ſecond Table the complements arithmetical of the ſines, to every of which if you add radius or 10, 0000000, they become ſecants: theſe being more neceſſary than the ſecants, and by which the ſecant of any arch is moſt readily found; for if the ſine of an arch be in the firſt column, his ſecant is in the laſt, (adding as aforeſaid radius) if the ſine be in the ſecond, the ſecant is in the laſt but one. As if I would have the ſecant

of

of 22 deg. 37′, the ſine thereof is in the firſt column, therefore I look for the ſecants in the laſt, where I find 0347520, to which adding 10,0000000 or 10, it is 10, 0347520, the ſecant of 22 deg. 37′.

5. *Of the Character of Logarithms.*

The Character or Characteriſtical note of every Logarithm in theſe tables is the firſt figure or figures towards the left hand, diſtinguiſhed from the reſt by a Comma: and it ſheweth of how many places above the place of unites, the abſolute number to that logarithm belonging doth conſiſt. And thus the character of the logarithms of every number leſs than 10 is 0, but the character of the logarithm of 10 is 1, and ſo of all other numbers to 100: but the character of the logarithm of 100 is 2, and ſo of the reſt to 1000 and the character of the logarithm of 1000 is 3 and ſo of the reſt to 10000; and ſo forward. Wherefore, by the character of a logarithm you may know of how many places the abſolute number anſwering to that logarithm doth conſiſt.

6. *To find readily the complement arithmetical of a logarithm.*

The complement arithmetical of a logarithm(as it is moſt uſually taken) is the reſidue of that logarithm unto 10, 000000. As the complement arithmetical of 7, 1079054 is that which makes it up 10, 0000000: if therefore 7, 1079054 be ſubſtracted from 10. 0000000 the remainer is his complement arithmetical.

But to ſubſtract it readily, I begin (contrary to the ordinary courſe)with the firſt figure toward the left hand, and write the complement or reſidue thereof unto 9, and ſo I do with the reſt, till I come to the laſt figure towards the right hand, and thereof I ſet down the reſidue unto 10. Thus for the complement arithmetical of 7, 1079054 I write, for 7 his reſidue unto 9, which is 2; for 1, 8; for 0, 9; for 7, 2; for 9, 0; for 0, 9; for 5, 4; and for 4, 6; and ſo I have this number 2, 8920946, which is the complement arithmetical of 7, 1079054 unto 10, 0000000.

So if I deſire the complement arithmetical of 9, 9652480 unto 20, 0000000: I write for 9, 0: for 9, again 0; for 6, 3 for 5,4; for 2, 7; for 4, 5; for 8, 2; and the cypher: and ſo I have 0,0347520; and before all putting an unite it is 10,0347520, the complement arithmetical required.

The complementsar ithmetical of the artificial ſines are expreſſed in tables;and the complements arithmetical of the tangents are the tangents of their complements: as we shall further shew hereafter.

7. *To find the Logarithm of a number that hath a fraction annexed, as also of a proper fraction.*

Reduce your number that hath a fraction annexed into an improper fraction, and substract the logarithm of the denominator from the logarithm of the numerator, the remainer is the Logarithm of the whole number and fraction proposed. As if I desire the logarithm of $13\frac{1}{3}$, I reduce it into an improper fraction making it $\frac{40}{3}$ and finding the logarithm of 40 to be 1,6020600, and the logarithm of 3 to be 0, 4771212, I substract the later from the former, the remainer is, 1, 1249388, which is the logarithm of $13\frac{1}{3}$, required.

Numerator	40	1,6020900
Denominator	3.	0,4771212
	$13\frac{1}{3}$	1,1249388

The reason is, for that every fraction (whether proper or improper) signifies some part or parts of an unite, the denominator shewing into how many parts the unite is divided, and the numerator shewing how many of those parts are by that fraction signified: Wherefore, as the denominator is in proportion to the numerator, so is 1 to the value of that fraction; therefore (by the *corr.* of 3 *prop. chap.* 2.) the sum of the logarithms of the denominator and of the fraction, is equal to the sum of the logarithms of the numerator and of 1; but the logarithm of 1 being 0, the logarithm of the numerator alone, is equal to the sum of the logarithms of the denominator and of the fraction. Therefore if from the logarithm of the numerator be substracted the logarithm of the denominator, the remainer is the logarithm of the fraction. Thus in the foregoing examples.

		Logarithms.
As the Denominator	3.	0,4771212
to the Numerator	40.	1, 6020600
So is	1.	0, 0000000
to $\frac{40}{3}$: or to	$13\frac{1}{3}$.	1, 1249383

And for the same reason we may in like manner find the logarithm of a proper fraction. Where it is to be noted, that seeing the logarithm of the unite 1, is 0, and every proper fraction is less than

an

an unite; therefore the Logarithm of every proper fraction is less than 0. As if we desire the logarithm of this proper fraction $\frac{2}{3}$; I find the logarithm of its numerator 2 to be 0,3010300, and of its denominator 3 to be 0,4771213, and substracting the later from the former, there remains——0, 1760913, for the logarithm of $\frac{2}{3}$ that is 0, 1760913, less than 0: which though it may seem strange to some, yet being a thing well understood by the skilful in Arithmetick, and of no great use here, I pass it over without further explanation.

2.	0,3010300
3.	0,4771213
$\frac{2}{3}$.	0,1760913

8. *To correct any number found in these Tables by the part proportional*

I put these things here at the beginning as the fittest place for them, not that I esteem it necessary for young beginners to have them all perfectly before they pass any further; for, for ordinary occasions the numbers in the Tables may (for the most part) satisfie without correction by the part proportional; especially if in plain triangles you reduce the measures of the sides into their smallest parts: as if a side be given in paces, you may reduce it into feet or inches, (keeping within the compass of the Table:) if in poles you may reduce it into yards or feet: if in miles, you may reduce it into furlongs, poles or paces. Or, which is most easie and ready, you may reduce all measures into decimal parts, as into tenths and hundredth parts, putting behind the number given a cypher or two. As if a side of a plain triangle be 57 leagues, if we put a cypher behind, it will be 570 tenths of a league: if two cyphers it will be 5700 centesmes or hundredths of a league; and so for any other measures. And the question being wrought, the answer will come forth in the like parts, which are easily reduced again to integers with their parts.

As suppose the side of a plain triangle given be 57 leagues, and we desire to find one of the other sides to the hundredth part of a league: I put behind it two cyphers, and so it becomes 5700, and working as you shall hereafter be directed, admit there come forth for the side required 3475, then I say, that the side required is 3475 centesmes or hundredth parts of a league, that is $34\frac{75}{100}$ leagues, or 34 leagues and 75 centesmes of a league.

If there be a fraction annexed to your number given. As if you would reduce $57\frac{2}{3}$ leagues to centesmes, I put behind 57 two cyphers (that

(that is, I multiplyit by 100) and so it becomes 500: also I put behind the numerator of the Fraction, namely, behind 1, two Cyphers, and so it becomes 100, which divided by the denominator 3, the quotient is 33 (omitting the Fraction) which added to 5700, the sum is 5733: And so much is 57 $\frac{1}{3}$ leagues in centesmes of a league. If you would have it only in tenths, you put behind the whole number, and likewise behind the numerator of the Fraction, only one Cypher, and in all things else do as before: which being easie and common, I forbear to be large therein.

But when more exactness is required, you may attain to it by the part proportional, after the form of these examples following.

Example 1.

Let there be required the absolute number answering to this Logarithm 1, 9369826. Looking for this Logarithm in the Chiliads, I find not the same, but the nearest less than it is, 1,9344984, against which I find 86, which you may correct by the part proportional, thus. I change the Character given, making it to be 3, and so it becomes 3,9369826, for this I look in the Chiliads, but not finding the same, I find the nearest less than it to be 3,9369659, and against it this absolute number 8649; whence it appears, that the number answering to the Logarithm proposed, is 86$\frac{49}{100}$; and something more.

But if you desire more exactness, as to correct it two places further; substract 3,9369659, the nearest lesser Logarithm from 3,9370161, the nearest greater, noting the difference which is here 502: Also substract the lesser 3,9369659, out of the Logarithm given 3,9369826, noting the difference which is here 167. Then say by the Rule of proportion,

$$\left.\begin{array}{l}3.9369826\\3.9369659\end{array}\right\}\textit{differ.}\ 167 \qquad \left.\begin{array}{l}3.9369659\\3.9370161\end{array}\right\}\textit{differ.}\ 502$$

As the greater difference 502, is to the lesser 176:

So is 100 to 33 (and somewhat more, which we omit) which put behind 8649 towards the right hand, shews the number required to be 86$\frac{4933}{10000}$, and so is it verified to 6 places.

Example 2.

Let there be required the absolute number answering to this Logarithm 5,9369826.

Because the Character or Characteristick is here 5, therefore the

 absolute

abſolute number anſwering to this Logarithm, muſt conſiſt of ſix places: whereas the abſolute numbers in theſe *Chiliads*, conſiſt but of four places: therefore changing the Character to 3, I look for 3,9369826, and find the neareſt in the Table leſs than it to be 3,9369659, differing from it 167, and againſt it I find the abſolute number 8649, which I note: and the neareſt greater than the Logarithm given is 3,9370161, differing from his next before found 502; therefore, I ſay, by the Rule of proportion,

3,9369826 } *differ.* 167
3,9369659 }
3,9370161 } *differ.* 502

As the greater difference 502, is to the leſſer 167:

So is 100 to 33, which put behind 8649 towards the right hand, ſhews the number anſwering to the Logarithm given to be 864933: and ſo may you find any number not exceeding ſix places, anſwering to any Logarithm propoſed.

If in either of theſe Examples you deſire it but to five places, then for the third Number in the Rule of proportion (which is here 100) put 10, and ſo the Quotient will come out in one Figure, which put towards the right hand as before.

Example 3.

Let it be required to find the Logarithm anſwering to this abſolute Number 864933.

I find in the *Chiliads* the Logarithm of the firſt four Figures 8649, to be 3,936659, and becauſe the Number given conſiſts of 6 places, the Characteriſtick muſt be 5, therefore 5,9369659, is the Logarithm of 864900. But to find the part proportional to be added to this Logarithm for the 33 remaining: I ſubſtract the Logarithm of 8649, from the Logarithm 8650, and find the difference to be 502: therefore, I ſay, by the Rule of proportion,

As 100 is in proportion to 33:

So is the difference 502 to 166 *ferè*.

Which 166 added to 5,9369659, the ſum is 5.9369825, the Logarithm of the abſolute Number 864933 required: if the abſolute Number conſiſt but of 5 places; then for the firſt Number in the Rule of proportion (which here is 100) put 10, and proceed as before.

And although in theſe three Examples, we have verified but to the ſixth place of the abſolute Number; yet might we by theſe Tables proceed

Proceed to the ſeventh place, ſeldom erring one whole Unite ; the operation is after the ſame manner, ſave only inſtead of 100 uſed in the Rule of proportion, we put 1000.

And thus much touching the part proportional in the uſe of the firſt Table of Chiliads. Now for the ſecond Table of Artificial Sines and Tangents.

Example 4.

Let there be required the arch anſwering to this Artificial Tangent 9, 6197888.

Looking in the Column of Tangents, I find not exactly the ſame, but the neareſt leſs than it is 9, 6197205, being the Tangent of 22 deg. 37′: therefore the arch required is 22 deg. 37′, and ſome part of a minute more. Now if you deſire to know what part of a minute, namely, how many ſeconds it is more, we may find it thus, I find the next greater than the Tangent given to be 9,6200762, from which ſubſtracting the next leſſer, namely, 9,6197205, the difference is 3557, alſo ſubſtracting this leaſt from the Tangent given 9,6197888 the difference is 683 : I ſay therefore, by the Rule of proportion,

$$\left.\begin{matrix}9,6197888\\9,6197205\end{matrix}\right\}\textit{differ.}\,683$$

$$\left.\begin{matrix}9,6197205\\9,6200762\end{matrix}\right\}\textit{diff.}\,3557$$

As the greater difference 3557, to the leſſer 683 :

So is 60 ſeconds, to 11 ſeconds and ſomething more.

Therefore the arch required, anſwering to this Tangent given 9,6198888, is 22 deg. 37′, 11″ and ſome part of a ſecond more ; but thus it is verified to a ſecond.

And in like ſort you may deal with any other, whether it be Sine or Tangent.

Example 5.

Let there be required the artificial Tangent for this arch 22 deg. 37′, 11″. I find in the table the Tangent 22 deg. 37′ to be 9,6197205, and the Tangent of 22 deg. 38′ to be 9, 6200762, the difference of theſe two is 3557, for one minute, or 60 ſeconds : therefore by the Rule of proportion,

As 60 ſeconds to 11 ſeconds : ſo the difference 3557, to 652 ; which added to the leſſer 9, 6197205, the ſum is 9,6197857, the artificial Tangent of 22 deg. 37′. 11″. And in like ſort you may find the artifical Sines or Tangents of other arches conſiſting of degrees, minutes, and ſeconds.

The general Rule and reaſon for all theſe Examples, may briefly be this.

As the difference of any two next Logarithms in the Tables is to any part of that difference,

So is the difference of the two numbers to which they belong, to the proportional part of that difference; and the contrary.

But becauſe this holds truer in the latter part of the Chiliads where the numbers are great, than in the former; therefore we have ſhewed in the Examples (as occaſion requires) how to bring the numbers propoſed to the latter part of the Chiliads. And thus much touching the part proportional.

9. *If one number multiply another, the Sum of their Logarithms is equal to the Logarithm of their product.*

As let the two numbers multiplyed together be 36 and 15, the product is 540. I ſay then, that the ſum of the Logarithms of 36 and 15, is equal to the Logarithm of 540, as here you may ſee.

36.	1. 5563025
15.	1. 1760913
540.	2. 7323938

The Reaſon is, for that (by the ground of Multiplication) As a Unite is in proportion to the Multiplier; ſo is the Multiplicand, to the product: therefore (by the *Coroll.* of the 3 *Prop. Chap.* 2.) the ſum of the Logarithms of Unite and of the Product, is equal to the ſum of the Logarithms of the Multiplier and Multiplicand: but the Logarithm of Unite is 0; therefore the Logarithm of the Product alone, is equal to the ſum of the Logarithms of the Multiplier and Multiplicand.

And by the like Reaſon, if three or more numbers be multiplied together, the ſum of all their Logarithms is equal to the Logarithm of the Product of them all.

Corollary. *Whence it is manifeſt, That the Logarithm of a number doubled, is the Logarithm of the ſquare of that number: and the Logarithm of a number trebled is the Logarithm of the Cube of the ſame number, &c.*

Thus the Logarithm of 4 being doubled, is the Logarithm of 16, which is the ſquare of 4; and being trebled, it is the Logarithm of 64, which is the Cube of 4; as is here to be ſeen.

	Logarithms.
4.	0.6020600
16.	1.2041200
64.	1.8061800

10. If

10. *If one number divide another, the Logarithm of the Divisor substracted from the Logarithm of the Dividend, leaves the Logarithm of the Quotient.*

As let 540 be divided by 36, the quotient will be 15. I say then, if the Logarithm of 36, be substracted from the Logarithm of 540, there will remain the Logarithm of 15, as is here to be seen.

Logarithms.	
540.	2.7323938
36.	1.5563025
15.	1.1760913

For seeing the Quotient multiplied by the Divisor produceth the Dividend, therefore by the last Prop. the sum of the Logarithms of the Quotient, and of the Divisor, is equal to the Logarithm of the Dividend: if therefore from the Logarithm of the Dividend, be substracted the Logarithm of the Divisor, there remains the Logarithm of the Quotient.

And by the like Reason, if the first Quotient be divided by a second Divisor, and the second Quotient by a third Divisor, *&c.* the sum of the Logarithms of all the Divisors, substracted from the Logarithm of the first Dividend, leaves the Logarithm of the last Quotient.

As if 540 be divided by 36, the Quotient is 15, which again divided by 5, the Quotient is 3: I say then, that if the sum of the Logarithms of the Divisors 36 and 5, be substracted from the Logarithm of the Dividend 540, there will remain the Logarithm of the last Quotient 3.

Corol. *Hence it is manifest, that the half of the Logarithm of any number, is the Logarithm of the square root of that number; and that the third part of the Logarithm of any number, is the Logarithm of the cubique root of the same number.*

Thus half the Logarithm of 64, is the Logarithm of 8, which is the square root of 64: and the third part of the Logarithm of 64, is the Logarithm of 4, which is the cubique Root of 64, as by this Example may be seen.

Logarithms.	
64.	1.8061800
8.	0.9030900
4.	0.6020600

And thus much for a taste of the nature and affections of Logarithms, sufficing for our present occasion: he that desires to be further acquainted with the construction and diverse applications of them, may read Mr. *Briggs* in his *Arithmetica Logarithmica.*

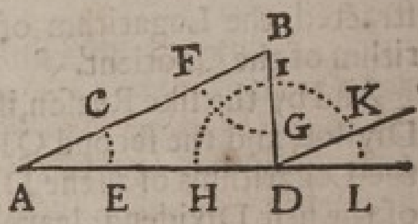
CHAP.

CHAP. III.

Of the Four fundamental Axioms of the Doctrine of Plain Triangles, *and of the Cases deduced from them.*

LEMMA.

The Three Angles of a Right-lined Triangle, are equal to two right Angles : Euclid, Lib. 1. Prop. 32.



THe Angles of a Triangle are measured (as we have said) by arches of a circle, the arch being described on an angular point as on a center : thus the Arch CE is the measure of the Angle at A; so that look how many degrees, minutes, seconds, *&c.* are in the arch CE, so much is the measure of the Angle at A. In like sort, the arch FG is the measure of the Angle at B, and IH the measure of the Angle BDA : and these three arches CE, FG, and IH, are 180 degrees, which is the measure of two right Angles (90 degrees being the measure of one right Angle) for these thee arches CE, FG, and IH, are equal to the semicircle HIKL: FG being equal to IK, and CE, to KL.

If therefore a Triangle be right angled, one of its acute Angles, is the complement of the other to 90 degrees.

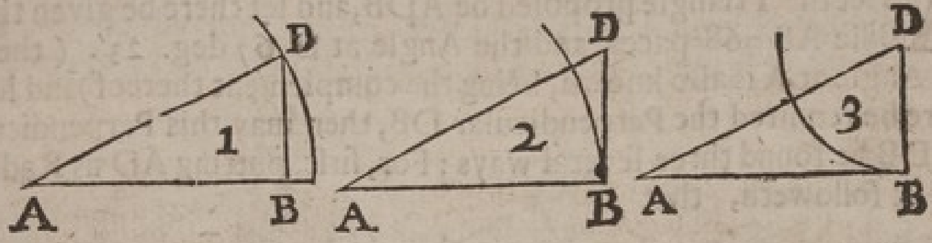
If it be an oblique angled Triangle, yet one of his Angles substracted from two right Angles (that is, from 180 degrees) the remainer is the sum of the other two; or if the sum of two of its Angles be substracted from 180 degrees, the remainer is the third Angle.

AXIOM

AXIOM I.

Of right angled Triangles.

In a plain right angled Triangle, any of the three sides may be put as Radius: and the other sides will be as Sines, Tangents or Secants.



AS if AD be Radius, or the semidiameter of the circle, or the whole Sine (for by these several names it is called) then BD is the Sine of the Angle at A, and AB the Sine of the Angle at D.

If AB be Radius (as in the second Figure) then BD is the Tangent, and AD the Secant of the Angle at A.

If DB be Radius (as in the third Figure) then AB is the Tangent, and AD the Secant of the Angle at D.

And what proportion the side put as Radius, hath unto Radius: the same proportion have the other sides, unto the Sines, Tangents, or Secants by them represented.

As in the third Figure, look what proportion DB hath unto Radius: the same proportion hath AB, to the Tangent of the Angle at D, and the same hath AD to the Secant of that Angle: and the like is to be understood of the rest.

And from this ground are deduced the Corollaries or Cases following, for the resolution of plain right angled Triangles, by three things known several wayes.

And for distinction sake, we call the side subtending the right Angle, the Hypothenusal: and one of the sides containing the right Angle, we call the Base, and the other side the Perpendicular. As in these Triangles, the Hypothenusal is marked with AD, the Base with AB, and the perpendicular with DB: and it will not be amiss to mark them always so. The right Angle is always one of the three things given.

In

In the Examples, *s* ſtands for *ſine*: *t* for *tangent*: *ſc.* for *ſine complement*: *tc.* for *tangent complement*: *ſec.* for *ſecant.*

CASE 1.

The Angles and Baſe given, to find the Perpendicular.

As let the Triangle propoſed be ADB, and let there be given the Baſe AB 768 paces, and the Angle at D 67 deg. 23′. (then the Angle at A is alſo known, being the complement thereof) and let there be required the Perpendicular DB, then may this Perpendicular DB be found three ſeveral ways: For, firſt, putting AD as Radius, it followeth, that

As Sine the Angle at the Perpendicular	*s*. D 67 deg. 23′	9.9652480
is in proportion to the Baſe:	AB 768 paces	2.8853612
ſo is Sine the Angle at the Baſe,	*s*. A 22-37.	9.5849685
		12.4703297
In proportion to the Perpendicular,	DB 320 paces,	2.5050817

Here (according to the 3 *Prop. Ch.* 2.) I add the Logarithms of the ſecond and third, and from that ſum ſubſtract the Logarithm of the firſt, and the remainer, which is 2,5050817 is the Logarithm of the fourth: Wherefore looking in the Table for the abſolute number anſwering thereto, I find the neareſt to be 320, which is the fourth number required. It is ſomething more than 320, but for brevity, and the eaſe of the Learner, I omit the Fraction, having before ſhewed how to find it: And if (according to the *Corol.* of 3 *Prop. Cap* 2.) inſtead of ſubſtracting the Logarithm of the firſt, I add his complement Arithmetical, that total abating Radius is alſo 2,5050817 as before, And the work ſtands in this manner.

s, D 67 deg. 23′ *comp.ar.*	0.0347520
AB 768 paces.	2.8853612
s, A 22-37	9.5849685
DB 320 paces	2.5050817

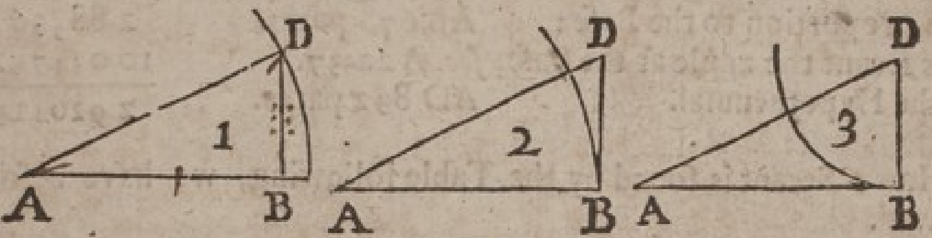
Thus having ſufficiently explained the operation in this firſt Example, we ſhall be briefer in the reſt that follow, underſtanding the like in them alſo.

2. If

2. If we make A B *Radius, the proportion holds thus.*

As Radius,	*rad. ſ.* 90 deg. *co. ar.*	
to the baſe :	AB 768 paces.	2.8853612
ſo tang. the angle at the baſe	*t* A 22-37.	9.6197205
to the perpendicular :	DB 320 paces.	2.5050817

Here becauſe the compl. arith. of Radius (which is in the firſt place) is 0, therefore I ſet down in the firſt place only Cyphers or nothing.



3. If we make DB *Radius, then*

As tang. the angle at the perpen.	*t* D 67 deg. 23′ *co. ar.*	9.6197205
is to the baſe :	AB 768 paces.	2.8853612
ſo is Radius	*s* 90-00	10.
to the perpendicular.	DB 320 paces.	2.5050817

Becauſe the Arithmetical complement of a tangent to twice Radius or 20.0000000. *is the tangent of his complement (as hereafter ſhall be ſhewed) therefore in the former Example we have put for the complement Arithmetical of tang.* D. *his tangent complement, and ſo abate twice Radius : and the like you may always do when you have a tangent in the firſt place.*

CASE 2.

The Angles and Baſe given, to find the Hypothenuſal.

LEt there be given AB 768 paces, and the angle D 67 deg. 23′, and let there be required the Hypothenuſal AD.

1. *Making* AD *Radius.*

As ſine the angle at the perpen.	*s*D 67 deg. 23′ *co. ar.*	0.0347520
is in proportion to the Baſe :	AB 768 paces.	2.8853612
ſo is Radius,	*s* 90-00	10.
to the Hypothenuſal.	AD 832 paces.	2.9201132

almoſt 832 paces.

2. *Making* AB *Radius.*

As Radius,	*s* 90 deg. 00′, *co. ar.*	0.
is in proportion to the Baſe :	AB 678 paces.	2.8853612
ſo is ſecant the angle at the Baſe,	*ſec.* A 22-37.	10.0347520
to the Hypothenuſal.	AD 832 paces.	2.9201132

How a Secant is found by the Table following, we have before ſhewed.

3. *Making* DB *Radius.*

As tang. the angle at the perpen.	*t* D 67 deg. 23′ *c. a.*	9.6197205
is in proportion to the Baſe :	AB 768 paces.	2.8853612
ſo is the ſecant of the ſame angle,	*ſec.* D 67-23	10.4150315
to the Hypothenuſal.	AD 832 paces.	2.9201132

CASE 3.

The Angles with the Hypothenuſal given, to find the Baſe.

Dat. AD 832 *paces,* D 67 *deg.* 23′. *Required* AB.

1. *Making* AD *Radius*

As Radius,	*s* 90 deg. 00′. *co. ar.*	0.
to the Hypothenuſal :	AD 832 paces.	2.9201233
ſo ſine the angle at the perpen.	*s* D 67-23,	9.9652480
to the Baſe.	AB 768 paces.	2.8853713

2. *Making* A B *Radius.*

As the ſecant of the angle A, is unto the Hypothenuſal AD : ſo is Radius to the Baſe AB.

3. *Making*

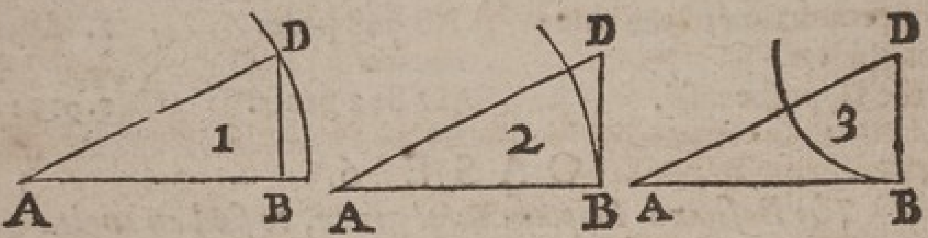
3. *Making* DB *Radius.*

As the ſecant of the angle D, is unto the Hypothenuſal AD: ſo is the tangent of the angle D, to the baſe AB.

CASE. 4

The Baſe and Perpendicular given, to find an Angle.

Dat. AB 768 *paces,* DB 320 *paces. Required* A *or* D.



1. *Making* AB *Radius.*

As the baſe,	AB 768 paces *co. ar.*	7.1146388
is in proportion to Radius:	*s* 90 deg. 00′.	10.
ſo is the perpendicular,	DB 320 paces.	2.5051500
to tang. the angle at the baſe.	*t* A 22-37.	9.6197888

2 *Making* DB *Radius.*

As the perpendicular,	DB 320 paces. *co. ar.*	7.4948500
is in proportion to Radius:	*s* 90 deg. 00′.	10.
ſo is the baſe,	AB 768 paces.	2.8853612
to tang. the angle at the perp.	*t* D 67-23.	10.3802112

And thus are theſe angles found with leſs than a minute error, he that deſires exactneſs, may uſe the ways we have before ſhewed, Cap. 2. Prop.8. *It ſhall ſuffice in the Examples of this Book, to ſet down the meaſure of arches and angles in degrees and minutes: as well for brevity, as not to burthen young Beginners with all things at the firſt.*

CASE 5.

The Base and Perpendicular given, to find the Hypothenusal.

Dat. AB 768 *paces*, DB 320. *Required* AD.

First, by the fourth Case.

As the perpendicular,	DB 320 paces. *co. ar.*	7.4948500
is in proportion to Radius:	*s* 90-00	
so is the base,	AB 768 paces.	2.8853612
to tang. the angle at the perp.	*t* D 67 deg. 23′	10.3802112

Secondly, by the second Case.

As sine the angle at the perpen.	*s* D 67 deg. 23′. *co. ar.*	0.0347520
is in proportion to the base:	AB 768 paces	2.8853612
so is Radius,	*s* 90-00	
to the Hypothenusal.	AD 832 paces.	2.9201132

CASE 6.

The Base and Hypothenusal given, to find an angle.

Dat. AB 768 *paces*, AD 832 *paces*, *required* D.

1 *Making* AD *Radius*.

As the Hypothenusal	AD 832 pac. *co. ar.*	7.0798767
is in proportion to Radius:	*s* 90 00′	
so is base,	AB 768 paces.	2.8853612
to sine the angle at the perpen.	*s* D 67 deg. 23′	9.9652379

2 *Making* AB *Radius*.

As the base AB, is in proportion to Radius:
so is the Hypothenusal AD, to the secant of the angle at the base A.

CASE 7.

The Base and Hypothenusal given to find the perpendicular.

Dat. AB 768 *paces*, AD 832 *paces*, *required* DB.

First, by the sixth Case.

As the Hypothenusal	AD 832 pac. *co. ar.*	7.0798767
is in proportion to Radius:	*s* 90-00′	
so is the base,	AB 768 paces.	2.8853612
to sine the angle at the perpen.	*s* D 67 deg. 23′.	9.9652379

Secondly

Secondly, by the first Case.

As Radius	s 90 deg. 00' co. ar.	0.
is in proportion to the base :	AB 768 paces.	2.8853612
so is tang. the angle at the base,	t A 22-37	9.6197205
to the perpendicular	DB 320 paces.	2.5050817

Mr. *Briggs* in his *Arithmetica Logarithmica* C. 19. but in the second edit. C. 17. resolves this Case more readily thus.

Take the Logarithms of the sum and difference of the Hypothenusal and side given, half the sum of those two Logarithms, is the Logarighm of the perpendicular or side required.

As, let

			Logarithm.
the side given be 768	the summ 1600		3.2041200
the Hypothenusal 832	difference 64		1.8061800
		sum	5.0103000
the side require 320		½ sum	2.5051500

The difference between this Logarithm here found, and that which was found by the former operation, ariseth chiefly by neglecting certain seconds in the angle D, and consequently in the angle A; for the angle A is indeed 22 deg. 37' 11", and somewhat more.

And thus may right angled Triangles be distinguished into 7 Cases, though the resolution of all these Cases depends upon one Rule, which is the Axiom before put.

The three Axioms following are true in all plain Triangles, but are chiefly intended for the oblique angled; which now we come to handle.

AXIOM

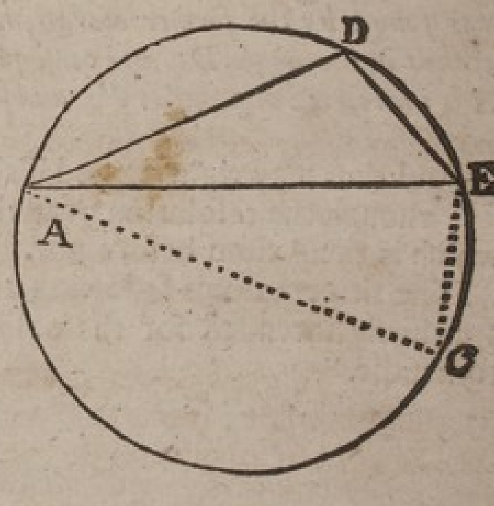
AXIOME II.

In all plain Triangles, the ſides are in ſuch proportion one to another, as are the ſines of their oppoſite angles.

AS in the Triangle ADE. *As the ſide* AD *is in proportion to* ED *ſo is the ſine of the angle at* E, *to the ſine of the angle at* A. *And ſo of the reſt.*

Conſt. *About the Triangle* ADE, *deſcribe the Circle* ADEC, *by* 5. 4 Euclid.

Demonſt. *Then are the ſides of the Triangle* ADE, *as ſubtendents or chords in the Circle* ADEC. *So that as the chord of the arch* AD *is in proportion to the chord of the arch* ED; *ſo is the ſide of the Triangle* AD, *to the ſide* ED; (*and the like is to be underſtood of* AE) *But the half chords are ſines of half the arches ſubtended by thoſe chords; and as the whole is to the whole, ſo is the half to the half: Therefore as the ſine of half the arch* AD, *is in proportion to the ſine of half the arch* ED: *ſo is the ſide* AD, *to the ſide* ED. *But half the arch* AD, *is the meaſure of the angle at* E; *and half the arch* ED *is the meaſure of the angle at* A (*by* 20. 3. Euclid. *therefore as the ſine of the Angle at* E, *is in proportion to the ſine of the angle at* A; *ſo is the ſide* AD *to the ſide* ED. *And the like is to be underſtood of the ſide* AE, *and his oppoſite angle at* D. *Therefore in all plain Triangles*, &c. *which was to be proved.*

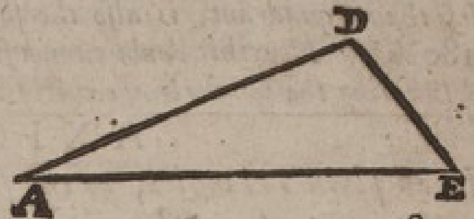


And ſeeing as the ſine of E *to the ſine of* A: *ſo is* AD *to* ED, *therefore alſo alternately* (*by* 16. 5. Euclid.) *As the ſine of the angle at* E, *is in proportion to* AD; *ſo is the ſine of the angle at* A *to the ſide* ED, *&c.* Therefore,

CASE

CASE 8.

The angles of a Triangle, with one of the ſides being given, to find any of the other two ſides.



LEt there be given the angle at A, 22 degrees 37′. and the angle at E 53 degrees 08′. and the ſide AD 780 paces.

And let there be required the ſide ED. Then by this Axiom

As the ſine of an angle,	sE 53 deg. 08′. *co ar.*	0.0968917
is to his oppoſite ſide given:	AD 780 paces.	2.8920946
ſo is the ſine of another angle,	sA 22-37	9.5849685
to his oppoſite ſide required.	ED 375 paces *ferè.*	2.5739548

Here it is not full 375 *paces, but wants about four inches, but* 375 *is the number in the Table neareſt agreeing to the Logarithm* 2.5739548 *without a fraction, and I would not trouble Beginners with fractions at firſt, having ſpoken ſufficiently of them,* Cap. 2. Sect. 7, *and* 8.

CASE 9.

Two ſides being given, with an angle oppoſite to one of them: to find an angle oppoſite to the other of them.

Dat. AD 780, *ED* 375, *the angle at E* 53 deg. 08′.

Required the angle at A.

As one of the ſides given,	AD 780 par. *c. a.*	7.1079054
to the ſine of his oppoſite ang. given,	sE 53 deg. 08′.	9.9031083
ſo is the other ſide given,	ED 375 parts.	2.5740313
to the ſine of his oppoſite angle req.	sA 22 deg. 37.	9.5850450

In the uſe of this laſt Caſe, the angle oppoſite to the greateſt ſide being required, it will be ſometimes doubtful whether it be acute or obtuſe; for in the Triangle ADE, in the ſcheme of the ſecond Axiom.

As ED 375 *parts, to* s A 22 deg. 37′.

So AE 945 *parts, to* s D 104 deg. 15′.

And

And in the Triangle AEC.

As EC 375 *parts, to* s EAC, 22 deg. 37′
so AE 945 *parts, to* s C, 75 deg. 45′

In either of which the operation is one and the same, and the sine found all one, though the angle in the one exceed a quadrant by 14 *deg.* 15′, *and in the other comes as much short: Because every sine of an arch less than a quadrant, is also the sine of the complement of that arch to* 180 *deg. Now this doubt cannot sometimes be otherwise cleared, but by delineating the Triangle as exactly as you can.*

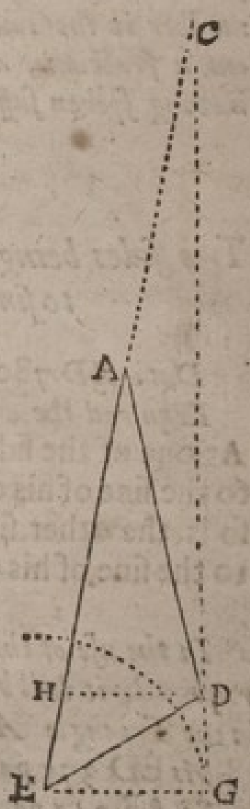
AXIOM III.

In all plain Triangles, as the sum of two sides, is to their difference: so is the tangent of the half sum of their two opposite angles, to the tangent of the difference of either of them, above or under the half sum.

Let ADE *be an oblique Triangle,*

Const. *Make* AC and AH *each equal to* AD, *and draw* DH, *and parallel thereto draw* EG; *and draw a line from* C *to* D, *extending it to* G.

Demonst. *And forasmuch as* AH *is equal to* AD. *therefore (by* 5.1.Euclid. *the angle* AHD *is equal to* ADH, *and by the like reason the angle* ACD, *is equal to* ADC, *therefore the whole angle* HDC *is equal to both these angles* CHD *and* HCD; *therefore (by the* corr. 31. 3. Euclid. *) the angle* HDC *is a right angle. And forasmuch as* EG *is parallel to* HD, *therefore (by* 29. 1. Euclid.*) the angle* EGC *is also a right angle: for it is equal to* HDC, *and (by the same) the angle* CEG *is equal to* CHD, *and* EDH *to* DEG. *But (by* 32. 1.Euclid.*) the outward angle* AHD *is equal to the two inward angles* HED *and* EDH, *but* ADH *common to both; then these two angles* AHD *and* ADH, *are equal to these two* AED *and* ADE; *therefore either of these two angles* AHD *and* ADH *is half the sum of those two angles* AED *and* ADE, *therefore also the angle* CEG *is half the sum of the same angles* AED *and* ADE.



Now

Now if to one of the sides of a triangle there be drawn a parallel, it divides the other sides proportionally (by 2. 6. Euclid.) *therefore as* CH *is in proportion to* HE, *so is* CD *to* DG: *therefore also composed (by* 18. 5. Euclid.) *As* CE *to* HE, *so is* CG *to* DG: *that is,*

As CE *the sum of the sides* AE *and* AD,
is in proportion to HE *their difference:*
so is CG *the tangent of half the sum of the angles* AED *and* ADE,
to DG *the tangent of the angle* DEG, *being that which the angle* AED *comes short of the half sum: as* HDE *is the excess of the angle* ADE, *above the half sum.*

Therefore in all plain triangles, as the sum of two sides, is to their difference; so, &c. *which was to be proved.*

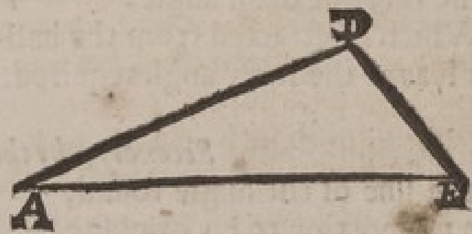
Therefore in any plain oblique triangle:

CASE 10.

Two sides, with their contained angle being given: to find the other angles.

Dat. { AE 189 *pac.* } *sum* 345; AD 156 *pac.* } *differ.* 33; A 22 deg. 37′.

Requ. D or E; *which together are* 157 deg. 23′, *being the complement of the angle* A *to* 180 deg. 00′, *by the first Lemma.*



As the sum of the sides given; (AE+AD) 345 parts.	*c.a.*		7.4621810
is in propor. to their difference (AE—AD) 33			1.5185139
so is the tang. of the half sum of their two opposite angles;	*t* ½(E+D)	78 deg. 41′½	10. 6990331
to the tangent of an angle	*t* F	25—33½	9.6797280
Which added to the half sum, makes the greater of the angles required.	D	104—15	
Or substracted leaves the lesser	E	53—08	

Here (AE+AD) signifies AE more AD, or the sum of them added together (AE—AD) AE less AD, or the remainder of AE when AD is substracted: $t\,\frac{1}{2}$ E+D the tangent of half the sum of the angles E and D.

The angle found, we mark with F only for distinction sake; and the like is to be understood when we meet with the like notes.

CASE 11.

Two sides and their contained angle given: to find the third side.

Dat. AE 189 *paces*: AD 156 *paces*: A 22 *deg.* 37′.
Req. ED.

First, by the tenth Case.

As the sum of the sides given;	(AE+AD) 345 par. *c.a.*		7.4621810
is in proportion to their difference:	(E—AD) 33 parts.		1.5185139
so is the tangent of the half sum of their two opposite angles:	$t\,\frac{1}{2}$ E+D)	78. de. 41 $\frac{1}{2}$	10.6990331
to the tangent of an angle:	t F	25—33 $\frac{1}{2}$	9.6797280
Which substracted from the half sum leaves the lesser angl. required.	E	53—08	

Secondly, by the eighth Case.

As the sine of the angle found,	sE 53 deg. 08′ *c.a.*	0.0968917
is in proportion to his opposite side:	AD 156 paces	2.1931246
so is the sine of the angle given;	s A 22 37	9.5849685
to this opposite side required.	ED 75 paces	1.8749848

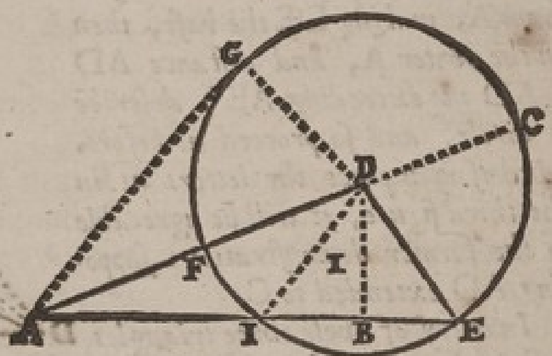
AXIOM

AXIOM IV.

In oblique Triangles, as the true baſe is in proportion to the ſum of the ſides: ſo is the difference of the ſides, to the alternate baſe.

As in the oblique Triangle ADE.

Caſe 1.



Admit AE *to be the true baſe*, Conſt. *Upon the point* D, *and diſtance* DE, (DE *not exceeding* DA) *deſcribe the circle* IEFG; *and producing* AD *to* C, *let fall the perpendicular* DB, *and draw the touch line* AG. *Then* DC *and* DF, *being each of them equal to* DE; AC *is the ſum, and* AF *the difference of the ſides* DE *and* DA; *and* AE *is the true baſe, and* AI *the alternate baſe.*

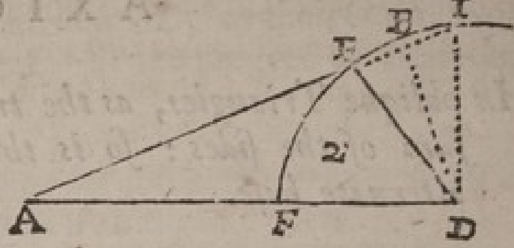
I ſay then, as the true baſe AE, *is to the ſum of the ſides* AC.
So is the difference of the ſides AF, *to the alternate baſe* AI.

Demonſt. *For ſeeing that from a point without the circle* A, *there is drawn the line* AC *cutting the circle, and the line* AG *touching the circle, therefore* (*by* 36. Prop. 3. Euclid.) *the rectangle figure of* AC *and* AF, *is equal to the ſquare of* AG: *and by the like reaſon, the rectangle of* AE, *and* AI, *is equal to the ſquare of* AG. *Therefore the rectangle of* AC *and* AF, *is equal to the rectangle of* AI *and* AE. *But equal rectangles have their ſides reciprocally proportional* (*by* 14 Prop. 6. Euclid.) *Therefore as* AE *is in proportion to* AC, *ſo is* AF *to* AI. *Which was to be proved.*

And this Caſe might ſuffice, there are two others, which are as followeth.

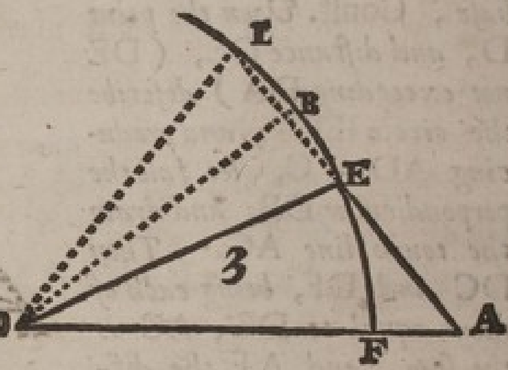
Case 2.

The like demonstration serves for the other two cases in this Axiom, namely, if we let fall the perpendicular from E, *making* AD *the base. For then upon the center* E *and distance* ED. (ED *not exceeding* EA) *describe the circle, &c. proceeding as before: and if you place the letters as in this second figure, it will be agreeable to the words of the former demonstration: supposing* AD *extended to* C.



Case 3.

Or if the perpendicular be let fall from A, *making* DE *the base, then on the center* A, *and distance* AD (AD *not exceeding* AE) *describe a circle, and so proceed as before. And if you place the letters as in the third figure, it will be agreeable to the former demonstration: supposing* AD *extended to* C.



In every of these three triangles, AE *is the true base, and* AI *is the alternate base.*

CASE 12.

Three sides of an oblique triangle being given: to find an angle

Dat. AE 189 *paces,* AD 156 *paces,* ED 75 *paces. Required* A. } In the first triangle.

First, (by this fourth Axiom) I resolve it into two right angled triangles, thus.

As the true base,	AE 189 pac. *co. ar.*	7.7235382
is to the sum of the sides	(AD+ED) 231 pac.	2.3636120
so is the difference of the sides	(AD—ED) 81 pac.	1.9084850
to the alternate base	AI 99 pac.	1.9956352

Having thus the true and alternate base, substract the lesser from the greater, and in the middle of the remainer falls the perpendicular: (by (by 3 *Prop.* 3. *Euclid.*) resolving the oblique triangle into two right angled triangles, in either of which the hypothenusal and base is known.

As the difference of the true and alternate base being 90 *paces, the half is EB* 45 *paces* (serving to find the angle at *E*) *being the base in the right angled triangle EBD.*

Which half here substracted from the true base AE 189 *paces, leaves the base in the other right angled triangle ABD, namely, AB* 144 *paces*; serving to find the angle at A.

Then in the right angled triangle *ADB*, having the base *AB* 144 *paces*, and the hypothenusal *AD* 156 *paces*; we may find the angle at *A* (by the 6 Case before going) thus.

As the hypothenusal,	AD 156 parts,	*co. ar.*	7.8068754
is in proportion to Radius:	*s* 90 deg. 00′.		
so is the base found,	AB 144 parts.		2.1583625
to the sine of the complement of the angle at the base.	*sc.* A 67 23		9.9652375

the complement whereof 22 deg. 37′ is the angle at A required.

In like manner might be found the angle at E.

In setting down this fourth Axiom, I have followed the Lord *Nepair*: *Pitiscus* and others have it thus.

As the greatest side is to the sum of the other two sides; so is the difference of these two, to a part of the greatest: which taken from the greatest, the perpendicular falls in the middle of the remainer.

As in the first figure before going; as the greatest side AE, is to the sum of the other sides AD and ED (that is AC:) so is the difference of those sides AF, to a part of the greatest AI: which taken from the greatest, the remainer is IE, in the middle whereof at B, falls the perpendicular.

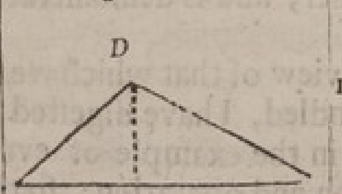
Which differs little from the former, and is demonstrated in the same manner.

Now that you may at once have a view of that which we have before in this Chapter more largely handled, I have digested into this Table the things given and required in the example of every Case, expressing also briefly their proportion and operation; so that hereby you may be sufficiently directed for the resolution of plain triangles. Though I would rather advise every man to commit to memory the four Axioms before going, and to ground his practice thereon.

An

An Exemplary Table of Plain Triangles.

		Case	Dat.	Req.	Proportionality.
In right angled triangles.	The ſide given is marked with AB, or if none be given, the ſide required is marked with AB, placing B always at the right angle, and AD to the Hypothenuſal.	1	AB. D	D B	Ra. t A. AB. DB.
		2		A D	s D. R A. AB. AD.
		3	AD. D	A B	Ra. s D. AD. A B.
		4	AB DB	D	D B. A B. Ra. t D.
		5		A D	{ D B. AB. Ra. t D. s D. Ra. AB. A D. }
		6	ABAD	D	A D. A B. Ra. s D
		7		D B	{ A D. A B. Ra. s D. Ra. t A. AB. D B. }
		Or for this laſt.	{ AD + A B }		{ D B. D B. { AD - AB }
In oblique angled triangles, Mark the things given and required with the letters here given and required in that Caſe.	Oppoſite ſides and angles given and required.	8	A E A. D.	E D.	s E. s A. AD. ED.
		9	AD. E. E. D.	A.	A D. E D. s E. s A.
	Two ſides & their contained angle given; to find { An Angle.	10	A E the longer, A D the ſhorter.	E or D	As (AE + AD) to (AE -- AD) ſo $\frac{1}{2}$ (E +) to t F. $\frac{1}{2}$ E + D } + F is D; —— F is E
	the third ſide.	11	A	ED.	Find by the laſt caſe F, then having A: F. A D. find by the 8 Caſe E D.
	Three ſides given: to find an angle.	12	A E baſe A D the longer, E D the ſhorter ſide	A	As A E to (AD + E D) ſo (A D — E D) to A I. $\frac{1}{2}$ differ. A E and A I is E B. A E + or —— E B is A B Then by the 6 Caſe; As A D to A B: ſo Ra: to ſc: A. or As E D to E B; ſo Ra: to ſc: E.



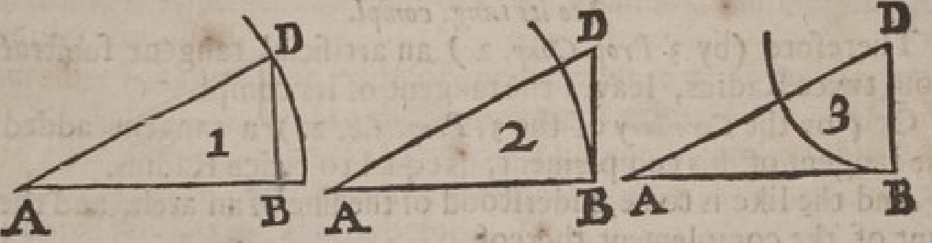
CHAP. IV.

PITISICUS in his *Trigonometria*, hath four Theorems for the varying of proportions, and for the finding out the thing required in a plain or sperical triangle several ways: which briefly are in effect as followeth.

The Grounds or Theorems for varying the terms of the proportions of Sines, Tangents and Secants.

Theorem 1.

The proportion of Radius to a sine, tangent or secant; and contrariwise the proportion of a sine, tangent or secant to Radius: may be varied three wayes, by the first Axiom of plain Triangles.



For,

As sine DB, *to Radius* AD; *in the first triangle,*
so Rad. DB, *to secant* AD; *in the third triangle, &* } And the converse.
so tang. DB, *to secant* AD; *in the second triangle.*

Again,

As tangent DB, *to Rad.* AB; *in the second triangle,*
so is Radius DB, *to tang.* AB; *in the third triangle, &* } And the converse.
so is sine DB, *to sine* AB; *in the first triangle.*

And the like is to be understood of secants, but this may suffice.

Hence then,

As the sine of an arch or angle, is to Radius:
so is Radius, to the secant compl of that arch; } And the converse.
and so is the tangent of that arch, to his secant;

Also

Alſo

As the tangent of an arch or angle, is to Radius :
ſo is Radius, to the tangent complement thereof : } And the converſ.
and ſo is the ſine thereof, to the ſine of its compl.

Corollary.

Hence it is evident, that Radius a mean proportional between the ſine of an arch, and the ſecant of the complement of the ſame arch: alſo between the tangent of an arch, and the tangent of the complement of the ſame arch.

And hence it is, that the complement arithmetical of the artificial ſine of an arch, is the artificial ſecant of that arches complement. And the complement arithmetical of the artificial tangent of an arch, is the tangent of the complement of that arch. (Here you are to underſtand the complement arithmetical to twice Radius, or to 20.0000000.)

For ſeeing the proportion is { *As a tangent to Radius : ſo is Radius to its tang. compl.*

Therefore (by 3 *Prop. Chap.* 2.) an artificial tangent ſubſtracted from twice Radius, leaves the tangent of its compl.

Or (by the *Corollary* of the 3. *Prop. Ch.* 2.) a tangent added to the tangent of his complement, is equal to twice Radius.

And the like is to be underſtood of the ſine of an arch, and the ſecant of the complement thereof.

Theorem 2.

The ſines of ſeveral arches, and the ſecants of their complements are reciprocally proportional. That is,

As the ſine of an arch or angle,
is to the ſine of another arch or angle :
ſo is the ſecant of the complement of that other,
to the ſecant of the complement of the former.

Demonſt. For (by the foregoing *Corollary*) Radius is the mean proportional between the ſine of any arch, and the ſecant of the complement of the ſame arch.

Therefore

Therefore the rectangle of any ſine, and of the ſecant of his complement, is equal to the ſquare of Radius (by 17. 6. *Euclid.*) ſo that all rectangles made of the ſines of arches, and of the ſecants of their complements, are equal one to another.

But equal rectangles have their ſides reciprocally proportional (by 14. 6. *Euclid.*) Therefore, *&c.*

Theorem 3.

The tangents of ſeveral arches, and the tangents of their complements, are reciprocally proportional. That is,

As the tangent of an arch or angle,
is to the tangent of another arch or angle :
ſo is the tangent of the complement of that other,
to the tangent of the complement of the former.

Demonſt. For (by the foregoing Corollary (Radius is the mean proportional between the tangent of every arch, and the tangent of his complement.

Therefore the rectangle made of any tangent, and of the tangent of his complement, is equal to the ſquare of Radius (by 17. 6. *Euclid.* ſo that all rectangles made of the tangent of arches, and of the tangents of their complements, are equal one to another.

But equal rectangles, *&c.* as before.

Theorem. 4.

If four magnitudes be proportional: then alternately alſo they are proportional : 16 Pro. 5. Euclid.

And the like is to be underſtood of Numbers.

As if 3 be in proportion to 4 ; as 9 to 12. then alſo,
As 3 is in proportion to 9 ; ſo is 4 to 12.

And hence (whereas we have before throughout this book compared ſides, to the ſines and tangents of angles, *&c.*) we may compare ſides to ſides, and angles to angles, as in the exemplary Table we have done.

And thus much touching the doctrine of Plain Triangles.

THE DOCTRINE OF SPHERICAL TRIANGLES.

CHAP. I

Of circles of the Sphere, and their Interſections; and of the kinds and affections of Spherical Triangles in general.

TO define in this place the ſeveral circles of the Sphere, were ſuperfluous, becauſe they are beſt underſtood in the *uſe of the Sphere or Globe*, wherewith it is requiſite the Reader ſhould be acquainted (at leaſt in part) before he apply himſelf to the *Doctrine of Spherical Triangles.* Therefore paſſing by theſe, we come to thoſe things which more immediately concern our preſent purpoſe.

Prop. 1. *The ſides of a Spherical Triangle are three arches of great circles, every arch being leſs than a ſemicircle.*

Therefore the arches of parallels, or other leſſer circles of the Sphere, are not to be taken as the ſides of a Spherical triangle.

2. *A great circle of the Sphere, is that which divides the Sphere equally into two Hemiſpheres: and is every where diſtant from its own poles, by a quadrant, or fourth part of a great circle.*

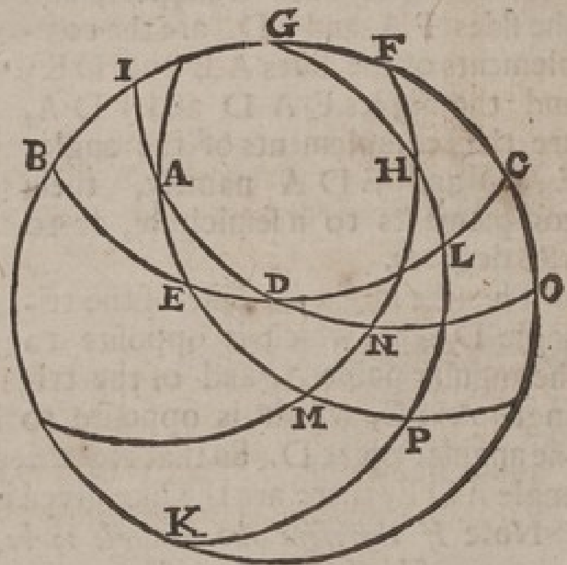
Thus the Equinoctial is a great circle of the Sphere, dividing it equally into the Northern and Southern Hemiſpheres; and it is every where diſtant from its own poles (namely, from the North and South poles of the world) by a quadrant, or 90 degrees. The like is to be underſtood of the Ecliptick, and of all Horizons, Meridians, Azimuths, and of all other great circles of the Sphere.

3. *A spherical angle is measured by the arch of a great circle, described on the angular points as a center, between the sides being extended to quadrants.*

Thus in the Scheam next following, the angle A D E is not measured by the arch A E, but by the arch I B: because I B is described on the angular point D, as a center between the sides D A and D E, being extended to quadrants.

4. *Any two great circles of the Sphere, intersect one another in two opposite points, making the angles at those points equal one to another and either of them equal to the distance of the poles of the same circle.*

As the Equinoctial and Ecliptick intersect one another in the points of *Aries* and *Libra*, which points are directly opposite one to another, being distant a semicircle or 180 degrees; and the angle by them comprehended at the beginning of *Aries*, is equal to that by them comprehended at the beginning of *Libra*: and either of these angles is equal to the distance of their poles, namely, 23 deg. 31′.

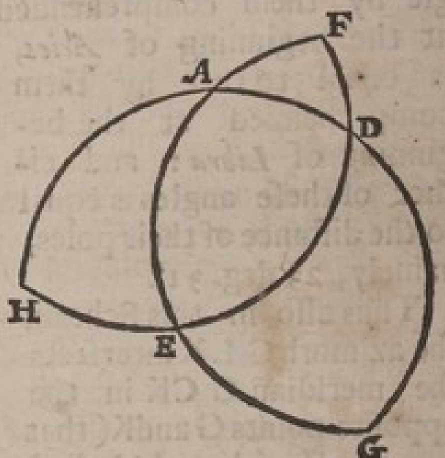


Thus also in this Scheam the azimuth G L K intersects the meridian G CK in the opposite points G and K (that is in the Zenith and Nadir) the angle of their intersection at G, being equal to that at K; either of which angles is measured by the arch of the Horizon C L, which is equal to E D, the distance of the poles of the same circles.

Corol. *Therefore if a great circle of the Sphere pass by the poles of another great circle, it divides the same at right angles; and the converse.*

5. *Every spherical triangle hath opposite to each angular point another triangle, having the same base with the former, and the angle opposite thereto equal, the other parts of it are the complements of the several parts of the former to a semicircle.*

Let A D E be a spherical triangle, and extend the sides thereof D A and DE, till they concur at H, allso A D and A E, till they concur at G; and lastly, E A and E D, till they concur at F. Then are the arches D A H, D E H, A E G, A D G, E D F, and E A F, semicircles (by the fourth Proposition.) And thus to each angular point of the triangle A D E, there is opposite another triangle having the same base with the former, *&c.* As to the angular point E, there is opposite the triangle A F D; whose angle at F is equal to the angle at E, and the base A D is common to both triangles; and the sides F A and F D, are the complements of the sides A E and D E; and the angles F A D aud F D A, are the complements of the angles E A D and E D A namely, their complements to a semicircle, or to 180 degrees.



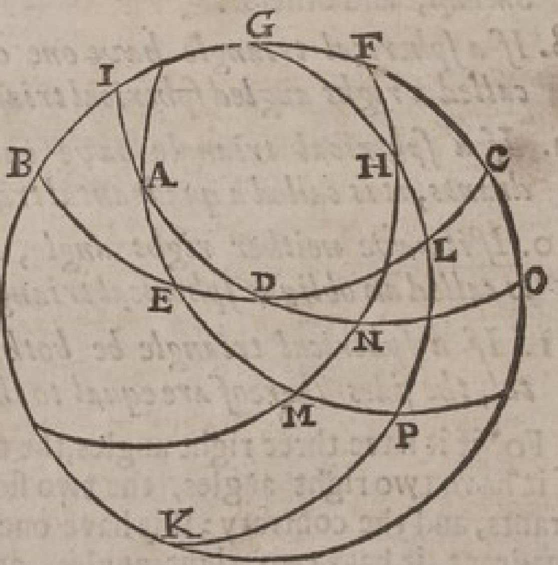
The like might be said of the triangle D G E, which is opposite to the angular point A, and of the triangle A H E, which is opposite to the angular point D. So that any three things being given in the triangle A D E, there are the like given in every of these triangles.

Note *If therefore the triangle to be resolved be obtuse angled, or have two of his sides either of them greater than a quadrant*: though you might find out the thing required in that, yet it will be more convenient to resolve one of the least of the three triangles opposite to his angular points. As if a question were proposed in the triangle A D E, it may more conveniently be wrought in the triangle A F D.

6. *If three great circles make by their interſections a ſpherical triangle; and if the poles of thoſe circles be the angular points of another ſpherical triangle: the angles of the firſt triangle ſhall be equal to the ſides of the ſecond, and the ſides of the firſt, to the angles of the ſecond.* If only inſtead of the greateſt ſide, or greateſt angle, you take the complement thereof to a ſemicircle.

This is apparent by the fourth Propoſition of this *Chapter*; and both this, and the latter part of that may be further manifeſted thus.

Let A D be an arch of the Equinoctial, A E an arch of the Ecliptick, E D an arch of the Horizon, making the triangle A D E; and let G be the pole of the Horizon, F the pole of the Equinoctial, and H the pole of the Ecliptick. Then on the point A as a center, and at the diſtance of a quadrant or 90 degrees A M or A N, deſcribe the arch M N which (by the third Propoſition) is the meaſure of the angle at A, and in like ſort O C, the meaſure of the angle at D, and P L, the meaſure of the complement of the greateſt angle A E D to a ſemicircle. And forasmuch as the arch M N is diſtant from A 93 degrees, and the poles of the arches A D and A E, namely, F and H, are alſo (by the ſecond Propoſiton) diſtant from the ſame point A 90 degrees; therefore the arch M N being produced, will paſs by the poles H and F. And for the like reaſon, the arch O C, will paſs by the poles F and G. And P L by the poles H and G, ſo making the triangle G H F. I ſay then, that the ſides of the triangle G H F, are equal to the angles of the triangle A E D.



For the quadrant F N is equal to the quadrant M H, and taking away

way N H, which is common to them both, there remains the side F H, equal to M N; which arch M N is the measure of the angle at A. And by the like reason G F is equal to C O, the measure of the angle at D, and G H is equal to L P, the measure of the complement of the greatest angle A E D to the two right angles. And in like sort we may prove that the side A E, is equal to M P, the measure of the angle at H; and E D equal to L C, the measure of the angle at G; and A D equal to N O, the measure of the complement of the greatest angle G F H to 180 degrees. Therefore, *If three great circles make by their intersections a triangle*, &c. which was to be proved.

Corollary.

Hence it is evident, that the angles of a spherical triangle, may be changed into sides, and the sides into angles.

7. *The three angles of every spherical triangle, are greater than two right angles.*

The demonstration hereof you may see in *Regiomontanus*, *Pitiscus*, *Snellius*, and others.

8. *If a spherical triangle have one or more right angles, it is called a right angled spherical triangle.*

9. *If a spherical triangle have one or more of his sides quadrants, it is called a quadrantal triangle.*

10. *If it have neither right angle, nor any side a quadrant, it is called an oblique spherical triangle.*

11. *If a spherical triangle be both right angled, and quadrantal, the sides thereof are equal to the opposite angles.*

For if it have three right angles, the three sides of it are quadrants; If it have two right angles, the two sides subtending them are quadrants, and the contrary; If it have one right angle, and one side a quadrant, it hath two right angles, and two quadrantal sides: all which is evident by the Corollary of the fourth Proposition. But if two sides be quadrants, the third measureth their contained angle by the third Proposition. Therefore for the solution of these kinds of triangles, there needs no further Rule.

To these, we may add three Propositions set down by the Baron of

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Merchistone, in his Book of the uſe of the admirable Table of Logarithms: being as followeth.

12. *Two oblique angles of a ſpherical triangle, are either of them of the ſame kind of which their oppoſite ſides are.*

Therefore knowing of what kind the one is, itappeare th alſo of what kind the other is.

13. *If any angle of a triangle be nearer to a quadrant than his oppoſite ſide: two ſides of that triangle ſhall be of one kind, and the third leſs than a quadrant.*

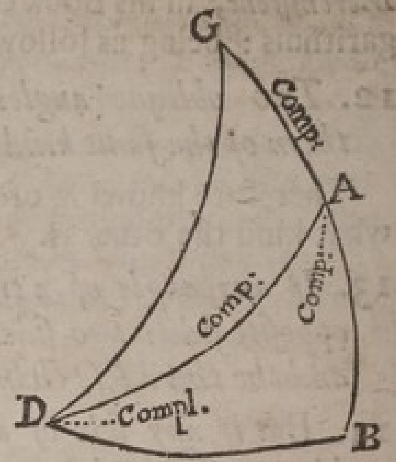
14. *But if any ſide of a triangle be nearer to a quadrant than his oppoſite angle, two angles of that triangle ſhall be of one kind, and the third greater than a quadrant.*

CHAP. II.

Of the firſt fundamental Axiom for ſpherical triangles: and of the ſolution of right angled and quadrantal triangles thereby.

PITISCUS, and others to theſe times, for the ſolution of right angled ſpherical triangles (not medling with quadrantals) have delivered two Axioms; by help whereof, two things given (beſides the right angle) a third may be found. But for the moſt part, the ſides of the triangle muſt be produced, that ſo there may be divers triangles made by their interſections, conſiſting of the parts of the firſt, or of the complements of thoſe parts diverſly. And then it muſt be conſidered, to which of all thoſe triangles one of the ſaid Axioms may aptly and immediately be applied, for finding the thing required, or the complement thereof. But the honourable Lord *Nepair*, amongſt many excellent Propoſitions by him framed in the *Doctrine of Triangles*, hath two, which we intend to make uſe of, as fundamental Axioms for the ſolution of all the caſes of ſpherical triangles. The firſt ſerving for the ſolution of right angled and quadrantal triangles, without producing any ſide, which after ſome preparation thereunto, we will ſet down with ſome little alteration, anſwerable to the nature of the Logarithms now in uſe.

It is first to be understood, that a right angled spherical triangle hath five parts besides the right angle; which he calls the natural parts: as the triangle A B D, right angled at B, hath the side A B, the angle at A, and the Hypothenusal A D, the angle A D B, and the side D B. Three of these parts which are farthest from the right angle, namely, the angle B A D, the Hypothenusal A D, and the angle A D B, we mark or note by their complements to a quadrant. As the angle



B A D we account as the complement of the same angle, and so write *compl.* B A D; for A D *compl.* A D; for A D B *compl.* A D B. But the two sides D B and A B. being next to the right angle, are not noted by their complements. And these parts thus noted, or accounted, he calls the five circular parts of a right-angled triangle. Namely, 1 A B, 2 *compl.* B A D, 3 *compl.* A D, 4 *compl.* A D B, 5 D B.

Likewise the quadrantal triangle A D G (whose side D G is a quadrant (hath five parts besides the quadrantal side. Namely, the side A G, the angle at G, the angle G D A, the side A D, and the angle D A G, which we may call his natural parts. But three of these parts, which are furthest from the quadrantal side, namely, the side G A, and the angle G A D, and the side A D, we account as the complements of the same parts, and so note them by their complements. As complement G A, complement G A D, or D A B (which is all one) complement A D. The other two angles A D G and D G A, being next to the quadrantal side, are not noted by their complements. And these five parts thus noted or accounted, he calls the five circular parts of a quadrantal triangle. Namely, 1 complement A G, 2 A G D, 3 G D A, 4 complement A D, 5 complement D A G or D A B.

Now of these five parts, two are always given to find a third; and of these three one is in the middle, and the other two are extreams, either adjacent to that middle one, or opposite to it. As in the triangle A D B, A B and A D lying next to the angle D A B, are said to be adjacent extreams to A; and for the like reason, the an-

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gles BDA and BAD, are extreams adjacent to the hypothenusal AD, and so are AD, and DB, to D; and D and *AB*, to DB: and lastly, *DB* and *A*, to *AB*; for the right angle at B, is not reckoned amongst the five circular parts. So also *AB* and *A*, are said to be opposite extreams to the angle ADB, because neither of them are adjoining to it: also *A* and AD, are opposite extreams to DB; AD and D, to *AB*; D and DB, to *A*; DB and *AB* to AD.

And the like is to be understood in the quadrantal Triangle DAG; namely, that the angles at D and *A*, are extreams adjacent to AD; AD and *AG*, to *A*; *A* and *G*, to *AG*; *AG* and D, to *G*; *G and* DA, to D, and in like manner *AG* and *G* are opposite extreams to AD; *G* and *D* to *A*; D and AD, to *AG*; AD and *A*, to *G*; *A* and *AG* to *D*.

1. *Fundamental* AXIOM.

Of the five circular parts in a spherical Triangle, right angled or quadrantal.

THE *sine of a middle part with Radius, is equal to the tangents of the extreams adjacent; or to the sines complement of the opposite extreams.*

Understanding, by sines and tangents, the artificial sines and tangents, that is, the Logarithms of the natural sines and tangents.

For,

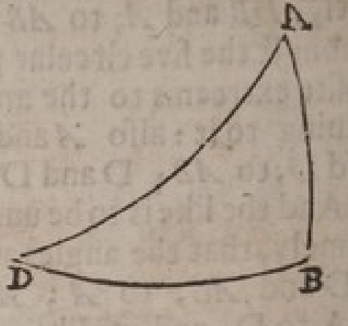
As Radius, to the tangent of one of the extreams adjacent: so is the Tangent of the other extream adjacent, to the sine of the middle part.

And,

As Radius, to sine complement of one of the opposite extreams: so is sine complement the other opposite extream, to the sine of the middle part.

The demonstration hereof, he hath briefly shewed in his Book of the use of the admirable Table of the Logarithms: and we more fully at the end of this Book. Therefore we will here only illustrate it by Examples, as followeth.

In the right angled Triangle ABD, we have shewed before how *AB* and AD are extreams adjacent to the angle at *A*: and that AD, as also the angle *A*, are noted by their complements. Therefore by this Axiom, the ſine of the complement of the angle at A. added to Radius, is equal to the tangent of the complement of *AD*, added to the tangent *AB*, which we may briefly expreſs thus: *ſc. A* + Radius == *tc. A D* + *t A B*: which is as much as to ſay, ſine complement *A*, more Radius, is equal to tangent complement *AD*, more tangent *AB*; this ſign + ſignifying more, or addition, this == equality, this —leſs, or ſubſtraction; as we have before noted upon the third Axiom of plain triangles.



Now admit		Then is	
AD 74 deg. 50′; *tc*	9.4330804, ==	*A* 70 deg. 03′ 03″ *sc.*	9.5329939
AB 51 32; *t*	10.0999135,	*Radius*	10.0000000
	19.5329939		19.5329939

Here the tangent of the complement of *AD*, being added to the tangent of *AB*, the ſum is 19.5329939; ſo alſo the ſine of the complement of *A*, added to *Radius*, the total is 19.5329939, as the other: and here the angle *A* is 70 deg. 03′, 02″, 35‴, but we neglect the thirds. Again (by the later part of this Axiom) the ſine of the complement of the angle *ADB*, more *Radius*, is equal to the ſine of the angle at *A*, more the ſine of the complement of the ſide *AB*, which we expreſs thus: *ſc D* + *Rad.* == *s A* + *ſc AB*; which may thus appear.

Admit		Then is	
A 70 deg. 03′ 03″ *s*	9.9731255 ==	*D* 54 deg. 12′ 58″. *ſc*	9.7669572
AB 51 32 00″ *ſc*	9.7938317	*Radius*	10.0000000
	19.7669572		19.7669572

So alſo (by this Axiom) in the quadrantal triangle *ADG*, the ſine of the complement of the angle at *A* more *Radius*, is equal to the tangent of the complement of *AG*, more the tangent of the complement of A*D*; which we expreſs thus: *ſc A* + *Rad.* == *tc AG* + *sc* A*D* which may thus appear.

Admit

AG 38-d. 28′; *tc*	10.0999135	==	*A* 70 deg. 03′ 03″ *sc*	9.5329939
AD 74 50 *tc*	9.4330804		*Rad.*	10,0000000
	19.5329939			19.5329939

And the like is to be underſtood of the reſt, as by this Table following may appear.

1 *s DB* + *Rad* = *s* AD + *s* A
2 *sc D* + *Rad* = *sc AB* + *s* A
3 *sc* AD + *Rad* = *sc* DB + *sc* AB
4 *sc* AD + *Rad* = *tc* D + *tc* A
5 *sc* A + *Rad* = *t* AB + *tc* AD
6 *s* AB + *Rad* = *tc* A + *t* DB

Or in ſtead of the ſecond, we may ſay 2 *sc* A + *Rad* = *sc* DB + *s D* And in like ſort he that liſteth, may ſet down the equality of the ſines and tangents of the other ſides and angles; and ſo there will be 10 of theſe, of every of which, according to the things given and required he may make 3 caſes, and ſo 30 in all, anſwerable to the ſeveral poſitions of the letters; as is done by the Honourable Lord *Nepair*: If inſtead of the equality of the two terms on the one ſide of the Equation, to the two terms on the other, you would expreſs the proportion of the four terms, it ſufficeth to put the terms reciprocally: As whereas in the firſt it is ſaid *s DB* + *Radius* == *s AD* + *s A*, we may put the terms reciprocally, and ſay, as *Radius*, to ſine *AD*, ſo is *s A* to *s DB*, or as *Radius* to *s A*, ſo is *s AD* to *s DB*, putting alwayes the term which is ſined with the term required, for the firſt number in the rule of proportion, and the two terms that are on the other ſide of the Equation, the one in the ſecond place, and the other in the third place of the Rule of Three. But this may here ſuffice; for to theſe may the ſixteen caſes of a right angled ſpherical triangle be reduced, namely, 3 to the firſt, 3 to the ſecond, 2 to the third, 2 to the fourth, 3 to the fifth, and 3 to the ſixth.

As admit there were given the hypothenuſal A*D*, and the angle at A and required the ſide DB; then by the firſt, ſeeing that *s* A*D* + *s* A, is equal to *s* DB + *Radius*. Therefore if from the ſum of the ſines of A*D* and A, we ſubſtract *Radius*, the remainer is the ſine of DB.

Secondly, admit there were given A*D* and DB, and required the angle at A, then ſeeing *s* DB + Rad. == *s* A*D* + *s* A; therefore if from *s* DB + Radius, we ſubſtract *s* A*D*, the remainer is A.

Or thirdly, if there were given DB, and the angle at *A*, and required the hypothenusal *AD*; then forasmuch as *s DB* + *Rad.* = *s AD* + *s A*; therefore if from the sum of *s DB* + Rad. we substract *s A*, the remainer is *s AD*; and the like is to be understood of the rest.

For if from equal things, we take equal things, the remainers are equal.

As if 6 + 10 be equal to 9 + 7; then if from 6 + 10, that is, from 16, we take 9, the remainer is 7; or if we take away 7, the remainer is 9 *&c.*

So also in the quadrantal Triangle *ADG* (whose side *DG* is a quadrant) the equality of the artificial sines and tangents of the parts, is such as here appeareth,

1	*s* G	+ Rad	= *s* A	+ *s* AD		
2	*sc* AG	+ Rad	= *sc* D	+ *s* AD		
3	*sc* A	+ Rad	= *sc* G	+ *sc* D		
4	*s* G	+ Rad	= *tc* AG	+ *t* D		
5	*sc* AG	+ Rad	= *tc* A	+ *t* G		
6	*sc* A	+ Rad	= *tc* AG	+ *tc* AD		

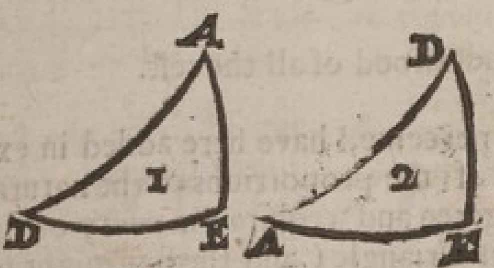
And to these 6. may the 16 cases of a quadrantal Triangle be reduced, in such sort as we have before touched in right angled Triangles, and shall further manifest in the Table following, though we do not in all places retain the same letters.

But because the work being thus ordered, would for the most part be performed by substraction, whereas it is something easier to add, than to substract; therefore you may instead of substracting a sine or tangent, add his complement arithmetical, whereof we have before spoken, and so the work may be conformable to these Tables following; whereof one serveth for right angled Triangles, the other for quadrantal.

In the use of these Tables, you are to mark the things given and required, with the letters in that Case given and required; and you must cut off from every sum, Radius or 1 in the first place towards the left hand; for indeed *s AB* + *t A*, is equal *t DB* + Radius, and so of the rest; except where you have the complement arith. of a sine, as your own reason in the use of this Table will direct you.

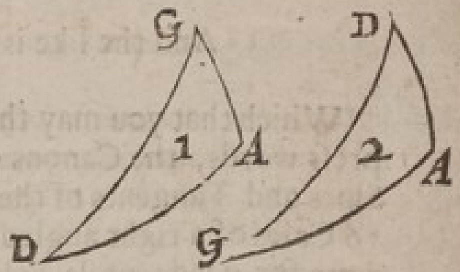
An

An Exemplary Table of the resolution of the several Cases of right angled spherical Triangles.					
Dat	Req	Operation or Equality.			Case
AB	DB	s AB † t	A = t	DB	1
A	D	sc A B † s	A = sc	D	2
	AD	sc A † tc	AB = tc	AD	3
DB	D	co.ar. sc DB † sc	A = s	D	4
A	AD	co.ar. s A † s	DB = s	AD	5
	AB	tc A † t	DB = s	AB	6
AD	AB	sc A † t	AD = t	AB	7
A	DB	s AD † s	A = s	DB	8
	D	sc AD † t	A = tc	D	9
AB	AD	sc. DB † sc	AB = sc	AD	10
DB	A	s AB † tc	DB = tc	A	11
AB	DB	co ar. sc AB † sc	AD = sc	DB	12
AD	A	t AB † tc	AD = sc	A	13
AD DB	A	co.ar. s AD †	DB = s	A	14
A	DB	co.ar. s D † sc	A = sc	DB	15
D	AD	tc D † tc	A = sc	AD	16



In all these Cases, the angle given is marked with A; or if none be given, the angle required is marked with A, the right angle with B, the hypothenusal with AD.

An Exemplary Table of the resolution of quadrantal Triangles, one of whose sides is a quadrant				
Dat	Req	Operation or Equality.		
AG	G	sc AG † t	A = t	G
A	D	s AG † s	A = s	D
	AD	sc A † t	AG = tc	AD
A	D	co.ar. sc G † sc	A = sc	D
G	AD	co.ar. s A † s	G = s	AD
	AG	tc A † t	G = sc	AG
AG	D	s G † t	AG = t	D
G	A	sc AG † tc	G = tc	A
	AD	s AG † sc	G = sc	AD
AG	G	t AG † t	D = s	G
D	A	co. ar. s AG † s	D = s	A
	AD	co. ar. sc D † sc	AG = s	AD
AG	A	tc AG † tc	AD = sc	AD
AD	G	co. ar. s AG † sc	AD = sc	G
D	A	sc D † sc	G = sc	A
G	AG	s G † tc	D = tc	AG



In all these Cases, the quadrantal side is marked with DG, and the opposite angle with A.

And thus we have ſhewed in theſe Tables, the Equality of the artificial Sines and Tangents of the things given and required in all ſuch ſpherical Triangles as have either a right angle, or one of their ſides a quadrant: But if you deſire the proportion of their natural ſines and tangents; it is

As Radius, to the firſt of the three,
ſo is the ſecond to the third.

Except there be the complement arithmetical of a ſine, for then

As that ſine is to Radius:
ſo is the ſecond in theſe Tables to the third.

Example of right angled Triangles.

1 *Caſe.* *s AB* + *t* A == *t* D B.

Therefore, as Radius, to *s* A*B*; ſo *t* A to *t* DB.

5 *Caſe. Compl. Arith.* *s.* A + *s* DB == *s* A*D*.

Therefore, as *s* A to Radius; ſo *s* DB, to *s* A*D*.

And the like is to be underſtood of all the reſt.

Which that you may the better perceive, I have here added in expreſs words, the Canons or Rules of the proportions of the natural Sines and Tangents of the things given and required in every of the 16 Caſes of a right angled ſpherical Triangle (and the like might be done for quadrantals) all which Rules (as may eaſily be perceived) depend upon the fundamental Axiom before going, and the Corollary of the third Propoſition of the ſecond Chapter of plain Triangles; and here the ſide ſubtending the right angle, we call the hypothenuſal, the other two containing the right angle, we may call ſimply the ſides; but for farther diſtinction, we call one of theſe containing ſides (it matters not which) the baſe, and the other the perpendicular.

The

Given	To find	Proportion
The baſe and angle at the baſe given: to find	1. The perpendicular.	*As Radius, to the ſine of the baſe: ſo is the tangent of the angle at the baſe, to the tangent of the perpendicular.*
	2. The angle at the perpendic.	*As Radius, to ſine compl. the baſe: ſo is ſine the angle at the baſe, to ſine compl. the angle at the perpendic.*
	3. The hypothenuſal.	*As Radius, to ſine compl. the angle at the baſe: ſo is tang. compl. the baſe, to tang. compl. the hypothenuſal.*
The perpendicular & angle at the baſe given. to find	4. The angle at the perpendic.	*As ſine compl. the perpendicular, to Radius: ſo ſine compl. the angle at the baſe, to ſine the angle at the perpend.*
	5. The hypothenuſal.	*As ſine the angle at the baſe, to Radius: ſo is the ſine of the perpendicular, to the ſine of the hypothenuſal.*
	6. The baſe.	*As Radius to tang. compl. the angle at the baſe: ſo is the tangent of the perpendicular, to the ſine of the baſe.*
The hypothenuſal, & angle at the baſe given: to find	7. The baſe	*As Radius to ſine compl. the angle at the baſe: ſo is the tangent of the hypothenuſal, to the tangent of the baſe.*
	8. The perpendicular.	*As Radius, to the ſine of the hypothenuſal: ſo is the ſine of the angle at the baſe, to the ſine of the perpendic.*
	9. The angle at the perpendic.	*As Radius, to ſine compl. the hypothenuſal: ſo tang. the angle at the baſe, to tang. compl. the angle at the perp.*
The baſe and perpend. given: to find	10. The hypothenuſal	*As Radius, to ſine compl. the perpendicular: ſo ſine compl. the baſe, to ſine compl. the hypothenuſal:*
	11. The angle at the baſe.	*As Radius to the ſine of the baſe: ſo the tangent compl. of the perpendic. to tang. compl. the angle at the baſe.*
The baſe and hypothenuſal given to find	12. The perpendicular.	*As ſine compl. the baſe, to Radius; ſo ſine compl. the hypothenuſal, to ſine compl. the perpendicular.*
	13. The angle at the baſe.	*As Radius, to the tangent of the baſe: ſo tangent compl. the hypothenuſal, to ſine compl. the angle at the baſe.*
	14. The angle at the perpend.	*As the ſine of the hypothenuſal, to Radius: ſo is the ſine of the baſe, to ſine the angle at the perpendicular.*
The angles at the baſe & perpend. given: to find	15. The perpendicular.	*As ſine the angle at the perpendicular, is to Radius: ſo ſine compl. the angle at the baſe, to ſine compl. the perpendic.*
	16. The hypothenuſal.	*As Radius, to tangent compl. the angle at the perpendicular: ſo tangent complement the angle at the baſe, to ſine complement the hypothenuſal.*

And

And because by the third *Prop. Chap.* 4 of plain Triangles,
As the tangent of an arch,
is to the tagent of another arch:
so is the tangent of the complement of that other,
to the tangent of the complement of the former.

And by the Corollary of the first Proposition of the same *Chapt.*
Radius is a mean proportional between the tangent of an arch,
and the tangent complement of the same arch:
so that as Radius, is to the tangent of an arch:
so is the tangent complement of that arch, to Radius

Therefore if any man desire either for variety, or conveniency, to alter the Propositions wherein there are Tangents, he may easily do it.

As instead of the first he may say,

As the sine of the base, is to Radius: so is the tangent complement of the angle at the base, to the tangent complement of the perpendicular.

For the third.

As sine complement the angle at the base, to Radius: so is the tangent of the base, to the tangent of the hypothenusal.

For the sixth.

As tangent the angle at the base, to tangent the perpendicular: so is Radius, to the sine of the base.

For the seventh.

As sine complement the angle at the base, to Radius: so tangent complement the hypothenusal, to tangent complement the base.

For the ninth.

As sine complement the hypothenusal, to Radius: so tangent complement the angle at the base, to tangent the angle at the perpendicular.

For the eleventh.

As the sine of the base is to Radius: so is the tangent of the perpendicular, to tangent the angle at the base.

For the thirteenth.

As the tangent of the hypothenusal, to the tangent of the base: so is Radius, to sine complement the angle at the base.

For the sixteenth.

As tangent the angle at the base, to tangent complement the angle at the perpendicular: so is Radius, to sine complement the hypothenusal.

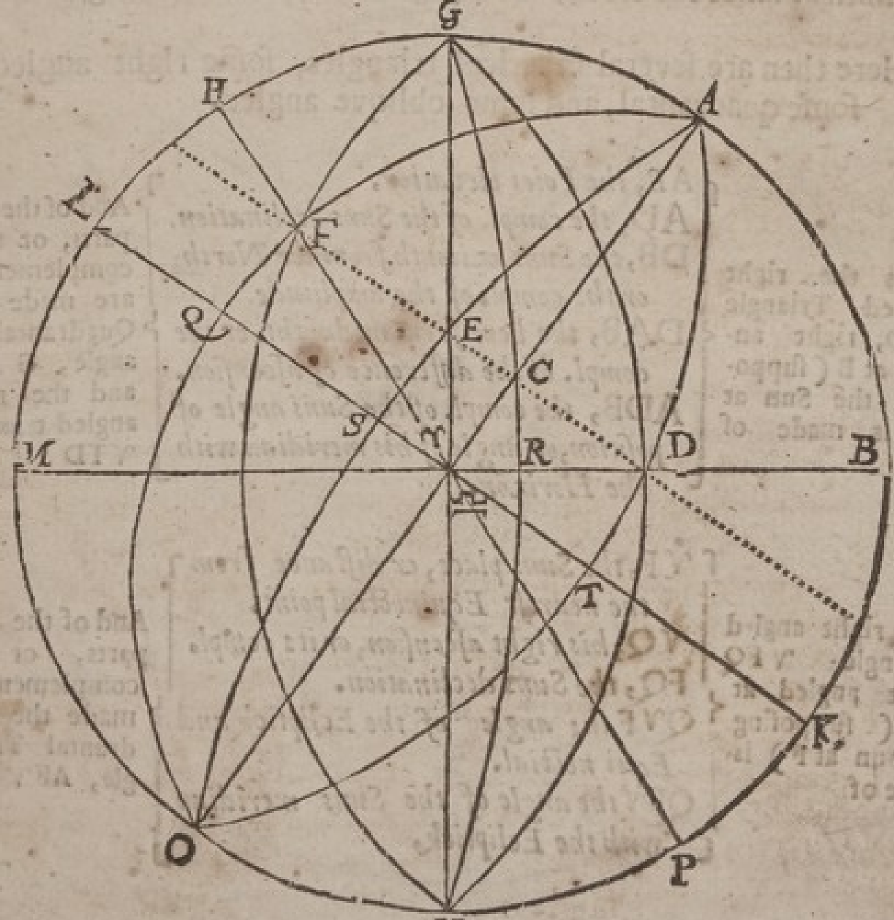
Many other ways might these Propositions be varied, by the fore-
said

said Corollary, and third and fourth Propoſition of the fourth Chapter of plain Triangles; and not only theſe, but the reſt wherein there are only ſines, are varied by theſe, and by the ſecond propoſition of the ſame Chapter; the varieties thence ariſing being very abundant, and of no great uſe, I rather leave to your own practice at your leiſure than beſtow further time therein.

CHAP. III.

Of the Caſes and Queſtions incident in every ſpherical triangle, right angled or quadrantal in general. And of the examples of the ſixteen caſes of a right angled triangle in particular.

WE come now to give examples of every of theſe caſes in the reſolution of ſome Problems of the Sphere. And ſuppoſing



the Reader to be already acquainted with the principal circles of the Sphere or Globe, we will forbear their definitions.

Let GMNB, represent the meridian of the place, LK the Equinoctial, HP the Ecliptick, ♈♎ the points of Aries and Libra; A the North-pole, O the South-pole, A O the axis of the World, or meridian of the Sun at six a clock, MB, the Horizon, G, the Zenith, N, the Nadir, GN, the azimuth of East, and West, or the first vertical, FD a parallel of declination, ADO, an arch of a meridian passing by the center of the Sun at his rising or setting. AEO, the meridian of the Sun being in the East or West azimuth. AF O the Suns meridian being at F, GDN, the Suns azimuth at his rising, GCN, the Suns azimuth at six of the clock, GFN, the Suns azimuth being at F.

Note. All the inward arches are indeed (in this kind of projection) Elliptical, though for readiness sake we describe them circular, and so also they do sufficiently represent the things intended.

Here then are several spherical triangles, some right angled, some quadrantal, and some oblique angled.

Thus the right angled Triangle ABD, right angled at B (supposing the Sun at D) is made of	*AB, the Poles elevation.* AD, *the compl. of the Suns declination.* DB, *the Suns azimuth from the North; or the compl. of the amplitude.* DAB, *the hour from midnight, or the compl. of the difference of ascension.* ADB, *the compl. of the Suns angle of position, or angle of his meridian with the Horizon.*	And of the like parts, or their complements, are made the Quadrantal triangle, G A D, and the right angled triangle, ♈TD
The right angled Triangle ♈FQ right angled at Q (supposing the Sun at F) is made of	♈F, *the Suns place, or distance from the nearest Equinoctial point.* ♈Q, *his right ascension, or its compl.* FQ, *the Suns declination.* Q♈F *the angle of the Ecliptick and Equi noctial.* QF♈ *the angle of the Suns meridian with the Ecliptick.*	And of the same parts, or their complements is made the quadrantal Triangle, AF♈

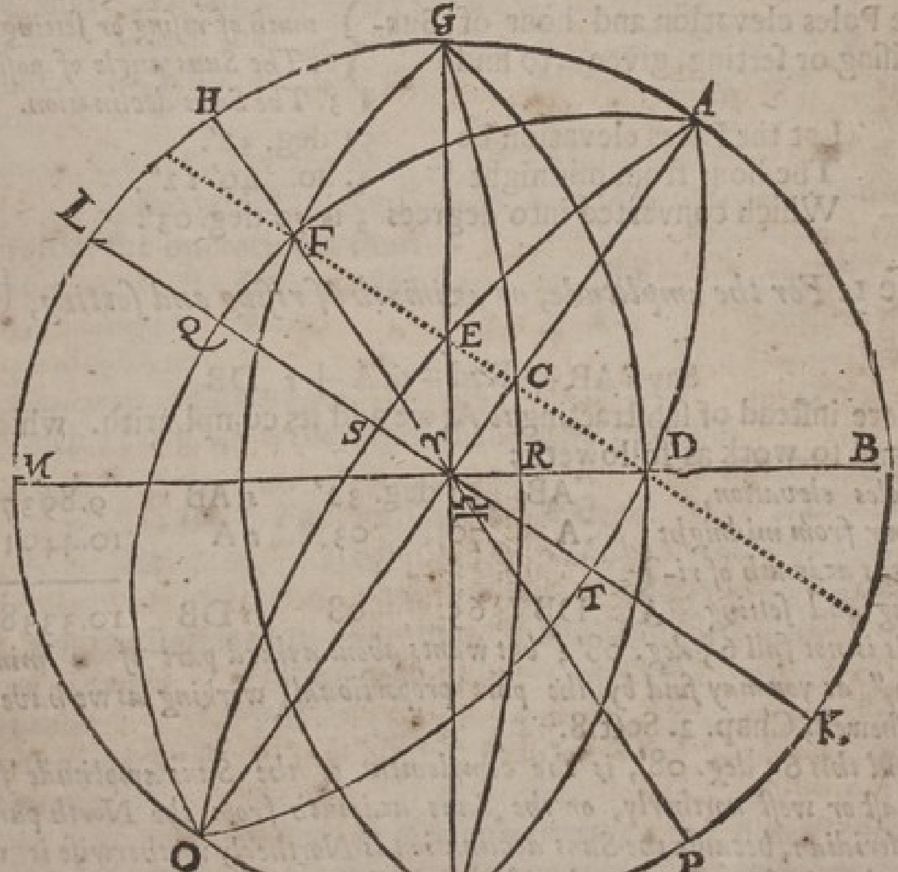
The

The right angled Triangle R ♈ C, right angled at R (if we suppose the Sun at C) is made of
- ♈C, *the Suns declination.*
- CR, *the Suns height at the hour of 6.*
- ♈R, *the Suns azimuth from East or West at the hour of 6.*
- C ♈R, *the Poles elevation.*
- ♈CR. *the angle of the Suns position.*

And of the same parts, or their complements, is made the quaprantal triangle, ♈GC.

The right angled Triangle ♈ SE, right angled at S (if we suppose the Sun at E) is made of
- SE, *the Suns declination.*
- S♈ *the hour from 6.*
- ♈E, *the Suns height being East or West.*
- S♈E, *the Latitude.*
- SE♈, *the angle of the Suns position.*

And of the like parts, or their complements is made the quadrantal Triangle, ♈EA.



The oblique angled triangle *AGF*, having neither right angle, nor any side a quadrant (if we suppose the Sun at F) is made of
- GA, *the complement of the Poles elevation,*
- FA, *the complement of the Suns declination,*
- GF, *the complement of the Suns height,*
- GAF, *the angle of the hour from Noon,*
- AFG, *the angle of the Suns position,*
- FGA, *the azimuth of the Sun from the north part of the Meridian.*

Other triangles are represented in this Scheam, but these I thought good to note, to give occasion to young Beginners to exercise themselves.

Now we will shew the solution of one of the right angled triangles, namely, *ADB*, also of the oblique angled triangle *AGF*, whereby you may understand the like operation in all others.

The Poles elevation and hour of Sun-rising or setting, given; to find
1. *The amplitude, or Suns azimuth of rising or setting:*
2. *The Suns angle of position.*
3. *The Suns declination.*

Let the Poles elevation be	51 deg. 32′.
The hour from midnight	4. ho. 40′ 12″.
Which converted into degrees	, is 70 deg. 03′.

Case 1. *For the amplitude, or azimuth of rising and setting,* DB.

Say *s* AB + Rad = *tc* A + *t* DB

Here instead of substracting *tc* A, we add its compl. arith. which is A, and so work as followeth:

Poles elevation,	AB	51 deg.	32′	*s* AB	9.8937452
hour from midnight	A	70	03	*t* A	10.4401146
Suns azimuth of rising and setting	DB	65	08	*t* DB	10.3338598

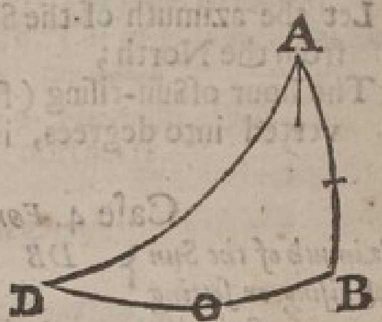
This is not full 65 *deg.* 08′; *but wants about a third part of a minute, or* 20,″ *as you may find by the part proportional, working as we have before shewed,* Chap. 2. Sect. 8.

And this 65 *deg.* 08′, *is the complement of the Suns amplitude from the East or west northerly, or the Suns azimuth from the North part of the Meridian, because the Suns declination is Northerly: otherwise it were his azimuth from the South, if the declination were Southerly; as you may understand by the foregoing Scheam turning it upside down.*

And

And where it is said Hour from midnight 70 deg 3', it is to be understood, the hour converted into deg. and min. which is done by allowing 15 degrees for an hour, and one degree for four minutes of time, and 15 minutes of a degree for one minute of time, &c. *Or saying by the Rule of Three, If one hour, or 60 minutes give 15 degrees, what gives the time proposed? and so the contrary; if you would convert degrees into hours, say, If 15 degrees give one hour, or 60 minutes of time, what give the degrees proposed?*

Note, that for your ease in resolving questions, whether in plain or spherical Triangles it will be expedient to mark the things given and required, as in this example, where the side *AB*, and the angle *A* being given, are each marked with a dash thus —, and the side required *DB*, with an o, or cypher thus, o.



Case 2. *For the Suns angle of position.*

Say *sc* D + Rad = *s* A + *sc* AB.

Therefore the operation is thus.

Poles elevation,	*AB*	51 deg. 32'	*sc AB*	9.7938317
Hour from midnight	*A*	70 03	*s A*	9.9731236
Suns angle of position is the complement of	*D*	35 47	*sc D*	9.7669553

Which 35 deg. 47 is the angle of the Suns position.

Case 3. *For the Suns declination.*

Say *sc* A + Rad = *t* AB + *tc* AD.

Here instead of substracting *t* AB, we add its compl. arith. which is *tc* AB, and the like is to be understood in the rest that follow.

Hour from midnight	A 70 deg. 03'	*sc*	A	9.5330090
Poles elevation	AB 51 . 32	*tc*	AB	9.9000865
Suns declination is the complement of	AD 15 10	*tc*	AD	9.4330955

Which 15 deg. 10' is the Suns declination towards the North pole (or elevated pole) because the hour from midnight is less than six; if it were more than six, the declination should be southerly; as is evident by the Scheam before going turned upside down.

After

After the form of these three examples: If there were given the amplitude, and angle of the Suns position, we might find the Poles elevation, the hour of Sun-rising or setting, and the Suns declination: and if you use the exemplary Table, you may use the second Triangle under the Table.

The amplitude, or azimuth of the Suns rising or setting, with the hour given: to find { 4. *The angle of position.* 5. *The Suns declination.* 9. *The Poles elevation.*

Let the azimuth of the Sun at his rising or setting be 65 deg. 08' from the North;

The hour of Sun-rising (from midnight) 4 ho. 40' 12'', which converted into degrees, is 70 deg, 03'.

Case 4. *For the angle of position.*

Azimuth of the Sun at rising or setting	*DB*	65 deg.	08'	*co. ar. sc.*	DB	0.3762257
Hour of Sun-rising	A	70	03	*sc*	A	9.5330090
Angle of position compl.	D	35	46	*s*	D	9.9092347

This *s D*, 9.9092347, gives an arch or angle of 54 deg. 14'; which is the angle that the Suns meridian makes with the horizon; but the angle of the Suns position is the complement thereof, namely, 35 deg. 46'.

Case 5. *For the Suns declination.*

Hour of Suns-rising	A	70 deg.	03'.	*co. ar. s*	A	0.0268764
Azimuth of rising	DB	65	08	*s*	DB	9.9577455
Suns declination compl.	AD	15	10	*s*	AD	9.9846219

Here (as we noted before) the arch answering to *s* AD 9.9846219 is 74 deg. 50.' but the Suns declination is the complement thereof, that is 15 deg. 10', and so of others.

Case 6. *For the Poles elevation.*

Hour of Sun-rising	A	70 deg.	03'	*tc*	A	9.5589854
Suns azimuth of rising	*DB*	65	08	*t*	*DB*	10.3339712
Poles elevation	AB	51	33	*s*	AB	9.8938566

Thus

Thus DB being 65 deg. 08′, we find AB to be 51 deg. 33′ but, if we should take DB to be but 65 deg. 07′ 40″ as before we found it, then AB the poles elevation would be but 51 deg. 32′, as before.

And (after the form of these three examples) if there were given the Poles elevation, and the angle of the Suns position, we might find the hour of Sun-rising, the Suns declination, and the amplitude or azimuth of rising and setting.

The Suns declination, and the hour of the Suns rising or setting given to find { *7. The Poles elevation. 8. The amplitude, or the Suns azimuth. 9. The angle of position.*

Let the Suns declination be 15 deg. 10′ northerly.
The hour of Sun-rising 4 ho. 40′ 12″,
Which converted into degrees, is 70 deg. 03′.

Case 7. *For the Poles elevation.*

Hour of Sun-rising,	A	70 deg.	03′	*sc* A	9.5330090
Suns declination compl.	AD	15	10	*t* AD	10.5669196
Poles elevation.	AB	51.	32	*t* AB	10.0999286

Case 8. *To find the Suns azimuth.*

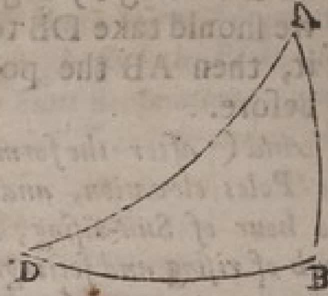
Suns declination compl.	*AD*	15 deg.	10′	*s AD*	9.9846033
Hour of Sun-rising	A	70	03′	*s A*	9.9731236
Suns azimuth from the north part of the meridian	*DB*	65	08	*s DB*	9.9577269

The complement hereof 24 deg. 52′, is the amplitude of the Suns rising and setting from the East and West northerly, because the declinationis northerly.

Case 9. *to find the angle of the Suns position.*

Suns declination compl.	AD	15 deg.	10′	*sc* AD.	9.4176837
Hour of Sun-rising	*A*	70	03	*t A*	10.4401146
The angle of position compl.	D	35	47	*tc* D.	9.8577983

And



And (after the form of these three examples (if there were given the Suns declination, and the angle of the Suns position at his rising, we might find the Suns azimuth, the Poles elevation, and the hour of Sun-rising.

The Poles elevation, and amplitude of Sun-rising or setting given : to find	10. *The suns declination.* 11. *The hour of Sun-rising, or setting.*

Let the Poles elevation be 51 deg. 32′.
Suns amplitude of rising and setting 24 deg. 52′ northerly.

Case 10. *To find the Suns declination.*

The amplitude is the complement of	DB	24	deg.	52′	*sc* DB	9.6237743
Poles elevation,	AB	51		32	*sc* AB	9.7938317
Suns declination compl.	AD	15		10	*sc* AD	9.4176060

This declination 15 deg. 10′ is northerly, because the amplitude given is northerly ; and when the one is southerly, so is the other.

Case 11. *To find the hour of Sun-rising and setting.*

Poles elevation,	AB	51 deg.	32′		*s* AB	9.8937452
Suns amplitude compl.	DB	24	52		*tc* DB	9.6660287
Hour of Sun-rising	A	70	03		*tc* A	9.5597739

Which 70 deg. 03′ converted into time, is 4 ho. 40′ 12″, which is the time of Sun-rising ; but if the amplitude had been southerly, the arch thus found had been the hour of Sun-setting, as is evident by the first general Scheam turned upside down.

And after the form of this last example, we might by the same things given, find the angle of the Suns position.

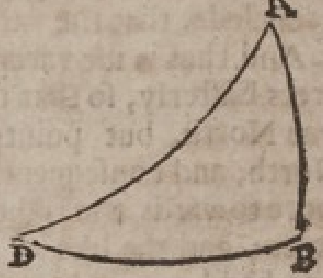
The

The elevation of the Pole, and declination of the Sun given: to find	12. *The amplitude.* 13. *The hour of Sun rising and setting.*

Let the elevation of the Pole be 51 deg. 32′,
Suns declination northerly 15 deg. 10′.

Case 12. *To find the Amplitude.*

The Poles elevation,	*AB* 51 *deg.*	32′ *co ar.*	*sc AB*	0.2061683
Suns declination compl.	*AD* 15	10	*sc AD*	9.4176837
The amplitude, the complement of	DB 24	52 56	DB	9.6238520



And this amplitude 24 deg. 52′ is northerly, because the Suns declination is northerly: That is, the Sun riseth 24 deg. 52′ to the northwards of the East, and sets as much to the northwards of the West. When the declination is southerly, the amplitude thus found is southerly, as may appear by the first general Scheam turned upside down.

Of the amplitude thus found there is often use made at Sea, for finding the variation of the Compass: which is done after this manner, if you do it by the Compass.

Supposing the circumference or outermost edge of the card or flie of the Compass to be divided into 360 degrees, and the points of the Needles to be placed directly under the Flower-de-luce or North and South points: you are to observe at Sun-rising or setting, how many degrees the Sun is from the East or West points of the Compass, which number of degrees, if they agree with the amplitude found by this Proposition, as is before shewed, and be on the same side, then hath the Compass no variation: but if they differ, look how many degrees that difference is, so much is the variation.

As for example, admit I find the amplitude (as before) to be 24 degrees, 52 minutes northerly, then I know that the Sun should set almost

almoſt 25 degrees from the Weſt to the Northwards, but obſerving at ſun-ſetting with my compaſs, admit I find it to ſet but 19 degrees from the Weſt-point of my compaſs to the North wards, then hereby I gather that the variation of my Compaſs is almoſt ſix degrees. And thus you may find how much the variation of the Compaſs is. Now,

To find which way the Compaſs varieth.

If the degree of the Compaſs, which ſhould directly reſpect the Sun at his riſing or ſetting (namely, the degree of amplitude found as before) be more towards the right hand, than the Sun-riſing or ſetting, the variation is Eaſterly; but if it be more towards the left hand, the variation is Weſterly; becauſe, when a mans face is towards the North, the Eaſt is on his right hand, and the Weſt on his left.

As in this Example, I find by the amplitude, that the Sun ſhould ſet almoſt 25 degrees from the Weſt point of my Compaſs, northerly; but ſetting the Sun, I ſee that the 25 degrees of my Compaſs is more towards the right hand, than the place of Sun-ſet; therefore I conclude, that the variation is Eaſterly.

And thus is the variation of the Compaſs found to be almoſt 6 degrees Eaſterly, ſo that the North point of the Compaſs ſhews not the true North, but points almoſt 6 degrees to the Eaſtward of the North, and conſequently all the other points of the Compaſs direct more towards the right hand than they ſhould do, almoſt by 6 degrees; and the like in all points is to be underſtood, if the obſervation had been made at Sun-riſing.

Note. It is fitteſt to make theſe obſervations when the Sun ſeems to be a little above the horizon, namely, when the lower edge of the Sun ſeems almoſt to touch the horizon, for then the Sun is in the horizon, though by reaſon of his refraction and parallax he ſeem to be above it.

Caſe 13. *To find the hour of Sun-riſing and ſetting.*

Poles elevation	*AB*	51 deg.	32′	*t*	*AB*	10.0999135
Suns declination compl.	*AD*	15	10	*tc*	*AD*	9.4330804
Hour of Sun-riſing	*A*	70	03	*sc*	*A*	9.5329939

This 70 deg. 03′ converted into time, is 4 ho. 40′ 12″, which is the time of Sun-riſing after midnight; but if the declination had been ſoutherly

ſoutherly, this 4 ho. 40′ 12″, thus found, had been the time of Sun-ſetting after Noon, as may appear by the general Scheam turned upſide down.

And after the form of this laſt example, if there were given the azimuth of the Suns riſing or ſetting, and the Suns declination, we might find the angle of the Suns meridian with the horizon: or the Poles elevation, after the form of the laſt but one.

Caſe 14. *The Declination of the Sun, and his azimuth of riſing and ſetting given: to find the hour.*

Let the Suns declination be 15 deg. 10′, northerly,
His azimuth at his riſing or ſetting 65 deg. 08′, from the North.

To find the hour.

Suns declinat. compl.	*AD*	15 deg.	10′	*co. ar. s AD*	0.0153967
Suns azimuth	*DB*	65	08	*s DB*	9.9577455
Hour of Sun riſing	*A*	70	03	*s A*	9.9731422

Which 70 deg. 03′ converted into time, is 4 ho. 40′ 12″, the hour of Sun riſing: but if the declination had been ſoutherly, this arch thus found had been the hour of Sun-ſetting.

And after the form of this example, if there were given (as in the thirteenth Caſe) the latitude, and Suns declination, we might find the angle of the Suns poſition, or the complement thereof, which is the angle of the Suns meridian with the horizon.

The hour of Sun-riſing or ſetting, and the angle of the Suns meridian, with the horizon given: to find { 15. *The amplitude.* 16. *The Suns declination.* }

Let the hour of Sun-riſing be 4 ho. 40′, 12″,
Which converted into degrees, is 70 deg. 03′.
The angle of the Suns meridian with the horizon 54 deg. 13′.

Caſe 15. *To find the Amplitude.*

Angle of meridian and horizon,	D	54 deg.	13′	*co. ar. s* D	0.0908539
Hour of Sun riſing in deg.	A	70	03′	*tsc* A	9.5330060
Amplitude compl.	DB	24	52	*tc*DB	2.6938629

Case 16. *To find the Suns declination.*

Angle of merid. and horizon	D	54 deg.	13′ *tc*	D	9.8578031
Hour of Sun-rising	A	70	03 *tc*	A	9.5598854
Suns declination compl.	AD	15	10 *sc*	AD	9.4176885

Which declination 15 deg. 10 min. is northerly, because the hour of Sun-rising is before six: otherwise the said hour being after six, the declination should be southerly.

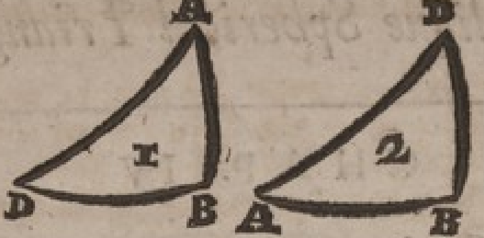
And after the form of the last Case but one, we may by the same things given find the Poles elevation.

And thus it is evident, that of the five circular parts of this right angled spherical triangle, namely, of the two oblique angles, the two sides, and the hypothenusal, there may be framed 30 Problems or Questions of the Sphere, and these 30 Problems are reduced to 16 Cases, and these 16 Cases to that one fundamental Axiom before set down; and the like is to be understood in other right angled spherical triangles.

The same 30 questions might also have been moved and resolved in the quadrantal triangle AGD, and they are also reduced to 16 Cases, and these 16 Cases to the aforesaid fundamental Axiom. Of which things having before given sufficient light, we will leave the practice thereof to the industrious Reader.

And it will not be amiss, when there is a question proposed in a right angled spherical triangle, to mark it with the Letters ABD; *setting B at the right angle, and AD to the hypothenusal; or if it be a quadrantal triangle, set DG to the quadrantal side, and A at angle thereto opposite.*

As if (in the general Scheam of the Sphere before going) I would resolve the triangle ♈QF, right angled at Q. I put for ♈, A, for Q, B, and for F, D, as in the first of these triangles: or I put for F, A, for Q, B, and for ♈, D, as in this second triangle.



In this first triangle. *In this second triangle.*

A, *is the Equinoctial point of* ♈ *and* ♎, *which in this second triangle is* D.

AB, *is an arch of the Equinoctial, which in the second is* DB.

DB, *is an arch of the Suns meridian, which in the second is* AB.

And thus,

AD, *is the Suns place or distance from the nearest Equinoctial point, which in the second triangle is also* DA.

AB, *is the Suns right ascension from the nearest Equinoctial point, which in the second triangle is* DB.

DB, *is the Suns declination, which in the second triangle is* AB.

A, *is the angle of the Ecliptick with the Equinoctial, which in the second triangle is* D.

D, *is the angle of the Suns Meridian with the Ecliptick, which in the second triangle is* A.

And any two of these being given, we may find any third required; and so frame 30 *several questions, every of which in one of these triangles will be conformable to the exemplary table of right angled triangles before set down.*

And the like is to be understood in the other two triangles before mentioned R ♈ C, *and* ♈ SE: *so that in these four right angled triangles, you may frame* 120 *questions of the sphere, and their resolutiens. And the like you may do in their quadrantals: all which I leave to your own practice, desiring to use as much brevity as conveniently I may.*

And thus much touching the resolution of such spherical triangles as are either right angled or quadrantal: Now we come to those that are oblique, which have 12 *Cases, ten whereof do also depend upon the first general axiome afore-going, and might be thence deduced. But that all things may be the more easie and perspicuous, we will lay down two Consectaries following of the said first Axiom, after we have declared in general the Cases of an oblique triangle.*

Of

Of Oblique Spherical Triangles,

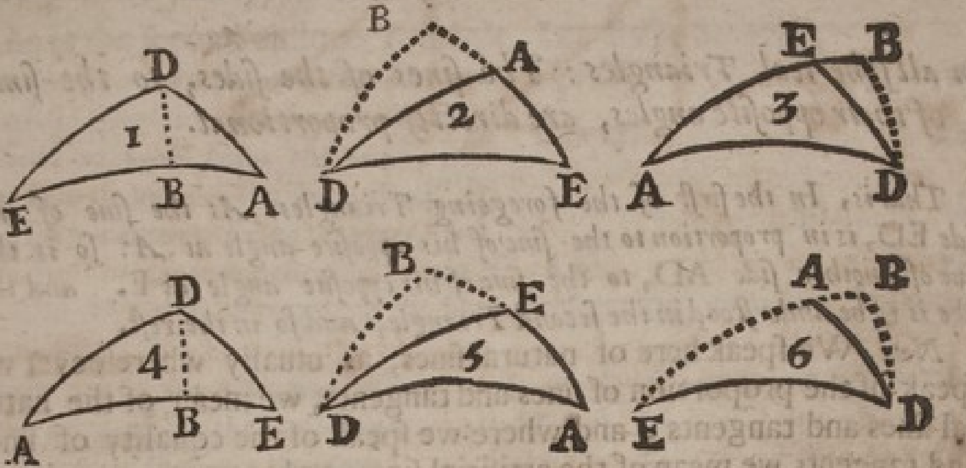
CHAP. IV

Of the Cases and Questions incident in every oblique spherical Triangle in general: and particularly of those two Cases wherein the things given and required are opposites.

TO the intent the application of the Doctrine of Spherical Triangles may be the better understood, we will here (as we have before in right angled Triangles) give examples of the several Cases of an oblique Triangle in the actual resolution of some known Triangle of the Sphere. And we have before noted in the general Scheam of the Sphere, *Chap.* 3. that *AGF* is an oblique angled Triangle. Let us suppose the first of these Triangles following marked with *ADE* to be the same (where we change the Letters, not of any necessity, but for the better conformity of all the examples.) So that *A* here may be in place of *A* there: namely, at the Pole of the world: *D* here, in place of *G* there, namely, at the Zenith; and E here, in place of F there, namely, at the Sun. Then is,

AD, the complement of the Poles elevation, or the distance of the Pole from the Zenith.
AE the complement of the Suns declination, or the distance of the Sun from the Pole.
ED, the complement of the Suns height, or the Suns distance from the Zenith.
A, the angle of the hour from Noon, or the angle of the meridian of the Sun, with the meridian of the place.
E, the angle of the Suns position in respect of the Pole and Zenith.
D, the Suns azimuth from the North part of the meridian.

And



And any three of these being given, the other three may be found. So that of these six parts conferred together there arise in this Triangle, and so in others, Sixty Questions or Problems of the Sphere: which are all reduced to 12 Cases, the resolution whereof we intend now to shew, and exemplifie in this Triangle, and withall to point out the said Sixty Questions here incident, referring every of them to their proper Cases.

And that these Sixty Problems may be the more conformable to the 12 Cases whereunto they are referred, I have marked this Triangle six several ways: that so the things given and required in every of these Triangles be noted by the same Letters, as are used in the Case and Example whereunto that Problem is referred; whereunto I am the rather induced, by the example of the honourable Lord *Nepair* in his 12 Cases of an oblique Triangle, set forth in his Book of the Construction of Logarithms.

But every man is at liberty to do herein as he thinks good, for the Rules are general, howsoever the Triangles or their parts are marked.

And thus having shewed in general, what Cases and Questions are incident in an oblique spherical Triangle, we come now to handle them particularly, laying for the two first Cases this ground.

Consectary

Consectary I.

In all spherical Triangles: The sines of the sides, to the sines of their opposite angles, are directly proportional.

That is, In the first of the foregoing Triangles. As the sine of one side ED, *is in proportion to the sine of his opposite angle at A: so is the sine of another side* AD, *to the sine of his opposite angle at* E. *and the like is to be understood in the second Triangle, and so in the rest.*

Note, We speak here of natural sines, as usually wheresoever we speak of the proportion of sines and tangents, we mean of the natural sines and tangents; and where we speak of the equality of sines and tangents, we mean of the artificial sines and tangents, that is, of the Logarithms of the natural sines and tangents: *For where there is an equality of the artificial, there is a reciprocal proportionality of the natural,* as is evident by the *Corol.* of 3 *Prop.* of 2 *Chap.* of *Plain Triangles.*

Construct. *Now touching this Consectary, let* AD E *be an oblique angled triangle; If then we let fall the perpendicular* DB, *it is resolved into two right angled triangles, ADB, and EDB.*

Demonst. *wherefore by the fundamental Axiom of right angled triangles, if we take the perpendicular* BD *for the middle part, and* AD *and A for his opposite extreams, in the triangle ADB; and* ED, *and* E, *for his opposite extreams, in the triangle EDB, then*

Rad + *s DB, is equal to s* AD + *s A, also*

Rad + *s DB is equal to s* ED + *s E.*

But things that are equal to one and the same thing, are equal one to another; therefore s AD + *s A, is equal to s* ED + *s E. Therefore by the Corol. of* 3 Prop. 2 Chap. *of Plain Triangles the proportion of their natural sines is reciprocal, thus:*

As the sine of ED. *is to the sine of the angle A:*

so is the sine of AD, *to the sine of the angle at E.*

And the like is to be understood in the second triangle. Therefore in all spherical triangles, &c. *which was to be proved*

And hence may two Cases in an oblique triangle be resolved. As,

Case

Case 1. *Two angles, with a side opposite to one of them given; to find the side opposite to the other.*

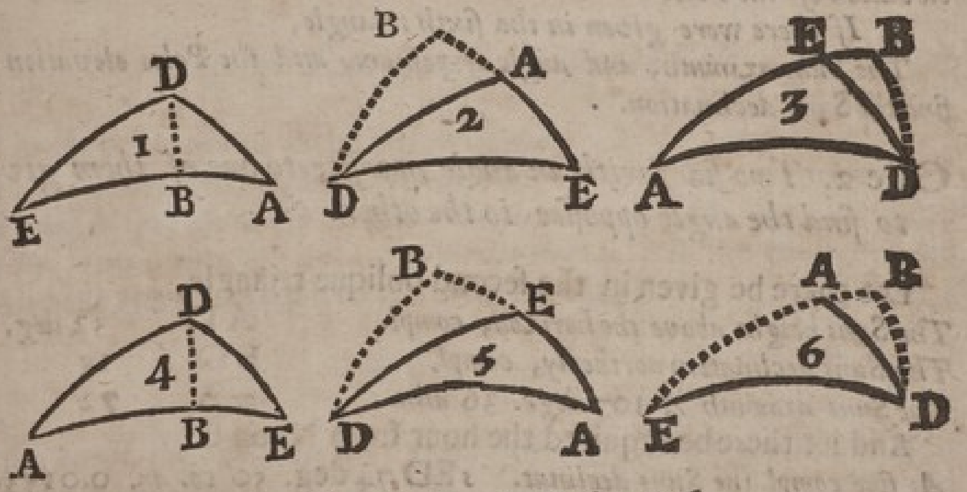
As in the second oblique Triangle, Let there be given

The Suns azimuth from the North	D A E,	107 deg.	36′
whose compl. to 180 *deg. being the Suns azimuth from the South, is*	B A D,	72	24
The hour from noon E 3 *ho.* 45′ 44″, *which converted into degrees, is*		56	26
The Suns height being the complement of	A D,	32	28

And let there be required the Suns declination, which is the complement of E D.

As the sine of the hour from Noon,	*s* E 56 *d.* 26′, *co. ar.*		0.0792283
to the sine compl. of the Suns height:	*s AD* 57	32	9.9261900
so the sine of the Suns azimuth,	*s A* 72	24	9.9791798
to the sine of the complement of the Suns declination.	*s ED* 74	50	9.9845981

Whereby the Suns declination appears to be 15 deg. 10′.



Another Example of this Case.

Let there be given in the fifth Triangle,

The Suns azimuth from the North, whose	D E A,	107 deg.	36′
complement to 180 *degrees, is*	B E D,	72	24
The hour from Noon A 3 *ho.* 45′ 44″, *which converted into degrees is*		56	26
The Suns declination, the complement of	AD	15	10

And let there be required the Suns height, being the compl. of ED.

As the sine of the azimuth,	*s* E	72 *deg.*	24′ *co. ar.*	0.0208202
to sine compl. the Suns declinat.	*s* AD	74	50	9.9846033
so the sine of the ho. from noon,	*s* A	56	26	9.9207717
to sine compl. the Suns height.	*s* ED	57	32	9.9261952

Whereby the Suns height appears to be 32 deg. 28 min.

Note. *By the imitation of either of these examples, there may four other questions in this Triangle, and so of any other, be resolved.*

As 3. *If (in the first triangle) there be given,*

The hour of the day, the angle of the Suns position, and the height of the Pole: to find the height of the Sun.

4. *If there were given in the fourth Triangle,*

The hour of the day, the angle of the Suns position, and the height of the Sun: to find the height of the Pole.

5. *If there were given in the third triangle,*

The Suns azimuth, and angle of position, and declination, to find the elevation of the Pole.

6. *If there were given in the sixth triangle,*

The Suns azimuth, and angle of position, and the Poles elevation: to find the Suns declination.

Case 2. *Two sides with an angle opposite to one of them given: to find the angle opposite to the other.*

Let there be given in the second oblique triangle,

The Suns height above the horizon, compl.	AD	32 *deg.*	28′
The Suns declination northerly, compl.	ED	15	10
The Suns azimuth A 107 *degr.* 36 *min.*	*or* A	72	24

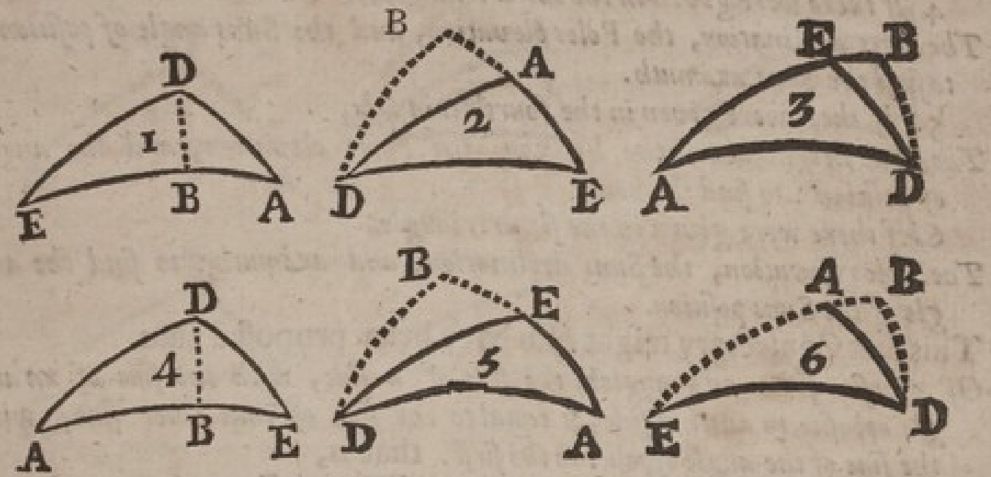
And let there be required the hour from Noon E.

As sine compl. the Suns declinat.	*s* ED	74 deg.	50′ *co. ar.*	0.0153967
to the sine of the azimuth;	*s* A	72	24	9.9791798
so sine compl. the Suns height,	*s* AD	57	32	9.9261900
to the sine of the ho. from Noon.	*s* E	56	26	9.9207665

Which 56 deg. 26 min. converted into time, is 3 ho. 45′ 44″, which in the forenoon is 14′ 16″ after 8 of the clock, but in the afternoon 45′ 44″ after three of the clock.

Note.

Note. *The arch or angle answering to 9.9207665, is not full 56 deg. 26 min. but wants almost a fifteenth part of a minute, or four seconds; but for the more facility and readiness, it shall suffice to give the examples to a minute; such as desire more preciseness, may do as we have shewed in the second Chapter of Plain Triangles,* Sect. 8.



Another Example of this second Case.

Let there be given in the fifth triangle,

The Suns declination northerly, complement	AD	15	deg.	10′
The Suns height above the horizon, complement	ED	32		28
The ho. from noon, 3 ho, 45′ 44″, which in deg. is	A	56		26

And let there be required the Suns azimuth E.

Proportion.

As sine compl. the Suns height,	*s* ED	57 deg.	32′	*co. ar.*	0.0738100
to the sine of the hour;	*s* A	56	26		9.9207717
so sine compl. the Suns declinat.	*s* AD	74	50		9.9846033
to the sine of the azimuth	*s* E	72	24		99791850

Which 72 deg. 24 min. is here the Suns azimuth from the South, the complement whereof to 180 degrees, is 107 deg. 36 min. the Suns azimuth from the north.

By imitation of either of these examples, there may four other questions in this triangle, and so of any other be resolved : As,

3. *If there were given in the first triangle,*

The Poles elevation, the Suns height above the horizon, and the hour from noon: to find the Suns angle of position.

4. *If there were given in the third triangle,*

The Suns declination, the Poles elevation, and the Suns angle of position ; to find the Suns azimuth.

5. *If there were given in the fourth triangle,*

The Suns height above the horizon, the Poles elevation, and the angle of position : to find the hour.

6. *If there were given in the sixth triangle,*

The Poles elevation, the Suns declination, and azimuth: to find the angle of the Suns position.

This first Consectary might also have been proposed thus.

Of opposite sides and angles, the sine of a side, with the sine of an angle opposite to another side, is equal to the sine of that other side, with the sine of the angle opposite to the first. that is,

s AD -|- *s* A is equal to *s* ED -|- *s* E.

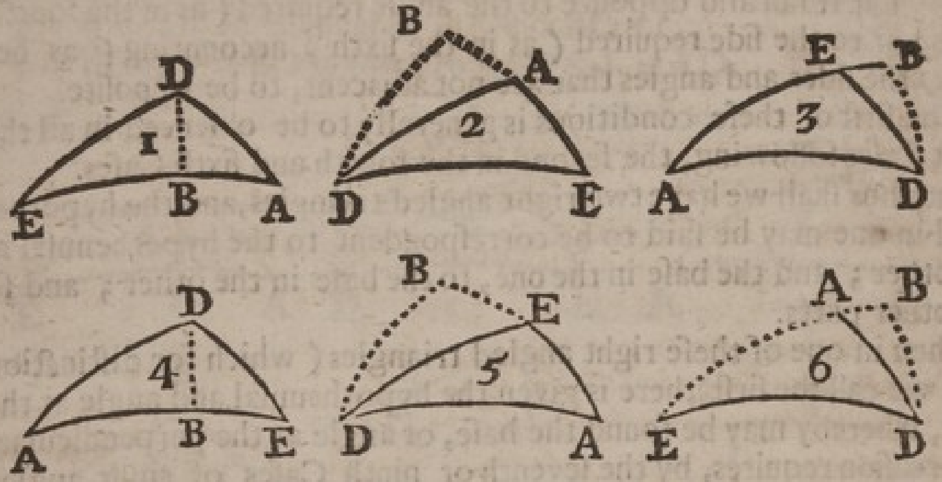
Which in effect is the same with the former, and in like sort demonstrated. But the former is to be preferred, being brief, perspicuous, and well known to such as have been conversant in spherical triangles.

But in the use of this Consectary, and of the two last Cases, there happens the like doubt, as we have noted upon the ninth Case of *Plain Triangles*. Namely, in spherical triangles it is doubtful, whether the angle nearest to a right angle, and his opposite sides be both of one and the same, or of divers kinds, unless you discover it by your work, or that it be a thing given by supposition.

This doubt may (for the most part) be removed by the exact delineation of the scheam or figure: whereby you shall perceive whether a spherical angle be acute or obtuse, and a side greater or less than a quadrant. But you may be further directed herein, by the three Propositions of the Baron of *Marchiston*, which I have for that purpose set down in the first *Chapter* of spherical triangles.

As in this last example, seeing the side *AD* 74 deg. 50 min. is nearer to a quadrant than his opposite angle at E being 72 deg. 24 min. or 107 deg. 36 min. therefore (by the last of those three) two angles of that triangle

triangle are of one kind,and the third greater than a quadrant. That is, the two angles at A and *D*, are acute, and the third at *E*, namely, *AED* is greater than a quadrant: therefore the angle there found *AED* is 107 deg. 36 min. and the like judgment is to be given of others.



CHAP. V.

Of eight other Caſes of an oblique ſpherical Triangle, reſolved at two operations by a perpendicular let fall.

NOte. If this way of reſolving theſe eight Caſes at two operations ſeem hard, you may more eaſily reſolve them at three operations, as is ſhewed in the ſixth *Chapter* next following; but here we ſhew their reſolution at two operations only, thus;

In the eight Caſes next following there are alſo three things(in an oblique triangle) given to find a fourth; for the finding whereof it is requiſite, that this triangle propoſed be reduced to two right angled triangles,by a perpendicular let fall from one of the angles to his oppoſite ſide; which perpendicular falls ſometimes within the triangle, ſometimes without.

If the angles at the baſe be both of one kind(that is, both obtuſe, or both acute) the perpendicular falls within the triangle, if of divers kinds, without: and the converſe.

In

In letting fall the perpendicular, obſerve, that foraſmuch as in every of theſe Caſes there is given a ſide with an angle adjoyning,

1. Let fall the perpendicular from the end of that ſide oppoſite to that adjacent angle:

And further when that ſufficeth not,

2. Let it fall alſo oppoſite to the angle required (as in the fourth Caſe) or to the ſide required (as in the ſixth) accounting (as before) the ſides and angles that are not adjacent, to be oppoſite.

The firſt of theſe conditions is generally to be obſerved in all the eight Caſes following, the ſecond in the fourth and ſixth Caſes.

And thus ſhall we have two right angled triangles, and the hypothenuſal in one may be ſaid to be correſpondent to the hypothenuſal in the other; and the baſe in the one, to the baſe in the other; and ſo the other parts.

Then in one of theſe right angled triangles (which for diſtinction ſake we call the firſt) there is given the hypothenuſal and angle at the baſe, whereby may be found the baſe, or angle at the perpendicular, as occaſion requires, by the ſeventh or ninth Caſes of right angled triangles; and this is the firſt operation.

For the ſecond, there muſt (of the things thus given and required) two things in one triangle, be compared to two correſpondent things in the other triangle, which two in each, with the perpendicular, make three things in each triangle, either adjacent (that is lying together) or oppoſite; of which three, the perpendicular is always one of the extreams, and the thing required, one of the other extreams; all which may appear in every of theſe ſix triangles.

So that by the firſt general Axiom of right angled ſpherical triangles.

$$1\left\{\begin{array}{l} \textit{Radius} + sc\ AD \\ sc\ DB + sc\ EB \end{array}\right\} \text{is equal to} \left\{\begin{array}{l} sc\ AB + sc\ DB. \\ sc\ ED + \textit{Radius}. \end{array}\right.$$

$$2\left\{\begin{array}{l} \textit{Radius} + s\ AB \\ t\ DB + tc\ E \end{array}\right\} \text{is equal to} \left\{\begin{array}{l} tc\ A + t\ DB. \\ s\ EB + \textit{Radius}. \end{array}\right.$$

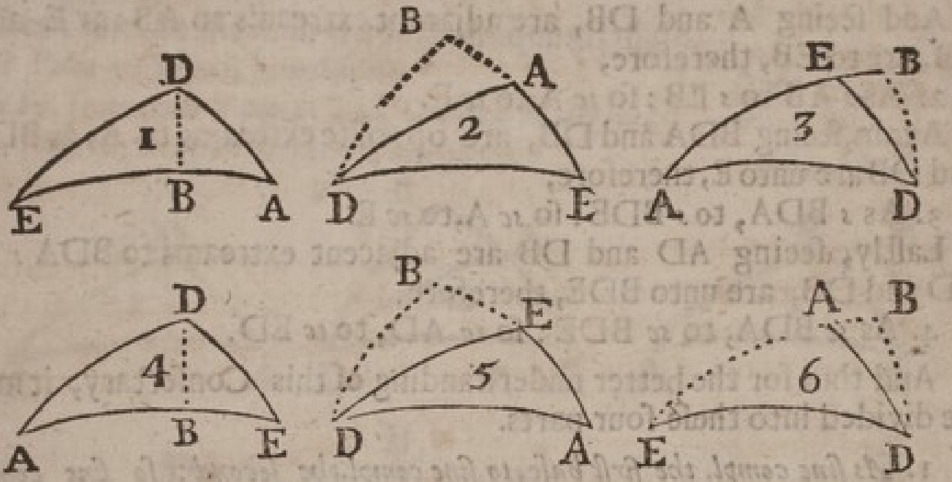
$$3\left\{\begin{array}{l} \textit{Radius} + sc\ A \\ sc\ DB + s\ BDE \end{array}\right\} \text{is equal to} \left\{\begin{array}{l} c\ BDA + sc\ DB. \\ sc\ E + \textit{Radius}. \end{array}\right.$$

$$4\left\{\begin{array}{l} \textit{Radius} + sc\ BDA \\ t\ DB + tc\ ED \end{array}\right\} \text{is equal to} \left\{\begin{array}{l} tc\ AD + t\ DB. \\ sc\ DBE + \textit{Radius}. \end{array}\right.$$

But

But if from equal things we take away equal things, the things remaining are equal ; therefore from either side taking *t* or *sc* DB and *Radius*, it follows, that.

1 *sc* AD + *sc* EB is equal to *sc* ED = *sc* AB.
2 *s* AB + *tc* E is equal to *t* BE + *tc* A.
3 *sc* A + *s* BDE is equal to *sc* E + *s* BDA.
4 *sc* BDA + *tc* ED is equal to *sc* BDE + *tc* AD.



Wherefore in each right angled triangle, supposing the three parts more remote from the right angle, to be noted, as is aforesaid, with their complements ; and using (as is expressed in the fundamental Axiom) the sines of the middle parts, and the tangents of the extreams adjacent, or the sines compl. of the opposite extreams, you may observe that

The middle part in the first triangle, with the extream in the second : is equal to the middle part in the second, with the extream in the first.

And by help of this Consectary might these eight Cases be resolved, which also by the *Corollary* of 3 *Prop. Chap.* 2. of *Plain Triangles*, may be proposed as followeth ; in which from we intend to use it.

Consectary II.

As the middle part in the first Triangle, is in proportion to the middle part in the second : so is the extream in the first, to the extream in the second.

Though

Though the perpendicular be always one of the extreams in either triangle (as is before noted) yet we use not that, but the other extream in both.

Wherefore in any of the six oblique triangles, seeing AB and DB. are opposite extreams to AD, as EB and DB are to ED, therefore,

1. As *sc* AB to *sc* EB: so *sc* AD to *sc* ED.

And seeing A and DB, are adjacent extreams to AB: as E and DB, are to EB, therefore,

2. As *s* AB to *s* EB: so *tc* A to *tc* E.

Again, seeing BDA and DB, are opposite extreams to A, as BDE and DB are unto E, therefore,

3. As *s* BDA, to *s* BDE: so *sc* A, to *sc* E.

Lastly, seeing AD and DB are adjacent extreams to BDA: as ED and DB, are unto BDE, therefore,

4. As *sc* BDA, to *sc* BDE: so *tc* AD, to *tc* ED.

And thus for the better understanding of this Consectary, it may be divided into these four parts.

1. *As sine compl. the first base, to sine compl. the second: so sine compl. the first hypothenusal, to sine compl. the second.*

And this serves for the 3 and 7. Cases following.

2. *As the sine of the first base to the sine of the second: so tangent compl. the first angle at the base, to tangent compl. the second.*

Which serves for the 4 and 10. Cases,

3. *As the sine of the first angle at the perpendicular, to the sine of the second: so sine compl. the first angle at the base, to sine complement the second.*

Which serves for the 5 and 9. Cases.

4. *As sine compl. the first angle at the perpendicular, to sine complement the second: so tangent compl. the first hypothenusal, to tangent compl. the second.*

And this serves for the 6 and 8. Cases following.

The words (*first* and *second*) we here use, to distinguish the two right angled triangles.

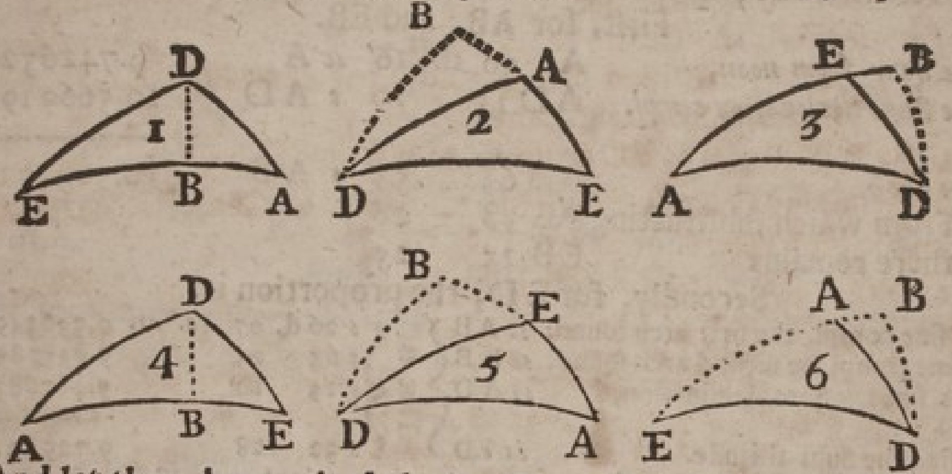
This Consectary might have been otherwise demonstrated, as by producing the sides of the oblique triangle to Quadrants, *&c.* But I have the rather used this form, that so the deduction thereof from the

the firſt fundamental Axiom before going might the better appear; and this ground thus laid, we come now to the eight Caſes thereon depending.

Caſe 3. *Two ſides, and their contained angle given: to find the third ſide.*

Let there be given in the firſt oblique triangle,

The Poles elevation, complement	AD,	51 deg.	32′
The ho. from noon 3 ho. 45′. 44″, which in degrees is	A	56	26
The Suns declination northerly, complement	AE,	15	10



And let there be required the Suns height, complement ED.

Firſt, by the ſeventh Caſe of right angled triangles, to find AB and E B.

The hour from noon,	A	56 deg.	26′ *sc* A	9.7426520
The Poles elevation compl.	AD 51	32	*t* AD	9.9000865
The arch	AD 23	43	*t* AB	9.6427385

The ſum or remainer of AB and AE is EB.

But here from AE	74 d.	50′	Or if to compl. AE	15 deg.	10 min.
ſubſtracting AB	23	43	we add AB	23	43
There remains EB	51	07	we have compl. EB and ſo of the reſt.	38	53

L

Secondly,

Secondly, for ED, by the second Consectary, the proportion is,

As sine compl. the first arch found,	sc AB	That is	s 66 d.	15′	co. ar.	0.0383200
to sine compl. the second arch found,	sc EB		s 38	53		9.7977775
so is the sine of the Poles elevation,	sc AD		s 51	32		9.8937452
to the sine of the Suns altitude.	sc ED		s 32	28		9.7298427

2 *Example.*

Let there be given in the fifth Triangle,

The Suns declination northerly, compl.	AD	15	deg.	10′
The hour from noon, 3 ho. 45′ 44″, which in degrees is the angle.	A	56		26
The Poles elevation *complement*	AE	38		28

And let there be required the Suns height, compl. ED.

First, for AB, and EB.

The hour from noon,	A	56 d.	26′	sc A	9.7426520
The Suns declination compl.	AD 15		10	t AD	10.5669195
The arch	AB 63		53	t AB	10.3095715
From which substracting	AE 38		28		
there remains	EB 25		25		

Secondly, for ED, the proportion is,

As sine compl. the first arch found,	sc AB	That is	s 26 d.	07′	co. ar.	0.3563496
to sine compl. the second arch found,	sc EB		s 64	35		9.9557890
so is sine the Suns declination,	sc AD		s 15	10		9.4176837
to sine the Suns altitude.	sc ED		s 32	28		9.7298223

Note. *Although there be a difference between the artificial sine here found and the former; yet the difference of their arches is little more than one tenth part of a min. which ariseth, by neglecting the seconds and thirds in the arch first found* A B. *He that desires to work to seconds may do it as we have shewed,* Chap. 2. Sect. 8. *of* Plain Triangles. *But in these examples, we would not trouble Beginners with them at the first, it being sufficient for ordinary occasions, if the work be true to a minute.*

And after the form of either of these examples, we may calculate Tables of the Suns height for every hour and minute of the day; by which Tables may be made the Quadrants and Ring-Dials, and other instrumental and fixed Dials, that give the hour of the day by the Suns height.

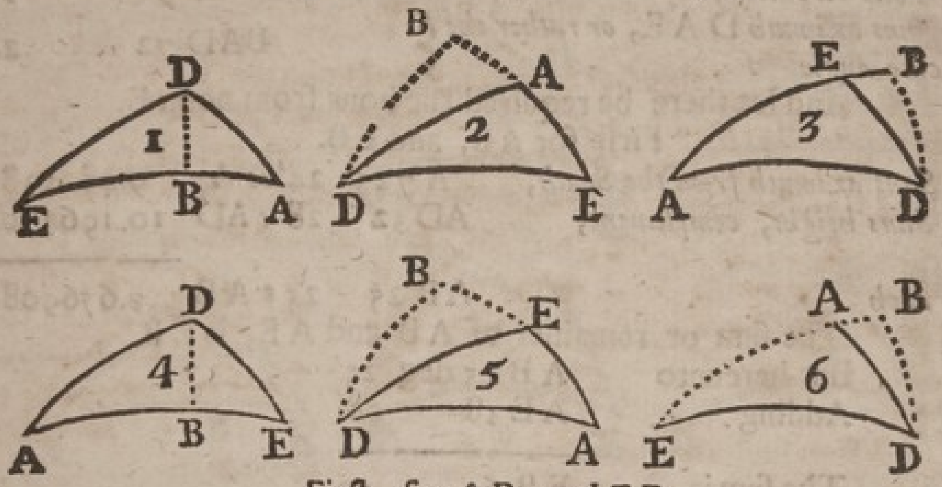
3. *Example.*

3. *Example.*

Let there be given in the ſecond oblique triangle,

The Suns height above the horizon,	*complement*	A D	32 deg.	28′
The Suns azimuth D A E,	*or rather the acute ang.*	BAD	72	24
The Poles elevation	*complement,*	A E	51	32

And let there be required the Suns declin. *compl.*, ED.



First, for A B, and E B.

The Suns azimuth from the South,	A 72 d.	24′	*sc* A	9.4805385
The Suns height, complement,	AD 32	28	*t* AD	10.1963704
The arch	AB 25	25	*t* AB	9.6769089
Whereto adding	AE 38	28		
The ſum is	EB 63	53		

Secondly, for E D, the proportion is,

As ſine compl. the firſt arch found,	*sc* A B	That is	*s* 64 d.	35′	*co. ar.*	0.0442110
to ſine compl. the ſecond arch found,	*sc* E B		*s.* 26	07		9.6436504
ſo is the ſine of the Suns height,	*sc* A D		*s* 32	28		9.7298197
to the ſine of the Suns declination,	*sc* E D		*s* 15	10		9.4176811

The ſame might be found by the ſame things given in the ſixth triangle, where the perpendicular falls from the Pole.

And after the form of any of theſe three examples, there may a third queſtion in this triangle, and ſo in any other be reſolved:

As 3. If in the third or fourth triangle there be given,

The Suns declination, the Suns height above the horizon, and the angle of the Suns poſition: to find the Poles elevation.

Caſe 4. *Two ſides, and their contained angle given: to find one of the other angles.*

Let there be given in the ſecond oblique triangle,

The Suns height above the horizon complement	A D,	32 deg.	28′
The Poles elevation, complement	A E,	51	32
The Suns azimuth D A E, *or rather the acute angle*	BAD	72	24

And let there be required the hour from noon E.

First for A B, and E B.

The Suns azimuth from the South,	A 72 d.	24′	*sc* A	9.4805385
The Suns height, complement,	AD 32	28	*t* AD	10.1963704
The arch	AB 25	25	*t* A B	9.6769089

The ſum or remainer of A B and A E, is E B.

But hereunto	A B 25 deg.	25′
Adding	A E 38	28
The ſum is	E B 63	53

Secondly, for E, by the ſecond Conſectary, the proportion is,

		That is				
As the ſine of the firſt arch found,	*s* A B		*s* 25 d.	25′	*co. ar.*	0.3673424
to ſine the ſecond arch found:	*s* E B		*s* 63	52		9.9532277
ſo tang. compl. the azimuth	*tc* A		*t* 17	36		9.5013588
to tang. compl. the hour	*tc* E,		*t* 33	34		9.8219289

Whoſe compl. 56 deg. 26 min. converted into time, is 3 ho. 45′ 44″ before or after noon.

Or the proportion is
As the ſine of the firſt arch found,
to the ſine of the ſecond arch found:
ſo is the tang. of the azimuth from Eaſt or Weſt,
to the tangent of the hour from ſix.

Or by the 3. Theorem of ch. 4. of plain Triangles.
As the ſine of the ſecond arch found;
is to the ſine of the firſt arch found:
ſo is the tang. of the azimuth from the Meridian,
to the tangent of the hour from noon.

Note. The like variety may be uſed in the next example, and alſo in the examples of the 6, 8, and 10 Caſes, and partly in every Caſe; which having here briefly noted, we ſhall leave to your own practice, as your occaſion requires.

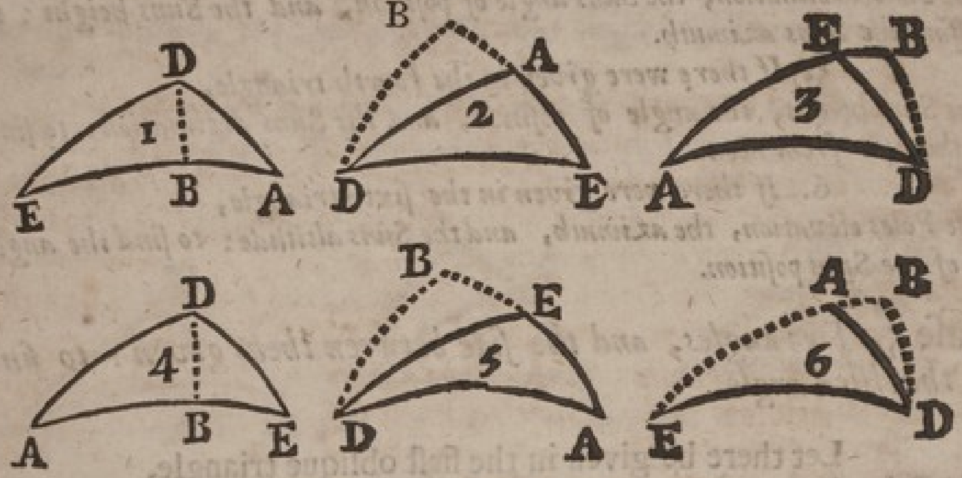
2. *Exam.*

2. Example.

Let there be given in the fifth Triangle,

The Suns declination northerly, complement	AD	15	deg.	10′
The ho. from noon 3 ho. 45′ 44″, which in deg. is	A	56		26
The Poles elevation, complement	AE	51		32

And let there be required the Suns azimuth E,



First, for A B and E B.

The ho. from noon in degr.	A 56 deg. 26′	*sc* A		9.7426520
The Suns declinat. compl.	AD 15 10	*t* AD		10.5669195
The arch	AB 63 53	*t* AB		10.3095715
		Or unto		AB 63 53
From which subtracting	AE 38 28	Adding com.		AE 51 32
The remainer is	EB 25 25	Sum is		EB 25 25

Secondly for E.

As the sine of the first arch found,	*s* AB	That is	*s* 63 d. 53′ *co. ar.*	0.0467723
to sine the second arch found,	*s* EB		*s* 25 25	9.6326576
so is tangent compl. the hour,	*tc* A		*t* 33 34	9.8218803
to tangent compl. the azimuth,	*tc* E		*t* 17 36	9.5013102

Which 17 deg. 36′ is the Suns azimuth from the East or West, and the complement thereof 72 deg. 24′, is the Suns azimuth from the south, whose complement to 180 deg. that is, 107 deg. 36′ is his azimuth, from the North.

Hence might Tables be framed shewing the Suns azimuth for every hour of the day, and for several seasons of the year, whereby may be made the Dyals rendring the hour by the Suns azimuth. By

By imitation of either of these examples, there may four other questions in this triangle, and so of any other be resolved: As,

3. *If there were given in the first oblique triangle,*
The Poles elevation, the hour, and the Suns declination: to find the Suns angle of position.

4. *If there were given in the third triangle,*
The Suns declination, the Suns angle of position, and the Suns height: to find the Suns azimuth.

5. *If there were given in the fourth triangle,*
The Suns height, the angle of position, and the Suns declination: to find the hour from noon.

6. *If there were given in the sixth triangle,*
The Poles elevation, the azimuth, and the Suns altitude: to find the angle of the Suns position.

Case 5. *Two angles, and the side between them given: to find the third angle.*

Let there be given in the first oblique triangle,

The Poles elevation, complement	AD	51	deg.	32′
The ho. from noon 3 ho. 45′ 44″, which in degrees is	A	56		26
The Suns azimuth,	D	107		36

And let there be required the angle of position, E.

First, for the angles BDA and BDE, by the ninth Case of right angled triangles.

The Poles elevation, compl.	AD	51 d.	32′	*sc*	AD	9.8937452
The hour from noon	A	56	26	*t*	A	10.1781197
The angle	BDA	40	17	*tc*	BDA	10.0718649

The sum or remainer of BDA and D, is BDE.

But here from	D	107 d.	36′
substracting	BDA	40	17
remainer is	BDE	67	19

Secondly, for the angle E, by the second Consectary.

As the sine of the first angle found,	*s*	BDA	That is	*s* 40 d.	17′	*co.ar.* 0.1893859
to the sine of the second angle found,	*s*	BDE		*s* 67	19	9.9650371
so is the sine compl. the hour,	*sc*	A		*s* 33	34	9.7426520
to sine compl. the angle of position.	*sc*	E		*s* 52	05	9.8970750

There-

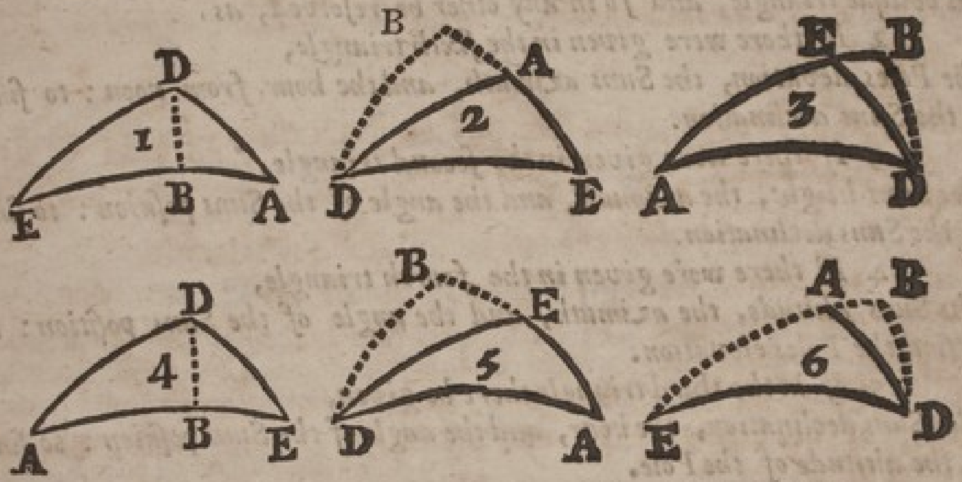
Therefore the angle of position E, is 37 deg. 55 min.

The same might be found by the same things given in the sixth triangle where the perpendicular falls from the Pole, as here from the Zenith.

And after the form of this example, there may two other questions in this triangle, and so in any other be resolved: As,

2. *If in the second and fourth triangle there were given*
The Suns altitude, the Suns azimuth, and angle of position: to find the hour.

3. *If in the third and fifth triangle there were given*
The Suns declination, the hour and angle of position: to find the Suns azimuth.



Case 6. *Two angles, and the side between them given: to find one of the other sides.*

Let there be given in the first oblique triangle,

The Poles elevation, complement	AD,	51 d.	32
The ho. from noon, 3 ho. 45′ 44″, which in degrees is	A,	56	26
The Suns azimuth from the north, the obtuse angle	D,	107	36

And let there be required the Suns height, compl. E D.

First for the angles B D A, and B D E,

The Poles elevation, compl.	A D	51 d.	32′	*sc* AD	9.8937452
The hour from noon in degr.	A	56	26	*t* A	10.1781197
The angle	B D A	40	17	*tc* BDA	10.0718649

The

The ſum or remainer of B D A and D, is B D E.

But here from	D 107 deg.	36′	
ſubſtracting	B D A 40	17	
The remainer is	B D E 67	19	

Secondly, For E D,

			That is		
As ſine compl. the firſt angle found,	sc	B D A		s 49 43′	co. ar. 0.1175572
to ſine compl. the 2d. angle found,	sc	B D E		s 22 41	9.5861794
ſo is tangent the Poles elevation,	tc	A D		t 51 32	10.0999135
to the tang. of the Suns altitude,	tc	E D		t 32 28	9.8036501

Note. *By imitation of this example, there may five other queſtions in this oblique triangle, and ſo in any other be reſolved, as*

2 *If there were given in the ſixth triangle,*
The Poles elevation, the Suns azimuth, and the hour from noon: to find the Suns declination.

3 *If there were given in the ſecond triangle,*
The Suns height, the azimuth, and the angle of the Suns poſition: to find the Suns declination.

4 *If there were given in the fourth triangle,*
The Suns altitude, the azimuth, and the angle of the Suns poſition: to find the Poles elevation.

5 *If in the third triangle there be given,*
The Suns declination, the hour, and the angle of the Suns poſition: to find the altitude of the Pole.

6 *If in the fifth triangle there be given,*
The Suns declination, the hour, and the angle of the Suns poſition: to find the Suns altitude.

Caſe 7. *Two ſides, with an angle oppoſite to one of them given: to find the third ſide.*

Let there be given in the ſecond oblique triangle,

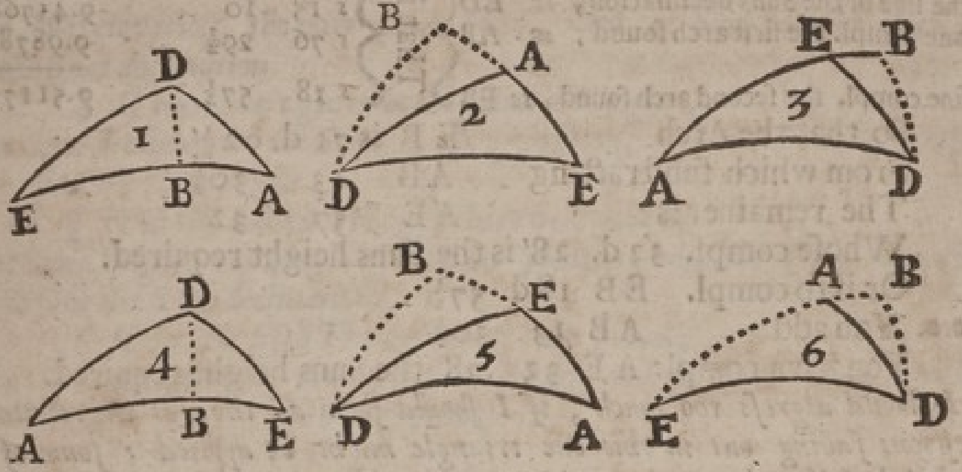
The Suns height above the horizon, complement	A D,	32 deg.	28′
The Suns azimuth, namely, the acute angle at	A,	72	24
The Suns declination northerly, complement	E D,	15	10

And let there be required the Poles elevation compl. A E.

First

First, for the arch *A B*.

The Suns azimuth,	A	72 deg.	24′	*sc*	A	9.4805385
The Suns height, complement,	AD	32	28	*t*	AD	10.1963704
The arch first found	AB	25	25	*t*	AB	9.6769089



Secondly, for *E B*, and so for *A E*.

As the sine of the Suns height,	*sc* AD	That is,	*s* 32 d.	28′	*co. ar.*	0.2701803
to the sine of the Suns declinat.	*sc* ED		*s* 15	10		9.4176837
so sine compl. the first arch found,	*sc* AB		*s* 64	35		9.9557890
to sine compl. the 2d arch found,	*sc* EB		*s* 26	07		9.6436530

So that the arch *E B*, is 63 deg. 53 min.

The sum or remainer of *A B* and *E B*, is *A E*.

But here from	*E B*	63 deg.	53′	
Substracting	*A B*	25	25	
The remainer is	*AE*	38	28	the side required.

2. *Example.*

Let there be given in the sixth triangle,

The Poles elevation,	*complement*	AD	51 deg.	32
The Suns azimuth from the meridian, the acute angle at		A	72	24
The Suns declination Northerly,	*complement*	ED	15	10

And let there be required the Suns height, compl. *A E*.

First, for the Arch A B.

The Suns azimuth,	A	72 deg.	24′	A *sc*	9.4805385
The Poles elevation compl.	AD	51	32	*t* A D	9.9000865
The Arch first found,	AB	13	30½	*t* A B	9.3806250

Secondly, for E B, and so for A E.

As the sine of the Poles elevation, *sc*	AD	That is,	*s* 51 d.	32′	*co. ar.*	0.1062548
to the sine of the Suns declination, *sc*	ED		*s* 15	10		9.4176837
so sine compl. the first arch found, *sc*	AB		*s* 76	29½		9.9878163
to sine compl. the second arch found, *sc*	EB		*s* 18	57½		9.5117548

So that the Arch E B is 71 d. 02½′
From which substracting A B 13 30½
The remainer is A E 57 32
Whose compl. 32 d. 28′ is the Suns height required.
Or if to compl. E B 18 d. 57½
Note. You add A B 13 30½
You have compl. A E 32 28 the Suns height required.

I should digress too much, if I should shew all the uses whereunto the questions falling out in this one triangle might be applied: some of the principal I thought good to point at, that I might give occasion of exercise, especially in these latter Cases, being something harder than the rest.

Thus by this Proposition you may for one day, in any Latitude, find how many degrees above the Horizon the Sun will be upon any point of the Compass; and thereby the variation of the Compass.

As admit, being in the Latitude of 51 *deg.* 32 *min. Northerly, I find by the Tables for that purpose the Suns declination Northerly, for some day, to be* 15 *deg.* 10 *min. And I would know how high the Sun will be that day being upon the East South-East point of the Compass, that is* 67 *deg.* 30 *min. from the Meridian. Here working according to the former example, I find the Suns height to be about* 35 *deg.* 33. *min. therefore I observe with Staff, Quadrant, or other Instrument, till I find the Sun to be* 35 *deg.* 33. *min. high, and then is the Sun East South-East. Wherefore at that instant setting the Sun with my Compass, if I find it to be upon the East South-East point, then hath it no variation: if it differ, look how much that difference is, so much is the variation. Which whether it be Easterly, or Westerly, may be known by the Rule before given after the* 12 *Case of the third Chapter of right angled spherical Triangles.*

By

By this Propoſition alſo are the azimuths drawn on thoſe quadrants that gives the Suns azimuth by his altitude, and ſo on thoſe Dyals that do the like.

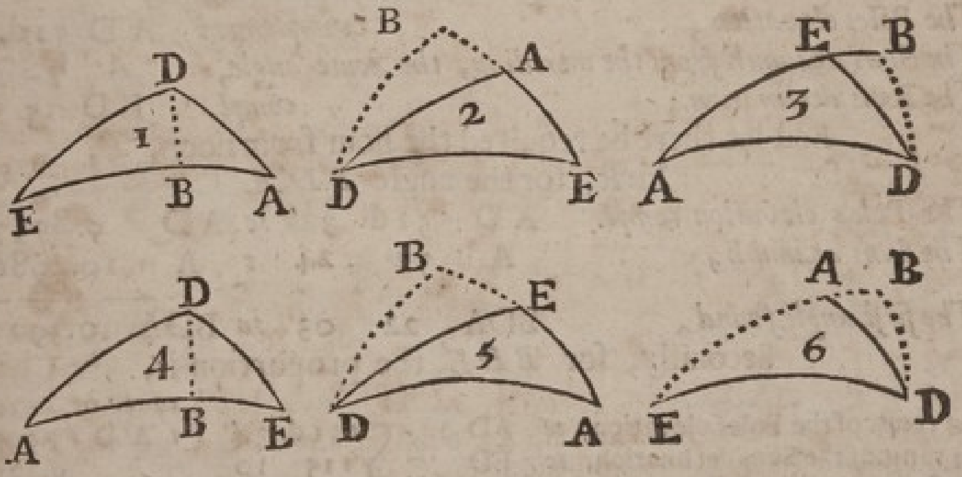
And after the form of either of theſe Examples, there may four other Queſtions in this oblique Triangle, and ſo in any other, be reſolved. As,

3 *If there were given in the firſt oblique Triangle,*
The Poles elevation, the hour from Noon, and the Suns height : to find the Suns declination.

4 *If there were given in the third Triangle ,*
The Suns declination, the Suns Angle of poſition, and the Poles elevation : to find the Suns height.

5 *If in the fourth Triangle there were given ,*
The Suns height, the Angle of the Suns poſition , and the Poles elevation : to find the Suns declination.

6 *If in the fifth Triangle there were given ,*
The Suns declination, the hour from Noon, and the Suns height above the Horizon : to find the Poles elevation.



Caſe 8. *Two ſides, with an angle oppoſite to one of them given : to find their contained angle.*

Let there be given in the firſt oblique Triangle,

The Poles elevation,	*compl. A D,*	51 *deg*.	32′
The ho. from noon 3 *ho.*45′-44″,*which in degr. is*	*A,*	56	26
The Suns altitude above the Horizon,	*compl. E D,*	32	28

And let there be required the Suns azimuth from the North, *D*.

First, for the angle *BDA*.

The Poles elevation compl.	AD	51 d.	32′	*sc* AD	9.8937452
The hour from noon,	A	56	26	*t* A	10.1781197
The first angle found	BDA	40	17	*tc* BDA	10.0718649

Secondly, for *B D E* the proportion is,

			That is,			*co. ar.* or	
As tang. of the Poles elevation,	*tc*	AD		*t* 51 d.	32′	*t* AD	9.9000865
to tang. of the Suns altitude,	*tc*	ED		*t* 32	28		9.8036196
so sine comp. the first ang. found,	*sc*	BDA		*s* 49	43		9.8824428
to sine comp. the second,	*sc*	BDE		*s* 22	41		9.5861589

The sum or remainer of the first and second angles found, namely of BDA *and* BDE, *is the angle required* D.

But here to	*B D A*	40 d.	17′
Adding	*B D E*	67	19
The sum is	*D*	107	36 the Suns azimuth required.

2. *Example.*

Let there be given in the sixth triangle,

The Poles elevation,	*complement*	AD	51 d.	32′
The Suns azimuth from the meridian, the acute angle,		A	72	24
The Suns declination;	*compl.*	ED	15	10

And let there be required the hour from noon, *D*.

First, for the angle *BDA*.

The Poles elevation compl.	AD	51 d.	32′	*sc* AD	9.8937452
The Suns azimuth,	A	72	24	*t* A	10.4986412
The first angle found,	BDA	22	03	*tc* BDA	10.3923864

Secondly, for *BDE* the proportion is,

			That is,			*co ar.* or	
As tang. of the Poles elevation,	*tc*	AD		*t* 51 d.	32′	*t* A D	9.9000865
to tang. of the Suns declination,	*tc*	ED		*t* 15	10		9.4330804
so sine com. of the first ang. found,	*sc*	BDA		*s* 67	57		9.9670125
to sine compl. the second,	*sc*	BDE		*t* 11	31		9.3001794

So that	*B D E* is	78 d.	29′	Or if unto *BDA* 22-03, you
From which take	*B D A*	22	03	add *co. BDE* 11-31, the sum
The remainer is	*D*	56	26	is *co. D* 33-34, the ho. from. 6.

Which 56 deg. 26′ converted into time, is 3 ho. 45′ 44″, from noon, that is, 14′ 16″ after eight of the clock in the forenoon, or 45′ 44″ after three of the clock in the afternoon. And

And thus in any place, for any day, you may frame a Table of the hour and minute of the Suns poſition upon every point of the Compaſs: whereby you ſhall manifeſtly ſee the error of the common Rule, of bringing 32 to 24.

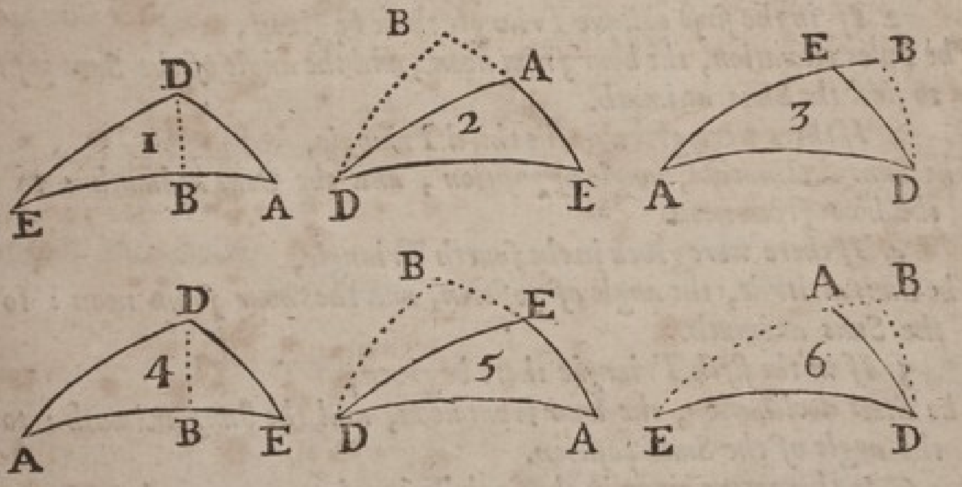
By imitation of either of theſe Examples, there may four other Queſtions in this triangle, and ſo of any other, be reſolved. As,

3. *If in the ſecond oblique triangle there were given,*
The altitude of the Sun, the azimuth, and the Suns declination : to find the angle of the Suns poſition.

4. *If in the third triangle there were given,*
The Suns declination, the angle of poſition, and the Poles elevation : to find the hour.

5. *If in the fourth triangle there were given,*
The Suns altitude, the angle of poſition, and the Poles elevation : to find the Suns azimuth.

6. *If in the fifth triangle there be given,*
The Suns declination, the hour, and the altitude of the Sun above the Horizon : to find the angle of poſition.



Caſe 9. *Two angles, and a ſide oppoſite to one of them given : to find the third angle.*

Let there be given in the ſecond oblique triangle,

The Suns height above the Horizon, complement	AD	32 d.	28′
The Suns azimuth from the meridian, the acute angle	A	72	24
The hour from noon, 3 ho. 45′--44″, which in deg. is	E	56	26

And let there be required the angle of poſition, D First,

First, for angle *B D A.*

The Suns altitude compl.	A D,	32 d.	28′	*sc* A D	9.7298197
The Suns azimuth,	A	72	24	*t* A	10.4986412
The angle first found,	B D A.	30	35	*tc* BDA	10.2284609

Secondly, for *B D E* the proportion is,

As ſine compl. the azimuth,	*sc* A	That is,	*s* 17 d.	36′	*co. ar.*	0.5194615
to ſine compl. the hour from noon,	*sc* E		*s* 33	34		9.7426520
ſo the ſine of the firſt angle found,	*s* B D A		*s* 30	35		9.5065394
to the ſine of the ſecond,	*s* B D E		*s* 68	30		9,9686529

The ſum or remainer of the firſt and ſecond angle found BDA and B D E, is the angle D required.

But in this Example, from B D E 68 d. 30′
ſubſtracting B D A 30 35
The remainer is D 37 55 the angle of poſition required.

After the form of this Example, there may five other queſtions in this oblique Triangle, and ſo in any other, be reſolved.

2 *If in the firſt oblique Triangle there be given,*
The Poles elevation, the hour from noon, and the angle of the Suns poſition: to find the Suns azimuth.

3 *If there were given in the third Triangle,*
The Suns declination, angle of poſition, and the Suns azimuth: to find the hour from noon.

4 *If there were given in the fourth Triangle,*
The Suns altitude, the angle of poſition, and the hour from noon: to find the Suns azimuth.

5 *If in the fifth Triangle there be given,*
The Suns declination, the hour from noon, and the Suns azimuth: to find the angle of the Suns poſition.

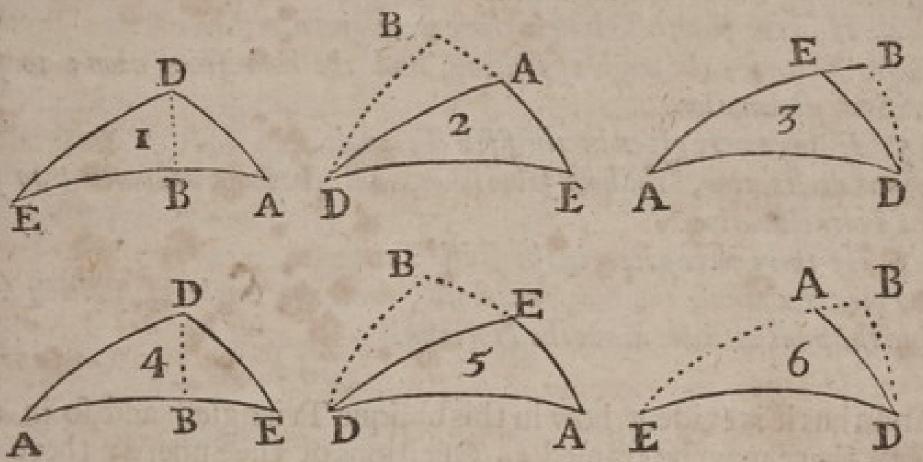
6 *If there were given in the ſixth Triangle,*
The Poles elevation, the Suns azimuth, and the angle of the Suns poſition: to find the hour from noon.

Case 10. *Two angles, and a side opposite to one of them given: to find the side between them.*

Let there be given in the second oblique Triangle,

The Suns height above the horizon complement	AD, 32	deg.	28′
The Suns azimuth from the merid. the acute angle	A, 72		24
The ho. from noon 3 ho.45′-44″, which in degr. is	E, 56		26

And let there be required the Poles elevation compl. A E.



First, for the Arch A B.

The Suns height, complement,	AD 32 deg.	28′	*t*	A D	10.1963704
The Suns azimuth,	A 72	24	*sc*	A	9.4805385
The arch first found,	AB 25	25	*t*	AB	9.6769089

Secondly, for E B

					co. ar. or	
As tang. compl. the Suns azimuth,	*tc* A	That is,	*t* 17	d. 36′	*t* A	10.4986412
to tang. compl. the hour,	*tc* E		*t* 33	34		9.8218803
so the sine of the first arch found,	*s* A B		*s* 25	25		9.6326576
to the sine of the 2d arch found,	*s* EB		*s* 63	53		9.9531791

The sum or remainer of the first and second arch found (A B and E B) is the side required A E.

But here from E B 63 deg. 53′
Substracting A B 25 25
The remainer is AE 38 28
Which is the complement of the Poles height required, 51 deg. 32′.

By

By imitation of this Example, there may five other Questions in this oblique Triangle, and so of any other be resolved. As,

2. *If in the first oblique Triangle there were given,*

The Poles elevation, the hour from noon, and the angle of the Suns position: to find the Suns declination.

3. *If in the third Triangle there were given,*

The Suns declination, the angle of position, and the azimuth: to find the Suns height above the horizon.

4. *If in the fourth Triangle there were given,*

The Suns altitude, the angle of position, and the hour from noon: to find the Suns declination.

5. *If there were given in the fifth Triangle,*

The Suns declination, the hour from noon, and the Suns azimuth: to find the Poles elevation.

6. *If there were given in the sixth Triangle,*

The Poles elevation, the Suns azimuth, and the angle of position: to find the Suns altitude above the Horizon.

And thus it is evident how in this oblique Triangle, and so in any other, there may be framed 54 Questions of the Sphere; there are also six more, which we shall touch hereafter; but these 54 are reduced, as we have shewed to ten Cases, and those ten Cases to two Consectaries, which two Consectaries are deduced from the first fundamental Axiom; so that the resolution of all the Cases and Questions hitherto handled, whether in right or oblique angled spherical triangles, depend upon that one Axiom, and may be thereunto reduced. There remain (as is said) six other Questions in this oblique triangle (and the like in any other) which are reduced to two Cases, namely, when three sides are given, to find an angle; or three angles given, to find a side. And these also might well be resolved by the grounds before laid, without adding any more; but because the ways devised by the Lord *Nepair* are more apt for this purpose, we will make use of them.

And as we have shewed the resolution of the 8 Cases last beforegoing, by help of a perpendicular; the same might have been done by drawing instead of the perpendicular, a quadrantal side: so reducing the triangle given to two quadrantal triangles. But this we must now leave to your practice.

CHAP.

CHAP. VI.

The eight last Cases of an oblique Triangle, resolved by finding the perpendicular.

THe resolution of these eight Cases, hath usually been at three operations, though (as we have shewed) they may be done at two; yet because the way at three operations is more easily understood, and is more immediately performed by the first general Axiom, without respect to the second Consectary; and because in many questions you have occasion to know the quantity of the perpendicular: therefore we shall here shew the resolution of these eight Cases at three operations, briefly and plainly; to the satisfaction (I hope) of such as complain of obscurity in the former.

First then, the oblique triangle is to be resolved into two right angled triangles by a perpendicular as (before) namely, that whereas in every of these eight Cases there is given an angle, and a side adjacent to that angle, you are to

1. *Let fall the perpendicular from the end of that side given, opposite to that angle.*

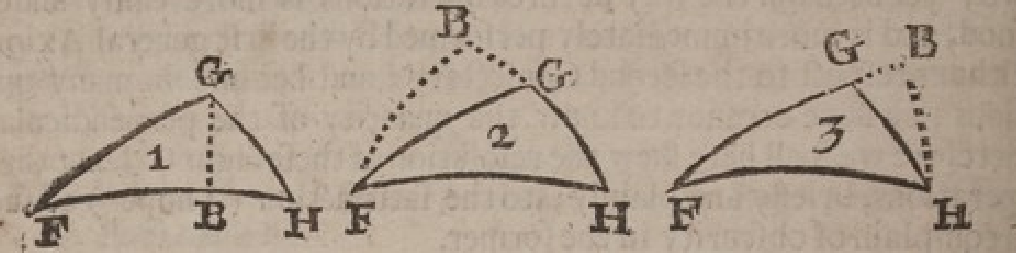
And further, when that sufficeth not,

2. *Let it fall also opposite to the angle required:* (as in the fourth Case) *or opposite to the side required* (as in the sixth.)

Accounting (as before) the sides and angles that are not adjacent, to be opposite.

And for helping your memory, you may (as is aforesaid in the first Case of *Spherical Triangles*) mark the sides or angles given with a dash thus ⟋, and that required with an o, or cypher, or with three pricks thus ⁝

And here we might mark the triangles with the same letters as before, namely, that whereas there is always (as I have said) an angle given, and a side adjacent to that angle, you may mark the said angle given with A, and the adjacent side given with A D, and the angle remaining with E, and the perpendicular with D B. but because there is no necessity that a man should hold himself always to that form (as I have before noted) we will here mark the same triangle with other letters at adventure, as with *F G H*, then the perpendicular falling from *G*, or *F*, or *H* (as the Propoſition in hand ſhall require) reſolves it into two right angled triangles, in one of which there is given the hypothenuſal and angle at the baſe, whereby you may find firſt the perpendicular; ſecondly, the baſe or angle of the perpendicular: Or you may firſt find the baſe or angle at the perpendicular; ſecondly, the perpendicular.



The firſt fundamental Axiom we will here again repeat, being as followeth:

Of the five circular parts in a right angled ſpherical triangle.

The ſine of a middle part, with Radius, is equal to the tangent of the adjacent extreams, or to the ſines Complement of the oppoſite extreams.

Hence we reſolve theſe eight Caſes in manner following.

Caſe 3. *Two ſides, and their contained angle being given: to find the third ſide.*

Dat. G H 38 d. 28′, F H 74 d. 50′, H 56 d. 26′, required F G.

Here in the firſt triangle, from G the end of the ſide G H given being adjacent to an angle given H, I let fall the perpendicular G B oppoſite to that angle: and ſo we have two right angled triangles, GBH, and G B F; and in the firſt there is given the hypothenuſal H G, and the angle at the baſe H, by which to find the perpendicular G B, I ſay by this Axiom.

s G B + Rad = *s* G H + *s* H, therefore from *s* G H + *s H* ſubſtracting Radius, the remainer is *s* G B; or to avoid ſubſtraction, add unto *s* GH + *s* H the complement arithmetical, (which for Radius is is oo) leaving out Rad. or the firſt unite in the ſum, and ſo the work is as followeth:

s GH 38 deg.	28′	9.7938317	Secondly, for the baſe *B H*, ſay
s H 56	26	9.9207717	*sc* H ⊹ Rad. = *tc* G H ⊹
s G B 31	13	19.7146034	*t B H*, and ſo the operation ſtands

thus as beneath.

t G H 38	28	9.9000065	The ſum or remainer of *B H*
sc H 56	26	9.7426520	and *F H* is *F B*.
t B H 23	43	9.6427385	But here from *F H* 74 deg. 50′
			ſubſtracting *B H* 23 43
			there remains *F B* 51 07

Thirdly, for the ſide required *F G*, having *G B* and *F B* ſay *sc F G* ⊹ Rad. = *sc G B* ⊹ *sc F B*, and ſo the operation ſtands thus.

G B 31 deg.	13′	*sc G B*	9.9320746
F B 51	07	*sc F B*	9.7977775
F G 57	32	*sc F G*	9.7298521

Which 57, 32, is the ſide *F G* required.

And as in this firſt Example, the perpendicular was let fall from the angle at G, ſo it might in this Caſe have been let fall from the angle at F, as in the ſecond Triangle, and in this ſecond Example.

Dat. *F H* 74 d. 50′, *H* 56 d. 26′, *G H* 38 28, required *F G*

Firſt, for the perpend. *F B* ſay, *s F B* ⊹ Rad. = *s F H* ⊹ *s H*

Secondly, for the baſe, *B H* ſay, *sc H* ⊹ Rad = *tc F H* ⊹ *t B H*,

And B H — G H = B G.

Thirdly, for the ſide required F G ſay, *sc* F G ⊹ Rad = *sc* F B ⊹ *sc* B G.

The Operations are as followeth.

I. *F H* 74 d. 50′	*s F H* 9.9846033		II. *F H* 74 50	*t F H*	10.5669195
H 56 26	*s H* 9.9207717		*H* 56 26	*sc H*	9.7426520
F B 53 32	*s F B* 9.9053750		*B H* 63 53	*t B H*	10.3097516
			— *G H* 38 28		
			B G 25 25		

III. *F B* 53 deg.	32′	*sc F B*	9.7740459
B G 25	25	*sc B G*	9.9557090
F G 57	32	*sc F G*	9.7298349

Which 37 32′ is the ſide required as before.

Third Example.

Dat. F G 57 d. 32′, GH 38 d. 28′; G, or rather the acute angle BGF 72 d. 24′ required F H.

The perpendicular may fall from F or H, but here we let it fall from F as in the second triangle.

Then for the perpendicular F B, say, F B + Rad = *s* F G + *s* G.

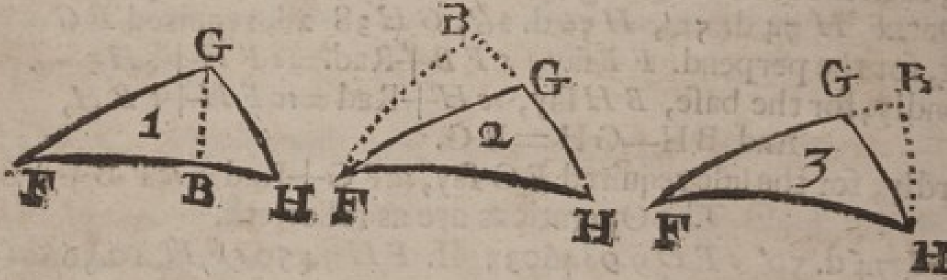
Secondly, for the base B G, say, *sc* G + Rad = *tc* FG + *t* B G.

Thirdly, for the side required F H, say, *sc* F H + Rad = *sc* B F + *sc* B H.

The Operations are as followeth.

s F G	9.9261901	*t* F G	10.1963704	*sc* B F	9.7740459
s G	9.9791798	*sc* G	9.4805385	*sc* B H	9.6436504
s F B	9.9053699	*t* B G	9.6769089	*sc* F H	9.4176963
F B	53 d. 32′	B G	25 d. 25′	F H 74 degrees, 50 min. the side required.	
		G H	38 28		
		B H	63 53		

In this, and the other Cases following, having by the first Operation found the Perpendicular, you may use it in the second Operation as one of the two things given, which we shall not need to exemplifie.



Case 4. *Two sides, and their contained angle given: to find one of the other angles.*

Dat. F G 57 d. 32′, G H 38 d. 28′; G 107 d. 36′, or G acute 72 d. 24′ required the angle H.

In this Case the perpendicular falls only from F (as in the second triangle) and so is opposite to the angle given G, and to the angle required H.

First,

First, then for the perpend. F B, say *s* F B + Rad = *s* F G + *s* G.
Secondly, for the base B G, say *sc* G + Rad = *tc* F G + *t* B G,
The sum or remainer of B G and G H, is B H.
Thirdly, for the angle required H, say, B H + Rad = *t* F B + *tc* H.

And accordingly we order the Operations as followeth.

I. *FG* 57 d.	32′	*s F G*	9.9261901	II. *F G* 57 d.	32′	*t F G*	10.1963704
G 72	24	*s G*	9.9791798	*G* 72	24	*sc G*	9.4805385
F B 53	32	*s F B*	9.9053699	*B G* 25	25	*t B G*	9.6769089
				+ *G H* 38	28		
				B H 63	53		

III. F B 53	32	*tc* F B	9.8686804
B H 63	53	*s* B H	9.9532278
H 56	26	*tc* H	9.8219082, which 56 deg. 26. min. is the angle required.

Second Example.

Dat F H 74 d. 50′, G H 38 d. 28′, H 56 d. 26′, required G, here in the second triangle as before.
First, for the perpendicular, F B. say, *s* F B + Rad = *s* F H + *s* H.
Secondly, for the base, B H, say, *sc* H + Rad = *tc* F H + *t* B H,
And B H — G H = B G.
Thirdly, for the angle required G, say *s* B G + Rad = *t* F B + *tc* G.

And accordingly the Operations are as followeth.

I.	*s F H*	9.9846037	
	s H	9.9207717	
	s F B	9.9053750	
So is *F B* 53 d. 32′			

II.	*t F H*	10.5669196
	sc H	9.7426520
	t BH	10.3095716
	B H 63	53
	— *G H* 38	28
	B G 25	25

III.	*tc F B*	9.8686804
	s BG	9.6326576
	tc G	9.5013380

So is *G* 72 d. 24′, or G obtuse 107 d. 36′ the angle required.

Case

Case 5. *Two angles, and the side between them given: to find the third angle.*

Dat H. 56. d. 26′, G 107 d. 36, G H 38 d. 28′, required the angle F. In this Case the perpendicular may fall from G or H, as here from G.

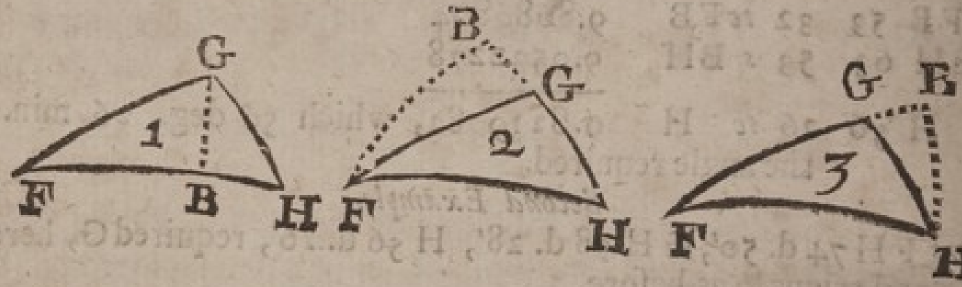
First then, for the perpend. G B, say *s* G B + Rad = *s* G H + *s* H.

Secondly, for the angles at the perpend. B G H and B G F } say *sc* G H + Rad = *tc* H + *tc* B G H.

The sum or remainer of G and B G H, is B G F.

Thirdly, for the angle required F, say, *sc* F + Rad = *s* B G F + *sc* B G.

The Operations are as followeth.



I. *s* G H	38 d.	28′	9.7938317	
s H	56	26	9.9207717	
s G B	31	13	9.7146034	

II. *t* H	56 d.	26′	10.1781197
sc G H	38	28	9.8937452
tc B G H	40	17	10.0718649
from G	107	36	
leaves B G F	67	19	

III. *s* B G F	67	19	9.9650371
sc B G	31	13	9.9320746
sc F	37	55	9.8971117

Which 37 d. 55′ is the angle at F required.

Case 6. *Two angles, and the side betwen them given: to find one of the other sides.*

Dat. G H 38 d. 28′, H 56 d. 26′, G 107 d. 36′, required F G.

Let fall the perpendicular from G as in the first Triangle; for so it falls from the end of the side given G H, opposite to its adjacent angle given H, and also opposite to the side required F G, as in this Case it ought to do. Then,

First,

First, for the perpend. G B. ſay, *s* G B + Rad = *s* H + *s* G H.

Secondly, for the Angle at the perpend. B G H, ſay, *sc* G H + Rad = *tc* H + *tc* BGH, the ſum or remainer of G, and B G H is B G F.

Thirdly, for the ſide required F G, ſay, *sc B G F* + Rad = *t B G* + *tc* F G.

The Operations are as followeth.

I.	*s H*	56 d.	26′	9.9207717
	s G H	38	28	9.7938317
	s G B	31	13	9.7046034

II.	*t H*	56 d.	26′	10.1781197
	sc GH	38	28	9.8937452
	tc BGH	40	17	10.0718649
	from *G*	107	36	
	reſts *BGF*	67	19	

III.	*tc. BG*	31	13	10.2175136
	sc B G F	67	19	9.5861795
	tc F G	57	32	9.8036931

Which 57 deg. 32′, is the ſide required.

Caſe 7. *Two ſides, with an Angle oppoſite to one of them given: to find the third ſide.*

Dat. F G 57 d. 32′, F H 74 d. 50′, F G H 107 d. 36′, or its complement to 180 degrees 72 d. 24′ required G H : here letting fall the perpendicular from F, as in the ſecond Triangle.

Firſt, for the perpendicular F B, ſay, *s* F B + Rad = *s* FG + *s* F G B.

Secondly, for the baſe B G, ſay, *sc* F G B + Rad = *tc* FG + *t* BG.

Thirdly, for the baſe B H, ſay, *sc* F H + Rad = *sc* F B + *sc* B H. The ſum or remainer of B G and B H is G H, the ſide required.

The Operations are theſe.

I.	*s F G*	57 d.	32′	9.9261901
	s F G B	72	24	9.9791798
	s F B	53	32	9.9053699

II.	*t F G*	57 d.	32′	10.1963704
	sc FGB	72	24	9.4805385
	t BG	25	25	9.6769089

III.	*Co. ar. sc F B*	53 d.	32′	10.2259541
	sc F H	74	50	9.4176963
	sc BH	63	53	9.6436404
	—BG	25	25	
	reſt GH	38	28, which is the ſide required.	

Second Example.

In the third triangle:

Dat. *G H* 38 d. 28′, *F H* 74 d. 50′, *G* or rather *B G H* 72 d. 24′ required *F G*.

First, for the perpendicular *B H*, say, *s B H* + Rad = *s G H* + *s B G H*.

Secondly, for the base *B G*, say *sc B G H* + Rad = *tc G H* + *t G B*.

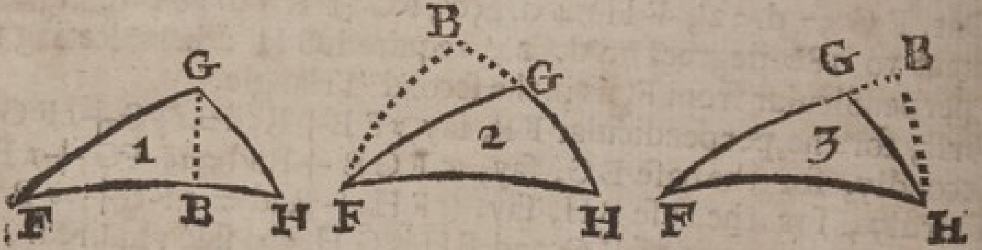
Thirdly, for the base *B F*, say, *sc F H* + Rad = *sc B H* + *sc B F*.

And here from *B F*, substracting *B G*, there remains *F G* required.

The Operations.

I. *s G H*	38 d.	28′	9.7938317	II. *t G H*	38 d.	28′	9.9000965
s BGH	72	24	9.9791798	*sc BGH*	72	24	9.4805385
s B H	36	22	9.7730215	*t BG*	13	$30\frac{1}{2}$	9.3806250

III. *Co. ar. sc. B H*	36 d.	22′	0.0940753
sc F H	74	50	9.4176963
sc B F	71	$02\frac{1}{2}$	9.5117716
—*B G*	13	$30\frac{1}{2}$	
rest *F G*	57	32, which is the side required.	



Case 8. *Two sides, with an angle opposite to one of them given: to find their contained Angle.*

Dat. *G F* 57 d. 32′, *G H* 38 d. 28′, *H* 56 d. 26′, required *G*.

Let fall the perpendicular from *G*, as in the first triangle.

First, for the perpendicular *G B*, say, *s G B* + Rad = *s G H* + *s H*.

Secondly, for the angle *B G H*, say, *sc G H* + Rad = *tc H* + *tc B G H*.

Thirdly, for the angle *B G F*, say, *sc B G F* + Rad = *t B G* + *tc G F*.

The sum or remainer of *B H* and *B G F* is the angle at *G* required.

The

The Operations are as followeth.

I. *s*	*GH*	38 d.	28′	9.7938317	II. *t*	*H*	56 d.	26′	10.1781197
s	*H*	56	26	9.9207717	*sc*	*GH*	38	28	9.8937452
s	*GB*	31	13	9.7146034	*tc*	*BGH*	40	17	10.0718649
III. *t*	*BG*	31 d.	13′	9.7824064					
tc	*GF*	57	32	9.8036296					
sc	*BGF*	67	19	9.5861160					
+	*BGH*	40	17						
	G	107	36, which is the angle required.						

2 *Example*, in the third triangle.

Dat. *FH* 74 d. 50′, *GH*, 38 d. 28′, the acute angle at *G* 72 d. 24′, required the angle at *H*, that is, *FHG*.

First, for the perpend. *BH*, say, *s BH* + Rad = *s BGH* + *s GH*.

Secondly, for the angle *BHG*, say, *sc GH* + Rad = *tc BGH* + *tc BHG*.

Thirdly, for the angle *BHF*, say, *sc BHF* + Rad = *t BH* + *tc FH*.

The Operations follow.

I. *s*	*BGH*	72 d.	24′	9.9791798	II. *t*	*BGH*	72 d.	24′	10.4986413
s	*GH*	38	28	9.7938317	*sc*	*GH*	38	28	9.8937452
s	*BH*	36 d.	22	9.7730115	*tc*	*BGH*	22	03½	10.3923865
III. *t*	*BH*	36 d.	22′	9.8670937					
tc	*FH*	74	50	9.4330804					
sc	*BHF*	78	29½	9.3001741					
—	*BHG*	22	03½						
rest	*GHF*	56	26, the angle required.						

Case 9. *Two angles, and a side opposite to one of them given: to find the third angle.*

Dat. F G 57 d. 32′, G acute 72 d. 24′, H 56 d. 26′, required F.

Let fall the perpend. from F, as in the second triangle.

First, for the perpend. F B, say, *s* F B + Rad = *s* F G + *s* F G B.

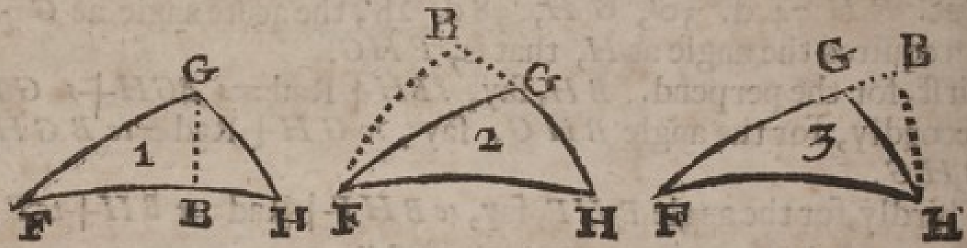
Secondly, for the angle BFG, say, *sc* FG + Rad = *tc* G + *tc* BFG.

Thirdly, for the angle BFH, say, *sc* H + Rad = *sc* F B + *s* BFH.

The sum or remainer of B F G and BFH, is G F H required.

The Operations.

I. *s FG*	57 d.	32′	9.9261901	II. *t G*	72 d.	24′	10.4986413
s G	72	24	9.9791798	*sc FG*	57	32	9.7298197
s FB	53	32	9.9053699	*tc BFG*	30	35	10.2284610
III. Co. ar. *sc FB*	53 d.	32′	0.2259541				
sc H	56	26	9.7426520				
s BFH	68	29	9.9686061				
—*BFG*	30	35					
GFH	37	54, the angle at *F* required.					



Case 10. *Two angles, and a side opposite to one of them given: to find the side between them.*

Dat. *H* 56 d. 26′, *G* acute 72 d. 24′, *FG* 57 d. 32′, required *GH*.
Here the perpendicular must fall from F, as in the second triangle.
First, for the perpend. *FB*, say, $s\,FB + \text{Rad} = s\,FG + s\,G$.
Secondly, for the base *BG*, say, $sc\,G + \text{Rad} = tc\,FG + t\,BG$.
Thirdly, for the base *BH*, say, $s\,BH + \text{Rad} = t\,FB + tc\,H$
The sum or remainer of *BG* and *BH*, is *GH*.

The Operations

I. *s FG*	57 d.	32′	9.9261901	II. *t FG*	57 d.	32′	10.1963704
s G	72	24	9.9791798	*sc G*	72	24	9.4805385
s FB	53	32	9.9053699	*t BG*	25	25	9.6769039
III. *t FB*	53 d.	32′	10.1313196				
tc H	56	26	9.8218803				
s BH	63	53	9.9532999				
—*BG*	25	25					
GH	38	28, the side required.					

And

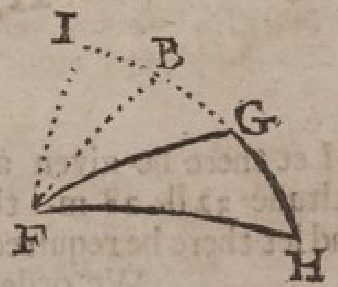
And this may suffice touching these eight Cases of an oblique spherical triangle, there remain two other Cases, namely, when the three sides are given to find an angle, or the three angles to find a side. The first of which is of frequent use, and therefore (though in the former Editions of this Book) we have shewed the resolution thereof three several ways, as may appear in the *Chapter* following; yet I conceive it will not be superfluous, to give here an Example or two more in that third way of application; which as it is easily wrought arithmetically, so it is the aptest for instrumental operations, whether you use Mr. *Gunters*'s Logarithmical Ruler, or Mr. *Wingates*, or any other right lined, or other circular, or serpentine projection of the Logarithms, or the Sector, *&c.*

Case 11. *Three sides of an oblique triangle given: to find an angle.*

The Rule and ground for the solution of this Problem, is shewed in the *Chapter* following, therefore we come to Examples.

The first Example may be this.

Let there be given the latitude of the place, or Poles elevrtion 51 d. 32 m. the Suns altitude 32 d. 28. min. the Suns declination northerly 15. d. 10. min. and let there be required the Suns azimuth.



In this triangle *F G H*, let *G* represent the Zenith, *H* the North-pole, *F* the Sun, then the complement of the Poles elevation, is *GH* 38 d. 28
the com. of the suns altitude *GF* 57 32
the com. of the suns declin. *HF* 74 50
or the suns distance from the North-pole.

Then is the angle *F G H* the Suns azimuth from the North, or *F G B* the Suns azimuth from the South, either of which is the angle required, and therefore opposite thereto I let fall the perpendicular *F B*, and make *B I* equal to *B G*. ordering the work as followeth.

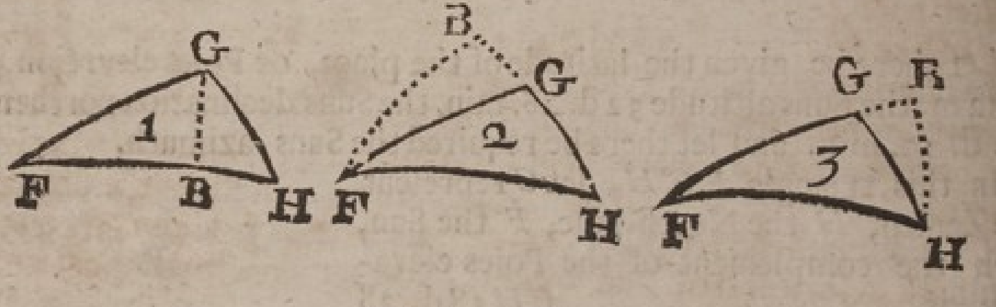
Poles elev. 51 32 whoſe com. GH	38 d.	28'	halved 19d.	14'	tc 10.4573123
Suns altitu. 32 28 whoſe com. FG	57	32	28	46	
Suns decli. 15 10 whoſe com. FH	74	50	37	25	
the ſum of half the ſides,			66	11	t 10.3551676
the difference of half the ſides			08	39	t 9.1822106
gives the half of the alternate baſe			$\frac{1}{2}$ *HI* 44	39	9.9946905
from which take half the true baſe			$\frac{1}{2}$ *GH* 19	14	
there remains			*BG* 25	25	

Thus in the right angled triangle *BGF*, having found the baſe *BG*, and the hypothenuſal *FG*, being before at firſt given, we may find the angle at *G*, ſaying,

$sc\,G + \text{Rad} = t\,BG + tc\,FG$, that is,

t BG	25 d.	25'	9.6768686
tc FG	57	32	
sc G	72	24	

And thus have we found the acute angle at *G*, namely, *BGF*, to be 72 deg. 24 m. which is the Suns azimuth from the South, which was required.



The Second Example.

Let there be given as before, the latitude 51 d. 32 m. the Suns altitude 32 d. 28 m. the Suns declination northerly 15 d. 10 m. And let there be required the hour from noon, or angle at *H*.

We order the Operation as followeth.

Latitude 51 d. 32′ whose com. is *GH* 38 d. 28′	halved	19 d. 14′ *tc*	10.4573123
Suns altit. 32 28 whose com. is *F G* 57 32		28 46	
Suns decl. 15 10 whose com. is *F H* 74 50		37 25	
the sum of half the sides		66 11 *t*	10.3551676
the difference of half the side		08 39 *t*	9.1822106
gives the half of the alternate base ½ *HI*		44 39 *t*	9.9946905
to which adding half the true base ½ *GH*		19 14	
the sum is the base *BH*		63 53	

Thus in the right angled triangle *BHF*, having the base *BH* 63 d. 53 m. and hypothenusal *F H*, being before at first given 74 d. 50 m. we may find the angle at *H*, saying,

sc.H+Rad=*t BH*+*tc FH*, that is,	*t B H*	63 53	10.3095777
	tc F H	74 50	9.4330804
	sc H	56 26	9.7426581

And thus have we found the angle of the hour from noon *H*, to be 56 d. 26 min. which converted into time, is 3 ho. 45′ 44″, before or after noon.

In like sort you may find the hour of night by any known star, for the same things being given, namely, the latitude of the place, the altitude of the star, and its declination, you may find the angle at *H*, as before, and so the true hour and minute (if it were the Sun) which note. Then from that stars right ascension, substract the Suns right ascension, and the remainer converted into time, add to the hour and minute before noted, that total is the true hour and minute of the night.

But in gathering the Suns right ascension, you must remember that it differs every day about one degree or four minutes of time (as more exactly in the Table appears) and so you must allow proportionably, for the time that the Sun is past the meridian of the place for which your Tables were made: as if it be six hours past it, the right ascension is increased by about one minute of time; if twelve hours, then about two minutes; if eighteen hours, then about three minutes of time, &c.

CHAP.

CHAP. VII.

Of the second Fundamental Axiom, and of the Cases thereon depending: with two other Axioms to the same purpose.

2 *Fundamental Axiom.*

IN a spherical triangle, if half the difference of the sides containing an angle, be added to half the side opposite to that angle, and likewise substracted from the same, and the sum and remainer noted: *Then as the rectangle of the sines of the containing sides, is to the square of Radius:*

So is the rectangle of the sines of the foresaid sum and remainer to the square of the sine of half the contained angle.

As in the triangle *ADE.*

Let D be the contained angle, and let AB be the difference of the containing sides AD and ED (for DB is equal to ED) and let AE, that is, AS, be the side opposite to the angle at D. Then making SK equal to AB, draw the subtendents AK and BS; and dividing the arch AK or BS equally in R, draw from the center the line HR. Then drawing QX parallel to HP, and BL and GO to AH, &c.

GQ is the versed sine of the angle ADE, as also of the arch GX. Therefore the arch GX, is the measure of the angle ADE: But QX is the right sine of the arch GX, therefore QX is also the right sine of the angle ADE.

And seeing AS is equal to the opposite side AE, and SK to AB, the difference of the containing sides, therefore the whole arch AK, is equal to AE and AB; therefore the half thereof AR, is the sum of the halves of AE and AB, that is, of half the opposite side, and of half the difference of the containing sides, the sine whereof is AW. And if the difference AB, be taken from the side AE, that is from AS, the remainer is BS, the half whereof is BR: So that if the half of AB be substracted from the half of AE or AS, the remainer is BR. And seeing GN is equal to AD, GO the sine of GN, is also the sine of AD and BC is the sine of DE or DB. So that BC and GO are the sines of the containing sides AD and ED, and AW and BR are the sines of the aforesaid sum and remainer, and GY the sine of half the angle at D. I say then that,

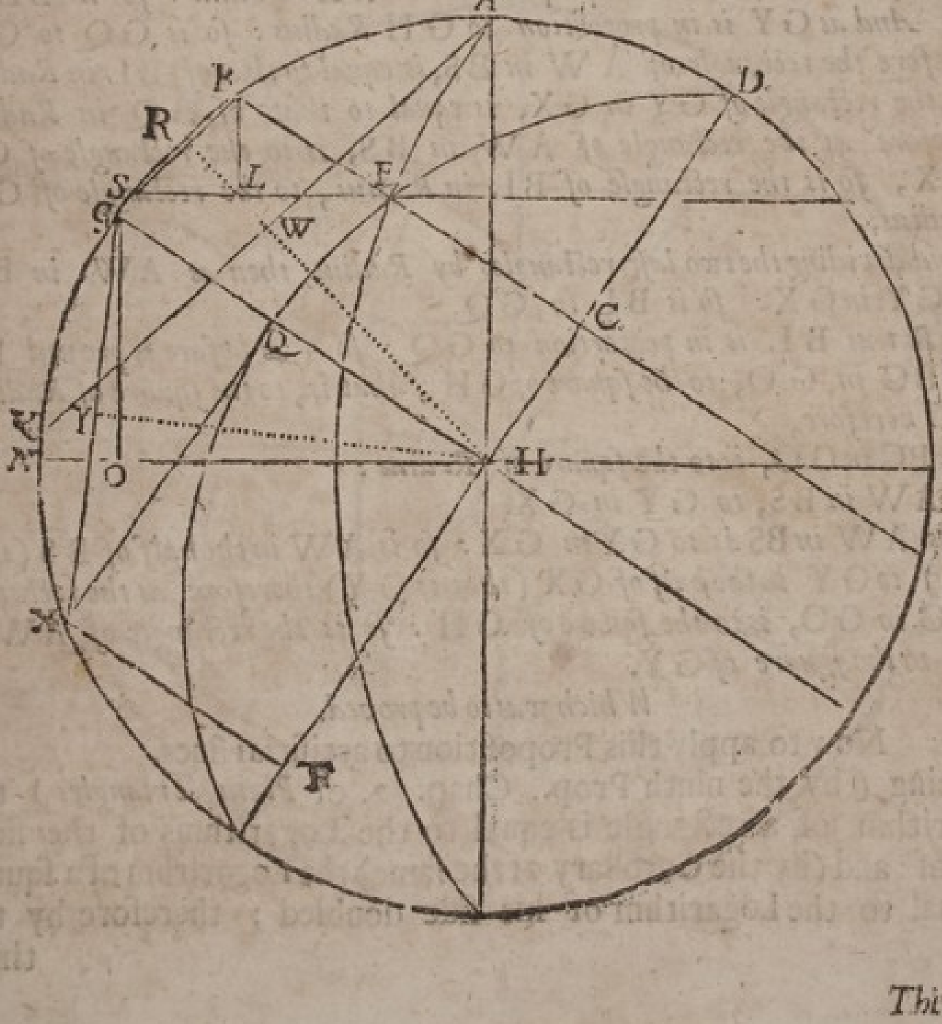
As

As the rectangle of the sines of the containing sides A D *and* E D, *is to the square of Radius:*
So is the rectangle of the sines of the sum and remain: A R *and* B R, *to the square of the sine of half the angle* A D E, *namely, to the square of the sine of half the arch,* G X.

That is,

As the rectangle of G O *and* B C, *is to the square of* G H:
So is the rectangle of A W *and* B R, *to the square of* G Y.

Demonstr. *For as* G H, *the semidiameter of a great circle, is in proportion to* B C *the semidiameter of a lesser: so is* Q H *the sine of a certain arch in the greater, to* E C *the sine of the like arch in the less; and so is* G Q *the versed sine in the one, to* B E *the versed sine in the other. Which is more largely demonstrated by* Pitiscus, lib. 5. and *by others.*



Therefore

Therefore as GH *is in proportion to* BC, *so is* GQ *to* BE.

And as GH *is in proportion to* GO, *so is* BE *to* BL. *For the triangles* GOH *and* BLE *are equiangled. Therefore as the square of* GH, *is to the rectangle of* BC *in* GO: *so is the rectangle of* GQ *in* BE, *to the rectangle of* BL in BE.

And dividing the two last rectangles by BE, *then as the square of* GH, *is to* BC *in* GO: *so is* GQ *to* BL.

Or the Converse, namely,

As BC *in* GO, *is to the square of* GH: *so is* BL *to* GQ.

Again, seeing that AK *is parallel to* BS, *and* BL *to* AH: *therefore the angle* SBL, *is equal to the angle* HAW: *therefore the right angled triangles* SBL *and* HAW, *are equiangled. Likewise seeing the right angled triangles* YGH, *and* QGX, *have the angle* YGH *common to them both, therefore they are also equiangle.*

Therefore as AW *is in proportion to* AH *Radius: so is* BL *to* BS. *And as* GY *is in proportion to* GH *Radius: so is* GQ *to* GX. *Therefore the rectangle of* AW *in* BS, *is equal to that of* BL *in Radius. Also the rectangle of* GY *in* GX, *is equal to that of* GQ *in Radius. Therefore as the rectangle of* AW *in* BS, *is to the rectangle of* GY *in* GX, *so is the rectangle of* BL *in Radius, to the rectangle of* GQ *in Radius.*

And dividing the two last rectangles by Radius, then as AW *in* BS, *is to* GY *in* GX: *so is* BL *to* GQ.

But as BL *is in proportion to* GQ: *so (as before is proved) is* BC *in* GO, *to the square of* GH; *that is, to the square of Radius: Therefore,*

As BC *in* GO, *is to the square of Radius:*
so is AW *in* BS, *to* GY *in* GX.

But as AW *in* BS *is to* GY *in* GX: *so is* AW *in the half of* BS *(that is* BR*) to* GY *in the half of* GX *(that is* GY*) therefore as the rectangle of* BC *in* GO, *is to the square of* GH: *so is the rectangle of* AW *in* BR, *to the square of* GY.

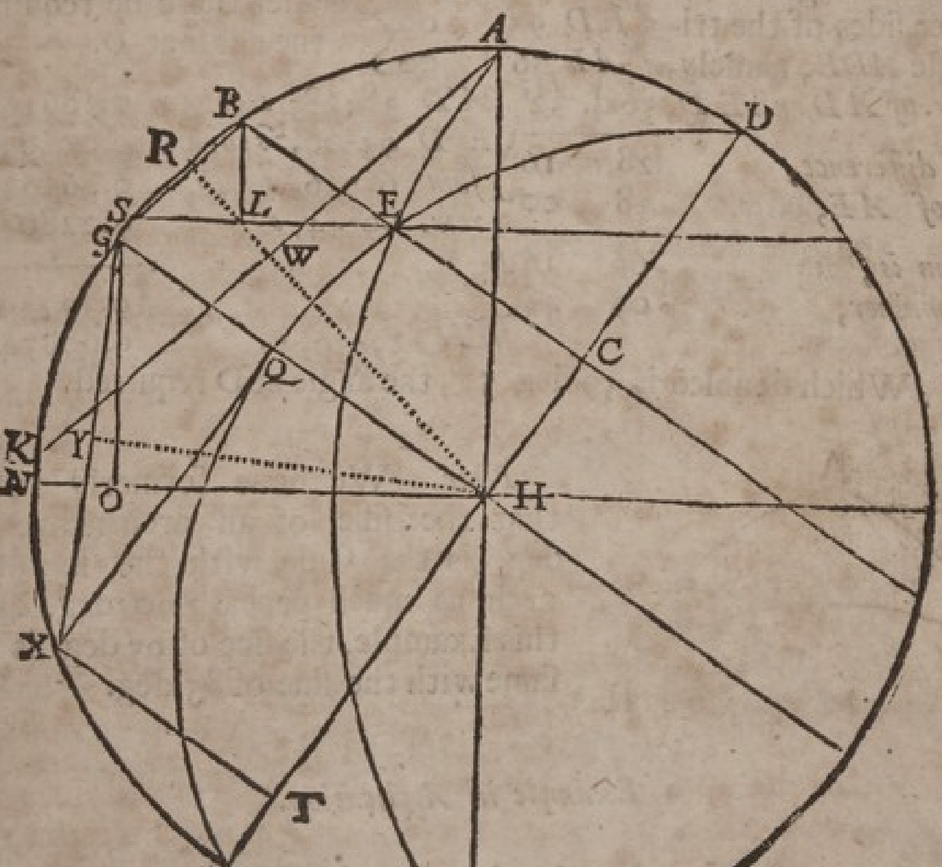
Which was to be proved.

Now to apply this Proposition to artificial sines.

Seeing (by the ninth Prop. Chap. 2. of *Plain Triangles*) the Logarithm of a rectangle is equal to the Logarithms of the sides thereof: and (by the Corollary of the same) the Logarithm of a square is equal to the Logarithm of his side doubled: therefore by the third

third *Prop.* of the ſame *Chap.* If unto the artificial ſines of the foreſaid ſum and remainer, be added twice Radius; and from that tota be ſubſtracted the ſines of the containing ſides: half the remainer is the ſine of half the contained angle required. Or, (by the 4 *Prop.* of that *Chap.*) If inſtead of ſubſtracting the ſines of the containing ſides, we add their ſeveral Complements arithmetical, the total is more than the remainer would have been by twice Radius. Therefore leaving out twice Radius: if to the ſeveral Complements arithmetical of the ſines of the containing ſides, be added the ſines of the aforeſaid ſum and remainer, half that total is the ſine of half the contained angle required.

This ground thus laid, we come to that two Caſes thereon depending



Case 11. *The three sides of a Spherical Triangle being given: to find an angle.*

Take half the difference of the sides containing the angle required, and add it to half the side opposite to that angle; and likewise substract it from the same, noting the sum and remainer.

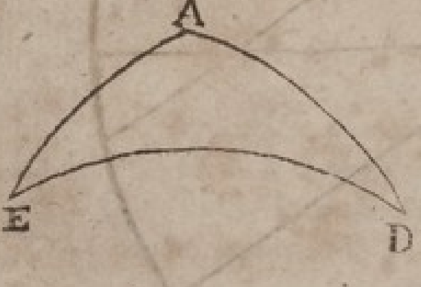
Then to the complements arithmetical of the artificial sines of the containing sides, add the artificial sines of the foresaid sum and remainer, and the half of that total is the artificial sine of half the angle required.

This being before proved, we proceed to Examples.

Let there be given the three sides of the triangle *ADE*, namely,	*AD* 38 d.	28′	And let there be required the angle at *D*.
	ED 95	00	
	AE 76	00	

Differ. of AD and ED,	56 d.	32′	*AD*	38-28, *s co. ar.*	0.2061683
Half difference,	28	16	*E D*	95-00, *s co. ar.*	0.0016558
Half of AE,	38	00	*sum*	66-16, *s*	9.9616244
the sum is,	66	16	*rem.*	09-44, *s*	9.2280481
the remainer,	09	44			19.3974966
			half D	29-59, *s*	9.6987483

Which doubled is 59 deg. 58′, the angle at D required.



Note. We have formerly noted that the sine of an arch above 90 deg. is the same with the sine of an arch as much beneath 90 deg. as in this Example, the sine of 95 deg. is the same with the sine of 85 deg.

1 *Example in Application.*

Let there be given in this Triangle,

The Poles elevation,	*compl.*	*A D,*	51 d.	32′	That is,	*A D,*	38 d.	28′
The Suns declination,	*compl.*	*E D,*	15	10		*E D,*	74	50
The Suns height,	*compl.*	*A E*	32	28		*A E,*	57	32

And let there be required the hour from noon D.

The

The difference of the sides AD and ED containing the angle required, } *is* 36 degr. 22′

The half of that difference is	18	11
The half of the opposite side AE, is	28	46
The sum of the half difference, and of the half side, is	46	57
The remainer of the half diff. taken from the half side, is	10	35

Which thus ordered, we resolve the Problem thus,

The Poles elevation compl. AD	38 deg.	28′	*s co. ar.*	0.2061683
The Suns declinat. compl. ED	74	50	*s co. ar.*	0.0153967
The aforesaid sum,	46	57	*s*	9.8637737
The aforesaid remainer,	10	35	*s*	9.2640274
			Sum	19.3493661
	28 deg.	13′,	*The half*	9.6746830

The arch answering to this sine 9.6746830, is 28 deg. 13′, which doubled is 56 deg. 26′, the angle at D required.

Which converted into time, is 3 ho. 45′ 44″, the hour from noon, namely, 14′ 16″, after eight of the clock in the morning, or 45′ 44″, after three of the clock in the afternoon. In like sort, may the hour of the night be found by some known star, as we have before touched at the end of the last Chapter.

2 *Example.*

Let there be given,

The Poles elevation, compl.	*AD* 51 d.	32′	That is,	*AD*	38 d.	28
The Suns delination, compl.	*ED* 15	10		*ED*	74	50
The Suns height, compl.	*AE* 32	28		*AE*	57	32

And let there be required the Suns azimuth from the North *A*.

The difference of the sides containing the angle required, namely the difference of AD and AE, } *is* 19 degr. 04′

Half of that difference, is	09	32
Half of the opposite side ED, is	37	25
Sum of the half difference, and of the half side, is	46	57
Remainer of the half differ. taken from the half side, is	27	53

Which

Which thus ordered, we resolve the Problem thus.

Poles elevation, compl.	*AD*	38 deg.	28′	*s*	*co. ar*	0.2061683
Suns altitude, compl.	*AE*	57	32	*s*	*co. ar*	0.0738100
Aforesaid sum,		46	57	*s*		9.8637737
Aforesaid remainer,		27	53	*s*		9.6696420
					Sum	19.8136940
		53 deg.	48′		*the half*	9.9068470

The arch answering to this sine 9.9068470, is 53 d. 48 min. which doubled, is 107 deg. 36 m. the angle at *A*, which is the Suns azimuth from the North part of the Meridian.

Otherwise the Operations in this Problem may be thus ordered.

							The halfs	
Poles elev. No.	51 d.	32′	*Co. of the Poles elev.*	*AD*	38 d.	28′	19 d.	14′
Suns altit.	32	28	*Co. of the Suns altit.*	*AE*	57	32	28	46
Suns decl. No.	15	10	*Compl. thereof*	*ED*	74	50	37	25
				difference			9	32
				sum			46	57
				remainer			27	53

Hence we resolve the Problem, as before.

AD	38 deg.	28′	*s*	*co. ar.*	0.2061683
AE	57	32	*s*	*co. ar.*	0.0738099
sum	46	57	*s*		9.8637737
remainer	27	53	*s*		9.6699420
					19.8136939
	53	48	*s*		9.9068469

Which doubled, is 107 36, the Suns azimuth from (the North.

Again, For the South declination.

							The halfs	
Poles elev. No.	51 d.	32′	*Co. of the Poles elev.*	*AD*	38 d.	28′	19 d.	14′
Suns altit.	05	10	*Co. of the Suns altit.*	*AE*	84	50	42	25
Suns decl. So	15	10	*Suns di. from no. pole.*	*ED*	105	10	52	35
				difference			23	11
				sum			75	46
				remainer			29	24

Hence

Hence we reſolve the Queſtion thus.

AD	38 deg.	28 m.	*s co. ar.*	0.2061683
AE	84	50	*s co. ar.*	0.0017682
ſum	75	46	*s*	9.9864593
remainer	29	24	*s*	9.6909964
				19.8853022
	61	13	*s*	9.9426511

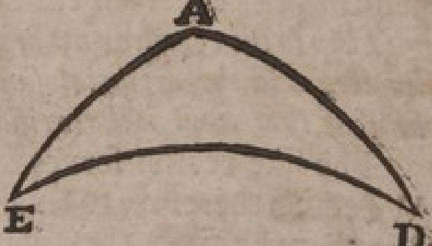
Which doubled, is 122 25, the Suns azimuth from (the North.

Note. *And after the form of either of theſe Examples, we may by the ſame things given, find the angle of the ſame poſition.*

3 *As if there were given the Poles elevation, the Suns declination, and the Suns height: to find the angle of the Suns poſition.*

This eleventh Propoſition is often uſed by Sea-men, eſpecially the ſecond Example, for finding the azimuth, whereby the variation of the Compaſs may be known at Sea, after this manner.

About the middle of the forenoon, or afternoon, the height of the Sun above the Horizon is to be taken by ſome Inſtrument for that purpoſe, which being noted down, you are at the ſame inſtant (ſo near as may be) to ſet the Sun with your Compaſs (fitted for that purpoſe, the outward circumference of the Fly or Card divided into degrees, and the Needle placed under the North and South points of the Card) and note down likewiſe upon what degree of the Compaſs (reckoning from the North) you found the Sun. Then knowing by your former obſervations and reckoning, your Latitude, and by your Tables for that purpoſe, the Suns declination, there is given the Poles elevation, the Suns declination, and the Suns height above the Horizon, whereby, according to the ſecond Example laſt before going, you may find the Suns true azimuth in degrees and minutes from the North; which compared with the degrees before found by the Compaſs, if both agree, the Compaſs hath no variation; if there be any difference, that difference is the variation: Which variation, whether it be Eaſterly or Weſterly,



westerly, may be known by the Rule before given upon the twelfth Case of the third Chapter of right angled triangles.

As in the second Example last before going. Admit that at the same instant, when I observed the height of the Sun in the morning to be 32 d.28 min. I set the Sun by my Compass, and found it to be from the East point towards the South 12 deg. that is, from the North 102 d. But the Suns true azimuth from the North found by calculation, is 107 deg. 36 min. the difference between these two is 5 deg. 36. m. which is the variation of the Compass.

But to know whether this variation be Easterly or Westerly, I consider that by the Suns true azimuth found by calculation, the Sun should have been from the North 107 deg. 36 m. that is, from the East point of the Compass to the Southwards 17 deg. 36 m. Whereas setting it with my Compass, it was from the East to the Southwards but 12 deg. So that the degree whereon the Sun should have been, was more toward the right hand, than the degr. whereon it was: therefore I affirm the variation to be Easterly 5 deg. 36 min. By the same Problem, may the variation of a Needle be found on the land.

Case 12. *The three angles of a spherical Triangle given: to find a side.*

This is performed by the last Axiom, the angles being converted into sides, and the sides into angles (as we have shewed *Chap.* 1 *Of Spherical Triangles*) taking instead of the greatest angle his complement to 180 deg.

Wherefore having taken instead of the greatest angle his complement to 180 deg. and all things else remaining as before.

Take half the difference of the angles that are adjacent to the side required, and add it to half the angle opposite to that side; and likewise substract it from the same, noting the sum and remainer.

Then to the complements arithmetical of the artificial sines of the adjacent angles, add the artificial sines of the foresaid sum and remainer, and the half of that total is the artificial sine of half the side required.

The like reason serves for this, as for the last Case before going. We come therefore to Examples.

Let there be given the three angles of the triangle *ADE*, namely,	*A* 107 d. 36′, that is	72 d. 24′	And let there be requir'd the side *ED*.
	D	56 26	
	E	37 55	

Differ.

Differ. of E and D, is	18 d.	31′	*D* 56-26	*s co. ar.*	0.0792283
The half difference,	09	$15\frac{1}{2}$	*E* 37-55	*s co. ar.*	0.2114677
The half of A, is	36	12	*sum* 45-$27\frac{1}{2}$	*s*	9.8529314
			rem. 26-$56\frac{1}{2}$	*s*	9.6561780
The Sum,	45	$27\frac{1}{2}$			
The remainer,	26	$56\frac{1}{2}$		*sum*	19.7998054
			52-35	*half*	9.8999027

Which doubled, is 105 deg. 10 min. the complement whereof to 180 deg. is 74 deg. 50 min. which is the side required. *E D.*

1 *Example in Application.* Let there be given,

The Suns azimuth,	*A* 107 deg. 36 m. *or.*	72 deg.	24 m.	*A.*
The hour from noon,	*D in degrees*	56	26	*D.*
The angle of position,	*E*	37	55	*E.*

And let there be required the Suns height, being the complement of *A E.*

The difference of the adjacent angles A and E, is	34 d.	29′
The half of that difference is	17	$14\frac{1}{2}$
The half of the angle D, opposite to the side required, is	28	13
The sum of the half difference and half angle, is	45	$27\frac{1}{2}$
The remainer of the half differ. taken from the half angle, is	10	$58\frac{1}{2}$

Then for the resolution of this Problem.

The Suns azimuth	*A* 72 deg.	24′	*s Compl. ar.*	0.0208202
The angle of position	*E* 37	55	*s Compl. ar.*	0.2114677
The foresaid sum	45	$27\frac{1}{2}$	*s*	9.8529314
The foresaid remainer	10	$58\frac{1}{2}$	*s*	9.2796227
			sum	19.3648420
	28	46	*half*	9.6824210

Which doubled, is 57 deg. 32 m. the side *A E,* the complement whereof 32 deg. 28 min. is the height of the Sun required.

And after the form of this Example, the same things being given: namely the Suns azimuth, the hour from Noon, and the angle of the Suns position being given: we may find 2 The Suns declination (as in the former example) 3 Or the Poles elevation.

Note. *Although in the conversion of angles into sides, you may alwayes (as is aforesaid) take instead of the greatest angle, his complement to 180 deg. yet you are not so to do of necessity, for you may take the complement of one of the lesser angles, to 180 deg. As*

Let

Let there be given the three angles of the triangle *ADE*, namely,	*A*		107 d. 36′	And let there be requir'd as before the side *E D*.
	D	56 d. 26′ or	123 34	
	E		037 55	

Differ. of E and D, is	85 d. 39′	*D* 56-26	*s*	*co. ar.*	0.0792283
		E 37-55	*s*	*co. ar.*	0.2114677
The half difference	42 49½	*sum* 83-22½	*s*		9.9971562
The half of A is	53 48	*rem.* 10-58½	*s*		9.2796227
The Sum,	96 58½				
The remainer,	10 37½				19.5674749
		37-25			9.7837374

Which doubled, is 74-50, *the side E D required.*

He hath another way very little inferiour to the former, for the solution of the two last Cases, which Mr. *Gunter* makes use of, As if *Three sides be given to find an angle.*

Add the three sides together, noting half that sum, and from that half, substract the side opposite to the angle required, and note the remainer. Then

As the rectangle of the sines of the containing sides,
is to the square of Radius;
so is the rectangle of the sines of the foresaid sum and remainer,
to the square of a sine, whose arches compl. doubled is the angle sought.

By containing sides, we mean the sides containing the angle required.

Therefore working by artificial sines,

Add to the complements arithmetical of the sines of the containing sides, the sines of the foresaid sum and remainer, half that total is the sine of an arch, whose complement doubled, is the angle sought.

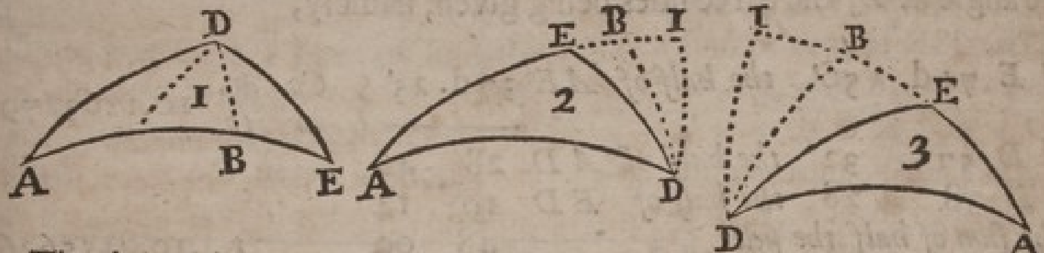
Let the Example be here as before, namely,

Let there be given	*AE*	72 d. 32′, and let there be required the angle at D.		
	AD	38 28	*s Compl. arith.*	0.2061683
	ED	74 50	*s Compl. arith.*	0.0153967
		170 50		
The half sum		85 25	*s*	9.9986090
The remainer		72 53	*s*	9.6699420
				19.8901160
The complement of this sines arch, is		28 deg. 13 m.		9.9450580
Which doubled, is		56 26	*the angle at D required.*	

If

If the three angles be given to find a side, you may convert the angles into sides, *&c.* as before is shewed.

Although either of these two last Axioms are very sufficient for the solution of the two last Cases of an oblique spherical triangle arithmetically; yet neither of them can so aptly be applied instrumentally. We will therefore here set down the third Axiom, which he hath to the same purpose.



The three sides of a triangle being given, and an angle required, let fall a perpendicular opposite to that angle, the side whereon that perpendicular falls, we call, for distinction sake, the base, and the other two the sides, thus in every of these triangles A E *is the base,* AD *and* ED *the sides:* D B *the perpendicular,* B *being placed at the right angle, and* B I *alwayes made equal to* B E : *Thus in every of them* A E *being the true base,* A I *is the alternate base, whose end* I *is as far from the perpendicular* B *one way, as the end of the true base* E, *is from the perpendicular the other way. Which things thus conceived, I say,*

As the tangent of the true semibase given,
is to the tangent of half the sum of the sides:
So is the tangent of half the difference of the sides,
to the tangent of the alternate semibase.

That is,

As the tangent of the half of A E,
to the tangent of half the sum of AD *and* E D.
So is the tangent of half the difference of A D *and* ED,
to the tangent of the half of A I.

The demonstration whereof, you may see in his second Book of Triangles.

Therefore adding the half of the true base A E, *to the half of the alternate base* A I; *the sum is* A B, *the base of the right angled triangle* A B D: *also the difference of the halves of* A E *and* A I, *is* E B, *the base of the other right angled triangle* E B D.

And thus in either of the right angled triangles A B D and E B D, We have the base and hypothenusal, whereby at one other operation either of the angles opposite to the perpendicular, namely, the angle at A, or that at E, may be found by the 13 *Case of right angled triangles. Therefore, the three sides being given, we may find an angle.*

As for Example, in the first of these triangles, let there be required the angle at *A*, the three sides being given, namely,

A E	74d.	50′	*the half of AE*	37d.	25′	*Co. ar. or tc.*	10.1163279
A D	57	32	*the half of A D*	28	46		
E D	38	28	*the half of E D*	19	14		
The sum of half the sides				48	00	*t*	10.0455626
The difference of half the sides				09	32	*t*	9.2251560
The half of A I				13	42	*t*	9.3847065
To which adding half of AE				37	25		
The sum is A B				51	07		

Secondly,

AB	51 deg.	07′	*the tangent of AB*	10.0934397
AD	57	32	*tan. compl. of AD*	9.8036296
A	37	55	*make sine compl. A*	9.8970693

And thus we have found the angle at *A* to be 37 deg. 55 min. and in like manner we might have found any of the other angles.

Note. For the resolution of questions of this nature instrumentally, Mr. *Gunter* (an ingenious man in contriving and applying of Instruments) makes use of the right and versed sines, and so resolves them at two operations, and sometimes he useth the right sines only, but then he hath three operations. Notwithstanding they may also be performed at two operations without versed sines, using only the tangents, as we have here shewed.

Now, as we have before for right angled triangles, so we will here for oblique, represent in a Table the operations used in every Case, by the view of which Table you may be directed in the resolution of any oblique spherical triangle.

	Dat.	Req.	*The Proportionality.*	Case
Two angles, and a side opposite to one of them given: to find the side opposite to the other.	*A* *E* *AD*	*ED.*	*sE, sAD, sA, sED*	1
Two sides, with an angle opposite to one of them given: to find the angle opposite to the other	*AD* *A* *ED*	*E.*	*sED, sA, sAD, sE*	2
Two sides with their contained angle given: to find — The 3d side	*AD* *A* *AE*	*ED*	*Ra. sc A, t AD, t AB.* sum or rem. of *AB* & *AE* is *EB* *sc AB, sc EB, sc AD, sc ED*	3
One of the other angles.		*E*	*Ra. sc A, t AD, t AB.* sum or rem. *AB* and *AE* is *EB* *s EB, s AB, t A, t E.*	4
Two angles and the side between them given: to find — The third angle.	*AD* *A* *D*	*E*	*Ra. sc AD, t A, tc BDA.* sum or re. *BDA*, & *D* is *BDE* *s BDA, s BDE, sc A, sc E.*	5
One of the other sides.		*ED*	*Ra. sc AD, t A, tc BDA.* sum or re. *BDA* & *D* is *BDE* *sc BDE, sc BDA, t AD, t ED*	6
Two sides with one of their opposite angles given: to find — The 3d side	*AD* *A* *ED*	*AE*	*Ra. sc A, t AD, t AB.* *sc AD, sc ED, sc AB, sc EB* sum or differ. *AB* and *EB* is *AE*	7
Their contained angle.		*D*	*Ra. sc AD, t A, tc BDA.* *tc AD, tc ED, sc BDA, sc BDE* sum or diff. *BDA* & *BDE* is *D*	8
Two angles with one of their opposite sides given: to find — The third angle.	*AD* *A* *E*	*D*	*Ra. sc AD, t A, tc BDA.* *sc A, sc E, s BDA, s BDE* sum or diff. *BDA* & *BDE* is *D*	9
The side between them		*AE*	*Ra. sc A, t AD, t AB.* *t E, t A, s AB, s EB.* sum or diff. of *AB* & *EB* is *AE*	10
			The Equality	
Three sides given: to find an angle.	*AD* *ED* *AE*	*D*	$\frac{1}{2}$*AE* + $\frac{1}{2}$dif. *AD* and *ED* is sum *F* — *c.a.s AD*, *c.a.s ED* — $\frac{1}{2}$ is $\frac{1}{2}$ *AE* = $\frac{1}{2}$dif. *AD* and *ED* is rem. *G* — *Sum s F*, *Rem. s G* — *s* $\frac{1}{2}$ *D*	11
Three angles given: to find a side.	*A* *D* *E*	*ED*	$\frac{1}{2}$*A* + $\frac{1}{2}$dif. *E* & *D* is sum *F* — *c.ar. s D*, *c.ar. s E* — $\frac{1}{2}$ is $\frac{1}{2}$ *A* − $\frac{1}{2}$ diff. *E* & *D* is rem. *G* — *Sum s F*, *Rem. s G* — *s* $\frac{1}{2}$ *ED*	12

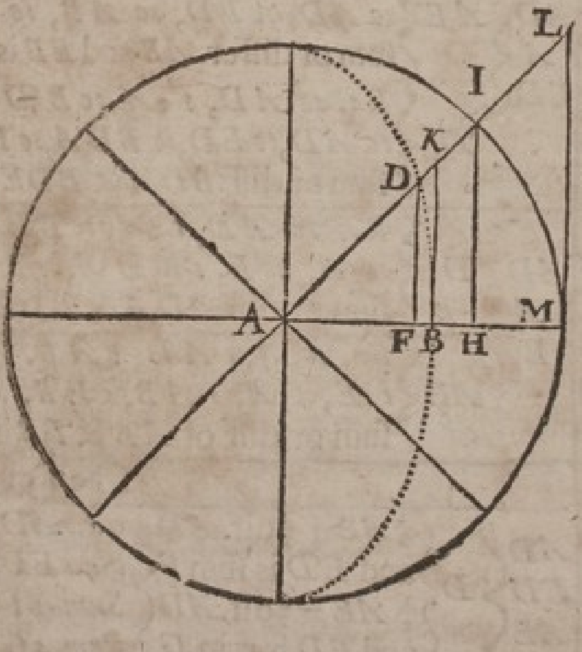
This laſt Table might be propoſed in other terms; as the firſt Caſe we might expreſs thus *co. ar. s E*+*s AD*+*s* A, makes ED, cutting off an unite or 1 in the firſt place toward the left hand, which thing being before ſufficiently explained, we ſhall not here need to inſiſt thereon.

Here I intended to conclude this work: but becauſe the demonſtration of the firſt fundamental Axiom for ſpherical triangles, as it is delivered by the Lord of *Marchiſton*, is very brief, and by him applied to another kind of Logarithms, ſo that it may ſeem obſcure, I have thought good here (though ſomething out of place) to illuſtrate the ſame, firſt premiſing certain *Lemma*'s ſerving to that purpoſe.

LEMMA 1.

In a right angled ſpherical triangle,

As the ſine of the baſe, is in proportion to Radius: ſo is the tangent of the perpendicular, to the tangent of the angle at the baſe.



As in this Diagram,

Let ADB repreſent a ſpherical Triangle, right angled at B; ſo that AD is the ſine of the hypothenuſal, AB the ſine of the baſe, and DB is the perpendicular.

Then is DAB the angle at the baſe, and IH the ſine, and LM the tangent thereof. Alſo DF is the ſine, and KB the tangent of the perpendicular DB.

I ſay

I say then,
As AB *the sine of the base,*
is in proportion to AM *Radius :*
so is BK *the tangent of the perpendicular,*
to ML *the tangent of the angle at the base.*

LEMMA 2.

In a right angled spherical Triangle ,
As the sine of the hypothenusal, is in proportion to Radius : so is the sine of the perpendicular, to the sine of the angle at the base.

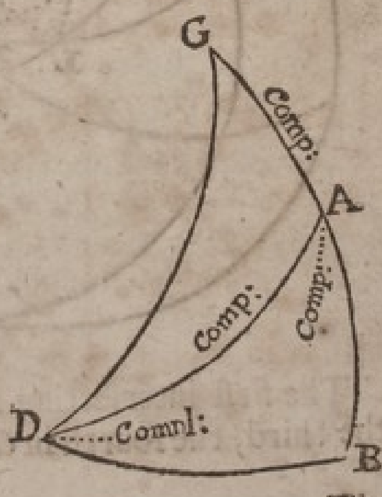
That is, in the foregoing figure,
As AD *the sine of the hypothenusal,*
is in proportion to AI *Radius :*
so is DF *the sine of the perpendicular,*
to IH *the sine of the angle at the base.*

These two *Lemma*'s might be demonstrated in this Diagram, but because the same in effect are at large demonstrated by *Lansbergius, Pitiscus, Snellius,* and others, we let that pass.

LEMMA 3.

The circular parts of a right angled Triangle, are the same with the circular parts of a quadrantal Triangle adjoyning.

As let *ABD* be a triangle right angled at *B* : and let one of the sides thereof, namely, *AB*, be extended, till it become a quadrant, that is to *G*, and draw an arch from *G* to *D*. Then is *GAD* a quadrantal triangle, adjoyning to the right angled triangle *ABD*. I say therefore that the circular parts of the quadrantal triangle *GAD*, are the same with the circular parts of the right angled triangle *ABD*. For the circular parts of either of them are, as here appeareth.



The

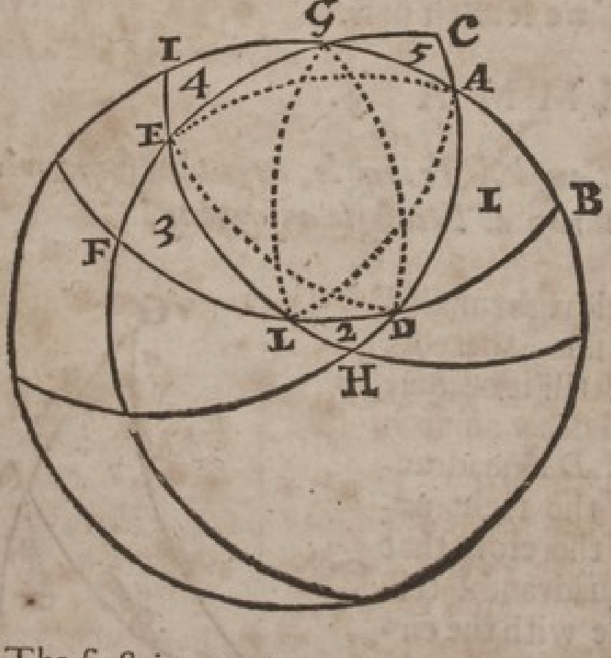
The five circular parts of the triangle.
{ *ABD*, are *AB*. *DB com. BDA. com. AD. com. A.*
{ *GAD*, are *com. AG. AGD. GDA. com. AD. com. A.*

Where it is evident, *GB* and *GD* being quadrants *GDB* is a right angle, and *DB* is the measure of the angle at *G*: so that the side *AB* in the one is equal to *compl. AG* in the other; and the side *BD* in the one, equal to the angle *AGD* in the other, and *compl. BDA* in the one is *GDA* in the other, and *compl. AD* in the one is the same with *compl. AD* in the other; and lastly, that *compl. A* in the one, is the same with *compl. A* in the other, for the complement of the acute angle *DAB* unto a quadrant, is also the *compl.* of the obtuse angle *GAD*.

LEMMA 4.

If five circles of the Sphere be so ordered, that the first intersect the second, the second the third, the third the fourth, the fourth the fifth, and the fifth the first, at right angles: the right angled triangles made by their intersections, do all consist of the same circular parts.

As in this Scheme,



Let *G* represent the Zenith, *A* the North Pole, and *D* the Sun being in the Horizon. So that *IGB* is an arch of the meridian of the place.

BDF an arch of the Horizon.

FEC, an arch of the circle describ'd about the Sun.

CAH, an arch of the meridian of the Sun.

HLI, an arch of the Equinoctial.

Then do these five arches retain the conditions required.

The first intersecting the second in *B*; the second, the third in *F*; the third, the fourth in *C*; the fourth, the fifth in *H*; and the fifth, the

the firſt in I, and theſe interſections at B, E, C H, I, are at right angles; therefore I ſay the right angled triangles made by the interſections of theſe circles, namely, ABD, DHL, L FE, E G I, and G C A, do all conſiſt of the ſame circular parts, for the circular parts in every of them are as here appeareth.

The five circular parts in the Triangle.	A B D, are	A B,	B D, com. B D A,	com. AD,	com. DAB	
	D H L, are com.	H L D. com.	L D, com.	LDH,	DH,	HL
	L F E, are com.	E L F,	L F,	F E. com.	FEL, com.	EL
	E I G, are	I G, com.	IGE, com.	G E, com.	G E I,	E I
	GCA, are com.	GA, com.	AGC,	G C	CA, com.	C A G

Where you may obſerve, that to the ſide A B in the firſt triangle, is equal *compl.* H L D in the ſecond, or *compl.* ELF in the third, or I G in the fourth, or *compl.* A G in the fifth. In like ſort, to the ſide DB in the firſt triangle, is equal *compl.* L D in the ſecond, the ſide L F in the third, *compl.* I G E in the fourth, or *compl.* A G C in the fifth: and the like is to be ſeen in the reſt, taken in ſuch order as they are placed.

To expreſs this more plainly: A B, the Poles elevation in the firſt triangle, is the complement of the angle H L D in the ſecond, or the complement of the angle E L F in the third, or the ſide I G in the fourth, or the complement of the hypothenuſal G A in the fifth; and the like is to be underſtood of the reſt.

The ſame uniformity of the circular parts is alſo apparent in quadrantal triangles.

As in the ſame Scheme G from D, D from E, E from A, A from L, and L from G, are diſtant by arches each equal to a quadrant; but the arches G A, A D, D L, L E, and E G, are not quadrants. Here are therefore five quadrantal triangles GAD, ADL, DLE, LEG, and EGA: whoſe circular parts are, as here appearth,

The five circular parts in the Triangle.	G A D, are com.	AG,	AGD,	GDA,	com. A D,	com. D A G
	A D L, are	ALD, com.	L D, com.	A D L, com.	A D	D A L
	D L E. are com.	DLE, com.	L D,	E D L,	D E L, com.	L E
	L E G, are	GLE,	LGE com.	E G, com.	L E G, com.	L E
	E G A, are com.	A G, com.	EGA, com.	E G.	G E A,	G A E

Where you may obſerve, that the circular parts in every of them remain the ſame unchangeable; and not only in theſe ten triangles, but in all others which do ariſe of the other interſections of theſe ten arches drawn forth to whole circles: which becauſe they are many and confuſed, we here let them paſs, this being ſufficient for our purpoſe.

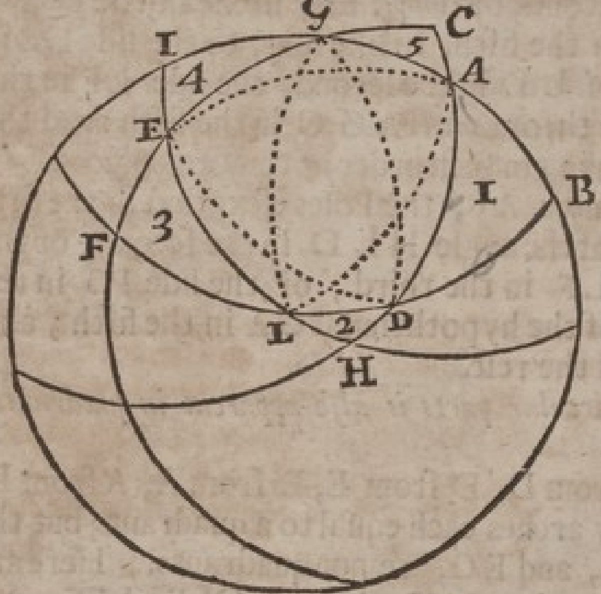
1. Fun-

1 Fundamental AXIOM.

Of the five circular parts in a spherical Triangle, right angled or quadrantal.

The sine of a middle part with Radius, is equal to the tangents of the extreams adjacent, or to the sines complement of the opposite extreams.

WHat a middle part, and what the extreams are, whether adjacent or opposite thereto, we have before shewed *Chap.* 2. of *spherical Triangles.*



Part 1. Now touching the first part of this Axiom in right angled triangles; the middle part is either one of the sides, or one of the oblique angles, or the hypothenusal.

Case 1. Let the middle part be a side; as in the triangle *ABD*, let *AB* be the middle part, and *DB*, and *compl. A* the extreams adjacent; then I say, that the sine of *AB* with Radius, is equal to the tangent of *DB*, with the tangent of the complement of *DAB*.

For (by the first *Lemma*) as the sine of *AB*, is in proportion to Radius: so is the tangent of *DB*, to the tangent of the angle at *A*; therefore also alternately, as sine *AB*, to tangent *DB*: so Radius to tangent *A*.

But (by the *Corollary* of the first Theorem of the fourth *Chapter* of *Plain Tringles*) Radius is a mean proportional between the tangent of an arch, and the tangent of the complement of the same arch; so that as Radius, is to tangent *A*, so is tang. compl. *A*, to Radius: therefore as *s AB*, to *t DB*: so is *tc A* to Radius: therefore (by the *Corollary* of 3 *Prop. Chap.* 2. of *Plain Triangles*) *s AB* + Radius, is equal to *DB* + *tc A*.

Case 2.

Case 2. Let the middle part be an angle, as in the triangle *DHL*; let compl. *H L D* be the middle part, and *HL* and compl. *L D* the extreams adjacent, then I say, that the sine complement of *H L D*, with Radius, is equal to the tangent of *HL*, with the tangent of the complement of *L D*.

For (by Lemma 4.) compl. *H L D* is equal to *A B*, and compl. *L D* to *D B*, and *H L* to compl. *D A B*, and here before we have proved, that *s A B*+Radius, is equal to *t D B*+ *tc A*, therefore also *sc HLD*+Radius, is equal to *tc LD*+*t H L*.

Case 3. Let the middle part be the Hypothenusal; as in the triangle *G C A*, let complement *A G* be the middle part, and complement *A G C*, and complement *CAG*, the extreams adjacent; Then also I say, *sc AG*+ Radius, is equal to *tc AGC*+*tc C A G*.

For we have before proved, that *s A B*+Radius, is equal to *t D B* +*tc A*, but (by the 4 Lemma) complement *AG*, is equal to *A B*, and compl. *A G C* to *D B*, and compl. *C A G* to compl. *D A B*, therefore also *sc AG*+Radius, is equal to *tc AGC*+ *tc CAG*.

Therefore in a right angled triangle, the sine of a middle part with Radius, is equal to the tangents of the extreams adjacent.

I say further, that

Part 2. *The sine of a middle part with Radius, is equal to the sines complement of the opposite extreams.*

For here also the middle part is either one of the sides, or the hypothenusal, or one of the oblique angles.

Case 1. Let the middle part be a side, as in the triangle *A B D* let *D B* be the middle part, and compl. *A D*, and compl. *A* the opposite extreams. Then I say, that the sine of *B D* with Radius, is equal to the sine of *A D* with the sine of *A*.

For (by Lemma 2.) as *s A D* to Radius: so *s D B* to sine *A*, therefore (by Corol. 3 Prop. 2. Chap. of plain triangles) *s D B* +Radius, is equal to *s A D*+*s A*.

Case 2. Let the Hypothenusal be the middle part, as in the triangle *D H L*, let compl. *L D* be the middle part, and *D H* and *H L* the opposite extreams; then I say, that *sc LD*+ Radius, is equal to *sc DH*+ *sc H L*.

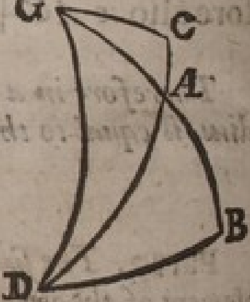
For comp. *L D* is equal to *D B*, and *DH* is equal to compl. *A D*; and *H L* to compl. *D A B* (by the 4 Lemma) therefore, *&c.*

Case 3. Let one of the oblique angles, be the middle part. As in the triangle *E I G* let compl. *I G E* be the middle part. Then I say that *sc I G E*+Radius, is equal to *s G E I*+ *sc E I*. For compl. *I G E* is equal to *D B*, and *G E I* is equal to *A D*, and *E I* to compl. *D A B*.

Therefore in a right angled triangle, *The sines of a middle part with Radius, is equal to the sines compl. of the opposite extreams.*

And seeing (by the third Lemma) the circular parts of a right angled triangle, are the same with the circular parts of the quadrantal triangle adjoyning; therefore that which is here proved touching right angled triangles, is also true of quadrantals, *Therefore in a spherical triangle, right angled or quadrantal*, &c. Which was to be proved.

The same might also have been demonstrated in this Diagram without the fourth Lemma beforegoing, but because that fourth Lemma is of singular invention, and of it self worthy to be known, I have chosen rather to follow herein the invention of the noble Author and Inventer of this *Prop.* and of that third and fourth Lemma, than otherwise.



And thus have we shewed the resolution of Plain and Spherical Triangles, by this late invention of *Logarithms*, not excluding the ways formerly used by natural sines, tangents, and secants; but delivering the Rules in such sort, as they may be applyed to either. What hath been largely handled by others I have lightly passed over; other things I have more insisted upon. In all I have endeavoured so much brevity, as might stand with perspicuity. Now touching the application hereof, I doubt not but he that is exercised in the Mathematicks, will be able to apply it divers ways, especially to those parts wherein he is conversant; yet for their help that are but newly entered, I hope to do something in that kind hereafter, as it shall please God to give opportunity. To whom alone is due all Glory in all things.

FINIS.

AN APPENDIX.

Touching the application of the Doctrine of Triangles in the three principal kinds of Sailing.

MY intent was here to have annexed a Treatise of *Navigation*, and especially of such Points therein as have reference to the *Doctrine of Plain and Spherical Triangles*: Being the rather thereunto induced, because I had my first breeding in Mathematical Studies and Practices at Sea; whereby I stand the more indebted, as to that excellent *Art*, so to the worthy Professors and Practisers thereof. But wanting time for the accomplishing of that according to my desire, by reason of my necessary absence and employment far from home all this Summer, I have here, instead thereof, shewed the resolution of certain Problems, touching the three principal kinds of Sailing.

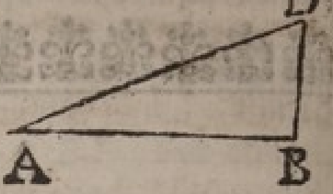
Questions of sailing by the plain or ordinary Sea-Chart.

Although the ground of the Projection of the ordinary Sea-Chart being false (as supposing the Earth and Sea to be a plain superficies) and so the conclusions thence derived must also for the most part be Erroneous: yet because it is most easie, and much used, and the Errors in small distances not so evident, we will not wholly neglect it.

Quest. 1. *Sailing 100 Leagues upon the sixth Rumb: how much shall I alter my Parallel or Latitude?*

Note. The angle that any Point of the Compass makes with the Meridian, we call the Rumb: but the angle that it makes with any Parallel, we call the complement of the Rumb.

And forasmuch as to every Point of the Compass there answers 11 deg. 15′, therefore the sixth Rumb from the Meridian (namely, *e n e*, *e s e*, *w s w*, or *w n w*) makes an angle therewith of 67 deg. 30′; whose complement 22 deg. 30′, is the angle of the same Rumb with every Parallel.



Now admit I ſail from *D* to *A. e n e* 100 Leagues; I demand the difference of Latitude *D B*.

By the third Caſe of plain triangles.

As Radius,		
to the diſtance run :	*A D* 100 Leagues	2.00000
ſo ſine compl. the Rumb,	*s A* 22 deg. 30 m.	9.58284
to the difference of Latitude,	*D B* $38\frac{41}{100}$ Leagues	1.58284

In like manner you may find the difference of Latitude for any diſtance run upon any other point of the Compaſs.

2 *Sailing* 100 *Leagues upon the ſixth Rumb : how far am I departed from the Meridian of the place from which I came?*

That is by the ſame things, as before I demand *A B*.

By the third Caſe of plain triangles.

As Radius,		
to the diſtance run :	*A D* 100 Leagues	2.00000
ſo is the ſine of the Rumb,	*s D* 67 deg. 30 m.	9.96562
to the departure from the Merid.	*A B* $92\frac{19}{100}$ Leagues.	1.96562

3 *Sailing upon the ſixth Rumb, till I alter my Latitude one degree, I demand how far I have ſailed?*

As ſailing from *D* to *A, e n e,* till the difference of Latitude *D B* be 20 Leagues; I demand the diſtance run *A D*.

Say by the ſecond Caſe of plain triangles.

As ſine compl. the Rumb,	*s A* 22 deg. 30 m. *co. ar.*	0.41716
to the difference of latit.	*DB* 20 Leagues	1.30103
ſo is Radius,		
to the diſtance run,	*A* D $52\frac{26}{100}$ Leagues.	1.71819

The like queſtion might be moved by the departure from the Meridian given.

4 *Sailing*

4 *Sailing upon the ſixth Rumb, till I have altered my latitude one degree: how much am I departed from my firſt Meridian?*

As ſailing from *D* to *A*, *e n e*, till the difference of latitude *D B* be 20 leagues; I demand *A B*, my departure from the Meridian.

By the firſt Caſe of plain triangles.

As Radius,		
to the difference of latitude:	*DB* 20 leagues	1.30103
ſo is the tangent of the Rumb,	*t D* 67 deg. 30′	10.38278
to the departure from the Merid.	*AB* $48\frac{28}{100}$	1.68381

In like manner by the departure from the Meridian given, you might find the difference of latitude.

5 *Sailing upon ſome Rumb, between the North and Eaſt* $52\frac{1}{4}$ *leagues, and finding that I have altered my latitude one degree: I demand upon what Point I have ſailed?*

As if I ſail from *D* to *A* (being ſome Rumb between the Eaſt and North) $52\frac{1}{4}$ Leagues, and then find the difference of Latitude *D B*, to be 20 Leagues; I demand the angle *A D B*.

Say by the ſixth Caſe,

As the diſtance run,	*A D* $52\frac{1}{4}$ Leag. *co. ar.*	8.28191
is to Radius:		
ſo is the difference of Latitude,	D *B*. 20 Leag.	1.30103
to ſine compl. the Rumb,	*s A* 22 deg. 30 m.	9.58294

Whoſe complement D 67 deg. 30 m. is the ſixth Point from the Meridian, namely, *e n e*. Here we neglect ſome part of a minute (as in theſe things not to be regarded) and ſo in other places.

6 *Sailing upon ſome Rumb between the North and the Eaſt* $52\frac{1}{4}$ *Leagues; and finding that I have altered my Latitude one degree, I would know my departure from my firſt Meridian.*

By

By the seventh Case.

To the distance run, add the distance of Latitude, and also substract it from the same, noting the sum and remainer. Then add together the Logarithms of this sum and remainer, and half the total is the Logarithm of the distance from the first meridian.

Distance run DA, $52\frac{1}{4}$ leagues	Sum	$72\frac{1}{4}$ leagues.	1.85884
Differ. of latit. DB, 20 leagues	Remain	$32\frac{1}{4}$ leagues.	1.50853
			3.36737
Departure from the meridian AB, $48\frac{28}{100}$ leagues.			1.68368

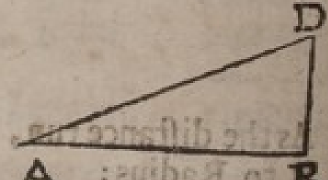
The same may be otherwise found by the same Case.

And in like sort might the difference of latitude be found, the departure from the meridian being known.

The distance of the meridians of two places, and the difference of the Latitudes of the same places being given, to find the Rumb and distance.

As let A represent the *Lizard* in the West-Part of *England*, and AB the parallel thereof, and let D represent St. *Mary's* Island, being one of the *Azores*, DB the meridian thereof.

Then is AB, the distance of the *Lizard* from the meridian of St. *Mary's*, which let be 272 leagues; and DB the distance of their parallels, or difference of their latitudes 256 leagues. I demand the Rumb: namely, the angle at D, and the distance in the Rumb, AD.



First, for the Rumb, say by the fourth Case.

As the difference of Latitude, DB 256 Leagues, *com. ar.*	7.59176
is in proportion to Radius:	
so is the distance of the meri. AB 272 leagues,	2.43457
to the tangent of the Rumb, tD 46 deg. 44 m.	10.02633

Which is the fourth Rumb from the meridian, and 1 deg. 44 m. more, which shews the course from St. *Mary's* to the *Lizard*, to be North-East 1 deg. 44 m. easterly: or from the *Lizard*, to St. *Mary's* South-West 1 deg. 44 m. westerly. And thus it should be by the plain Chart.

Secondly,

Secondly, for the distance AD; *say by the second Case,*

As the sine of the Rumb,	*s D* 46 deg. 44′ *co. ar.*	0.13776
to the distance of the Meridians	*AB* 272 leagues,	2.43457
so is Radius,		
to the distance of the places,	*AD* 373 ½ leagues,	2.57233

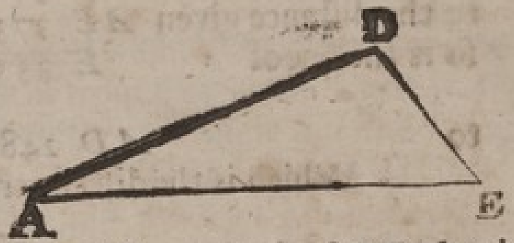
Or otherwise.

As sine compl. the Rumb,	*s A* 43 d. 16′ *co. ar.*	0.16406
to the difference of latitudes:	*DB* 256 leagues,	2.40824
so is Radius,		
to the distance of the places,	*AD* 373 ½ leagues,	2.57230

And such should be the distance by the plain Chart.

8. *Sailing away* w s w, *I see a Point of Land, which I set, and find to bear from me* w *by* n; *and having sailed six Leagues further, I find it bears from me* n w *by* w: *I would know how far it is distant.*

As let *E* be a point of Land, which when the Ship is at *A*, I set and find to bear from me *w* by *n*, but I hold on my course from *A* to *D* *w s w* 18 miles, and at *D*, I set the same Point of Land again, and find it to bear from me *n w* by *w*: I demand the distance thereof *DE*, that is, how far it was from me in my last observation.



First, I consider that between *A E* the *w* by *n*, and *A D* the *w s w* is three Points of the Compass, that is, 33 deg. 45 m. which is the angle at *A*: also between *E A*, the *e* by *s*, and *E D* the *s e* by *e*, are two Points, that is, 22 deg. 30 m.

Therefore by the 8 Case of Plain Triangles.

As sine the angle at the point seen,	*E* 22 deg. 30 m. *com. ar.*	0.41716
is to the distance run	*A D* 18 miles,	1.25527
so sine the angle at the first place of observation,	*s A* 33 deg. 45 m.	9.74474
to the distance of the Point seen *E D*	26 ⅛ miles,	1.41717

Whereby it appears, that the distance of the Point seen from the place of your last observation, is 26 miles, and a furlong. In like manner, you may find the distance thereof from the place of your first observation *A*.

Admit

Admit the course from the Lizard to St. Mary's *be* SW *the distance* $373\frac{1}{2}$ *Leagues. A certain Ship bound from the Lizard to St.* Mary's, *steers away* SSW, *and afterwards* W by S, *and so sometimes upon one of these points, sometimes upon the other, till she arrives at St.* Mary's; *now I demand how many Leagues she hath sailed upon one of these Points, and how many upon the other?*

Let *A* be the *Lizard*, *E* St. *Mary's*, and seeing *s s w* being from *s w* two points, makes an angle therewith of 22 degr. 30 m. which let be *A*; also *w* by *s* makes with *s w* an angle of 33 degr. 45 m. which let be *E*; also *s s w* makes with *w* by *s* an angle of 56 degr. 15 m. which let be the complement of *D* to 180 degr.

Therefore by the 8 *Case*,

As the sine of	*D*	56 degr. 15 m. *co. ar.*	0.08015
to the distance given	*AE*	$373\frac{1}{2}$ Leagues	2.57113
so is the sine of	*E*	33 degr. 45 m.	9.74474
to	*AD*	$248\frac{2}{10}$ Leagues	2.39602

Which is the distance run upon the *s s w* point.

Again,

As the sine of	*D*	56 degr. 15 m. *co. ar.*	0.08015
to the distance given	*AE*	$373\frac{1}{2}$ Leagues	2.57113
so is the sine of	*A*	22 degr. 30 m.	9.58284
to the way run	*ED*	$171\frac{44}{100}$	2.23412

Which is the distance run upon the *w* by *s* Point.

10. *A Merchant-Man being in the Latitude of* 43 *degrees, falls into the hands of Pyrats; who, amongst other things, take away his Sea-compass: But when he is gotten clear, he sails away as directly as he can, and after two days meets with a Man of War, who also had been the day before in the Latitude of* 43 *degr. and had sailed thence* s e by s 37 *leagues: He desirous to find these Pyrates, the Merchant-Man tells him, he left them lying to and fro where they took him, and he had sailed since at least* 64 *leagues between the South and West: what course shall the man of War shape to find these Pyrats?*

Let *A E* be the parallel of 43 degr. *D* the place where the Ships meet. Then is there given *A D* 64 leagues, *E D* 37 leagues, and the angle *D E A* five points, or 56 degr. 15 m.

Therefore

Therefore by the 9 Case of plain triangles.

As the distance run by the Merchant-Man,	} *A D* 64 leagues	*co. ar.*	8.19382
to sine the angle given :	*s* 56 d. 15 m.		9.91985
So is the distance run by the Man of War,	} *E D* 37 leagues,		1.56820
to sine an angle required,	*s A* 28 d. 44 m.		9.68187

That is *w s w* 6 d. 14 m. Southerly, and so hath the Merchant-Man sailed ; therefore to return to the same place, he must shape his course *e n e* 6 d. 14 m. Northerly.

11 *There are two Ports lying* n e, *and* s w *one of another, a ship sails from the westermost of these Ports* e s e, 47 *leag. another departing from the eastermost Port, sails* 66 *leag. and then meets with the former ; what course hath this second ship kept, and how far are these Ports asunder ?*

Let the North-east Port be *A*, the South-west *E*, and the place where these ships meet at *D* ; and forasmuch as from *E* to *A*, the course is *ne*, and from *E* to *D* East South-east : therefore the angle at *E* is 67 deg. 30 m. and the side *ED* 47 leagues, and *AD* 66 leagues.

Therefore by the 9 Case of plain triangles.

As *A D* 66 leag.	*co. ar.*	8.18046
to sine *E* 67 deg. 30 m.		9.96561
so *E D* 47 leag.		1.67210
to sine *A* 41 d. 08 m.		9.81817

And seeing from *A* to *E*, the course is South-west, and from *A* to *D*, 41 d. 08 m. more Southerly ; therefore the course from *A* to *D*, is South 3 d. 52 m. westerly.

Secondly, for the distance of these Ports *A E*, the angle at *A*, being 41 d. 08 m. and the angle at *E* 67 d. 30. m. the sum of them both is 108 d. 38. m. which substracted from 180 d. leaves the angle at *D* 71 d. 22 m.

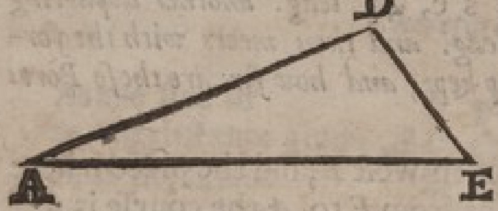
Therefore by the 8 Case of plain triangles.

As sine *E* 67 deg. 30 min.	*co. ar.*	0.03439
to *AD* 66 leag.		1.81954
so sine *D* 71 degr. 22. min.		9.97662
to *AE* $67\frac{7}{10}$ leag.		1.83055

So that the distance between the two Ports, is $67\frac{7}{10}$ leagues.

Some may think it requiſite, that the latter part of this Problem ſhould have been a diſtinct Caſe in plain Triangles: but becauſe the ſame things are here given as in the 9 Caſe, and the operation manifeſt by the 8 and 9, I thought it not neceſſary to make another Caſe of it.

12 *Coaſting along towards the Evening, I have ſight of a Cape or Headland, beyond which I deſire to ſteer in the next Morning; it bears from me* s s e, *and is diſtant by eſtimation* 11 *leagues; but I ſteer away South, till two of the Clock in the Morning, about* 12 *leagues; and then would know how the Cape bears from me, and how far it is off?*



As admit at *A*, I obſerve the Cape *D* to bear from me *s s e* 11 leagues; but I ſteer away South, to *E* 12 leagues. I have then *AD* 11 leagues, *AE* 12 leagues, the angle at *A* 22 degr. 30 m.

Firſt then for the angle at E *by the* 10 *Caſe.*

As *AE*+*AD* 23 leagues	*compl. ar.*	8.63828
to *AE*−*AD* 01 league,		
ſo *t* ½ (*E*+*D*) *t* 78 degr. 45 m.		10.70134
to tang. an angle *F* 12 degr. 20 m.		9.33962
Which ſubſtracted, there remains } *E* 66 degr. 25 m.		

In working this Example, becauſe the angle given *A* is 22 degr. 30′, therefore the other two *E* and *D* are 157 d. 30 m. (by the 1 Lemma of the 3 Chapter of Plain Triangles) the half whereof is 78 d. 45′, whereby we find an angle at *F*, 12 d. 20 m. which ſubſtracted from 78 d. 45 m. there remains the angle at *E* 66 d. 25 m. Wherefore ſeeing *EA* is a North line, *ED* is almoſt *e n e*, namely, *e n e* 1 d. 5′ Northerly.

Secondly, for the diſtance of the Cape ED *by the* 8 *Caſe.*

As ſign the angle found,	*s E* 66 d. 25 m. *co. ar.*	0.03788
to the diſt. in the evening:	*A D* 11 leagues,	1.04139
So the ſine of the ang. given,	*s A* 22 degr. 30	9.58284
to the diſt. in the morning	*E D* $4\frac{6}{10}$ leagues,	0.66211

That is above 4 leagues and an half diſtance.

13 *Admit I sail away from a certain Port* s s w 50 *leagues, and thence again* w *by* s 30 *leagues; upon what point have I made my way good, and how far am I come from that Port?*

As admit I sail from *A* to *D s s w* 50 leagues, and from *D* to *E w* by *s* 30 leagues, there is required the course *A*, or *E*, and distance *AE*. From the *s s w* to the *w* by *s*, are five points, that is 56 d. 15 m. which is the complement of the angle at *D*, to 180 degr. So that the angle at *D* is 123 d. 45 m. Wherefore here are given the two sides *AD* and *ED*, and their contained angle at *D*: Therefore,

As $AD+ED$ 80 leagues	*co. ar.*	8.09691
to $AD-ED$ 20 leagues		1.30103
so $t\,\frac{1}{2}(A+E)$ t 28 d. 08′,		9.72810
to tF 07 d. 37 m.		9.12604
Which substracted, there remains	*A* 20 degr. 31 m.	

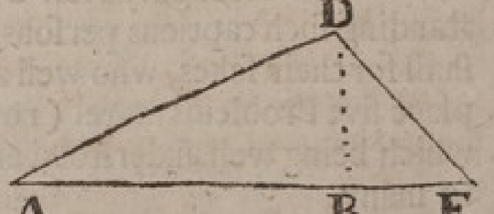
Wherefore seeing the course from *A* to *D* is *s s w*, the course from *A* to *E* is 20 d. 31 m. more Westerly, that is *s w* 2 deg. southerly; so that I have made my way good *s w* 2. degr. southerly.

Secondly, for the distance upon that Point.

As sine the angle found,	*s A* 20 degr. 31 m. *co. ar.*	0.45534
to his opposite side given:	*E D* 30 leagues	1.47712
so sine the angle given,	*s D* 56 degr. 15 m.	9.91985
to his opposite side requir.	*AE* 71 $\frac{1}{6}$ leagues	1.85231

Which is the distance from that Port.

14 *There are two Ports in one and the same parallel or latitude, distant 64 leagues; and there is a certain Island more Southerly, distant from the Eastermost of these Ports 47 leagues, and from the Westermost of them 34 leagues: I demand the course from the Eastermost Port to that Island?*



Let the Eastermost Port be *A*, the Westermost *E*, both in one and the same parallel *AE*, distant 64 leag. and let the Island be *D*, distant from *A* 47 leag. and from *E* 34 leag. there is required the course from *A* to *D*, that is the angle at *A*, or the complement thereof.

By the 12 Case of plain triangles.

As the distance of the Ports *AE* 64 leag.		*co. ar.*	8.19382
to the sum of *AD* and *ED* 81 leag.			1.90848
so is the difference of *AD* and *ED* 13 leag.			1.11394
to a certain line	*AI* 16$\frac{454}{1000}$		1.21624
which added to *AE* is	80$\frac{454}{1000}$		
the half whereof is	*AB* 40$\frac{227}{1000}$		

Then by the sixth Case of plain triangles.

As *AD* 47 leag.	*comp. arith.*	8.32790
to Radius		
So *AB* 40$\frac{227}{1000}$		1.60452
to *sc* *A*, *s* 58 d. 51 m.		9.93242

That is South-west and by West 2 d. 36 m. westerly, which is the course from the Eastermost Port of the Island.

15 *A Ship sails from one Port to a second* s s e 76 *leag. and from thence to a third* 54 *leag. and from that third to the first* 85 *leag. I demand the course from the second Port to the third, and from the third to the first?*

This and the like are to be wrought as the former, which therefore we leave to your own practice.

Some (as I have understood) who do little of themselves, but carp at others, and yet borrow of them, blame me for setting down so many Problems; but he that knows how to number aright the Questions that might be moved, knows that I leave untouched a far greater number of the same kind than those I handle, for I desire not to be tedious at any time. Yet he that learns no more than [needs must, will never be able to learn all that ; for we do not fully understand a thing till we have throughly view'd it on every side. Therefore notwithstanding such captious persons, as take offence without just cause ; I shall for their sakes, who well accepted my former labours, add in this place five Problems more (not handled by any other that I know) which being well understood and considered, may be as an introduction to many.

First,

First, Then it is be underſtood, that a Ship ſailing to windward, will (as I remember) uſually lie within 5 ½ points of the wind (if it be ſomething more or leſs, it matters not) yet by reaſon of her Lee-ward way, ſhe will ſcarce make her way good within 6 ½ points of the wind, ſometimes more, ſometimes leſs, according as the Sea is rougher, or ſmoother, and according to the mould of the Ship, and ſail ſhe bears: So that in ſailing to a place directly to windward, ſhe ſails uſually three or four times the diſtance of that place before ſhe arrive at it. But if the place to which ſhe ſails be not directly to windward, but within a point, two, three, four, five or ſix points of the wind, then though ſhe turn to windward, as before, yet ſhe will ſooner arrive at the place than before: but how, and in what proportion, for the one, and for the other, may appear by theſe enſuing Problems. As,

16 *Let the poſition from* A *to* B *(in this next figure) be South* 100 *miles, and the wind at South, and admit the Ship intending to ſail from* A *to* B, *make her way good within* 75 d. 31 m. *of the wind (which is almoſt* 6 ¾ *points of the Compaſs) I demand how far ſhe muſt ſail upon one tack, and how far upon the other, before ſhe arrive at* B?

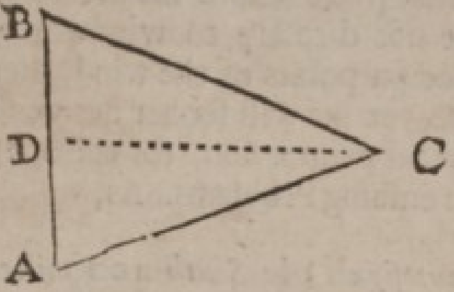
Then *AC* being the Ships way, ſo near the wind as ſhe can make her way good, the angle *BAC* is 75 d. 31 m. whereto is equal the angle *ABC* (for *AC* and *BC* croſs the ſouth line *AB* alike, or at equal angles) the ſum of theſe two angles at *A* and *B* is 151 d. 02′ which ſubſtracted from 180 d. leaves the angle at *C* 28 d. 58 m. and thus we have the angles of the triangle *ABC*, and the ſide *AB* 100 miles: Say then,

As ſine the angle *C* 28 d. 58 m.	*compl. arith.*	0.31488
to the ſide *AB* 100 miles		2.00000
ſo *s* the angle *A* 75, 32		9.98597
to the ſide *BC* 200 miles *ferè*		2.30085

Whereto is equal the ſide *AC* (becauſe the angles at *A* and *B* are equal) therefore I ſay, ſhe muſt ſail with her Larboord tack aboord 200 miles (whether at one or many boords) and as much with her Star-

Star-Boord tack a boord, in all 400 miles to come to *B*, being from *A* only 100 miles, but directly to wind-ward. But,

17 *Let the position from* A *to* B *be (as before) South* 100 *miles, and the wind at South; and admit a Ship sailing from* A *to* B *(making one or many boords) doth run* 300 *miles before she can reach* B, *that is* 150 *with the Lar-boord tack aboord, and* 150 *with the Star-boord tack aboard. I demand how neer to the wind she makes her way good?*

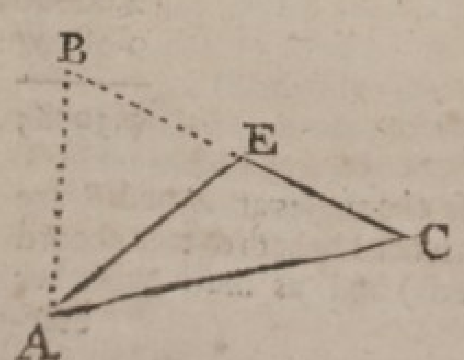


Let fall from *C* a perpendicular to *AB*, namely, *AD*, which divides the side *AB* into two equal parts, so that *AD*, and *DB* are each 50 miles, and *AC* and *BC* each 150 miles; therefore in the right angled triangle *ACD*, say,

As the side *AC* 150	*compl. arith.*	7.82391
to Radius:		
so the side *AD* 50		1.69897
to *s* the angle *DCA* 19. degr. 28 m.		9.52288

Whose compl. 72 degr. 32 m. is the angle *DAC*, shewing that she makes her way good within 70 degr. 32 m. of the wind.

18 *Let the distance from* A *to* E, *in this next Diagram, be* 100 *miles South-west, the wind at South; and let the Ship make her way good within* 70 *degr.* 32 *m. of the wind: I demand the distances* A C *and* C E, *that is the Ships way by dead reckoning upon the one tack and upon the other.*



Then *AB* being a South line (or point upon which the wind is) the angle *BAC* is 70 d. 32 m. from which substracting *BAE* 4 points, or 45 d. there remains the angle *EAC* 25 d. 32 m. Again, the complement of 70 d. 32 m. is 19 d. 28 m. which doubled is 38 d. 56. m. the angle at *C*, and adding these two, namely 25 d. 32. m. and 38 d. 56 m. the Sum is is 64 d. 28 m. the outward angle at *E*. Thus have we the angles of the triangle *AEC*, and the side *AE* 100 miles. Say then,

As *s C* 38 d. 56′ *co. ar.*	0.20175	As *s C* 38 d. 56′ *co. ar.*	0.20175
to *A E* 100 miles	2.00000	to *A E* 100 miles	2.00000
so *s E* 64 d. 28′	9.95537	so *s EAC* 25 d. 32′	9.63451
to *AC* 143 $\frac{6}{10}$	2.15712	to *E C* 68 $\frac{6}{10}$	1.83626

Thus it appears, that to sail from *A* to *E*, which is Southwest 100 miles with the wind at South, and making her way good within 70 d. 32 m. of the wind, she must sail with her Larboord tack aboord neer 143 $\frac{6}{10}$ miles, and with her Star-boord tack aboord near 68 $\frac{6}{10}$ miles: In all 212 $\frac{2}{10}$ miles that is near *w s w* a quarter point Westerly 143 $\frac{6}{10}$ miles, and *e s e* a quarter of a Point Easterly 68 $\frac{6}{10}$ miles.

19 *Let the distance from* A *to* E *be* 100 *miles Southwest, the wind at South: a Ship sails from* A *to* C, *so near the wind as she can by* 143 $\frac{6}{10}$ *miles, and from* C *to* E 68 $\frac{6}{10}$ *miles: I demand how near the wind she makes her way good?*

Here from	*A C*	143.6
substract	*E C*	68.6
there rests	*EB*	75 miles.

Then say,

As the side	*E B* 75 miles	*compl. ar.*	8.12494
to *s* the angle	*B AE* 45 d. 00 m.		9.84948
so is the side	*A E* 100 miles		2.00000
to *s* the angle at	*B* 70 d. 32 m.		9.97442

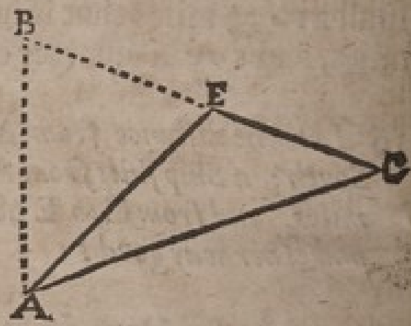
Whereto is equal the angle *BAC*, whence I conclude, that she makes her way good within 70 degrees, 32 minutes of the wind; so that the wind being at South, she makes her way good upon the one tack near *w s w* $\frac{1}{4}$ Point Westerly, and upon the other *e s e* $\frac{1}{4}$ Point Easterly.

I have about 22 years past, in my Book entituled, *The Sea-Man's Practice*, shewed (first I think of any man, though some have touched upon it since) the resolution of about a dozen questions touching

Currents,

Currents, I have added only this one in this place, leaving the rest (which are many) that might be moved (touching a ship sailing in a Current, or out of a Current, by a wind or large) to our ingenious young men at Sea, for their exercise at their leisure; having elsewhere opened cursorily the method for framing such Questions or Problems, in Subjects Mathematical, or otherwise.

Let the distance from A *to* E *be (as before)* 100 *miles Southwest, the wind at South, and a Current under the Lee-bow setting almost* e s e, *namely, South easterly* 70*d.* 32 *m. And admit a ship which will make her way good within* 70 *d.* 32 *m: of the wind, sails close by the wind from* A *towards* C *three dayes, and then arrives at* E : *I demand how far she sails by dead reckoning, and how fast that Current sets?*



Here then the angle *BAC* is 70 d. 32. m. from which substracting *BAE* 4 points, or 45 d. there remains the angle *EAC* 25 d. 32 m. And seeing the Current sets according to the line *CEB*, East South-east easterly, namely, South easterly 70 d. 32 m. therefore the angle at *B*, is also 70. d. 32 m. to which adding *BAC*, the sum is 141 deg. 04 min. which taken from two right angles, or 180 d. leaves the angle *ACB* or *ACE* 38 d 56 m. to which adding *EAC* 25 d. 32. the sum is the outward angle *BEA* 64 d. 28 m. And thus we have the three angles of the triangle *AEC*, and the side *AE* 100 miles, whereby we may find *AC* the distance run by dead reckoning, and *CE* the drift of the Current, in manner following.

As *s ACE* 38 d. 56′ *co. ar.* 20175
to the side *AE* 100 mil. 2.00000
so *s BEA* 64 d. 28 m. 9.95537

to the side *AC* 143 $\frac{6}{10}$ 2.15712
Which 143 $\frac{6}{10}$ is the distance run by dead reckoning.
Again,

As *s ACE*, 38 d. 56′ *co. ar.* 20175
to the side *AE* 100 mil. 200000
so *s EAC* 25, 32 9.63451

to the side *CE* 68 $\frac{6}{10}$ 1.83626
Which 68 $\frac{6}{10}$ miles, is the drift of the Current in 3 dayes, which is almost a mile an hour, namely, $\frac{95}{100}$ of a mile, or 95 centesimes of a mile hourly.

Of

Of Sailing by Mercator's *Chart.*

And thus much of the plain Chart, which as it hath this commodity that it is most easie: so it hath some discommodities intollerable. For there be very few places that can therein be expressed according to their true situation and distance one from another. Which as it is a great impediment in the practice of Navigation, so it hath caused much confusion in the *Geographical* and *Hydrographical* descriptions of places, insomuch as there are scarce extant any descriptions of the World, or the parts thereof, that are not pestered with notorious Errors, the greatest part of them hence arising. It is indeed ancient, and till the Sea-Compass was known, it was the aptest Chart that could be used, because till then Men were Coasters, and for the most part returned back the same way they went forth. And it may still serve without any great Error, in such places as are near the Equinoctial, also in many other places for short Voyages, and even for long Voyages, provided that a Man be sure to return the same way that he went, or near the same. Otherwise if he trust to the plain Chart, he will be most grosly deceived many times in his Course a Point or two of the Compass, and in his distance many hundred Miles. But in this Sea-Chart called *Mercator*'s, all or any parts of the World may be set down, according to their Longitudes, Latitudes, Courses, and Distances, as truly and far more conveniently for the Mariners use, than upon the Globe it self. So that it will truly shew the direction and distance from place to place, which way soever a Man goes or returns.

Some Men will say, that in divers reckonings by *Mercator*'s Chart, they have found as little certainty as by the plain Chart, which I deny not; but the reason is, because there are few or no Charts made directly according to this projection. It will be said, yes, there are many, and that a Man may have of them whensoever he will bespeak them. I grant, a Man may have those which are so called; but that which is such indeed, must not only have the Meridians, Parallels, and Rumbs drawn according to this projection; but the Sea-Coasts must be inserted by the like art and means as they have formerly been inserted into the common Sea-Chart; otherwise, he that shall transfer places out of the common Sea-Chart into *Mercator*'s, without due knowledge and respect upon what occasion, or for what reason they were so placed in the common-Sea-Chart, he shall transfer the

Errors of the one into the other, and that sometimes with increase. Wherefore it requires more than an ordinary Judgment, to draw a Plot directly according to this projection, for any place or places; and he must further know, or be made acquainted with the reckonings of Mariners frequenting those places; and that truly whether with allowance, or without; and whether agreeing, or disagreeing with their Plots; and so comparing one thing with another, and weighing all in the ballance of a good judgment, he shall be able to do it. The ground of the projection of this kind of Charts was pointed at by *Ptolomy*, many hundred years since, and according to that ground, *Mercator* did of late years set forth an universal Map of the World, whereupon these have been called *Mercators Charts.* But the way how to describe them, was first taught by that learned Navigator of our times, M. *Ed.Wright*, in his Book of the *Corrections of Errors in Navigation.* From whence also the grounds and reasons of these ensuing Problems are to be taken: and if we would be as grateful to our own Countreymen, as to Strangers, I see not, but we may ascribe as much to him in this, as to any other Man. Now that which he hath shewed to perform by the Chart it self, we will here shew to work by the doctrine of plain Triangles, using the help of his Table of Latitudes; of which, as M. *Gunter*'s Table for the division of the Meridian Line, is an abridgment; consisting of the quotients of every sixth number, divided by 6, and two figures cut off: so this which I here exhibit, and call a Table of Meridional parts, is also an abridgment of that Table of M.*Wrights*: namely, every sixth number, cutting off 4 figures. So that this Table sheweth how many parts every degree, and every tenth part of a degree of Latitude in this Chart, is from the Equinoctial: namely, of such parts as a degree of the Equinoctial contains 60; he that desires a larger Table, may use M. *Wright*'s extant in his Book before mentioned.

A Table of Meridional parts.

Lat. d. m.	*Mer. parts.*	Lat. d. m	*Mer. parts.*	Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*
0 00	00	3 00	180	6 00	361	9 00	542	12 00	725	15 00	910
06	06	06	186	06	367	06	548	06	731	06	917
12	12	12	192	12	373	12	554	12	738	12	923
18	18	18	198	18	379	18	560	18	744	18	929
24	24	24	204	24	385	24	567	24	750	24	935
30	30	30	210	30	391	30	573	30	956	30	942
36	36	36	216	36	397	36	579	36	762	36	948
42	42	42	222	42	403	42	585	42	768	42	954
48	48	48	228	48	409	48	591	48	774	48	960
54	54	54	234	54	415	54	597	54	781	54	966
1 00	60	4 00	240	7 00	421	10 00	603	13 00	787	16 00	973
06	66	06	246	06	427	06	609	06	793	06	979
12	72	12	252	12	433	12	615	12	799	12	785
18	78	18	258	18	439	18	621	18	805	18	991
24	84	24	264	24	445	24	627	24	811	24	998
30	90	30	270	30	451	30	634	30	818	30	1004
36	96	36	276	36	457	36	640	36	824	36	1010
42	102	42	282	42	463	42	646	42	830	42	1016
48	108	48	288	48	469	48	652	48	836	48	1023
54	114	54	294	54	475	54	658	54	842	54	1029
2 00	120	5 00	300	8 00	482	11 00	664	14 00	848	17 00	1035
06	126	06	306	06	488	06	670	06	855	06	1042
12	132	12	312	12	494	12	676	12	861	12	1048
18	138	18	318	18	500	18	682	18	867	18	1054
24	144	24	324	24	506	24	689	24	873	24	1060
30	150	30	330	30	512	30	695	30	879	30	1067
36	156	36	337	36	518	36	701	36	886	36	1073
42	162	42	343	42	524	42	707	42	892	42	1079
48	168	48	349	48	530	48	713	48	898	48	1086
54	174	54	355	54	536	54	719	54	904	54	1092
3 00	180	6 00	361	9 00	542	12 00	725	15 00	910	18 00	1098

A Table of Meridional parts.

Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*	Lat. d. m.	*Mer. parts.*
18 00	1098	21 00	1289	24 00	1484	27 00	1684	30 00	1888	33 00	2100
06	1104	06	1296	06	1491	06	1690	06	1895	06	2107
12	1111	12	1302	12	1497	12	1697	12	1902	12	2114
18	1117	18	1308	18	1504	18	1704	18	1909	18	2121
24	1123	24	1315	24	1510	24	1710	24	1916	24	2128
30	1130	30	1321	30	1517	30	1717	30	1923	30	2135
36	1136	36	1328	36	1524	36	1724	36	1930	36	2143
42	1142	42	1334	42	1530	42	1731	42	1937	42	2150
48	1149	48	1341	48	1537	48	1738	48	1944	48	2157
54	1155	54	1347	54	1543	54	1744	54	1951	54	2164
19 00	1161	22 00	1354	25 00	1550	28 00	1751	31 00	1958	34 00	2171
06	1168	06	1360	06	1557	06	1758	06	1965	06	2179
12	1174	12	1367	12	1563	12	1765	12	1972	12	2186
18	1181	18	1373	18	1570	18	1772	18	1979	18	2193
24	1187	24	1380	24	1577	24	1778	24	1986	24	2201
30	1193	30	1386	30	1583	30	1785	30	1993	30	2208
36	1200	36	1393	36	1590	36	1792	36	2000	36	2215
42	1206	42	1399	42	1596	42	1799	42	2007	42	2222
48	1212	48	1406	48	1603	48	1806	48	2014	48	2230
54	1219	54	1412	54	1609	54	1813	54	2021	54	2237
20 00	1225	23 00	1419	26 00	1616	29 00	1819	32 00	2028	35 00	2244
06	1232	06	1425	06	1623	06	1826	06	2035	06	2252
12	1238	12	1432	12	1630	12	1833	12	2043	12	2259
18	1244	18	1438	18	1637	18	1840	18	2050	18	2266
24	1251	24	1445	24	1643	24	1847	24	2057	24	2274
30	1257	30	1451	30	1650	30	1854	30	2064	30	2281
36	1264	36	1458	36	1657	36	1861	36	2071	36	2288
42	1270	42	1464	42	1663	42	1868	42	2078	42	2296
48	1276	48	1471	48	1670	48	1875	48	2085	48	2303
54	1283	54	1477	54	1677	54	1881	54	2092	54	2311
21 00	1289	24 00	1484	27 00	1684	30 00	1888	33 00	2100	36 00	2318

A Table of Meridional parts.

Lat. d. m.	Mer. parts.	Lat. d. m.	Mer. parts.	Lat. d. m.	Mer. parts.	Lat. d. m.	Mer. parts.	Lat. d. m.	Mer. parts.	Lat. d. m.	Mer. parts.
36 00	2318	39 00	2545	42 00	2782	45 00	3030	48 00	3292	51 00	3569
06	2325	06	2553	06	2790	06	3039	06	3301	06	3578
12	2333	12	2560	12	2798	12	3047	12	3310	12	3588
18	2340	18	2568	18	2806	18	3056	18	3319	18	3598
24	2348	24	2576	24	2814	24	3064	24	3328	24	3607
30	2355	30	2584	30	2822	30	3073	30	3337	30	3617
36	2363	36	2592	36	2830	36	3081	36	3346	36	3627
42	2370	42	2599	42	2839	42	3090	42	3355	42	3636
48	2378	48	2607	48	2847	48	3098	48	3364	48	3646
54	2385	54	2615	54	2855	54	3107	54	3373	54	3656
37 00	2393	40 00	2623	43 00	2863	46 00	3116	49 00	3382	52 00	3665
06	2400	06	2631	06	2871	06	3124	06	3391	06	3675
12	2408	12	2638	12	2880	12	3133	12	3401	12	3685
18	2414	18	2646	18	2888	18	3142	18	3410	18	3695
24	2423	24	2654	24	2896	24	3150	24	3419	24	3705
30	2430	30	2662	30	2904	30	3159	30	3428	30	3714
36	2438	36	2670	36	2913	36	3168	36	3437	36	3724
42	2446	42	2678	42	2921	42	3176	42	3447	42	3734
48	2453	48	2686	48	2929	48	3180	48	3456	48	3744
54	2461	54	2694	54	2938	54	3194	54	3465	54	3754
38 00	2468	41 00	2702	44 00	2946	47 00	3203	50 00	3475	53 00	3764
06	2476	06	2710	06	2954	06	3212	06	3484	06	3774
12	2484	12	2718	12	2963	12	3225	12	3493	12	3784
18	2491	18	2726	18	2971	18	3229	18	3503	18	3794
24	2499	24	2734	24	2979	24	3238	24	3512	24	3804
30	2507	30	2742	30	2988	30	3247	30	3522	30	3814
36	2514	36	2750	36	2996	36	3256	36	3531	36	3824
42	2522	42	2758	42	3005	42	3265	42	3540	42	3834
48	2530	48	2766	48	3013	48	3274	48	3550	48	3844
54	2537	54	2774	54	3022	54	3283	54	3559	54	3855
39 00	2545	42 00	2782	45 00	3030	48 00	3292	51 00	3569	54 00	3865

A Table of Meridional parts.

Lat.		Mer.	Lat.		Mer.	Lat.		Mer.	Lat.		Mer.	Lat.		Mer.	Lat.		Mer.
d.	m.	parts.	d.	m.	parts.	d.	m.	parts.	d.	m.	parts	d.	m.	parts.	d.	m.	parts.
54	00	3865	57	00	4183	60	00	4528	63	00	4905	66	00	5324	69	00	5795
	06	3875		06	4194		06	4540		06	4913		06	5339		06	5812
	12	3885		12	4205		12	4552		12	4932		12	5354		12	5829
	18	3896		18	4216		18	4564		18	4945		18	5369		18	5846
	24	3906		24	4227		24	4566		24	4959		24	5384		24	5863
	30	3916		30	4238		30	4588		30	4972		30	5399		30	5880
	36	3927		36	4250		36	4600		36	4986		36	5414		36	5997
	42	3937		42	4291		42	4613		42	4999		42	5429		42	5914
	48	3947		48	4272		48	4625		48	5013		48	5444		48	5932
	54	3958		54	4283		54	4637		54	5026		54	5459		54	5949
55	00	3968	58	00	4295	61	00	4650	64	00	5040	67	00	5475	70	00	5967
	06	3979		06	4306		06	4662		06	5054		06	5490		06	5984
	12	3989		12	4317		12	4674		12	5067		12	5505		12	6002
	18	4000		18	4329		18	4687		18	5081		18	5521		18	6020
	24	4010		24	4340		24	4699		24	5095		24	5537		24	6038
	30	4021		30	4352		30	4712		30	5109		30	5552		30	6056
	36	4031		36	4363		36	4725		36	5123		36	5568		36	6074
	42	4042		42	4375		42	4737		42	5137		42	5584		42	6092
	48	4053		48	4386		48	4750		48	5151		48	5600		48	6110
	54	4063		54	4398		54	4763		54	5165		54	5615		54	6128
56	00	4074	59	00	4409	62	00	4775	65	00	5179	68	00	5631	71	00	6147
	06	4085		06	4421		06	4788		06	5194		06	5648		06	6165
	12	4096		12	4433		12	4801		12	5208		12	5664		12	6184
	18	4106		18	4445		18	4814		18	5222		18	5680		18	6202
	24	4117		24	4456		24	4827		24	5237		24	5696		24	6221
	30	4128		30	4468		30	4840		30	5251		30	5712		30	6240
	36	4139		36	4480		36	4853		36	5265		36	5729		36	6259
	42	4150		42	4492		42	4866		42	5280		42	5745		42	6278
	48	4161		48	4504		48	4879		48	5295		48	5762		48	6297
	54	4172		54	4516		54	4892		54	5309		54	5779		54	6316
57	00	4183	60	00	4528	63	00	4905	66	00	5324	69	00	5795	72	00	6336

A Table of Meridional parts.

Lat. d. m.	*Mer.* parts.	Lat. d. m.	*Mer.* parts.	Lat. d. m.	*Mer.* parts.	Lat. d. m.	*Mer.* parts.	Lat. d. m.	*Mer.* parts.	Lat. d. m.	*Mer.* parts.
72 00	6336	75 00	5972	78 00	7746	81 00	8742	84 00	10141	87 00	12521
06	6355	06	5995	06	7775	06	8780	06	10199	06	12038
12	6375	12	7018	12	7804	12	8819	12	10258	12	12759
18	6394	18	7042	18	7834	18	8859	18	10318	18	12884
24	6414	24	7066	24	7864	24	8899	24	10379	24	13015
30	6434	30	7089	30	7894	30	8939	30	10441	30	13150
36	6454	36	7114	36	7924	36	8980	36	10504	36	13291
42	6474	42	7138	42	7954	42	9021	42	10569	42	13438
48	6495	48	7162	48	7985	48	9063	48	10634	48	13591
54	6515	54	7187	54	8016	54	9105	54	10701	54	13752
73 00	6535	76 00	7211	79 00	8048	82 00	9148	85 00	10770	88 00	13920
06	6556	06	7236	06	8079	06	9192	06	10839	06	14097
12	6577	12	7261	12	8111	12	9236	12	10910	12	14284
18	6598	18	7287	18	8148	18	9280	18	10983	18	14481
24	6618	24	7312	24	8176	24	9325	24	11057	24	14691
30	6640	30	7338	30	8209	30	9371	30	11133	30	14914
36	6661	36	7364	36	8242	36	9417	36	11210	36	15153
42	6682	42	7390	42	8275	42	9464	42	11290	42	15409
48	6704	48	7416	48	8309	48	9512	48	11371	48	15686
54	6725	54	7442	54	8343	54	9560	54	11454	54	15987
74 00	6747	77 00	7469	80 00	8377	83 00	9609	86 00	11539	89 00	16318
06	6769	06	7495	06	8412	06	9659	06	11626	06	16683
12	6791	12	7522	12	8447	12	9709	12	11716	12	17092
18	6813	18	7550	18	8483	18	9760	18	11808	18	17556
24	6835	24	7577	24	8518	24	9812	24	11902	24	18293
30	6857	30	7605	30	8555	30	9865	30	11999	30	18729
36	6880	36	7633	36	8591	36	9918	36	12099	36	19511
42	6903	42	7661	42	8628	42	9973	42	12202	42	20524
48	6925	48	7689	48	8666	48	10029	48	12308	48	21967
54	6948	54	7717	54	8703	54	10084	54	12408	54	24499
75 00	6972	78 00	7746	81 00	8742	84 00	10141	87 00	12521	90 00	Infinit.

The uſe of this Table ſhall partly appear in the Problems following, and may firſt be illuſtrated thus.

Probl. 1. *To find by this Table, what Meridional parts are contained in any difference of Latitude.*

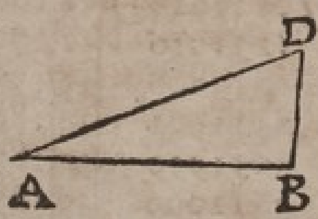
Take the Meridional parts anſwering to each Latitude, ſubſtract the leſſer from the greater; the remainer is the number of Meridional parts, contained in the difference of Latitude propoſed.

As let the one Latitude be	50 deg.	00′	3475	*Merid. parts.*
The other	32	25	2058	
The Merid. parts contained in the difference of Latitude			1417	*Difference.*

Probl. 2. *The Latitudes and Difference of Longitude of two places given; to find the Rumb and Diſtance.*

To the intent the application may be the more evident, we will give Examples of two places expreſſed in the Chart.

As admit the Latitude of the *Lizard* to be 50 deg. 00′, the Latitude of *Summers Iſlands*, ſometimes called the *Bermudas*, 32 deg. 25′, and the difference of Longitude to be 70 deg. 00′; the *Summers Iſlands* being ſo much to the Weſtward of the *Lizard*: I demand the courſe and the diſtance from the one to the other?



As in this right angled triangle *A D B*, let *A* repreſent the *Lizard*, and *A B* the parallel thereof, *D Summers Iſlands*, and *D B* the Meridian thereof.

Then is there given *D B* the difference of Latitude 17 deg. 35′, and *AB*, the difference of Longitude 70 deg. 00′; whereby the angles and hypothenuſal ſhould be found, by the 4 and 2 Caſes of plain Triangles. But becauſe in this kind of projection, the degrees of Longitude and Latitude are not equal (except in places near the Equinoctial) the degrees of Latitude at every parallel exceeding the degrees of Longitude, in ſuch proportion as the Equinoctial exceeds that parallel: Therefore theſe differences of Longitude and Latitude muſt firſt be expreſſed by ſome one common meaſure. And for that purpoſe ſerves the foregoing Table, which ſheweth how many ny equal parts are from the Equinoctial to every degree of Latitude; namely, of such equal parts as a degree of Longitude contains 60'.

Wherefore multiplying 70. d. 00 m. the difference of Longitude, by 60, I have 4200 for the Meridional parts contained in the difference of Longitude; also (by the last Problem) I find the meridional parts contained in the difference of Latitude to be 1417; so that *D B* is 1417 parts, and *A B* 4200 such parts.

Therefore by the 4 Case of Plain Triangles.

As the diff. of Latitude in parts,	*D B* 1417 parts. *co. ar.*	6.84863
is in proportion to Radius:		
So is the diff. of Longit. in parts,	*A B* 4200 parts.	3.62325
to the tangent of the Rumb,	*t D* 71 d. 21 m.	10.47188

Which sheweth the course from the *Summers Islands* to the *Lizard* to be *e n e* 3 d. 51 m. easterly; or from the *Lizard* to the *Summers Islands*, *w s w* 03 d. 51 m. westerly.

Secondly, for the distance in the Rumb.

Reduce the difference of Latitude into Miles (multiplying the degrees by 60, and to the product adding the minutes.)

Then by the 2 Case of Plain Triangles.

As sine complement the Rumb,	*s A* 18 d. 39' *co. ar.*	0.49514
to the difference of Latitude:	*D B* 1055 Miles	3.02325
So is Radius		
to the distance	*A D* 3299 Miles	3.51839

Which is almost 1100 Leagues, and this is the distance measured in the Rumb; there is a nearer Cut between these two places, whereof we shall speak hereafter in *Great Circle Sailing*; but here, whensoever we speak of the distance of two places, we mean their distance measured in their Rumb.

Prob. 3. *The Latitudes of two places, and their distance given, to find the Rumb, and difference of Longitude.*

Admit I sail from the *Lizard*, being in the Latitude of 50 degrees, upon some point to the Westward, 3299 Miles; and then find my self in the Latitude of 32 d. 25 m. I would know upon what point I have made my way good, and how much I have altered my Longitude?

The difference of Latitude *D B* is 17 d. 35 m. which reduced into Miles, is 1055 Miles.

As the diſtance ſailed,	*AD* 3299 miles, *co. ar.*		6.48161
is in proportion to Radius:			
ſo is the differ. of latitude,	*DB* 1055 miles,		3.02325
to ſine compl. the Rumb,	*s A* 18 deg. 39′		9.50486

That is *w s w* 3 deg. 51 min. weſterly.

Secondly, for the difference of Longitude.

Find by the firſt Problem what meridional parts are contained in the difference of latitude, which are here 1417, then ſay,

As Radius		
to the differ. of latitude in parts:	*DB* 1417 parts	3.15137
So is the tangent of the Rumb,	*t D* 71 deg. 21′	10.47188
to the differ. of longitude of parts,	*AB* 4200 parts	3.62325

Which parts reduced into degrees, dividing them by 60, the quotient is 70 deg. the difference of longitude required.

Probl. 4. *By the Rumb, and latitude of two places given: to find their diſtance and difference of longitude.*

Admit I ſail from the *Lizard*, being in the latitude of 50 d. *w s w* 3 deg. 51 min. weſterly, till I find my ſelf in the latitude of 32 deg. 25 min. I demand how far I have ſailed, and how much I have altered my longitude?

The diſtance is found, as in the latter part of the ſecond Problem, thus. The difference of latitude converted into miles, is 1055 miles. Say then,

As ſine compl. the Rumb,	*s A* 18 d. 39′ *co. ar.*	0.49514
to the difference of latitude,	*DB* 1055 miles	3.02325
So is Radius		
to the diſtance.	*AD* 3299 miles	3.51839

And ſo much is the diſtance: the difference of longitude may be found, as in the latter part of the third Problem, ſaying,

As Radius, to the difference of latitude in meridional parts: ſo is the tangent of the Rumb, to the difference of longitude in minutes.

Probl. 5. *By the difference of longitude, Rumb, and one latitude: to find the other latitude, and the diſtance.*

Admit I ſail from the *Lizard*, being in the latitude of 50 deg. *w s w* 3 deg. 51 min. weſterly, till I have altered my Longitude 70 deg.

deg. how much have I laid the Pole, and how far am I from the *Lizard?*

Reduce the difference of Longitude into minutes, by 60, and so it makes 4200; then say,

As the tangent of the Rumb,	*t D* 71 d. 21′ *co. ar.*	9.52829
to the differ. of longitude in parts :	*A B* 4200 parts	3.62325
So is Radius,		
to the differ. of latitude in parts.	*D B* 1417	3.15154

Now, the meridional parts answering the latitude of 50 d. 00 m. are 3475, from which substracting 1417 here found, there remains 2058, against which I find in the first Column of the Table 32 deg. 25 min. which is the latitude required of that other place to which I am come; so that the difference of latitude is 17 d. 35 m.

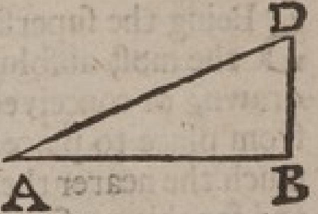
Secondly for the distance.

Having already the Rumb, and difference of latitude, it may be found, as in the second and fourth Problems, saying,

As sine compl. the Rumb,	*s A* 18 d. 39′ *co. ar.*	0.49514
to the difference of latitude,	*D B* 1055 miles	3.02325
So is Radius		
to the distance	*A D* 3299 miles.	3.51839

Probl. 6. *By the Rumb, the distance, and one latitude given: to find the other latitude, and the difference of longitude.*

Admit I sail *w s w* 3 d. 51′ westerly, 3299 miles, and then find my self in the latitude of 32 d. 25 m. I demand the latitude of the place from which I came, and the difference of longitude between that and this?



First, for the difference of latitude.

As Radius,		
to the distance run:	*A D* 3299 miles	3.51838
So sine compl. the Rumb,	*s A* 18 d. 39 m.	9.50486
to the differ. of latitude,	*D B* 1055 miles	3.02324

Which 1055 miles converted into degrees, is 17 deg. 35′ the difference of latitude required: which added to 32 deg. 25′, makes 50 deg. 00′ the latitude of the first place.

The difference of longitude is found as before in the third Problem, saying,

As Radius to the difference of Latitude in meridional parts :
So is the tangent of the Rumb, to the differ. of Longit. in minutes.
And thus the difference of Longitude will be found as in this Example to be 70 d. 00′.

If at any time you desire to convert **this difference of Longitude** found in any parallel into miles, you may do it **after this Example.**

7. Admit there be two places, both in the parallel of 50 deg. which differ in Longitude 70 deg. 00′: I demand the distance of these two places?

First, it is to be understood, that the minutes of Longitude in any parallel, are in proportion to the distance in Miles, as the Æquinoctial is to that parallel; or as the Semidiameter of the one is to the Semidiameter of the other. That is,

As Radius is in proportion,		
to sine compl. the Latitude;	*sc* 50 deg, 00′	9.80807
So is the differ. of Longitude,	4200 minutes,	3.62325
to the distance in that parallel,	2700 miles,	3.43132

Problems of Sailing by a great Circle.

SEeing the superficies of the Earth and Sea is spherical, therefore the most absolute way of Sailing is by the arch of a great Circle, drawn, or conceived to be drawn on the spherical surface of the Sea from place to place; and other wayes are so much the better, by how much the nearer they approach thereto, or may be thereunto reduced; and for this cause, the Sailing according to *Mercator*'s Chart, is to be preferred before the Sailing according to the common Sea-Chart, being more reducible to the spherical superficies of the Earth and Sea. Neither have I at any time said otherwise, whatsoever some in Print would make me say without any assent or knowledge of mine. It will be said, that there is some more difficulty in Sailing according to *Mercator*'s Chart, than by the common Sea-Chart; and somewhat more difficult Sailing by the arch of a great Circle, than by either of them: No doubt, since the fall of Man, there are thorns and briars, or difficulties encountring our best endeavours : But truth and exactness, though joyned with some difficulty, is to be preferred before Error, though never so easie; alwayes endeavouring to make the way of truth

truth as easie as we can. Therefore we come now briefly, to shew the way of Sailing by the arch of a great Circle, by help of the *Doctrine of Spherical Triangles*, forasmuch as there is no way discovered to the World more absolute.

In the former Problems of Sailing, whether by the plain Chart, or that called *Mercator*'s, we have used Meridians, Parallels, and Rumbs, as the sides of every Triangle. But here we use not the Rumbs so because they are not Circles, but helispherical lines; nor the Parallels, because they are not great Circles: whereas the sides of every spherical Triangle, must be arches of great Circles: But here we use arches of the Meridians, and of the Æquinoctial, and of other great Circles drawn, or imagined to be drawn from one place to another, upon the spherical superficies of the Earth and Sea. First, therefore,

If two places lie under the Æquinoctial, their position is East and West, and the degrees of their difference of Longitudes converted into Leagues or Miles, is their distance in Leagues or Miles.

If two places be in the same Meridian, their position is North and South, and the degrees of their difference of Latitude, converted into Leagues or Miles, is their distance.

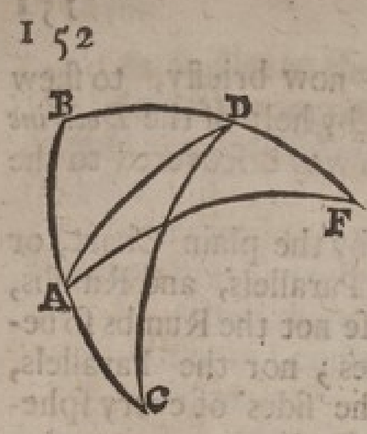
And thus far doth this kind of Sailing agree with the two former; the difference between this and them, may appear in the Problems following.

Prob. 1. *Two places being proposed, the one under the Æquinoctial, the other in any Latitude given: and the difference of the Longitude of the same places being also known: to find,*

1. *The nearest distance in a great Circle:*
2. *The direct position of the first place from the second:*
3. *And of the second place from the first.*

The angle that the Rumb leading from one place to another, makes with the Meridians, is sometimes called the position of those places: But because the arch of a great Circle, drawn between two places, is the most direct way, and nearest distance from one place to the other: therefore the angles which that arch makes with the Meridians of those places we here call the angles of the *direct position* of those places one from another.

Now



Now in this Diagram, let *D* represent that part of the entrance of the River of *Amazones*, which lieth under the Equinoctial line; *D B* an arch of the Equinoctial; and let *A* represent the *Lizard*, lying in the latitude of 50 d. 00 m. northerly, and *AB* the meridian thereof; and admit their difference of longitude *D B* to be 51 deg. 00 m.

Then in this triangle *ADB*, right angled at *B*, there is required *AD*, the nearest distance of these places in the arch of a great Circle, the angle *BAD*, which is the angle of the direct position of the *Amazones* from the *Lizard*, and the angle *BDA*, being the compl. of the angle of the direct position of the *Lizard* from the *Amazones*.

1. *For the nearest distance* AD. Seeing there are given the sides *AB* and *DB*: therefore by the first fundamental Axiom of spherical triangles.

sc AD + Rad. = *sc AB* + *sc DB*, therefore *sc AB* + *sc DB* — Rad. = *sc AD*, and so it falls into the 10 Case, thus.

The difference of longitude is	*DB*	51 d.	00′	*sc DB*	9.79887
The difference of latitude is	*AB*	50	00	*sc AB*	9.80807
The distance is	*AD*	66	08	*sc AD*	9.60694

Which 66 d. 08′ converted into leagues, is 1322 ⅔ leagues, which is the nearest distance between these two places.

2. *For the direct position from the Lizard to the Amazones*, namely, the angle *BAD* by the same things given.

s AB + Rad. = *t DB* + *tc BAD*; therefore *s AB* + Rad. — *t DB* = *tc BAD*, that is *s AB* + *tc DB* = *tc BAD*, abating Radius, and thus it falls into the 11 Case, and is wrought thus.

The difference of latitude is	*AB*	50 d.	00′	*s AB*	9.88425
The difference of longitude is	*DB*	51	00	*tc DB*	9.90837
The angle of position is	*BAD*	58	11	*tc A*	9.79262

3. *For the direct position from the Amazones towards the Lizard*, namely, the complement of the angle *BDA*.

s DB + Rad. = *t AB* + *tc D*, therefore *s DB* + Rad. — *t AB* = *tc D*, therefore *s DB* + *tc AB* = *tc D*, still abating Radius, and so it falls into the 11 Case, and is thus wrought.

The

The difference of longitude is	*D B* 51 d. 00′	*s D B*	9.89050
The difference of latitude is	*A B* 50 00	*tc A B*	9.92381
The angle of position is compl.	*B D A* 33 07	*tc A*	9.81431

If you would have the letters in all Examples to agree with the exemplary Tables, you must mark your right angled triangle two ways, and the oblique six wayes, as we have before shewed; and it will not be amiss to do so, especially if you use those Tables. But as I have before said, I would rather wish every man to deduce his operations from the two fundamental Axioms, and their Consectaries, in such sort as I have here shewed in these three Examples, for the like is to be conceived in all others, though it be not expressed. Yet I have set down those Exemplary Tables for all the Cases in all kinds of triangles, as well because some others have in part done the like before (though in a different manner) as because a man may by them readily examine the form of his work.

The three parts of this Problem, and so the rest that follow, might have been as well resolved in the quadrantal triangle *A D G*: where *G* represents the North-Pole; the angle at *G*, the difference of longitude, *A G* the complement of the latitude of the *Lizard*; *A D G* the angle of direct position from the *Amazones* to the *Lizard*, &c. As admit this last angle *A D G* were required: Then forasmuch as there is given the angle *G*, being the difference of longitude, and *AG*, the complement of the latitude: therefore by the first fundamental Axiom.

$s\,G + \text{Rad.} = tc\ AG + t\ ADG$, therefore $s\,G \frac{+}{-} t\ AG = t\ ADG$, and thus it falls into the 7 Case of quadrantal triangles, and is wrought, as in this Example.

The difference of longitude is	*G* 51 d. 00′	*s G*	9.89050
The latitude is compl.	*AG* 50 00	*t AG*	9.92381
The angle of position is	*A D G* 33 07	*t ADG*	9.81431

The same might have been found in the quadrantal triangle, *ADF*, all which to handle particularly would be too tedious; therefore it shall suffice hereafter to shew this application only in right angled triangles; for by this one example of Quadrantals, you may conceive the rest.

And thus it appears, that he which would sail the nearest way from the *Amazones* to the *Lizard*, ſhould at firſt ſhape his courſe 33 degr. 07 m. from the Meridian to the Eaſtward, that is almoſt 3 points of the Compaſs, namely, *n e* by *n*. Now admit the wind ſhould ſo ſerve, that he might come away *n e* by *n*, yet it is to be underſtood, that in this kind of Sailing, he is not to continue this courſe long, but to ſhift it as often as occaſion requires, ſtill inclining more and more to the Eaſtwards; which how it may be done, we ſhall more expreſly ſhew hereafter.

Probl. 2. *Two places being propoſed, the one under the Equinoctial, the other in any Latitude given; and the neareſt diſtance in a great Circle of the ſame places being alſo known: to find,*

1 *Their difference of Longitude,*
2 *The direct poſition from the firſt place to the ſecond,*
3 *And from the ſecond place to the firſt.*

Let the places be the ſame as before, and let there be given the difference of Latitude *A B* 50 d. 00 m. and their neareſt diſtance *A D* 1322 ¾ Leagues, that is 66 d. 08 m. in the arch of a great Circle.

Firſt, then for the difference of Longitude D B, *by the* 12 *Caſe of right angled Triangles.*

The latitude is	AB	50 d. 00′	*co. ar.*	*s*	AB	0.19193
The neareſt diſtance is	AD	66 08		*sc*	AD	9.60704
The diff. of longitude is	DB	51 00.		*sc*	DB	9.79897

Secondly, for the direct poſition from A *to* D, *by the* 13 *Caſe.*

The latitude is	AB	50 d. 00′	*t*	AB	10.07619
The neareſt diſtance is	AD	66 08	*tc*	AD	9.64586
The poſition is	BAD	58 11	*sc*	A	9.72205

Thirdly, for the direct poſition from D *to* A, *by the* 14 *Caſe.*

The neareſt diſtance is	AD	66 d. 08′	*co. ar.*	*s*	AD	0.03882
The latitude is	AB	50 00		*s*	AB	9.88425
The poſition is compl.	BDA	33 07		*s*	BDA	9.92307

In like ſort, if there were given the Latitude *A B*, and the angle of direct poſition *B A D*: we might find the difference of longitude *BD*, by the firſt Caſe of ſpherical triangles; the direct poſition *BDA*, by the ſecond Caſe, and the neareſt diſtance *A D* by the third Caſe. And thus we might proceed to frame in all 30 Queſtions touching theſe 2 places, as we have before ſhewed in handling right angled ſpherical triangles; which things I leave to your own practice, deſiring to uſe as much brevity as I may.

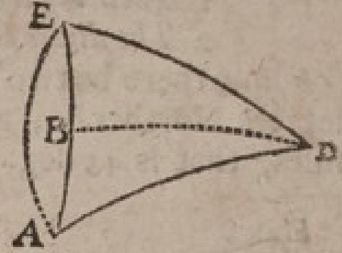
Probl.

Probl. 3. *Two places proposed both in one and the same latitude given, and their difference of longitude being also known: to find*

1 *The nearest distance of those two places.*

2 *The direct position of the one place from the other.*

Admit there be two places, both in the latitude of 50 degrees 00′, Northerly, and differing in longitude 70 deg. 00′ I demand their nearest distance in the arch of a great Circle, and the direct position of the one from the other?



In the 7 problem of sailing by *Mercators Chart*, there was required the distance of these two places measured in their parallel: but here is required their nearest distance in the arch of a great Circle.

As in this example *E A D*, let the two places be *E* and *A*, and let *D* be the North Pole, then *A D* and *E D* are either of them 40 deg. 00′: namely, the complement of the latitude, and the angle *E D A* is the difference of longit. 70 deg. 00′; there is required the nearest distance *E B A*: and the direct position from the one to the other, *D E A* or *D A E*, for in this Case those two angles are equal.

And seeing *E D* is equal to *A D*, therefore letting fall the perpendicular *D B*, the Triangle *E D A* is divided into two right angled triangles *E D B* and *A D B*, which are every wayes equal. Wherefore,

First, For the nearest distance E A; there is given in the right angled Triangle *ADB*, the complement of the latitude *A D* 40 deg. 00′, and half the difference of longitude *A D B* 35 deg. 00′; whereby I find *A B* agreeable to the 8 Case thus:

The compl. of the latitude is	AD	40 d.	00′	*s* AD	9.80807
Half the differ. of longitude is	ADB	35	00	*s* ADB	9.75859
Half the distance is	AB	21	38	*s* AB	9.56666
Which doubled is	AE	43	16		

And this converted into miles, is 2596 miles, the nearest distance of these two places in the arch of a great Circle, being less than their distance measured in their parallel by 104 miles.

Secondly, For the direct position DAB *by the 9 Case.*

The compl. of the latitude is	AD	40 d.	00′.	*sc* AD	9.88425
Half the differ. of longit. is	ADB	35	00	*t* ADB	9.84523
The angle of position is	DAB	61	48	*tc* DAB	9.72948

X

Which

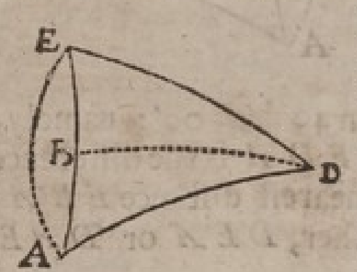
Which sheweth, that he which would go the nearest way from *A* to *E*, must not go West, though both be under one parallel ; but he is at first to shape his course from *A w n w* half a point northerly ; afterwards *w n w*, and so by little and little *w* by *n* ; then West, then *w* by *s*, afterwards *w s w*, and at last *w s w* $\frac{1}{2}$ a point Southerly.

Prob. 4. *Two places proposed, both in one and the same latitude given, and their nearest distance being also known: to find,*

1 *Their difference of Longitude.*

2 *The direct position of the one place from the other.*

Admit there be two places, as *A* and *E*, both in the latitude of 50 degrees Northerly ; and let their nearest distance be *ABE* 2596 miles, that is 43 deg. 16′ : I demand their difference of longitude, which is the angle *ADE*, and the direct position of the one from the other, namely, the angle *DAE*, or *DEA*?



First, For the difference of Longitude, ADE. Seeing that *ABE* is 43 deg. 16′. therefore *AB* is 21 deg. 38′ : wherefore by the 14 Case of right angled spherical triangles, I find *ADE* thus:

The compl. of the latit. is	AD 40 deg.	00′	*co. ar.*	*s* AD.	0.19193
Half the distance is	AB 21	38.		*s* AB	9.56663
Half the differ. of long.	ADB 35	00		*s* ADB	9.75856

Which doubled is ADE 70 00, the difference of longitude required.

Secondly, for the direct position DAE *or* DAB *by the* 13 *Case.*

The latitude is the compl. of AD 50 deg.	00′,	*tc* AD	10.07619
Half the distance is	AB 21	38	*t* AB	9.59835
The angle of Position is	DAB 61	48	*sc* DAB	9.67454

Probl. 5. *Two places proposed, both in one and the same latitude given; and the distance of those places in their parallel being also known: to find,*

1 *Their difference of longitude.*

2 *Their nearest distance in the arch of a great Circle.*

3 *The direct position of the one from the other.*

Admit there be two places, both in the latitude of 50 degrees, 00 minutes northerly ; and let the distance of these places in their parallel

parallel be 2700 miles ; there is required their difference of Longitude, *&c.*

We have noted before, that as the ſemidiameter of a parallel is in proportion to the ſemidiameter of the equinoctial : ſo is any number of miles in that parallel, to the minutes of longitude, anſwering to thoſe miles : and if we ſuppoſe the ſemidiameter of the equinoctial to be Radius, then the ſemidiameter of any parallel is the ſine of that parallels diſtance from the Pole, that is the ſine of the complement of the latitude of that parallel. Therefore,

As ſine complement the latitude, so 50 *deg.* 00′, *co. ar.*	0.19193
to Radius :	
So the diſtance in that parallel, 2700 *miles,*	3.43136
to the difference of longitude, 4200 *miles,*	3.62329

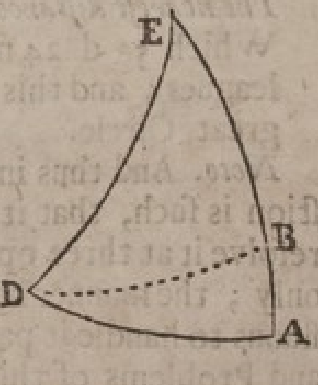
Which converted into degrees, is 70 deg. 00′ the difference of longitude required.

And thus having found the difference of longitude, the neareſt diſtance, and the direct poſition may be found as in the third Problem before going, which with ſuch other queſtions as might be moved in this Triangle *A E D*, I leave to your own practice.

Probl. 6. *The latitudes of two places being given, together with their difference of longitude : to find,*

1 *Their neareſt diſtance in the arch of a great Circle.*
2 *The direct poſition from the firſt place to the ſecond.*
3 *And from the ſecond place to the firſt.*

As in the Triangle *A D E.* Let *A* repreſent the North pole, *D* the *Lizard* lying in the latitude of 50 deg. 00 min. the complement whereof is *A D* 40 deg. 00 min. and let *E* repreſent the *Summers Iſlands*, lying in the latitude of 32 degrees, 25 min. the complement whereof is *A E* 57 degrees, 35 minutes ; and let their difference of longitude be 70 deg. 00 min. namely, the contained angle *D A E* : there is required the neareſt diſtance of theſe two places *E D*, and the ſeveral poſitions of the one from the other ; namely, the angles *A D E*, and *A E D*. So that here are given two ſides *A D* and *A E* with



with their contained angle *D A E*: and first there is required the third side *E D*.

Wherefore according to the directions, *Chap*. 5. of Spherical Triangles, I let fall a perpendicular from *E* or *D*, for so it will fall from the end of a side given, and opposite to an angle given, *&c*. As first, let it fall from the point of the *Lizard* represented here by *D*, upon the meridian of *Summers Islands AE*: and because the angles at *A* and *E* are both of one kind, namely, both acute; therefore the perpendicular falls within the Triangle.

Then for the nearest distance required *E D*, the way hath been formerly to find it at three operations, thus:

1. *For the perpend.* D B, *by the* 8 *Case of right angled triangles.*

The compl. of latitude	A D *is* 40 d.	00 m.	*s* A D	9.80807
The differ. of longitude	DAB *is* 70	00	*s* A	9.97298
The perpendicular	DB *is* 37	10	*s* D B	9.78105

2. *For the dist. of the perpend. from the pole* A B *by the* 7 *Case.*

The differ. of longitude	DAB *is* 70 d.	00 m.	*sc* DAB	9.53405
The compl. of latitude	AD *is* 40	01	*t* A D	9.92381
The first arch	A B *is* 16	01	*t* AB	9.45786
Which substracted from	A E 57	35,	there remains	
the second arch	E B 41	34		

3. *Having found* D B, *and* E B, *we may find* ED *by the* 10 *Case, thus,*

The perpendicular	DB *is* 37 d.	10 m.	*sc* DB	9.90139
The second arch	E B *is* 41	34	*sc* E B	9.87401
The nearest distance	E D *is* 53	24	*sc* E D	9.77540

Which 53 d. 24 m. converted into miles, is 3204 miles, or 1068 leagues; and this is the nearest distance required in the arch of a great Circle.

Note. And thus in any oblique spherical triangle, when the question is such, that it requires the perpendicular to be let fall, you may resolve it at three operations, by the Cases of a right angled triangle only; the manner how, is of it self so manifest, that it seemed superfluous to handle it particularly. Wherefore, as before in the Cases and Problems of this nature, so in those which follow, it shall suffice to shew their resolution at two operations; which, as it is much readier being well understood, so it is something harder to be understood than the former.

First,

First, Therefore the complement of the one latitude being *AD* 40 d. and of the other *AE* 57 d. 35 m. and the difference of longitude *DAE* 70 d. we may find the nearest distance *E D* at two operations agreeable to the 3 Case of oblique spherical triangles; thus,

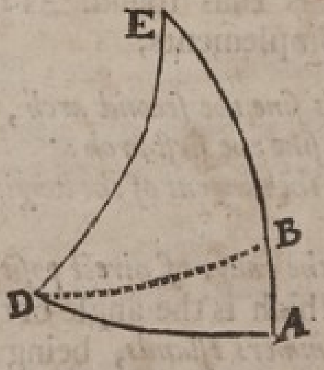
The difference of longitude	DAB *is* 70 d.	00′	*sc* DAB		9.53405
The complem. of latitude	AD *is* 40	00	*t* A D		9.92381
The first arch	A B *is* 16	01	*t* A B		9.45786
which substracted from	A E 57	35		there remains	
the second arch	E B 41	34			
As sine compl. the first arch, sc AB *sc*	16 d.	01 m.			0.01719
to sine compl. the second: sc EB *sc*	41	34			9.87401
So the sine of the latitude, sc AD *s*	50	00			9.88425
to sine compl. the distance, sc E D *s*	36	36			9.77545

Therefore the arch *E D* is 53 deg. 24 m. which is the distance of these two places in the arch of a great Circle; and this converted into leagues, is 1063 leagues, as before.

Secondly, *By the same things given: to find the direct position of the one place from the other.*

As first, to find the position from *Summers Islands*, which suppose to be at *E*, to the *Lizard* at *D.*

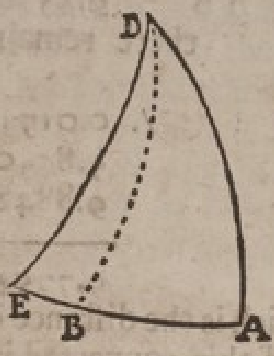
Here according to the second condition of letting fall a perpendicular, *Chap.* 5. I let it fall from the *Lizard* at *D*, that so it may be opposite, not only to the angle given at *A*, but also to the angle required at *E.* And then agreeable to the fourth Case of oblique spherical triangles, I first find as before *AB* to be almost 16 d. 1 m. and *EB* 41 d. 34 m. then I say, As *s AB* to *s E B*, so *tc A* to *tc E.* Or if you would not work by their complement: Say,



As sine the second arch,	*s* EB	41 d.	34′	*co. ar.*	0.17816
to sine the first arch,	*s* AB	16	01		9.44044
So the tang. of the longit.	*t* DAE	70	00		10.43893
to the tang. of direct posi.	*t* AED	48	47		10.05753

Whereby it appears, that the angle of position from *E* towards *D*, is is 48 deg. 47′, that is, from the North part of the Meridian *E A* 4 points 3 deg. 47′, namely, *ne* 3 deg. 47′ easterly.

Thirdly, By the same things given, to find the direct position from the second place to the first. As from the Lizard to Summers Islands.



Here the work differs not from the former, provided, that you let fall the perpendicular so, as it may be opposite to the angles given and required. As in this Triangle, let *A* be the Pole, *E* the *Lizard*, D *Summers Islands*, the perpendicular I let fall from *D* to *B*, that so it may be opposite to the angle given at *A*, and to the angle required at *E*. Then is *A D* 57 degrees 35′, *AE* 40 deg. 00′, *DAE* 70 deg. 00′, therefore I say,

The differ. of longitude	DAB *is* 70 d.	00′,	*sc* DAB		9.53405
The compl. of latitude	AD *is* 57	35	*t* AD		10.19721
The first arch	AB *is* 28	18	*t* AB		9.73126

Which taken from AE 40 00 there remains
The second arch EB 11 42, whereby the angle at E is thus found. As *s* AB, to *s* EB: so *tc* A, to *tc* E, or to shun the complements,

As sine the second arch,	*s* EB	11 d.	42′.	*co. ar.*	0.69296
to sine the first arch:	*s* AB	28	12		9.67445
So the tangent of the longit.	*t* A	70	00		10.43895
to the tang. of direct position	*t* E	81	08		10.80634

Which is the angle of the direct position from the *Lizard* toward *Summers Islands*, being from the North part of the Meridian to the Westwards 7 points of the Compass, and almost a quarter, that is, *w* by *n* 2 deg. 23′ westerly.

And thus it appears, that he which would sail the nearest way from *Summers Islands* to the *Lizard*, must at first shape his course *ne* Easterly, afterwards by degrees *ne* by *e*, then *e n e*, then *e* by *n*, then East, then East Southerly, *&c.* as we shall more particularly shew hereafter, and the like is to be understood of other places. But

But here, after the first part of this Problem was wrought, namely, after the distance of the two places *E* and *D* was found, the angles of position from the one to the other, might have been more readily found, either of them at a single operation, as in this following problem.

Prob. 7. *The nearest distance of two places, with their difference of longitude, and one of their latitudes given: to find the direct position thereof from the other.*

As admit the distance in a great Circle from the *Lizard* to *Summers Islands*, namely, from *E* to *D*, to be as it was before found 1068 leagues, or 53 deg. 24′; and let their difference of longitude *E A D* be 70 deg. 00′; and let the latitude of the *Lizard* be 50 deg. 00′, whose complement *E A* is 40 deg. 00′; there is required the direct position from *Summers Islands* to the *Lizard*, namely the angle *ADE*. Then doth this Problem come under the second Case of oblique spherical Triangles, and is thus resolved.

As the sine of the distance of the places.	*s E D* 53 d. 24′,	*co. ar.*	0.09538
To sine their differ. of longit.	*s D A E* 70 00,		9.97298
So sine compl. the latitude of to one place given,	*s A E* 40 00,		9.80807
To the sine of the direct position from the other.	*s A D E* 48 48,		9.87643

Whereas there is a minute difference between the arch before found, and this; it may arise by neglecting some seconds or parts of a minute in the work, which here we regard not.

In like manner, by the complement of the other latitude given, *A D*, we might find the direct position from the *Lizard* to *Summers Islands*, namely, the angle *A E D*.

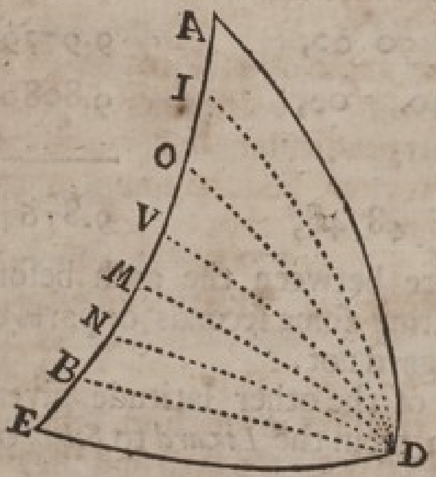
And thus we might proceed to frame many other questions in this Triangle, to the number of 60, touching the distance, difference of longitude, latitudes and angles of position of these two places which will not be hard to him that understandeth what we have before delivered touching oblique spherical Triangles.

And what hath been said touching these two places, the same is to be conceived of any other two places differing in their longitudes

tudes and latitudes. And though the one place ſhould have latitude Northerly, and the other Southerly, yet is the operation little different, for ſtill the arches of their Meridians intercepted between them and the neareſt Pole, are two ſides of the triangle, the arch of a great Circle intercepted between the two places is the third ſide; the angles contained between that arch and the Meridian of either place, are the angles of poſition; and the angle comprehended between their two Meridians, is their difference of longitude. Therefore paſſing over theſe, we haſte to ſuch things as more neceſſarily concern the practice of ſailing by a great Circle.

Probl. 8. *To find by what longitudes and latitudes the arch of a great Circle doth paſs.*

We have ſhewed before how to find the diſtance of two places in the arch of a great Circle, as alſo the angles of direct poſition from the one to the other; here is required the longitudes and latitudes, by which that arch of a great Circle doth paſs.



As in this Triangle, Let *A* be *Summers Iſlands*, *E* the *Lizard*, *A E* an arch of the great Circle paſſing by theſe places; it is required to ſhew the longitudes and latitudes by which this arch *A E* doth paſs.

Here it is requiſite to let fall a perpendicular from the pole *D*, to the arch *A E* (extended if need ſo require) which let be *D B*; then firſt to find the length of that perpendicular; Secondly, the parts of the vertical angle *A D B* and *E D B*, for theſe being had, every other queſtion will fall in right angled Triangles, and ſo be reſolved by the addition of two numbers only.

Firſt then for the perpendicular DB, there are given the hypothenuſal *A D* 57 d. 35′, and the angle of poſition at *A* was before found 48 d. 48′: therefore by the 8 Caſe,

The

The complement of latitude AD *is* 57 d. 35′ *s* AD 9.92643
The angle of position A *is* 48 48 *s* A 9.87645

The perpendicular DB *is* 39 26 *s* DB 9.80288

And this 29 d. 26 min. is the complement of the greatest latitude, by which the great Circle *ABE* doth pass, therefore the greatest obliquity or latitude from the Equinoctial of that Circle is 50 d. 34′.

Secondly, for the angles ADB *and* EDB, *by the Ninth Case.*
The latitude is the compl. of AD 32 d. 25′ *sc* AD 9.72921
The angle of direct position is A 48 48 *t* A 10.05778

The angle at the perpend. is ADB 58 31 *tc* ADB 9.78700

And seeing the whole *ADE* is 70 d. 00′, therefore the angle *EDB* is 11 d. 29′. So that for the greatest latitude of this Circle, which is *B*, we have found the difference of longitude from *E* to *EDB* 11 d. 29 m. and from *A* the angle *ADB* 58 d. 31 m.

Now the difference of longitude from *A* to *E*, namely, the angle *ADE* being 70 d. 00 m. let it be required to find by what latitudes the arch *AE* doth pass for every tenth degree of longitude from *A*. As supposing the point *I*, to differ in longitude from *A* 10 d. I would know the latitude of the same point *I*.

Here seeing we have before found the angle *ADB* to be 58 d. 31 m. and the angle *ADI*, being by supposition 10 deg. therefore the angle *IDB* is 48 deg. 31 m. and the perpendicular *DB* we found before to be 39 deg. 26 m. by which we may find the complement of the latitude *DI* according to the third Case, thus.

The angle IDB 48 d. 31′ *sc* IDB 9.82112
The perpendicular DB 39 26 *tc* DB 10.08492

The latitude is the compl. of DI 38 51 *tc* DI 9.90604

In like manner supposing the point *O*, to differ in longitude from *A* 20 deg. 00 m. *V* 30 deg. *M* 40 deg. *N* 50 deg. we shall find the latitude of the point *O* to be 43 deg. 34 m. the latitude of *V* 46 deg. 54 m. the latitude of *M* 49 deg. 04 m. and the latitude of *N* 50 deg. 15 m.

Note. For every of these differences of longitude proposed, we might also find the distances and angles of position; contrariwise, for any difference of latitude given, we might find the difference of longitude, the distance and angle of position: and for any distance given, we might find the difference of longitude and latitude, and the angle of poſition. All which will be eaſily performed by him that is a little exerciſed in ſpherical triangles.

Probl. 9. *To find how far a man ſails by the arch of a great Circle, and how much he ſhall alter his longitude and latitude, before he alter his courſe any number of degrees propoſed.*

We found before that the angle of poſition at *A* was 48 d. 48 m. ſhewing, that he which would ſail from *Summers Iſlands*, here repreſented by *A*, to the *Lizard* at *E*, the directeſt and neareſt way, muſt at firſt ſhape his courſe from *A* North-Eaſt 3 d. 48 m. Eaſterly. Yet he is not to continue this courſe, but to incline by degrees more and more to the Eaſtwards, *&c.* Now then I demand, how far a man ſails from *A* in the arch of a great Circle, before he alters his courſe 7 d. 27 m. that is, before he may ſteer away *n e* by *e*, and how much ſhall he firſt alter his longitude and latitude?

Suppoſe he muſt firſt come to *I*, before he alter his courſe 7d. 27 m. then is there required the diſtance *A I*, and the longitude and latitude of the point *I*.

Here it is requiſite, that the perpendicular *D B* be known, which we before found to be 39 d. 26 m. alſo the parts of the baſe *A B* and *E B*, which we may find by the ſeventh Caſe, thus,

The angle of poſition given	A *is*	48 d.	48′	*sc*	A	9.81868
The complement of latitude	A D *is*	57	35	*t*	A D	10.19720
The baſe	A B *is*	46	03	*t*	A B	10.01588
Which taken from	A E	53	24			
there remains	E B	07	23			

Theſe things premiſed, we come to reſolve the queſtion. And conſidering that the courſe given at *I*, is *n e* by *e*, which Rumb makes with the meridian an angle of 56 d. 15 m. therefore in the triangle *D I B*, the angle at *I* is 56 d. 15 m. and the perpendicular *D B* is 39 d. 26 m. whereby we may find *I B* by the ſixth Caſe, thus,

The angle of poſition given	I 56 d.	15′	*tc*	D I B	9.82489
The perpendicular is	D B 39	26	*t*	D B	9.91507
The baſe is	I B 33	20	*s*	I B	9.73996
Which taken from	A B 46	03			
there remains	A I 12	43			

Which

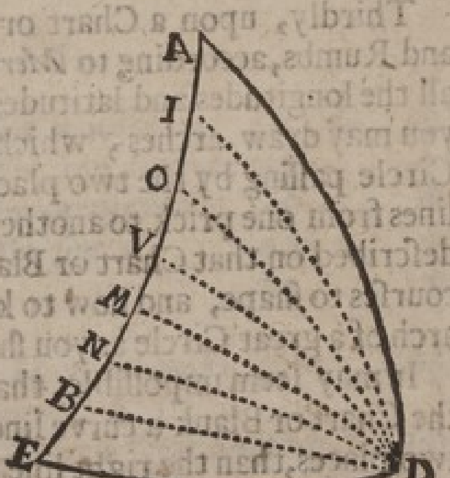
Which converted into leagues, is 254 $\frac{1}{3}$ leagues, and so far you are to sail from *A* in the arch of a great Circle, before you alter your course 7 deg. 27 min. And in like sort you may find it for every single degree to be such, as by this Table appeareth.

Angle of Position.	*Dist. in d. & m.*
deg. min.	*deg. min.*
48—48	00—00
49—48	02—02
50—48	03—56
51—48	05—43
52—4	07—25
53—4	09—03
54—4	10—35
55—4	12—04
56—15	2—43

Where you may perceive, that having run from *A* towards *E* by the arch of a great Circle 2 deg. 2 min. that is 40 $\frac{2}{3}$ leagues, you alter your course one degree more Easterly than you began. When you have run 3 deg. 56 min. you alter your course 2 deg. 00 min. *&c.* as in the Table.

Now for finding the longitude and latitude of any of these points, it may be done by help of the perpendicular, and angle of position given. As if there were required the longitude and latitude of the point *I*, there is given in the triangle *I D B*, the angle of position at *I*, and the perpendicular *D B*, wherefore by the 5 Case I find the complement of the latitude *D I*, and by the 4 Case the difference of longitude *B D I*, the angle *B D A* being before known.

But notwithstanding all that hath hitherto been said, it may seem hard to direct a ship, and to keep such a reckoning as may be agreeable to this method of sailing by a great Circle. And indeed, as it is in a manner impossible, so neither is it necessary, that a ship should alwayes persevere exactly in the arch of a great Circle. It may suffice, and is almost the same in effect, if a ship be so directed that she go near this arch. Which, how it may be done, and that with facility, we come now to shew in this next Problem.



Probl.

Probl. 10. *How a man may direct his courses, and keep his reckoning, that would Sail near the arch of a great Circle.*

That this may be the more plain, we will briefly repeat some things before handled, serving for this purpose; and first, suppose the latitudes, and the difference of longitude of the two places to be given; then may you find their nearest distance in the arch of a great Circle, and the angles of position of the one from the other, as we have shewed in the sixth and seventh Problems before going. And thus all the parts of the Triangle proposed are known, namely, the three angles and the three sides.

Secondly, you may find (as we have before shewed in the eighth Problem) by what longitudes and latitudes this arch of a great Circle doth pass, namely, the arch that goes by the two places proposed; and this you may do for every fifth degree of longitude, or for every single degree, if you will take that pains: or if your difference of latitude be more than your difference of longitude, you may do it for every fifth degree of difference of latitude, or for every single degree.

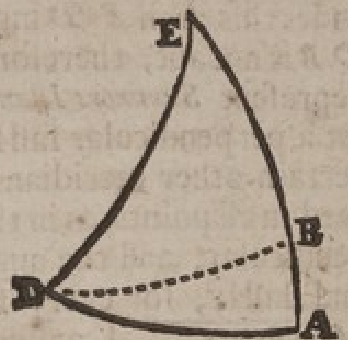
Thirdly, upon a Chart or Blank lined with Meridians, Parallels, and Rumbs, according to *Mercator's* Projection; you may prick down all the longitudes and latitudes found as aforesaid, by which pricks you may draw arches, which shall represent the arch or the great Circle passing by the two places proposed: or if you only draw right lines from one prick to another, it may suffice. Which arch being thus described on that Chart or Blank, you shall easily see thereby what courses to shape, and how to keep your reckoning, sailing so near that arch of a great Circle as you shall think convenient.

It may seem impossible, that this arch of a great Circle, being upon the Chart or Blank a curve line, should be a shorter passage between two places, than the right line drawn on the Chart from the one to the other: But he that well understands the ground and projection of this Chart, will be able of himself to resolve this Paradox; forasmuch as the degrees of latitude by which the arch doth pass, are greater than the degrees of latitude by which the right line doth pass: whence it is, that the degrees contained in the arch, are fewer than those contained in the right line; therefore to proceed.

Let

Let us take for Example the two places before mentioned, namely, *Summers Islands*, lying in the latitude of 32 d. 25 m. and the *Lizard* in the latitude of 50 d. 00 m. and let their difference of longitude be 70 deg.

As in this Diagram, let *E* represent *Summers Islands*, *D* the *Lizard*, *A* the North-pole: Then is *AE* the complement of the latitude of *Summers Islands* 57 d. 35 m. *AD* the complement of the latitude of the *Lizard* 40 d. *DAE* their difference of longitude 70 d. 00 m. By which things given, we may find their nearest distance *ED*, as in the sixth Problem thus.



To sine complement	DAB *that is, to sine compl.*	70	d. 00'
Add the tangent of	AD *that is, the tangent of*	40	00
The sum is the tangent of	AB *that is, the tangent of*	16	01
Which substracted from	AE *that is, from*	57	35
There remains	EB,	41	34

Then I say,

As sine complement	AB	*that is, sine complement*	16 d.	01'
to sine complement	EB	*that is, sine complement*	41	34
So sine complement	AD	*that is, sine complement*	40	00
to sine complement	ED	*that is, the sine of*	36	36
Therefore the arch	ED	*is*	53	24

Which is the distance of the *Lizard* from *Summers Islands*, in the arch of a great Circle, namely, 1068 leagues.

This done, we may find their positions one from another, namely, the angles at *E* and *D*, by the seventh Problem, saying,

As sine *ED* 53 d. 24 m. to sine *DAE* 70 d. 00 m.
So sine *AE* 57 d. 35 m. to sine *ADE* 81 d. 08 m. the direct position from the *Lizard* to *Summers Islands*. Also,

As

As sine *E D* 53 deg. 24 min. to sine *D A E* 70 deg. 00 min.

So sine *A D* 40 deg. 00 min. to sine *A E D* 48 deg. 48 seconds, the direct position from *Summers Islands* to the *Lizard*. And thus are all the sides and angles of this triangle discovered.

Secondly, By the 8 Problem, I find by what longitudes and latitudes this arch *E D* must pass; for which the former perpendicular *D B* is not apt, therefore in the foregoing triangle, *page* 165. Let *A* represent *Summers Islands*, *E* the *Lizard*, *D* the North-Pole, and let a perpendicular fall from the pole *D*, which let be *D B*: and draw certain other meridians, as *D I*, *D O*, *D V*, &c. And so proceed in all points, as in the 8 Problem, to find the length of this perpendicular, and the angles at the perpendicular *A D B* and *E D B*: and lastly, for every several longitude from *A*, find the latitude answerable. Thus supposing the point *I* to differ in longitude from the point *A*, 5 degrees, that is, supposing the angle *A D I* to be 5 degrees, we shall find the latitude of that point *I* to be 35 degrees, 52 min. or supposing that angle *A D I* to be 10 degrees, we shall find the latitude of that point *I* to be 38 degr. 51 min. and so of the rest, as by this Table appears.

Longit. from A	*Latit.*	
deg.	*min.*	*deg.* *min.*
00—00	32	25
05	35	52
10	38	51
15	41	24
20	43	34
25	45	24
30	46	54
35	48	07
40	49	04
45	49	47
50	50	15
55	50	31
60	50	33
65	50	23
70	50	00

Thirdly, I draw a blank according to *Mercator*'s projection (which may be done either by Mr. *Wrights* own Tables, as he hath shewed in his Book of the *Correction of Errors in Navigation*, *Chap.* 5. or by the abridgment thereof, which I have before placed, and call a Table of meridional parts) so as there may a meridian be drawn by every fifth degree of longitude. In which blank, I set down *Summers Islands*, and the *Lizard*, according to their latitudes, and difference of longitude before given, and in the meridian, that is 5 degrees to the Eastwards of *Summers Islands*, I make a prick or mark at 35 deg. 52 min. of latitude; likewise in the meridian that is 10 deg. to the Eastwards of *Summers Islands*, I make a mark at 38 degrees, 51 minutes of latitude; and so I proceed with all the rest, as by this Table I am directed. Then by these pricks or marks thus made on the Blank, I draw the arches of Circles or right lines from one to another, and so shall I describe a curve line on the Blank, representing so near as shall be necessary, an arch of the great Circle passing from *Summers Islands* to the *Lizard*. And if it were done for every single degree (as here it is for every fifth degree) it would come nearer the exact truth. Which curve line being thus described on your Blank, you shall thereby see what courses to shape, to keep as near it as you think good; and you may set down your reckoning on that Blank accordingly.

As having drawn the aforesaid curve line upon the Blank, according to the several longitudes and latitudes expressed in the foregoing Table; I see by that Blank, that I may first shape my course from *Summers Islands*, *n e* half a point Easterly about 200 leagues; so shall I have run my self into the latitude of 38 degrees, 45 minutes; and have altered my longitude 9 degrees, 30 minutes: From thence again, I see I may sail away *n e* by *e*; or if I would not come near the Bank of *New-Found-Land*, I may shape a more Easterly course; but suppose I still desire to keep near the arch of a great Circle, then I say I may sail away *n e* by *e* 200 leagues, and so should be in the latitude of 41 degrees 32 minutes, and have altered my longitude 14 degrees 56 minutes. From thence again I may sail *e n e* half a point Northerly 165 leagues, and then should be in the latitude of 45 degrees 25 minutes, having altered my longitude 24 degrees, 58 minutes. From thence again sailing *e n e* 130 leagues, I shall be in the latitude of 47 degrees, 54 minutes, and have altered my longitude 33 degrees 42 minutes. From thence *e n* half a point easterly 88 leagues, into the latitude of 49 degrees, 11 min. and difference of longitude 40 deg. 5 min. From thence again if I sail *e b n* 70 leagues, I shall be in the latitude of 49 degrees, 52 min. and have altered my longitude from *Summers Islands* to the Eastward 45 deg. 22 minutes. And thus being near the parallel of the *Lizard*, I keep in the same parallel, sailing East, till I come right off from it, which by this reckoning should be 317 leagues; and so the whole distance from *Summers Islands* to the *Lizard*, according to these courses, should be about 1070 leagues, going over the Bank of *New-Found-Land*. Now, I say, coming into the latitude of 49 degrees, 32 minutes, or thereabouts,

abouts, though by my reckoning, well rectified by obſervations, I find my ſelf to be ſtill ſhort of the *Lizard*, about 317 leagues: yet I follow not the great Circle any further, but that I may the more certainly fall with the place intended, whether *Selly* or the *Lizard*, I keep my ſelf in that parallel; and the rather, becauſe the reckonings outward and homeward, of Voyages made to this and other places of the *Weſt-Indies*, do for the moſt part diſagree much. Which diſagreement ariſeth partly by the currant ſetting homeward from thoſe parts; but chiefly becauſe thoſe reckonings are kept upon the plain or common Sea-Chart; which Chart, except a man return the ſame way home that he went out, is commonly ſubject to groſs Errors.

And whereas I know, that the moſt part are wholly addicted to the uſe of this Chart; ſome alſo deſpiſing all others, and may happily be offended that I ſhould thus tax it with groſs Errors; I ſhall make it appear (partly in this preſent Example) that I do it not without juſt cauſe.

In ſailing from the *Lizard* to theſe *Iſlands*, and ſo to other parts of the *Weſt-Indies*; Men commonly run far to the Southwards, as ſometimes into the latitude of 30 degrees, ſometimes more Southerly, to get a wind; but coming homewards, their courſes are commonly more Northerly than the Rumb leading from thence home. But in this Example following, let us keep a mean; and to make ſhort, ſuppoſe a man ſhould ſail from the *Lizard* Southweſt 500 leagues, and then find himſelf in the latitude of 32 degrees, 20 minutes, and from thence Weſt 782 leagues, till he find himſelf directly South from *Summers Iſlands*, and about two leagues off: Then by this reckoning on the plain Chart, *Summers Iſlands* ſhould be diſtant from the *Lizard* 1189 leagues in a ſtraight courſe. Now admitting this reckoning outward bound to be true, and theſe places to be thus ſituated on the common Chart; let us ſuppoſe the reckoning homewards to be alſo kept on the ſame Chart. And becauſe coming home men keep to the Northwards, let us ſuppoſe that he ſteers a way *ne* half a point eaſterly 200 leagues; then *ne* by *e* 100 leagues, *ene* half a point Northerly 165 leagues, *ene* 130 leagues, Eaſt-North-Eaſt half a point Eaſterly 88 leagues; Eaſt and by North 70 leagues; and *e* 317 leagues. Then by this reckoning upon the plain Chart, he ſhould be ſhort of the *Lizard* about 160 leagues.

leagues. Whereas by a true reckoning, he ſhould be as far ſhort as the *Lizard*. And hence it is that they which come from thence, and other parts of the *Weſt-Indies* (making no allowance) are at home before their reckoning ſometimes 200 leagues and more. For a mans reckoning by the plain Chart, makes him ſhorter than he ſhould be by 160 leagues ; ſometimes more, and ſometimes leſs ; and the current may put him forwards 50 or 60 leagues more, ſo that his Ship may be above 2[illegible]0 leagues before his reckoning.

And thus much at preſent, touching the three principal kinds of Sailing : which I hope, I ſhall have opportunity to handle more fully hereafter, with ſome other things of like nature ; and to correct ſuch faults, as may peradventure be here committed through haſte.

A Table for the Angles which every Rumb maketh with the Meridian.

North	*South*	D	M	*South*	*North*
		02	49		
		05	37		
		08	26		
N *by* E	S *by E*	11	15	*S* by *W*	*N* by *W*
		14	04		
		16	52		
		19	41		
NNE	*S S E*	22	30	*S S W*	*N N W*.
		25	19		
		28	07		
		30	56		
N*E by* N	*S E by S*	33	45	*S W* by *S*	*N W* by *N*
		36	34		
		39	22		
		42	11		
N *E*	*S E*	45	00	*S W*	*N W*
		47	49		
		50	37		
		53	26		
N *E by E*	*S E* by *E*	56	15	*W* by *W*	*W N* by *W*
		59	04		
		61	52		
		64	41		
E N E	*E S E*	67	30	*W S W*	*W N W*
		70	19		
		73	07		
		75	56		
E by N	*E* by *S*	78	45	*W* by *S*	*W* by *N*
		81	34		
		84	22		
		87	11		
Eaſt	*Eaſt*	90	00	*Weſt.*	*Weſt*

Of the Declination of the Sun, and fixed Stars.

BECAUSE in the practice and application of the doctrine of Triangles, it is often requisite, that the Suns declination be known, I have thought good here to place four Tables thereof: The first, shewing the Suns declinations for every day of the first four years after the Leap-years; namely, for the years 1677, 1681, 1685. 1689, 1693, 1697. The second, for the second years after the Leap-years; namely, for 1678, 1682, 1686, 1690, 1694, 1698. The third, for the third years after the Leap-years; namely, for 1679, 1683, 1687, 1691, 1695, 1699. And the fourth, for these Leap-years 1680, 1684, 1688, 1692, 1696, 1700, according as they are expressed in the head of each Table. And because the observations of our Countreyman Mr. *Edward Wright*, are not (as I take it) inferior to any other at this day extant, therefore I have drawn these Tables out of his, rectifying them by Prosthapheresis for these next ensuing times.

To these I have added (chiefly for the use of Sea-men) Rules for finding the latitudes of places by the declination and meridian altitude of the Sun or Stars; and a Table of the right ascensions and declinations of about 74 principal fixed Stars, calculated according to their Longitudes and Latitudes set down by *Tycho Brahe*, *Anno* 1600, with allowance for their motion of Longitude, or for the procession of the Æquinoxes for some time to come. I have also noted at what times of the year these Stars will be upon the Meridian at four of the Clock in the Morning, whereby you may readily see when they are in season to be observed for finding the Latitude; by which also you may conjecture their other times of being upon the Meridian. For the Star which in any day proposed is upon the Meridian at Four of the Clock in the Morning, will about fifteen days after be on the Meridian at Three of the Clock in the Morning, and about a Month after at Two, &c. Wherein also Mariners use to help themselves by their Compass, whereby they

they ſee when the Sun or Star is near the Meridian. Such as deſire the exact time of a Stars coming to the Meridian for any day, may ſubſtract the right aſcenſion of the Sun for that day from the right aſcenſion of the Star (adding thereto, if need require, twenty four hours) the remainer ſhews how many hours it will be after Noon, before the Star be upon the Meridian.

The Suns right aſcenſion for any day, may be found by his declination for that day, by the reſolution of a right angled ſpherical Triangle, as of the Triangle ♈ F Q in the general Scheam of the third Chapter of *Spherical Triangles*. But I have annexed an exact Table of the Suns right aſcenſion at the end.

Alſo for the Stars near the Æquinoctial, I have ſet down (in this fourth Edition) their Longitudes and Latitudes, that ſo the Moons place may be diſcovered by her Longitude from any of them, eſpecially being in her Ninetieth degree; whereby the Longitude of places on Sea or Land may be nearly gathered. For the performance whereof, I intended to have handled the Moons motion, and to have ſet down the beſt ways I have thought upon; but other urgent occaſions have hindred me. Notwithſtanding, if you find by ſome exact Ephemerides the Moons true Longitude at the time of obſervation, and obſerving with meet inſtruments her Longitude from ſome of thoſe Stars, and withal the hour and minute of the Night (which by the right aſcenſions and declinations of the Sun and Stars may be known) you may nearly gather the difference of Longitude: For which cauſes I thought it not ſuperfluous to ſet down their Longitudes and Latitudes, and an exact Table of the Suns right aſcenſion, though I cannot proſecute the reſt at preſent; alſo by the Longitudes and Latitudes of theſe Stars, their right aſcenſions and declinations may be examined.

The Table of the Suns Declination for

	1677			1681			1685			1689			1693			1697		
Days	*January.*			*February.*			*March.*			*April.*			*May*			*June.*		
	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.
1	21	41	10	13	43	20	03	22	24	08	38	22	18	07	15	23	11	04
2	21	31		13	23		02	58		09	00		18	22		23	15	
3	21	21	11	13	03	20	02	34	24	09	22	22	18	36	14	23	18	03
4	21	10		12	43		02	11		09	43		18	51		23	21	
5	20	59	12	12	22	21	01	47	24	10	04	21	19	05	14	23	23	02
6	20	47		12	01		01	23		10	26		19	19		23	26	
7	20	35	12	11	40	21	01	00	23	10	47	21	19	32	13	23	27	01
8	20	23		11	18		South	36		11	08		19	45		23	29	
9	20	10	13	10	57	22		12	24	11	28	20	19	58	13	23	29	00
10	19	56		10	35		North	12		11	49		20	11		23	30	
11	19	43	14	10	14	22		35	23	12	09	20	20	23	12	23	30	00
12	19	29		09	52		00	59		12	29		20	34		23	30	
13	19	15	15	09	30	23	01	22	24	12	49	20	20	46	11	23	29	01
14	19	00		09	07		01	46		13	09		20	57		23	28	
15	18	45	15	08	45	23	02	10	23	13	28	19	21	08	10	23	26	02
16	18	30		08	23		02	33		13	47		21	18		23	24	
17	18	14	16	08	00	23	02	56	23	14	07	19	21	28	10	23	22	03
18	17	58		07	37		03	20		14	25		21	38		23	19	
19	17	42	17	07	14	23	03	43	23	14	44		21	47	09	23	16	04
20	17	25		06	51		04	06		15	02	18	21	56		23	12	
21	17	08	18	06	28	23	04	30	23	15	20	18	22	04	08	23	08	05
22	16	51		06	05		04	53		15	38		22	12		23	03	
23	16	33	18	05	42	23	05	16	23	16	56	17	22	20	07	22	58	
24	16	15		05	19		05	39		16	13		22	27		22	52	06
25	15	57	19	04	56	24	06	01	22	16	30	17	22	34		22	48	
26	15	39		04	32		06	24		16	47		22	41		22	41	07
27	15	20	19	04	09	24	06	47	23	17	03	16	22	47	06	22	35	
28	15	01		03	45		07	09		17	20		22	53		22	28	07
29	14	42	19				07	32	23	17	36	16	22	58	05	22	21	
30	14	23					07	54		17	51		23	03		22	13	08
31	14	03	20				08	16	22				23	08				

the first years after the Leap years, *viz.*

Days	1677			1681			1685			1689			1693			1697		
	July.			*August.*			*Septem.*			*October.*			*November*			*December.*		
	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.
1	22	04	08	15	08	18	04	19	23	07	19	23	17	43	6	23	08	04
2	21	56		14	49		03	56		07	42		17	59		23	12	
3	21	47	09	14	31	19	03	33	23	08	04	23	18	15	15	23	16	03
4	21	38		14	12		03	10		08	27		18	30		23	19	
5	21	29	10	13	54	19	02	47	24	08	49	22	18	45	15	23	22	03
6	21	19		13	35		02	23		09	11		19	00		23	25	02
7	21	09	10	13	15	20	02	00	23	09	33	22	19	15	14	23	27	
8	20	58		12	56		01	37		09	55		19	29		23	28	01
9	20	47	11	12	36	20	01	13		10	17	22	19	43	14	23	29	
10	20	36		12	16			50	24	10	39		19	57		23	30	00
11	20	24	12	11	56	20		26		11	00	22	20	10	13	23	30	
12	20	12		11	36		North South	03		11	22		20	23		23	30	00
13	20	00	13	11	16	21		21	23	11	43	21	20	35	12	23	29	01
14	19	47		10	55			44		12	04		20	47		23	28	02
15	19	34	13	10	34	21	01	08		12	24	20	20	59	11	23	26	03
16	19	21		10	13		01	31	23	12	45		21	10		23	23	
17	19	07	14	09	52	21	01	55		13	05	20	21	21	11	23	21	04
18	18	53		09	31		02	18		13	25		21	32		23	17	
19	18	39		09	09		02	42	24	13	45		21	42	11	23	14	04
20	18	24	14	08	48		03	05		14	05	20	21	51	10	23	10	
21	18	10	15	08	26	22	03	28	24	14	25		22	01		23	05	05
22	17	55		08	04		03	52		14	44	19	22	09	09	23	00	
23	17	39	16	07	42	22	04	15	23	15	03		22	18		22	54	
24	17	23		07	20		04	38		15	22	18	22	26	08	22	48	06
25	17	07	16	06	58	23	05	02	23	15	40		22	33		22	42	
26	16	51		06	35		05	25		15	59	18	22	40	07	22	35	07
27	16	34	17	06	13	23	05	48	23	16	17		22	47		22	28	
28	16	18		05	50		06	11		16	34	18	22	53	06	22	20	08
29	16	00	17	05	28	23	06	34	23	16	52		22	59		22	12	
30	15	43		05	05		06	57		17	09	17	23	04	05	22	03	09
31	15	26		04	42					17	26					21	54	

The Table of the Suns Declination for

Days	1678			1682.			1686			1690			1694			1698		
	January.			*February.*			*March.*			*April.*			*May.*			*June.*		
	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif	deg.	m	dif
1	21	44	10	13	48	20	30	27	23	08	33	22	18	03	15	23	10	04
2	21	34		13	28		03	04		08	55		18	18		23	14	
3	21	23	10	13	08	20	02	40	24	09	16	22	18	33	14	23	17	03
4	21	12	11	12	48		02	16		09	38		18	47		23	20	
5	21	01		12	27	21	01	53	24	09	59	22	19	01	14	23	23	02
6	20	50	12	13	06		01	29		10	21	21	19	15		23	25	
7	20	38		11	45	21	01	05		10	42		19	29	13	23	27	01
8	20	26	13	11	24			42	24	11	03	20	19	42		23	28	
9	20	13		11	02	21		18		11	23		19	55	13	23	29	01
10	20	00	14	10	41		South | North	06	23	11	44	21	20	08		23	30	
11	19	46		10	19			29		12	05		20	20	12	23	30	00
12	19	32	14	09	57	22		53		12	24	20	20	32		23	30	01
13	19	18		09	35		01	17	23	12	44		20	43	11	23	29	
14	19	04	15	09	13	22	01	40		13	04	20	20	54		23	28	02
15	18	49		08	51		02	04	23	13	24		21	05	11	23	26	
16	18	33	15	08	28	23	02	27		13	43	19	21	16	10	23	25	03
17	18	18		08	05		02	51	23	14	02		21	26		23	22	
18	18	02	16	07	43	23	03	14		14	21	18	21	35	10	23	19	03
19	17	46		07	20		03	38		14	39		21	45	09	23	16	
20	17	29	17	06	57	23	04	01	23	14	58	18	21	54		23	13	04
21	17	12		06	34		04	24		15	16		22	02	08	23	09	
22	16	55	17	06	11		04	47	23	15	34	18	22	10		23	04	04
23	16	38		05	48	23	05	10		15	52		22	18	08	23	00	
24	16	20	18	05	25		05	33	23	16	09	17	22	26	07	22	54	05
25	16	02		05	01		05	56		16	26		22	33		22	49	
26	15	40		04	38	24	06	19		16	43	16	22	39	07	22	43	06
27	15	19	19	04	14		06	41	22	16	59		22	46	06	22	37	
28	15	00		03	51	23	07	04		17	16	16	22	52		22	30	07
29	14	47					07	26	23	17	32		22	57	05	22	23	
30	14	28	20				07	49	22	17	47		23	02		22	15	
31	14	08					08	11					23	07				

the second years after the Leap years, *viz.*

Days	1678 July. deg.	m.	dif.	1682 August. deg.	m.	dif.	1686 Septem. deg.	m.	dif.	1690 October. deg.	m.	dif.	1694 November deg.	m.	dif.	1698 December. deg.	m.	dif.
1	22	06	08	15	12	18	04	25	23	07	14	23	17	38	7	23	07	04
2	21	58		14	54		04	02		07	36		17	55		23	11	
3	21	49	09	14	30	19	03	39	24	07	59	23	18	11		23	15	04
4	21	40		14	17		03	15		08	22		18	26	16	23	19	03
5	21	31	10	13	58	19	02	52	23	08	44	22	18	42		23	22	
6	21	21		13	39		02	29		09	06		18	57	15	23	24	02
7	21	11	10	13	20	19	02	06	24	09	28	22	19	12		23	26	
8	21	01		13	01		01	42		09	50		19	26	14	23	28	01
9	20	50	11	12	41	20	01	19		10	12	22	19	40		23	29	
10	20	39		12	21			56	24	10	34		19	54	13	23	30	
11	20	27	12	12	01	20	North	32	23	10	55	21	20	07		23	30	00
12	20	15		11	41			09		10	16		20	20	12	23	30	
13	20	03	13	11	21	21	South	15	23	11	38	21	20	32		23	29	01
14	19	50		11	00			38		11	59		20	44	12	23	28	
15	19	37	13	10	39	21	01	02	23	12	19	21	20	56		23	26	02
16	19	24		10	18		01	25		12	40		21	08	11	23	24	
17	19	11	14	09	57	21	01	49	23	13	00	20	21	19		23	21	03
18	18	57		09	36		02	12		13	21		21	29	10	23	18	
19	18	43	15	09	15	22	02	36	23	13	41		21	39		23	15	04
20	18	28		08	53		02	59		14	00	20	21	49	09	23	11	
21	18	13	15	08	31	22	03	23	23	14	20		21	58		23	06	05
22	17	58		08	09		03	46		14	39	19	22	07	09	23	01	
23	17	43	16	07	47	22	04	09	24	14	58		22	16	08	22	56	06
24	17	27		07	25		04	33		15	17	19	22	24		22	50	
25	17	11	17	07	03	22	04	56	23	15	36		22	31	08	22	44	07
26	16	54		06	41		05	19		15	54	18	22	39		22	37	
27	16	38	16	06	18		05	42	23	16	12		22	45	07	22	30	08
28	16	22	17	05	56	23	06	05		16	30	18	22	52		22	22	
29	16	05		05	33		06	28	23	16	48		22	57	06	22	14	09
30	15	47	17	05	10	23	06	51		17	05	17	23	03		22	05	
31	15	30		04	48					17	22					21	56	

The Table of the Suns Declination for

Days	1679 January. deg.	m.	dif.	1683. February. deg.	m.	dif.	1687 March. deg.	m.	dif.	1691 April. deg.	m.	dif.	1695 May. deg.	m.	dif.	1699 June. deg.	m.	dif.
1	21	46	10	13	53	20	03	33	24	08	27	22	17	59	15	23	09	04
2	21	36		13	33		03	09		08	49		18	14		23	13	
3	21	26	11	13	13	20	02	46	24	09	11	22	18	29	15	23	16	04
4	21	15		12	53	21	02	22		09	33		18	44		23	20	
5	21	04	11	12	32		01	58	24	09	54	21	18	58	14	23	22	03
6	20	53	12	12	10		01	45		10	15		19	12		23	25	02
7	20	41		11	50	21	01	21	24	10	37	20	19	26	13	23	27	
8	20	29	13	11	29			47		10	57		19	39		23	28	01
9	20	16		11	08	22		24	24	11	18	21	19	52	13	23	29	
10	20	03	13	10	46		South | North	00		11	39		20	05		23	30	
11	19	50		10	24	22		24	23	11	59		20	17	12	23	30	00
12	19	36	14	10	02			47		12	19	20	20	29		23	30	
13	19	22		09	40	22	01	11	24	12	39		20	40	12	23	29	01
14	19	07	15	09	18		01	35		12	59	20	20	52	11	23	28	
15	18	52		08	56	22	01	58	24	13	19		21	03		23	27	02
16	18	37	15	08	34		02	22		13	38	20	21	13	10	23	25	
17	18	22		08	11	23	02	41		13	58		21	23		23	23	03
18	18	06	16	07	48		03	09	23	14	16	19	21	33	09	23	20	
19	17	50		07	26	23	03	32		14	35		21	42		23	17	03
20	17	33	17	07	03		03	55	24	14	53	19	21	51	09	23	14	
21	17	16		06	40	23	04	18		15	12	18	22	00		23	10	04
22	16	59	17	06	17		04	44		15	30		22	08	08	23	06	
23	16	42		05	53	23	05	05	23	15	47	18	22	16		23	01	05
24	16	24	18	05	30		05	28		16	05		22	24	07	22	56	
25	16	06		05	07	24	05	50	23	16	22	17	22	31		22	50	06
26	15	48	19	04	43		06	13		16	39		22	38	06	22	44	
27	15	29		04	20	23	06	36	22	16	55	17	22	44		22	38	06
28	15	11	19	03	57		06	58		17	12		22	50	06	22	32	07
29	14	52					07	21	22	17	28	16	22	56		22	25	08
30	14	32	20				07	43		17	44		23	01	05	22	17	
31	14	13					08	05					23	06				

the third years after the Leap-year, *viz.*

Days	1679			1683.			1687			1691			1695			1699		
	July			*August.*			*Septem.*			*October.*			*November*			*December*		
	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif
1	22	08	08	15	16	18	04	30	23	07	08	23	17	34	17	23	05	05
2	22	00		14	58		04	07		07	31		17	51		23	10	
3	21	52	09	14	40	18	03	44	23	07	54	22	18	07	16	23	14	04
4	21	43		14	22		03	21		08	16		18	23		23	18	
5	21	33	09	14	03	19	02	58	23	08	38		18	38	15	23	21	03
6	21	24	10	13	44		02	35		09	01	22	18	53		23	24	
7	21	14		13	25	20	02	11	23	09	23		19	08	14	23	26	02
8	21	03	11	13	05		01	48		09	45	22	19	22		23	28	
9	20	52		12	46	20	01	25	24	10	07		19	37	13	23	29	01
10	20	41	11	12	26		01	01		10	28	22	19	50		23	30	
11	20	30		12	06	20		38	24	10	50		20	04	13	23	30	00
12	20	18	12	11	46			14		11	11	21	20	17		23	30	
13	20	06		11	26	21	North / South	09	24	11	32		20	29	12	23	29	01
14	19	53	12	11	05			33		11	53	21	20	41		23	28	
15	19	41		10	44	21		56		12	14		20	53	12	23	27	02
16	19	27	13	10	23		01	20	23	12	35	20	21	05		23	25	
17	19	14		10	02	20	01	43		12	55		21	16	11	23	22	03
18	19	00	14	09	42		02	07	23	13	16	20	21	27		23	19	
19	18	46		09	20		02	30		13	36		21	37	10	23	16	04
20	18	32	15	08	58	21	02	54	23	13	56	19	21	47		23	12	
21	18	17		08	37		03	17	23	14	15		21	56	09	23	07	05
22	18	02	15	08	15	22	03	40		14	34	20	22	05		23	02	
23	17	47		07	53		04	04	23	14	54		22	14	08	22	57	06
24	17	31	16	07	31	22	04	27		15	13		22	22		22	51	
25	17	15		07	09		04	50	24	15	31	19	22	30		22	45	06
26	16	59	17	06	46	22	05	14		15	50		22	37	07	22	39	08
27	16	42		06	24		05	37	23	16	08		22	44		22	31	
28	16	26	17	06	01	22	06	00		16	25	18	22	50	06	22	24	08
29	16	09		05	39		06	23	23	16	43		22	56		22	16	
30	15	52	18	05	16	23	06	46		17	01	17	23	01	05	22	07	08
31	15	34		04	53					17	18					21	59	

The Table of the Suns Declination for

Days	1680			1684			1688			1692			1696			1700		
	January.			February.			March.			April.			May			June.		
	deg.	m.	dif	deg.	m.	dif.	deg.	m.	dif	deg.	m.	dif	deg.	m.	dif	deg.	m.	dif
1	21	48	10	13	58	20	03	15	24	08	44	22	18	11	15	23	12	04
2	21	38		13	38		02	51		09	06		18	26		23	16	
3	21	28	10	13	18	20	02	28	24	09	27	22	18	40	15	23	19	03
4	21	18	11	12	58		02	04		09	49		18	55		23	20	
5	21	07		12	37	21	01	41	24	10	10	21	19	09		23	24	02
6	20	55	11	12	16		01	17		10	31		19	22	14	23	26	
7	20	44	12	11	55	21	South	53	24	10	52	21	19	36		23	28	01
8	20	32		11	34			29	23	11	13		19	49	13	23	29	
9	20	19	13	11	13	22		06		11	34	20	20	02		23	30	00
10	20	06		10	51		North	18	24	11	54		20	14	12	23	30	
11	19	53	14	10	30	22		42		12	15	20	20	26		23	30	01
12	19	39		10	08		01	05		12	35		20	38	11	23	29	
13	19	25	14	09	46	22	01	29	24	12	54	20	20	49		23	28	01
14	19	11		09	24		01	52	23	13	14		21	00	11	23	27	
15	18	56	15	09	01	22	02	16	23	13	34	19	21	11		23	25	02
16	18	41		08	39		02	39		13	53		22	21	10	23	23	
17	18	25	15	08	16	22	03	03	23	14	12	18	21	31		23	21	03
18	18	10	16	07	54		03	26		14	30		21	40	09	23	18	
19	17	54		07	31	23	03	49		14	49	18	21	49		23	15	04
20	17	37	17	07	08		04	13	23	15	07		21	58	09	23	11	
21	17	20		06	45	23	04	36		15	25	18	22	07		23	07	05
22	17	03	17	06	22		04	59	23	15	43		22	14	08	23	02	
23	16	46		05	59	23	05	22		16	00	18	22	22		22	57	05
24	16	30		05	36		05	45		16	18	17	22	29	07	22	52	
25	16	11	19	05	13	24	06	08	22	16	35		23	36		22	46	06
26	15	52		04	49		06	30	23	16	51	17	22	43	06	22	40	
27	15	34	19	04	26	24	07	53		17	08		22	49		22	33	07
28	15	15		04	02		07	15	23	17	24	16	22	54	05	22	26	
29	14	56	19	03	39	24	07	38		17	40		22	59		22	19	08
30	14	37					08	00	22	17	55	16	23	04	05	22	11	
31	14	18					08	22					23	09				

these following Leap·years, *viz.*

	1680.			1684			1688			1692			1696			1700		
	July.			*August.*			*Sept mber*			*October.*			*November*			*December.*		
Days	deg.	m.	dif.	deg.	m.	dif.	deg.	m.	dif	deg.	m.	dif	deg.	m.	dif.	deg.	m.	dif.
1	22	02	08	15	03	18	04	13	23	07	26	22	17	47	16	23	09	04
2	21	54		14	44		03	50		07	48		18	03		23	13	
3	21	45	09	14	26	19	03	27		08	11	22	18	19	15	23	17	03
4	21	36		14	07		03	03	23	08	33		18	34		23	20	
5	21	26	10	13	48	19	02	40		08	55	22	18	50	14	23	23	02
6	21	16		13	29	19	02	17	23	09	17		19	04		23	25	
7	21	06	11	13	10		01	54	24	09	39	22	19	19	14	23	27	02
8	20	55		12	51	20	01	30		10	01		19	33		23	29	
9	20	44	11	12	31		01	07	24	10	23	22	19	47	13	23	29	01
10	20	33		12	11	20	North	43	23	10	45		20	00		23	30	00
11	20	21	12	11	51	21		20		11	06	21	20	14	12	23	30	
12	20	09		11	30			03		11	27		20	26		23	29	01
13	19	56	12	11	10	21	South	27	24	11	48	21	20	39	12	23	28	
14	19	44	13	10	49			51		12	09		20	51		23	27	02
15	19	31		10	28	21	01	14	24	12	30	20	21	02	11	23	25	
16	19	17	14	10	07		01	38		12	50		21	13		23	23	03
17	19	03		09	46	21	02	01	24	13	11	20	21	24	10	23	20	
18	18	49	14	09	25		02	25		13	31		21	34		23	16	03
19	18	35	15	09	03	21	02	48	23	13	51	19	21	44	10	23	13	
20	18	20		08	42		03	11		14	10		21	54		23	08	04
21	18	06	16	08	20	22	03	35	23	14	30		22	03	09	23	04	
22	17	50		07	58		03	58		14	49	19	22	12		22	58	05
23	17	35	16	07	36	22	04	21	24	15	08		22	20	08	22	53	
24	17	19		07	14		04	45		15	27	18	22	28		22	47	06
25	17	03		06	52	23	05	08	23	15	45		22	35	07	22	40	
26	16	46	16	06	29		05	31		16	03	18	22	42		22	33	07
27	16	30	17	06	07	23	05	54	23	16	21		22	49	06	22	26	08
28	16	13		05	44		06	17		16	39	17	22	55		22	18	
29	15	56	18	05	22		06	40	23	16	56		23	00	05	22	09	08
30	15	38		04	59	23	07	03		17	13	17	23	05		22	01	
31	15	21		04	36					17	30					21	52	

Stars near the Equinoctial or Declining to 50 Degrees. *Their Longitudes, Latitudes, Right Aſcenſions, and Declinations,* Anno Domini 1660. *compleat with their Seaſons for Obſervation.*

Mag.	*Their Names.*		*Long.* d. m.		*Latit.* d. m.	*R. Aſ.* d. m.		*Decli.* d. m.	*Seaſons.*
2	In the Whales tail the brighteſt	♓	27.48	s	20.47	6.39	s	19.52	*July* 17
2	In the girdle of Andromeda	♈	25.41	n	25.59	12.42	n	33.52	*July* 23
3	In the Whales back the Weſtermoſt	♈	07.03	s	16.55	13.17	s	12.43	*July* 24
3	In the Whales back Eaſtermoſt	♈	11.34	s	15.46	16.51	s	09.55	*July* 27
3	In the Whales belly	♈	17.17	s	20.19	23.45	s	11.57	*Aug.*03
3	In the Rams horn the firſt	♈	28.29	n	07.08	23.47	n	17.36	*Aug.*04
2	In the ſouth foot of Andromeda	♉	09.31	n	27.46	25.51	n	40.41	*Aug.*06
3	In the Rams head	♉	02.58	n	09.57	27.05	n	21.51	*Aug.*07
3	Perſeus right ſhoulder	♉	25.18	n	34.30	40.09	n	52.09	*Aug.*22
2	In the Whales jaw the brighteſt	♉	09.39	s	12.37	41.13	s	02.45	*Aug.*23
3	Meduſa's head, or Algol	♉	21.29	n	22.22	41.38	n	39.37	*Aug.*23
2	Perſeus right ſide	♉	27.09	n	30.05	44.51	n	48.33	*Aug.*26
3	In the Pleiades the brighteſt	♉	25.16	n	04.00	51.52	n	23.01	*Sept.* 3
1	Bulls eye, Aldebaran	♊	05.04	s	05.31	64.10	n	15.46	*Sept.* 17
1	The Goat, or Wagoners, *&c.*	♊	17.08	n	22.50	73.17	n	43.36	*Sept.* 27
1	In Orions left foot	♊	12.09	s	31.11	74.37	s	08.38	*Sept.* 28
2	Wagoners right foot	♊	17.52	n	05.20	76.15	n	28.15	*Sept.* 30
2	Orions left ſhoulder	♊	16.15	s	16.53	76.48	n	05.59	*Octob.* 1
2	Firſt in Orions girdle	♊	17.43	s	23.38	78.46	s	00.38	*Octob.* 3
2	Second in Orions girdle	♊	18.46	s	24.33	79.48	s	01.20	*Octob.* 4
2	Third in Orions girdle	♊	19.58	s	25.21	80.57	s	02.15	*Octob.* 5
2	Wagoners right ſhoulder	♊	25.20	n	21.28	83.53	n	44.51	*Octob.* 8
2	Orions right ſhoulder	♊	24.04	s	16.06	84.16	n	07.17	*Octob.* 9
2	The great Dogs forefoot	♋	02.34	s	41.18	92.03	s	17.49	*Oct.* 17
2	In the bright foot of the Twins	♋	04.23	s	06.48	94.33	n	16.38	*Oct.* 19

Mag.	Their Names.		Long. d. m.		Latit. d. m.	R. Asc. d. m.		Decli. d. m.	Seasons.
1	The great Dog in his mouth	♋	99.27	s	39.30	97.35	s	16.15	*Oct.* 22
2	In the upper head of the twins Castor	♋	15.33	n	10.02	108.15	n	32.34	*Nov.* 2
2	The lesser Dog	♋	21.10	s	15.57	110.27	n	06.03	*Nov.* 4
2	In the lower head Pollux	♋	18.35	n	06.38	111.10	n	28.47	*Nov.* 5
1	Hydra's heart	♌	22.37	s	22.24	137.47	s	07.14	*No.* 30
1	Lyons heart	♌	25.09	n	00.26	147.36	n	13.35	*Dec.* 9
2	Lyons neck	♌	24.51	n	08.47	150.18	n	21.31	*Dec.* 11
2	Lyons back	♍	06.33	n	14.20	164.00	n	22.23	*Dec.* 23
1	Lyons tail	♍	16.55	n	12.18	172.58	n	16.28	*Dec.* 31
1	Virgins spike	♎	19.08	s	01.59	196.53	s	09.21	*Jan.* 23
1	Arcturus	♎	19.31	n	31.22	210.15	n	21.19	*Feb.* 6
2	South ballance	♏	10.23	n	00.26	218.06	s	14.34	*Feb.* 14
2	North ballance	♏	14.40	n	08.35	224.45	s	08.04	*Feb.* 21
2	In the Crown the brightest	♏	07.30	n	44.23	230.06	n	27.54	*Feb.* 27
1	Scorpions heart	♐	05.05	s	04.27	242.15	s	25.34	*Mar* 12
3	In Ophiucas right foot	♐	15.53	n	02.16	254.55	s	20.30	*Mar* 26
1	In the Harp the brightest	♑	10.35	n	61.48	276.24	n	38.32	*Ap.* 18
2	Eagles heart, *aliàs* Vultures	♑	27.01	n	29.22	293.35	n	08.03	*May* 6
3	Dolphins tail	♒	09.24	n	29.08	304.18	n	10.13	*Ma* 17
2	In the Swans tail	♓	00.46	n	59.57	307.31	n	44.07	*Ma* 20
2	Water-pourers leg	♓	04.14	s	08.10	339.14	s	17.37	*Jun* 20
1	Fomahant	♒	29.04	s	21.00	339.38	s	31.20	*Jun* 20
2	In Pegasus leg	♓	24.42	n	31.08	341.54	n	26.19	*Jun* 22
2	In Pegasus shoulder	♓	18.48	n	19.26	342.01	n	13.25	*Jun* 23
2	The head of Andromeda	♈	09.39	n	25.42	357.47	n	27.15	*July* 8
2	In Pegasus wing, the last	♈	04.30	n	12.35	359.03	n	13.18	*July* 9

Stars near the North-Pole, Their Right Ascensions, Declinations, and Distance from the Pole, Anno Christi 1660. *compleat with their Seasons for Observation.*

Mag.	*The Names of the Stars.*	*R. Asc.* d. m.	*Decli.* d. m.	*Distan.* d. m.	*Seasons.*
3	In the breast of Cassiopeia	005.29	54.42	35. 18	*July* 16
3	The North Star	008.04	87.31	02. 29	*July* 18
3	In the hip of Cassiopeia	009.16	58.54	31. 06	*July* 19
3	In Cassiopeias knee	016.05	58.27	31. 33	*July* 26
3	In Cassiopeias leg	022.43	61.59	28. 01	*Aug.* 2
2	In Perseus right shoulder	040.09	52.09	37. 51	*Aug.*20
2	In the great Bears side	160.09	58.11	31. 49	*Dec.*20
2	In the great Bears back	160.37	63.34	26. 26	*Dec.*20
2	In the great Bears thigh	173.52	55.35	34. 25	*Jan.* 1
3	In Dragons tail, the last but one	175.56	71.37	18. 23	*Jan.* 4
2	In the great Bears rump	179.37	58.54	31. 06	*Jan.* 7
2	Between her tail and the Lyons	188.58	40.37	49. 23	*Jan.*16
2	First in the great Bears tail	189.41	57.50	32. 10	*Jan.*16
2	The middlemost in her tail	197.30	56.43	33. 17	*Jan.*24
2	In the end of her tail	203.30	51.03	38. 57	*Jan.*30
2	In the bending of Dragons tail	209.34	65.59	24. 01	*Feb.* 5
2	The foremost guard	222.45	75.38	14. 22	*Feb.* 19
3	The hindermost guard	231.09	73.18	16. 42	*Feb.* 28
3	In Dragons head foremost	260.44	52.35	37. 25	*Apr.* 1
3	In Dragons head hindermost	267.12	51.37	38. 23	*Apr.* 9
3	In Cepheus girdle	321.02	69.08	20. 52	*Jun.* 2
3	In Cepheus left foot	333.53	64.15	25. 16	*Jun.*15
3	In the back of Cassiopeias chair	357.54	57.18	32. 42	*Jul.* 08

Rules for finding the Latitude or Poles elevation by the meridian altitudes of the Sun or Stars, and by the Table of their Declinations before-going.

Case 1. *If the Sun or Stars be on the Meridian to the Southwards, and have South declinatiou.*

Add the Suns declination to his meridian altitude, and taking that total from 90 degrees, the remainder is the Latitude, or the Poles elevation Northerly.

As admit upon the 10 of *January*, 1649, I find by the foregoing Tables,

The Suns declination Southerly	20 deg.	00′
The Suns meridian altitude by observation	17	55.
The sum or total is	37	55.
Which substracted from	89	60.
There remains the Latitude Northerly	52	05.

But when you have added the Suns declination to his meridian altitude, if the total exceed 90 deg. substract from it 90 deg. and the remainder is your Latitude to the Southwards.

As admit the Suns declination to be Southerly	20 deg.	11′.
The meridian altitude by observation	70	35.
The sum or total is	90	46.
From which substracting	90	00.
There remains the Latitude Southerly	00	46.

Case 2. *If the Sun or Star be on the Meridian to the Southwards, and have North declination.*

Substract the Suns declination from his meridian altitude, and that which remains, substract from 90 deg. then that which remains, is your Latitude or Elevation Northerly.

As admit upon the 20 of *April*, 1649, I find

The Suns declination Northerly	15 deg.	01′.
The meridian altitude by observation	64	22.
The remainder, substracting the declination, is	49	21.
Which substracted from	89	60.
There remains the Latitude Northerly	40	38.

Case 3. *If the Sun or Star be on the Meridian to the Northwards, and have North declination.*

Add the Suns declination to his meridian altitude, that total take from 90 deg. and the remainer is your Latitude Southerly, or the Elevation of the South Pole.

But

But when you have added the Suns declination to his meridian altitude, if it exceed 90 degrees, substract from it 90 degrees, and the remainer is your Latitude Northerly.

Case 4. *If the Sun be to the Northwards at Noon, and have South declination.*

Substract the Suns declination from his meridian altitude, and that which remains, substract from 90 degrees, then that which remains is your Latitude Southerly.

These Rules might have been set down divers other ways, but let this suffice. And what is here said of the Sun, is also to be understood of the Stars being upon the Meridian.

5. *If you chance to observe when the Sun hath no declination.*

Substract his meridian altitude from 90 degrees, and the remainer is your Latitude.

6. *If you chance to observe when the Sun or Star is in the Zenith, that is 90 degrees above the Horizon.*

Look in the Table for the declination of the Sun, or of that Star, and the same is your Latitude.

7. *If the Sun come to the Meridian beneath the Pole.*

If you be within the artick or antartick circle, and observe the Sun upon the Meridian under the Pole, substract the Suns declination from 90 degrees, the remainer is the Suns distance from the Pole, which distance added to his meridian altitude, the sum or total is your Latitude or Poles elevation.

And the like is to be understood of the Stars; for which cause touching those Stars that are near the Pole, we have expressed in the foregoing Table, the complements of their Declination, that is their distances from the North-pole.

If therefore you observe any of these Stars upon the Meridian beneath the Pole: add to its meridian altitude found by observation, his distance from the Pole, the totall is the elevation of the North-pole, or your Latitude Northerly.

If you observe any of those Stars upon the meridian above the Pole then from the meridian altitude of that Star substract his distance from the Pole; the remainer is the height of the North pole. Or out of the Stars distance from the Pole, substract his meridian altitude, the remainer is your Latitude Southerly.

FINIS.

The Epilogue, or Conclusion.

IN handling the Doctrine of Triangles, I have not set down all that I might, but this I have chiefly endeavoured according to my slender ability, namely, to found it upon such Axioms, as might be few in number, easie for memory, ready in practice, and consonant to the nature of Logarithms: yet so, as they might also direct the operations by natural sines, tangents and secants, and likewise by instruments. In the demonstration of these Axioms, I have laboured to be brief and perspicuous. In deducing the cases from them, I have opened the method how it is done, and of all the questions incident in every case, whereby the Reader may conceive the like in any triangle proposed. The Examples I have set down in such sort as might best manifest the Operation, and be a most ready way of practice. The application I have partly shewed, in handling the cases, but further in a subject wherein all the problems of plain and spherical triangles may aptly, ordinarily, and to good purpose be used. The Tables I have so ordered, as I thought might be most easie and ready for ordinary use, according to the method I have used. Many varieties that might have been shewed, I have purposely omitted, that I might not seem tedious. As I have shewed from one ground how to resolve all the cases and questions of a plain right angled triangle as hath been usual before. Whereas for the fifth case where the base and perpendicular are given; to find the hypothenusal: Mr. Briggs hath shewed a more peculiar way, in his Arithmetica Logarithmica, chap. 19. So likewise I have shewed the resolution of the twelfth case, (where three sides of an oblique triangle are given: to find an angle) by an Axiom brief, easie, and the same in effect that hath been long used for that purpose: whereas it might have been done, and that peradventure a little more speedily, by such a way as may be gathered from Mr. Briggs his Arithmetica Logarithmica, chap. 18. though he do not expresly handle it. But then I conceived the rule would not have been so easie for memory, nor so applyable to instrumental operations, which I intended briefly to touch, if other occasions had not hindred. Yet since understanding it would have been acceptable to divers, and being very apt for the Arithmetical work, I have thought good here to place it.

Mr. Briggs hath ſhewed Chap. 18. Sect. 3 and 5 having the three ſides of a triangle, how to find the Semidiameter of the inſcribed circle, and any of the angles thus, or to this effect.

Subſtract the three ſides ſeverally from half the perimeter, and note the remainers then, firſt,

B. As half the perimeter.
C. to one of the remainers;
DF. ſo is the rectangle of the other two
GG. to the ſquare of the ſemidiameter of the inſcribed circle.

Secondly,

C. As one of the foreſaid remainers
G. to the Semidiameter of the inſcribed circle;
R. ſo is Radius
A. to the tangent of half the angle oppoſite to that remainer, theſe he hath there demonſtrated.

By the firſt of theſe it is evident, that As B to C, ſo is DF to GG; and multiplying the firſt and ſecond by the ſecond, As BC to CC, ſo is DF to GG: And alternately as BC to DF, ſo is CC to GG.

Again, by the ſecond, As C to G; ſo R to A, and ſquaring them, as CC to GG; ſo is RR to AA: But as CC to GG; ſo is BC to DF as before was proved. Therefore as BC to DF; ſo is RR to AA.

that is,

BC. As the rectangle of half the perimeter in one of the foreſaid remainers;
DF. is to the rectangle of the other two remainers;
RR. ſo is the ſquare of Radius,
AA. to the ſquare of the tangent of half the angle oppoſite to that firſt remainer.

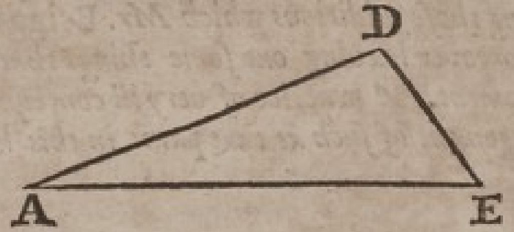
Thus being limited, that I cannot conveniently in this place demonſtrate by words at large, this Algebraical deduction and demonſtration may ſuffice, which to the learned in that kind will not be obſcure: Hence then,

The three ſides of a plain triangle being given; we may find any of the angles.

Sub-

Subſtract the three ſides ſeverally from half the perimeter, noting the remainers. Then to the complements arithmetical of half the perimeter, and of the remainer oppoſite to the angle required; Add the Logarithms of the other two remainers, half the ſum of theſe four is the tangent of half the angle oppoſite to that firſt remainer.

As let A D E be the triangle whoſe three ſides are given.



AE. 189	}	And let there
AD. 156	}	be required
ED. 075	}	the angle at D

The perimeter	420			
half the perimeter	210		*co. ar.*	7.6777807
from which ſubſtract { AE	189 remains	21.	*co. ar.*	8.6777807
{ AD	156 rem.	54	logar.	1.7323937
{ ED	075 rem.	135	logar.	2.1303337
	d. m.			20.2182888
	52——07½		$t \frac{1}{2}$ D	10.1091444

which double is 104——15 the angle at D required.

Note, that the ſide oppoſite to the angle required, which is here AE. 189 being ſubſtracted from half the perimeter 210, the remainer 21 is that which we have before called the remainer oppoſite to the angle required.

2. Example. Let there be required the angle at E.

Half the perimeter 210			*co. ar.*	7.6777807
from which ſubſtract { AD	156 rem.	54	*co. ar.*	8.2676063
{ AE	189 rem.	21	logar.	1.3222193
{ ED	075 rem.	135	logar.	2.1303337
	d. m.			19.3979400
	26——34		$t \frac{1}{2}$ E	9.6989700

Which doubled is 53——08 the angle at E required.

Now whereas I have here, and in ſundry places of this Book, cited Mr. Briggs *his* Arithmetica Logarithmica, *(leſt I may ſeem to abuſe the Reader) you are to underſtand not the Book put forth about*

about a month since in English, as a translation of his, and with the same Title; being nothing like his, nor worthy his name; but the Book which himself put forth with this Title in Latin, being printed at London, Anno 1624. *And here I have just occasion to blame the ill dealing of these men, both in the matter before mentioned, and in printing a second Edition of his* Arithmetica Logarithmica *in Latin, whilst he lived, against his mind and liking; and brought them over to sell, when the first were unsold; so frustrating those additions which Mr.* Briggs *intended in his second Edition, and moreover leaving out some things that were in the first Edition, of special moment. A practice of very ill consequence, and tending to the great disparagement of such as take pains in this kind.*

TEN CHILIADES OR THE LOGARITHMS Of absolute Numbers from a unite to 10000.

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
1	0.0000000	36	1.5563025	71	1.8512583	106	2.0253058
2	0.3010300	37	1.5682017	72	1.8573325	107	2.0293838
3	0.4771212	38	1.5797836	73	1.8633228	108	2.0334237
4	0.6020600	39	1.5910646	74	1.8692317	109	2.0374265
5	0.6989700	40	1.6020600	75	1.8750612	110	2.0413927
6	0.7781512	41	1.6127838	76	1.8808136	111	2.0453230
7	0.8450980	42	1.6232493	77	1.8864907	112	2.0492180
8	0.9030900	43	1.6334684	78	1.8920946	113	2.0530784
9	0.9542425	44	1.6434527	79	1.8976271	114	2.0569048
10	1.0000000	45	1.6532125	80	1.9030900	115	2.0606978
11	1.0413927	46	1.6627578	81	1.9084850	116	2.0644580
12	1.0791812	47	1.6720978	82	1.9138138	117	2.0681858
13	1.1139433	48	1.6812412	83	1.9190781	118	2.0718820
14	1.1461280	49	1.6901961	84	1.9242793	119	2.0755469
15	1.1760912	50	1.6989700	85	1.9294189	120	2.0791812
16	1.2041200	51	1.7075702	86	1.9344984	121	2.0827854
17	1.2304489	52	1.7160033	87	1.9395192	122	2.0863598
18	1.2552725	53	1.7242759	88	1.9444827	123	2.0899051
19	1.2787536	54	1.7323937	89	1.9493900	124	2.0934217
20	1.2010300	55	1.7403627	90	1.9542425	125	2.0969100
21	1.3222193	56	1.7481880	91	1.9590414	126	2.1003705
22	1.3424227	57	1.7558748	92	1.9637878	127	2.1038037
23	1.3617278	58	1.7634280	93	1.9684829	128	2.1072099
24	1.3802112	59	1.7708520	94	1.9731278	129	2.1105897
25	1.3979400	60	1.7781512	95	1.9777236	130	2.1139433
26	1.4149733	61	1.7853298	96	1.9822712	131	2.1172713
27	1.4313637	62	1.7923917	97	1.9867717	132	2.1205739
28	1.4471580	63	1.7993405	98	1.9912225	133	2.1238516
29	1.4623980	64	1.8061800	99	1.9956325	134	2.1271048
30	1.4771212	65	1.8129133	100	2.0000000	135	2.1303337
31	1.4913617	66	1.8195439	101	2.0043214	136	2.1335389
32	1.5051500	67	1.8260748	102	2.0086002	137	2.1367205
33	1.5185139	68	1.8325089	103	2.0128372	138	2.1398791
34	1.5314789	69	1.8388491	104	2.0170333	139	2.1430148
35	1.3440680	70	1.8450980	105	2.0211893	140	2.1461280

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
141	2.1492191	176	2.2455126	211	2.3242824	246	2.3909351
142	2.1522883	177	2.2479732	212	2.3263358	247	2.3926969
143	2.1553360	178	2.2504200	213	2.3283796	248	2.3944517
144	2.1583625	179	2.2528530	214	2.3304138	249	2.3961993
145	2.1613680	180	2.2552725	215	2.3324384	250	2.3979400
146	2.1643528	181	2.2576786	216	2.3344537	251	2.3996737
147	2.1673173	182	2.2600714	217	2.3364597	252	2.4014005
148	2.1702617	183	2.2624511	218	2.3384565	253	2.4031205
149	2.1731862	184	2.2648178	219	2.3404441	254	2.4048337
150	2.1760912	185	2.2671717	220	2.3424226	255	2.4065402
151	2.1789769	186	2.2695129	221	2.3443923	256	2.4082399
152	2.1818436	187	2.2718416	222	2.3463530	257	2.4099331
153	2.1846914	188	2.2741578	223	2.3483048	258	2.4116197
154	2.1875207	189	2.2764618	224	2.3502480	259	2.4132997
155	2.1903317	190	2.2787536	225	2.3521825	260	2.4149733
156	2.1931246	191	2.2810333	226	2.3541084	261	2.4166405
157	2.1958996	192	2.2833012	227	2.3560258	262	2.4183013
158	2.1986571	193	2.2855573	228	2.3579348	263	2.4199557
159	2.2013971	194	2.2878017	229	2.3598355	264	2.4216039
160	2.2041200	195	2.2900346	230	2.3617278	265	2.4232459
161	2.2068258	196	2.2922561	231	2.3636120	266	2.4248816
162	2.2095150	197	2.2944662	232	2.3654880	267	2.4265112
163	2.2121876	198	2.2966652	233	2.3673559	268	2.4281348
164	2.2148438	199	2.2988531	234	2.3692158	269	2.4297523
165	2.2174839	200	2.3010300	235	2.3710678	270	2.4313637
166	2.2201081	201	2.3031960	236	2.3729120	271	2.4329693
167	2.2227164	202	2.3053513	237	2.3747483	272	2.4345689
168	2.2253093	203	2.3074960	238	2.3765770	273	2.4361626
169	2.2278867	204	2.3096301	239	2.3783979	274	2.4377505
170	2.2304489	205	2.3117538	240	2.3802112	275	2.4393327
171	2.2329961	206	2.3138672	241	2.3820170	276	2.4409091
172	2.2355284	207	2.3159703	242	2.3838153	277	2.4424797
173	2.2380461	208	2.3180633	243	2.3856063	278	2.4440448
174	2.2405492	209	2.3201463	244	2.3873898	279	2.4456042
175	2.2430380	210	2.3222193	245	2.3891660	280	2.4471580

Num	Logarithm	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
281	2.4487063	316	2.4996871	351	2.5453071	386	2.5868873
282	2.4502491	317	2.5010593	352	2.5465426	387	2.5877110
283	2.4517864	318	2.5024271	353	2.5477747	388	2.5888317
284	2.4533183	319	2.5037907	354	2.5490033	389	2.5899496
285	2.4548448	320	2.5051500	355	2.5502283	390	2.5910646
286	2.4563660	321	2.5065050	356	2.5514500	391	2.5921767
287	2.4578819	322	2.5078559	357	2.5526682	392	2.5932861
288	2.4593925	323	2.5092025	358	2.5538830	393	2.5943925
289	2.4608978	324	2.5105450	359	2.5550944	394	2.5954962
290	2.4623980	325	2.5118833	360	2.5563025	395	2.5965971
291	2.4638930	326	2.5132176	361	2.5575072	396	2.5976952
292	2.4653828	327	2.5145477	362	2.5587086	397	2.5987905
293	2.4668676	328	2.5158738	363	2.5599066	398	2.5998831
294	2.4683473	329	2.5171959	364	2.5611014	399	2.6009729
295	2.4698220	330	2.5185139	365	2.5622929	400	2.6020600
296	2.4712917	331	2.5198280	366	2.5634810	401	2.6031444
297	2.4727564	332	2.5211381	367	2.5646661	402	2.6042260
298	2.4742162	333	2.5224442	368	2.5658478	403	2.6053050
299	2.4756712	334	2.5237464	369	2.5670263	404	2.6063813
300	2.4771212	335	2.5250448	370	2.5682017	405	2.6074550
301	2.4785665	336	2.5263393	371	2.5693739	406	2.6085260
302	2.4800069	337	2.5276299	372	2.5705429	407	2.6095944
303	2.4814426	338	2.5289167	373	2.5717088	408	2.6106602
304	2.4828736	339	2.5301997	374	2.5728716	409	2.6117233
305	2.4842998	340	2.5314789	375	2.5740313	410	2.6127838
306	2.4857214	341	2.5327544	376	2.5751878	411	2.6138418
307	2.4871384	342	2.5340261	377	2.5763413	412	2.6148972
308	2.4885507	343	2.5352941	378	2.5774918	413	2.6159500
309	2.4899585	344	2.5365584	379	2.5786392	414	2.6170003
310	2.4913617	345	2.5378191	380	2.5797836	415	2.6180481
311	2.4927604	346	2.5390761	381	2.5809250	416	2.6190933
312	2.4941546	347	2.5403295	382	2.5820634	417	2.6201360
313	2.4955443	348	2.5415792	383	2.5831988	418	2.6211763
314	2.4969296	349	2.5428254	384	2.5843312	419	2.6222140
315	2.4983105	350	2.5440680	385	2.5854607	420	2.6232493

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
421	2.6242821	456	2.6589648	491	2.6910815	526	2.7209857
422	2.6253124	457	2.6599162	492	2.6919651	527	2.7218106
423	2.6263403	458	2.6608655	493	2.6928469	528	2.7226339
424	2.6273657	459	2.6618127	494	2.6937269	529	2.7234557
425	2.6283889	460	2.6627578	495	2.6946052	530	2.7242759
426	2.6294096	461	2.6637009	496	2.6954817	531	2.7250945
427	2.6304279	462	2.6646420	497	2.6963564	532	2.7259116
428	2.6314438	463	2.6655810	498	2.6972293	533	2.7267272
429	2.6324573	464	2.6665180	499	2.6981005	534	2.7275412
430	2.6334684	465	2.6674529	500	2.6989700	535	2.7283538
431	2.6344773	466	2.6683859	501	2.6998377	536	2.7291648
432	2.6354837	467	2.6693169	502	2.7007037	537	2.7299743
433	2.6364879	468	2.6702458	503	2.7015680	538	2.7307823
434	2.6374897	469	2.6711728	504	2.7024305	539	2.7315888
435	2.6384892	470	2.6720978	505	2.7032914	540	2.7323937
436	2.6394865	471	2.6730209	506	2.7041505	541	2.7331973
437	2.6404814	472	2.6739420	507	2.7050079	542	2.7339993
438	1.6414741	473	2.6748611	508	2.7058637	543	2.7347998
439	2.6424645	474	2.6757783	509	2.7067178	544	2.7355989
440	2.6434527	475	2.6766936	510	2.7075702	545	2.7363965
441	2.6444386	476	2.6776069	511	2.7084209	546	2.7371926
442	2.6454223	477	2.6785184	512	2.7092699	547	2.7379873
443	2.6464037	478	2.6794279	513	2.7101174	548	2.7387805
444	2.6473830	479	2.6803355	514	2.7109631	549	2.7395723
445	2.6483600	480	2.6812412	515	2.7118072	550	2.7403627
446	2.6493348	481	2.6821451	516	2.7126497	551	2.7411516
447	2.6503075	482	2.6830470	517	2.7134905	552	2.7419391
448	2.6512780	483	2.6839471	518	2.7143297	553	2.7427251
449	2.6522463	484	2.6848453	519	2.7151673	554	2.7435098
450	2.6532125	485	2.6857417	520	2.7160033	555	2.7442930
451	2.6541765	486	2.6866623	521	2.7168377	556	2.7450748
452	2.6551384	487	2.6875289	522	2.7176705	557	2.7458552
453	2.6560982	488	2.6884198	523	2.7185017	558	2.7466342
454	2.6570558	489	2.6893088	524	2.7193313	559	2.7474118
455	2.6580114	490	2.6901961	525	2.7201593	560	2.7481880

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
561	2.7489628	596	2.7752462	631	2.8000293	666	2.8234742
562	2.7497363	597	2.7759743	632	2.8007171	667	2.8241258
563	2.7505084	598	2.7767012	633	2.8014037	668	2.8247765
564	2.7512791	599	2.7774268	634	2.8020892	669	2.8254261
565	2.7520484	600	2.7781512	635	2.8027737	670	2.8260748
566	2.7528164	601	2.7788745	636	2.8034571	671	2.8267225
567	2.7535830	602	2.7795965	637	2.8041394	672	2.8273693
568	2.7543483	603	2.7803173	638	2.8048206	673	2.8280151
569	2.7551123	604	2.7810369	639	2.8055008	674	2.8286599
570	2.7558748	605	2.7817554	640	2,8061800	675	2.8293038
571	2.7566361	606	2.7824726	641	2 8068580	676	2.8299467
572	2.7573960	607	2.7831887	642	2.8075350	677	2.8305887
573	2.7581546	608	2.7839036	643	2.8082110	678	2.8312297
574	2.7589119	609	2.7846173	644	2.8088859	679	2.8318698
575	2.7596678	610	2.7853298	645	2.8095597	680	2.8325089
576	2.7604225	611	2.7860412	646	2.8102325	681	2.8331471
577	2.7611758	612	2.7867514	647	2.8109043	682	2.8337844
578	2.7619278	613	2.7874605	648	2.8115750	683	2.8344207
579	2.7626785	614	2.7881684	649	2.8122447	684	2.8350561
580	2.7634280	615	2.7888751	650	2.8129133	685	2.8356906
581	2.7641761	616	2.7895807	651	2.8135810	686	2.8363241
582	2.7649230	617	2.7902851	652	2.8142476	687	2.8369567
583	2.7656685	618	2.7909885	653	2.8149132	688	2.8377884
584	2.7664128	619	2.7916906	654	2.8155777	689	2.8382192
585	2.7671558	620	2.7923917	655	2.8162413	690	2.8388491
586	2.7678976	621	2.7930916	656	2.8169038	691	2.8394780
587	2.7686381	622	2.7937904	657	2.8175654	692	2.8401061
588	2.7693773	623	2.7944880	658	2.8182259	693	2.8407332
589	2.7701153	624	2.7951846	659	2.8188854	694	2.8413595
590	2.7708520	625	2.7958800	660	2.8195439	695	2.8419848
591	2.7715875	626	2.7965743	661	2.8202014	696	2.8426092
592	2.7723217	627	2.7972675	662	2.8208580	697	2.8432328
593	2.7730547	628	2.7979596	663	2.8215135	698	2.8438554
594	2.7737864	629	2.7986506	664	2.8221681	699	2.8444772
595	2.7745169	630	2.7993405	665	2.8228216	700	2.8450980

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
701	2.8457180	736	2.8668778	771	2.8870544	806	2.9063350
702	2.8463371	737	2.8674675	772	2.8876170	807	2.9068735
703	2.8469553	738	2.8680564	773	2.8881795	808	2.9074114
704	2.8475726	739	2.8686444	774	2.8887410	809	2.9079485
705	2.8481891	740	2.8692317	775	2.8893017	810	2.9084850
706	2.8488047	741	2.8698182	776	2.8898617	811	2.9090208
707	2.8494194	742	2.8704039	777	2.8904210	812	2.9095560
708	2.8500332	743	2.8709888	778	2.8909796	813	2.9100905
709	2.8505462	744	2.8715729	779	2.8915374	814	2.9106244
710	2.8512583	745	2.8721563	780	2.8920946	815	2.9111576
711	2.8518696	746	2.8727388	781	2.8926510	816	2.9116901
712	2.8524800	747	2.8733206	782	2.8932067	817	2.9122220
713	2.8530895	748	2.8739016	783	2.8937618	818	2.9127533
714	2.8536982	749	2.8744818	784	2.8943161	819	2.9132839
715	2.8543060	750	2.8750613	785	2.8948696	820	2.9138138
716	2.8549130	751	2.8756399	786	2.8954225	821	2.9143431
717	2.8555191	752	2.8762178	787	2.8959747	822	2.9148718
718	2.8561244	753	2.8767950	788	2.8965262	823	2.9153998
719	2.8567289	754	2.8773713	789	2.8970770	824	2.9159272
720	2.8573325	755	2.8779469	790	2.8976271	825	2.9164539
721	2.8579353	756	2.8785218	791	2.8981765	826	2.9169800
722	2.8585372	757	2.8790959	792	2.8987252	827	2.9175055
723	2.8591383	758	2.8796692	793	2.8992732	828	2.9180303
724	2.8597387	759	2.8802418	794	2.8998205	829	2.9185545
725	2.8603380	760	2.8808136	795	2.9003671	830	2.9190781
726	2.8609366	761	2.8813846	796	2.9009131	831	2.9196010
727	2.8615344	762	2.8819550	797	2.9014583	832	2.9201233
728	2.8621314	763	2.8825245	798	2.9020029	833	2.9206450
729	2.8627275	764	2.9830933	799	2.9025468	834	2.9211660
730	2.8633228	765	2.8836614	800	2.9030900	835	2.9216865
731	2.8639174	766	2.8842288	801	2.9036325	836	2.9222063
732	2.8645111	767	2.8847953	802	2.9041744	837	2.9227254
733	2.8651041	768	2.8853612	803	2.9047155	838	2.9232440
734	2.8656960	769	2.8859263	804	2.9052560	839	2.9237620
735	2.8662873	770	2.8864907	805	2.9057959	840	2.9242793

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
841	2.9247960	876	2.9425041	911	2.9595184	946	2.9758911
842	2.9253121	877	2.9429996	912	2.9599948	947	2.9763500
843	2.9258276	878	2.9434945	913	2.9604708	948	2.9768083
844	2.9263424	879	2.9439889	914	2.9609462	949	2.9772662
845	2.9268567	880	2.9444827	915	2.9614211	950	2.9777236
846	2.9273704	881	2.9449759	916	2.9618955	951	2.9781805
847	2.9278834	882	2.9454686	917	2.9623693	952	2.9786369
848	2.9283958	883	2.9459607	918	2.9628427	953	2.9790929
849	2.9289077	884	2.9464523	919	2.9633155	954	2.9795484
850	2.9294189	885	2.9469433	920	2.9637878	955	2.9800034
851	2.9299296	886	2.9474337	921	2.9642596	956	2.9804579
852	2.9304396	887	2.9479236	922	2.9647308	957	2.9809119
853	2.9309490	888	2.9484130	923	2.9652017	958	2.9813655
854	2.9314579	889	2.9489018	924	2.9656720	959	2.9818186
855	2.9319661	890	2.9493900	925	2.9661417	960	2.9822712
856	2.9324738	891	2.9498777	926	2.9666110	961	2.9827234
857	2.9329808	892	2.9503648	927	2.9670797	962	2.9831750
858	2.9333873	893	2.9508514	928	2.9675480	963	2.9836263
859	2.9339932	894	2.9513375	929	2.9680157	964	2.9840770
860	2.9344984	895	2.9518230	930	2.9684829	965	2.9845273
861	2.9350031	896	2.9523080	931	2.9689497	966	2.9849771
862	2.9355073	897	2.9527924	932	2.9694159	967	2.9854265
863	2.9360108	898	2.9532763	933	2.9698816	968	2.9858753
864	2.9365137	899	2.9537597	934	2.9703470	969	2.9863238
865	2.9370162	900	2.9542425	935	2.9708116	970	2.9867717
866	2.9375179	901	2.9547248	936	2.9712758	971	2.9872192
867	2.9380191	902	2.9552065	937	2.9717396	972	2.9876663
868	2.9385197	903	2.9556877	938	2.9722028	973	2.9881128
869	2.9390198	904	2.9561684	939	2.9726656	974	2.9885589
870	2.9395192	905	2.9566486	940	2.9731278	975	2.9890046
871	2.9400181	906	2.9571282	941	2.9735896	976	2.9894498
872	2.9405165	907	2.9576073	942	2.9740509	977	2.9898946
873	2.9410142	908	2.9580858	943	2.9745117	978	2.9903388
874	2.9415114	909	2.9585639	944	2.9749720	979	2.9907827
875	2.9420086	910	2.9590414	945	2.9754318	980	2.9912261

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
981	2.9916690	1016	3.0068937	1051	3.0216027	1086	3.0358298
982	2.9921115	1017	3.0073209	1052	3.0220157	1087	3.0362295
983	2.9925535	1018	3.0077478	1053	3.0224284	1088	3.0366289
984	2.9929951	1019	3.0081742	1054	3.0228406	1089	3.0370279
985	2.9934362	1020	3.0086002	1055	3.0232524	1090	3.0374265
986	2.9938769	1021	3.0090257	1056	3.0236639	1091	3.0378247
987	2.9943171	1022	3.0094509	1057	3.0240750	1092	3.0382226
988	2.9947569	1023	3.0098756	1058	3.0244857	1093	3.0386201
989	2.9951963	1024	3.0102999	1059	3.0248960	1094	3.0390173
990	2.9956352	1025	3.0107239	1060	3.0253059	1095	3.0394141
991	2.9960736	1026	3.0111473	1061	3.0257154	1096	3.0398105
992	2.9965117	1027	3.0115704	1062	3.0261245	1097	3.0402066
993	2.9969492	1028	3.0119931	1063	3.0265333	1098	3.0406023
994	2.9973864	1029	3.0124154	1064	3.0269416	1099	3.0409977
995	2.9978231	1030	3.0128372	1065	3.0273496	1100	3.0413927
996	2.9982593	1031	3.0132587	1066	3.0277572	1101	3.0417873
997	2.9986951	1032	3.0136797	1067	3.0281644	1102	3.0421816
998	2.9991305	1033	3.0141003	1068	3.0285712	1103	3.0425755
999	2.9995655	1034	3.0145205	1069	3.0289777	1104	3.0429691
1000	3.0000000	1035	3.0149403	1070	3.0293838	1105	3.0433623
1001	3.0004341	1036	3.0153597	1071	3.0297895	1106	3.0437551
1002	3.0008677	1037	3.0157787	1072	3.0301948	1107	3.0441476
1003	3.0013009	1038	3.0161973	1073	3.0305997	1108	3.0445398
1004	3.0017337	1039	3.0166155	1074	3.0310043	1109	3.0449315
1005	3.0021661	1040	3.0170333	1075	3.0312085	1110	3.0453230
1006	3.0025980	1041	3.0174507	1076	3.0318124	1111	3.0457140
1007	3.0030295	1042	3.0178677	1077	3.0322157	1112	3.0461048
1008	3.0034605	1043	3.0182843	1078	3.0326188	1113	3.0464952
1009	3.0038912	1044	3.0187005	1079	3.0330214	1114	3.0468852
1010	3.0043214	1045	3.0191163	1080	3.0334437	1115	3.0472749
1011	3.0047511	1046	3.0195317	1081	3.0338257	1116	3.0476642
1012	3.0051805	1047	3.0199467	1082	3.0342273	1117	3.0480532
1013	3.0056094	1048	3.0203613	1083	3.0346284	1118	3.0484418
1014	3.0060379	1049	3.0207755	1084	3.0350293	1119	3.0488301
1015	3.0064660	1050	3.0211893	1085	3.0354297	1120	3.0492180

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
1121	3.0496056	1156	3.0629578	1191	3.0759118	1226	3.0884905
1122	3.0499928	1157	3.0633333	1192	3.0762762	1227	3.0888446
1123	3.0503797	1158	3.0637085	1193	3.0766404	1228	3.0891984
1124	3.0507663	1159	3.0640834	1194	3.0770043	1229	3.0895519
1125	3.0511525	1160	3.0644580	1195	3.0773679	1230	3.0899051
1126	3.0515384	1161	3.0648322	1196	3.0777312	1231	3.0902580
1127	3.0519239	1162	3.0652061	1197	3.0780941	1232	3.0906107
1128	3.0523091	1163	3.0655797	1198	3.0784568	1233	3.0909631
1129	3.0526939	1164	3.0659530	1199	3.0788192	1234	3.0913151
1130	3.0530784	165	3.0663259	1200	3.0791812	1235	3.0916669
1131	3.0534626	1166	3.0666985	1201	3.0795430	1236	3.0920185
1132	3.0538464	1167	3.0670708	1202	3.0799045	1237	3.0923696
1133	3.0542299	1168	3.0674428	1203	3.0802656	1238	3.0927206
1134	3.0546130	1119	3.0678145	1204	3.0806265	1239	3.0930712
1135	3.0549958	1170	3.0681859	1205	3.0809870	1240	3.0934217
1136	3.0553783	1171	3.0685569	1206	3.0813473	1241	3.0937718
1137	3.0557604	1172	3.0689276	1207	3.0817073	1242	3.0941216
1138	3.0561423	1173	3.0692980	1208	3.0820669	1243	3.0944711
1139	3.0565237	1174	3.0696681	1209	3.0824263	1244	3.0948204
1140	3.0569048	1175	3.0700379	1210	3.0827854	1245	3.0951693
1141	3.0572856	1176	3.0704073	1211	3.0831441	1246	3.0955180
1142	3.0576661	1177	3.0707765	1212	3.0835026	1247	3.0958664
1143	3.0580462	1178	3.0711453	1213	3.0838608	1248	3.0962146
1144	3.0584260	1179	3.0715138	1214	3.0842187	1249	3.0965624
1145	3.0588055	1180	3.0718820	1215	3.0845763	1250	3.0969100
1146	3.0591846	1181	3.0722499	1216	3.0849336	1251	3.0972573
1147	3.0595634	1182	3.0726175	1217	3.0852906	1252	3.0976043
1148	3.0599419	1183	3.0729847	1218	3.0856473	1253	3.0979511
1149	3.0603200	1184	3.0733517	1219	3.0860037	1254	3.0982975
1150	3.0606978	1185	3.0737183	1220	3.0863598	1255	3.0986437
1151	3.0610753	1186	3.0740847	1221	3.0867156	1256	3.0989896
1152	3.0614525	1187	3.0744507	1222	3.0870712	1257	3.0993353
1153	3.0618293	1188	3.0748164	1223	3.0874264	1258	3.0996806
1154	3.0622058	1189	3.0751818	1224	3.0877814	1259	3.1000257
1155	3.0625820	1190	3.0755470	1225	3.0881361	1260	3.1003705

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
1261	3.1007151	1296	3.1126050	1331	3.1241780	1366	3.1354507
1262	3.1010593	1297	3.1129400	1332	3.1245042	1367	3.1357685
1263	3.1014033	1298	3.1132747	1333	3.1248301	1368	3.1360861
1264	3.1017471	1299	3.1136091	1334	3.1251558	1369	3.1364034
1265	3.1020905	1300	3.1139433	1335	3.1254813	1370	3.1367206
1266	3.1024337	1301	3.1142773	1336	3.1258064	1371	3.1370374
1267	3.1027766	1302	3.1146110	1337	3.1261314	1372	3.1373541
1268	3.1031192	1303	3.1149444	1338	3.1264561	1373	3.1376705
1269	3.1034616	1304	3.1152776	1339	3.1267806	1374	3.1379867
1270	3.1038037	1305	3.1156105	1340	3.1271048	1375	3.1383027
1271	3.1041455	1306	3.1159432	1341	3.1274288	1376	3.1386184
1272	3.1044871	1307	3.1162756	1342	3.1277525	1377	3.1389334
1273	3.1048284	1308	3.1166077	1343	3.1280760	1378	3.1392492
1274	3.1051694	1309	3.1169396	1344	3.1283993	1379	3.1395643
1275	3:1055102	1310	3.1172713	1345	3.1287223	1380	3.1398791
1276	3.1058507	1311	3.1176027	1346	3.1290450	1381	3.1401937
1277	3.1061909	1312	3.1179338	1347	3.1293678	1382	3.1405080
1278	3.1065308	1313	3.1182647	1348	3.1296899	1383	3.1408222
1279	3.1068705	1314	3.1185954	1349	3.1300119	1384	3.1411361
1280	3.1072100	1315	3.1189257	1350	3.1303338	1385	3.1414498
1281	3.1075491	1316	3.1192559	1351	3.1306553	1386	3.1417632
1282	3.1078880	1317	3.1195858	1352	3.1309767	1387	3.1420765
1283	3.1082266	1318	3.1199154	1353	3.1312978	1388	3.1423895
1284	3.1085650	1319	3.1202448	1354	3.1316187	1389	3.1427022
1285	3.1089031	1320	3.1205739	1355	3.1319393	1390	3.1430148
1286	3.1092410	1321	3.1209028	1356	3.1322597	1391	3.1433271
1287	3.1095785	1322	3.1212314	1357	3.1325798	1392	3.1436392
1288	3.1099159	1323	3.1215598	1358	3.1328998	1393	3.1439511
1289	3.1102529	1324	3.1218880	1359	3.1332195	1394	3.1442628
1290	3.1105897	1325	3.1222159	1360	3.1335389	1395	3.1445742
1291	3.1109262	1326	3.1225435	1361	3.1338581	1396	3.1448854
1292	3.1112625	1327	3.1228709	1362	3.1341771	1397	3.1451964
1293	3.1115985	1328	3.1231981	1363	3.1344958	1398	3.1455071
1294	3.1119343	1329	3.1235250	1364	3.1348144	1399	3.1458177
1295	3.1122698	1330	3.1238516	1365	3.1351326	1400	3.1461280

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
1401	3.1464381	1436	3.1571544	1471	3.1676127	1506	3.1778250
1402	3.1467480	1437	3.1574568	1472	3.1679078	1507	2.1781132
1403	3.1470577	1438	3.1577589	1473	3.1682027	1508	3.1784013
1404	3.1473671	1439	3.1580608	1474	3.1684975	1509	3.1786892
1405	3 1476763	1440	3.1583625	1475	3.1687920	1510	3.1789769
1405	3.1479853	1441	3.1586640	1476	3.1690863	1511	3.1792645
1407	3.1482941	1442	3.1589653	1477	3.1693805	1512	3.1795518
1408	3.1486026	1443	3.1592663	1478	3.1696744	1513	3.1798389
1409	3.1489110	1444	3.1595672	1479	3.1699582	1514	3.1801259
1410	3.1492191	1445	3.1598678	1480	3.1702617	1515	3.1804126
1411	3.1495270	1446	3.1601683	1481	3.1705550	1516	3.1806992
1412	3.1498347	1447	3.1604685	1482	3.1708482	1517	3.1809852
1413	3.1501422	1448	3.1607686	1483	3.1711411	1518	3.1812718
1414	3.1504494	1449	3.1610684	1484	3.1714339	1519	3.1815578
1415	3.1507564	1450	3.1613680	1485	3.1717264	1520	3.1818436
1416	3.1510632	1451	3.1616674	1486	3.1720188	1521	3.1821292
1417	3.1513698	1452	3.1619666	1487	3.1723110	1522	3.1824146
1418	3.1516762	1453	3.1622656	1488	3.1726029	1523	3.1826999
1419	3.1519824	1454	3.1625644	1489	3.1728947	1524	3.1839850
1420	3.1522883	1455	3.1628630	1490	3.1731863	1525	3.1822698
1421	3.1525941	1456	3.1631614	1491	3.1734776	1526	3.1835545
1422	3.1528996	1457	3.1634595	1492	3.1737688	1527	3.1838390
1423	3.1532049	1458	3.1637575	1493	3.1740598	1528	3.1841233
1424	3.1535100	1459	3.1640553	1494	3.1743506	1529	3.1844075
1425	3.1538149	1460	3.1643528	1495	3.1746412	1530	2.1846914
1426	3.1541195	1461	3.4646502	1496	3.1749316	1531	3.1849752
1427	3.1544240	1462	3.1649474	1497	3.1752218	1532	3.1852588
1428	3.1547282	1463	3.1652443	1498	3.1755118	1533	3.1855421
1429	3.1550322	1464	3.1655411	1499	3.1758016	1534	3.1858253
1430	3.1353360	1465	3.1658376	1500	3.1760913	1535	3.1861084
1431	3.1556396	1466	3.1661340	1501	3.1763807	1536	3.1863912
1432	3.1559430	1467	3.1664301	1502	3.1766699	1537	3.1866739
1433	3.1562462	1468	3.1667260	1503	3.1769590	1538	3.1869563
1434	3.1565491	1469	3.1670218	1504	3.1772478	1539	3.1872366
1435	3.1568519	1470	3.1673173	1505	3.1775365	1540	3.1875207

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
1541	3.1878026	1576	3.1975562	1611	3.2070955	1646	3.2164298
1542	3.1880844	1577	3.1978317	1612	3.2073650	1647	3.2166936
1543	3.1883659	1578	3.1981070	1613	3.2076344	1648	3.2169572
1544	3.1886473	1579	3.1983821	1614	3.2079035	1649	3.2172206
1545	3.1889285	1580	3.1986571	1615	3.2081725	1650	3.2174839
1546	3.1892095	1581	3.1989319	1616	3.2084414	1651	3.2177471
1547	3.1894903	1582	3.1992065	1617	3.2087100	1652	3.2180100
1548	3.1897709	1583	3.1994809	1618	3.2089785	1653	3.2182728
1549	3.1900514	1584	3.1997552	1619	3.2092468	1654	3.2185355
1550	3.1903317	1585	3.2000293	1620	3.2095150	1655	3.2187980
1551	3.1906118	1586	3.2003032	1621	3.2097830	1656	3.2190603
1552	3.1908917	1587	3.2005769	1622	3.2100508	1657	3.2193225
1553	3.1911714	1588	3.2008505	1623	3.2103185	1658	3.2195845
1554	3.1914510	1589	3.2011239	1624	3.2105860	1659	3.2198464
1555	3.1917304	1590	3.2013971	1625	3.2108534	1600	3.2201081
1556	3.1920096	1591	3.2016702	1626	3.2111205	1661	3.2203696
1557	3.1922886	1592	3.2019431	1627	3.2113876	1662	3.2206310
1558	3.1925674	1593	3.2022158	1628	3.2116544	1663	3.2208921
1559	3.1928461	1594	3.2024883	1629	3.2119211	1664	3.2211533
1560	3.1931246	1595	3.2027607	1630	3.2121876	1665	3.2214142
1561	3.1934029	1596	3.2030329	1631	3.2124540	1666	3.2216750
1562	3.1936810	1597	3.2033049	1632	3.2127201	1667	3.2219356
1563	3.1939590	1598	3.2035768	1633	3.2129862	1668	3.2221960
1564	3.1942367	1599	3.2038485	1634	3.2132521	1669	3.2224563
1565	3.1945143	1600	3.2041200	1635	3.2135178	1670	3.2227165
1566	3.1947917	1601	3.2043913	1636	3.2137833	1671	3.2229764
1567	3.1950690	1602	3.2046625	1637	3.2140487	1672	3.2232363
1568	3.1953460	1603	3.2049335	1638	3.2143139	1673	3.2234959
1569	3.1956229	1604	3.2052044	1639	3.2145789	1674	3.2237555
1570	3.1958996	1605	3.2054750	1640	3.2148438	1675	3.2240148
1571	3.1961762	1606	3.2057455	1641	3.2151086	1676	3.2242740
1572	3.1964525	1607	3.2060159	1642	3.2153732	1677	3.2245331
1573	3.1967287	1608	3.2062869	1643	3.2156376	1678	3.2247920
1574	3.1970047	1609	3.2065560	1644	3.2159018	1679	3.2250507
1575	3.1972806	1610	3.2068259	1645	3.2161659	1680	3.2253093

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
1681	3.2255677	1716	3.2345173	1751	3.2432861	1786	3.2518815
1682	3.2258260	1717	3.2347703	1752	3.2435341	1787	3.2521246
1683	3.2260841	1718	3.2350232	1753	3.2437819	1788	3.2523675
1684	3.2263421	1719	3.2352759	1754	3.2440296	1789	3.2526103
1685	3.2265999	1720	3.2355284	1755	3.2442771	1790	3.2528530
1686	3.2268576	1721	3.2357809	1756	3.2445245	1791	3.2530956
1687	3.2271151	1722	3.2360331	1757	3.2447718	1792	3.2533380
1688	3.2273724	1723	3.2362853	1758	3.2450189	1793	3.2535803
1689	3.2276296	1724	3.2365373	1759	3.2452658	1794	3.2538224
1690	3.2278867	1725	3.2367891	1760	3.2455127	1795	3.2540645
1691	3.2281436	1726	3.2370408	1761	3.2457593	1796	3.2543063
1692	3.2284004	1727	3.2372923	1762	3.2460059	1797	3.2545481
1693	3.2286570	1728	3.2375437	1763	3.2462523	1798	3.2547897
1694	3.2289134	1729	3.2377950	1764	3.2464986	1799	3.2550312
1695	3.2291697	1730	3.2380561	1765	3.2467447	1800	3.2552725
1696	3.2294258	1731	3.2382471	1766	3.2469907	1801	3.2555137
1697	3.2296818	1732	3.2385479	1767	3.2472365	1802	3.2557548
1698	3.2299377	1733	3.2387986	1768	3.2474823	1803	3.2559957
1699	3.2301934	1734	3.2390491	1769	3.2477278	1804	3.2562365
1700	3.2304489	1735	3.2392995	1770	3.2479733	1805	3.2564772
1701	3.2307043	1736	3.2395497	1771	3.2482186	1806	3.2567177
1702	3.2309596	1737	3.2397998	1772	3.2484636	1807	3.2569582
1703	3.2312146	1738	3.2400498	1773	3.2487087	1808	3.2571984
1704	3.2314696	1739	3.2402996	1774	3.2489536	1809	3.2574386
1705	3.2317244	1740	3.2405492	1775	3.2491984	1810	4.2576786
1706	3.2319790	1741	3.2407988	1776	3.2494430	1811	3.2579184
1707	3.2322335	1742	3.2410481	1777	3.2496874	1812	3.2581582
1708	3.2324879	1743	3.2412974	1778	3.2499318	1813	3.2583978
1709	3.2327421	1744	3.2415465	1779	3.2501759	1814	3.2586373
1710	3.2329961	1745	3.2417954	1780	3.2504200	1815	3.2588766
1711	3.2332500	1746	3.2420442	1781	3.2506639	1816	3.2591158
1712	3.2335038	1747	3.2422929	1782	3.2509077	1817	3.2593549
1713	3.2337574	1748	3.2425413	1783	3.2511513	1818	3.2595939
1714	3.2340108	1749	3.2427898	1784	3.2513948	1819	3.2598327
1715	3.2342641	1750	3.2430380	1785	3.2516382	1820	3.2600714

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
1821	3.2603099	1856	3.2685780	1891	3.2766915	1926	3.2846563
1822	3.2605484	1857	3.2688119	1892	3.2769211	1927	3.2848817
1823	3.2607867	1858	3.2690457	1893	3.2771506	1928	3.2851070
1824	3.2610248	1859	3.2692794	1894	3.2773800	1929	3.2853322
1825	3.2612629	1860	3.2695129	1895	3.2776092	1930	3.2855573
1826	3.2615008	1861	3.2697464	1896	3.2778383	1931	3.2857823
1827	3.2617385	1862	3.2699797	1897	3.2780643	1932	3.2860071
1828	3.2619762	1863	3.2702128	1898	3.2782762	1933	3.9862318
1829	3.2622137	1864	3.2704459	1899	3.2785250	1934	3.2864565
1830	3.2624511	1865	3.2706788	1900	3.2783536	1935	3.2866810
1831	3.2626883	1866	3.2709116	1901	3.2789821	1936	3.2869054
1832	3.2629255	1867	3.2711443	1902	3.2792105	1937	3.2871296
1833	3.2631625	1868	3.2713769	1903	3.2794388	1938	3.2873538
1834	3.2633993	1869	3.2716093	1904	3.2796669	1939	3.2875778
1835	3.2636361	1870	3.2718416	1905	3.2798950	1940	3.2878017
1836	3.2638727	1871	3.2720738	1906	3.2801229	1941	3.2880255
1837	3.2641092	1872	3.2723058	1907	3.2803507	1942	3.2882492
1838	3.2643455	1873	3.2725378	1908	3.2805784	1943	3.2884728
1839	3.2645817	1874	3.2727696	1909	3.2808059	1944	3.2886963
1840	3.2648178	1875	3.2730013	1910	3.2810034	1945	3.2889196
1841	3.2650538	1876	3.2732328	1911	3.2812607	1946	3.2891428
1842	3.2652896	1877	3.2734643	1912	3.2814879	1947	3.2893659
1843	3.2655253	1878	3.2736956	1913	3.2817150	1948	3.2895889
1844	3.2657609	1879	3.2739268	1914	3.2819419	1949	3.2898118
1845	3.2659964	1880	3.2741578	1915	3.2821688	1950	3.2900346
1846	3.2662317	1881	3.2743888	1916	3.2823955	1951	3.2902573
1847	3.2664669	1882	3.2746196	1917	3.2826221	1952	3.2904798
1848	3.2667020	1883	3.2748503	1918	3.2828486	1953	3.2907022
1849	3.2669369	1884	3.2750809	1919	3.2830750	1954	3.2909246
1850	3.2671717	1885	3.2753113	1920	3.2833012	1955	3.2911468
1851	3.2674064	1886	3.2755417	1921	3.2835274	1956	3.2913688
1852	3.2676410	1887	3.2757719	1922	3.2837534	1957	3.2915908
1853	3.2678754	1888	3.2760020	1923	3.2839793	1958	3.2918127
1854	3.2681097	1889	3.2762320	1924	3.2842051	1959	3.2920344
1855	3.2683439	1890	3.2764618	1925	3.2844307	1960	3.2922561

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
2241	3.3504419	2276	3.3571722	2311	3.3638000	2346	3.3703280
2242	3.3506356	2277	3.3573630	2312	3.3639878	2347	3.3705131
2243	3.3508293	2278	3.3575537	2313	3.3641756	2348	3.3706981
2244	3.3510228	2279	3.3577443	2314	3.3643633	2349	3.3708830
2245	3.3512163	2280	3.3579348	2315	3.3645510	2350	3.3710678
2246	3.3514098	2281	3.3581253	2316	3.3647386	2351	3.3712526
2247	3.3516031	2282	3.3583156	2317	3.3649260	2352	3.3714373
2248	3.3517963	2283	3.3585059	2318	3.3651134	2353	3.3716219
2249	3.3519895	2284	3.3586961	2319	3.3653007	2354	3.3718065
2250	3.3521825	2285	3.3588862	2320	3.3654880	2355	3.3719909
2251	3.3523755	2286	3.3590762	2321	3.3656751	2356	3.3721753
2252	3.3525684	2287	3.3592662	2322	3.3658622	2357	3.3723596
2253	3.3527613	2288	3.3594560	2323	3.3660492	2358	3.3725438
2254	3.3529539	2289	3.3596458	2324	3.3662361	2359	3.3727279
2255	3.4531465	2290	3.3598355	2325	3.3664230	2360	3.3729120
2256	3.3533391	2291	3.3600251	2326	3.3666097	2361	3.3730960
2257	3.3535316	2292	3.3602146	2327	3.3667964	2362	3.3732799
2258	3.3537239	2293	3.3604041	2328	3.3669830	2363	3.3734637
2259	3.3539162	2294	3.3605934	2329	3.3671695	2364	3.3736475
2260	3.3541084	2295	3.3607827	2330	3.3673559	2365	3.3738311
2261	3.3543006	2296	3.3609719	2331	3.3675423	2366	3.3740147
2262	3.3544926	2297	3.3611610	2332	3.3677285	2367	3.3741983
2263	3.3546846	2298	3.3613500	2333	3.3679147	2368	3.3743817
2264	3.3548764	2299	3.3615390	2334	3.3681008	2369	3.3745651
2265	3.3550682	2300	3.3617278	2335	3.3682869	2370	3.3747483
2266	3.3552599	2301	3.3619166	2336	3.3684728	2371	3.3749316
2267	3.3554515	2302	3.3621053	2337	3.3686587	2372	3.3751147
2268	3.3556430	2303	3.3622939	2338	3.3688445	2373	3.3752977
2269	3.3558345	2304	3.3624825	2339	3.3690302	2374	3.3754807
2270	3.3560259	2305	3.3626709	2340	3.3692159	2375	3.3756636
2271	3.3562171	2306	3.3628593	2341	3.3694014	2376	3.3758464
2272	3.3564083	2307	3.3604476	2342	3.3695869	2377	3.3760292
2273	3.3565994	2308	3.3632358	2343	3.3697723	2378	3.3762118
2274	3.3567905	2309	3.3634239	2344	3.3699576	2379	3.3763944
2275	3.3569814	2310	3.3636120	2345	3.3701428	2380	3.3765769

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
2101	3.3224260	2136	3.3296012	2171	3.3366598	2206	3.3436055
2102	3.3226327	2137	3.3298045	2172	3.3368598	2207	3.3438023
2103	3.3228393	2138	3.3300077	2173	3.3370597	2208	3.3439991
2104	3.3230457	2139	3.3302108	2174	3.3372595	2209	3.3441957
2105	3.3232521	2140	3.3304138	2175	3.3374593	2210	3.3443923
2106	3.3234584	2141	3.3306167	2176	3.3376589	2211	3.3445887
2107	3.3236645	2142	3.3308195	2177	3.3378584	2212	3.3447851
2108	3.3238706	2143	3.3310222	2178	3.3380579	2213	3.3449814
2109	3.3240766	2144	3.3312248	2179	3.3382572	2214	3.3451776
2110	3.3242825	2145	3.3314273	2180	3.3384565	2215	3.3453737
2111	3.3244882	2146	3.3316297	2181	3.3386557	2216	3.3455698
2112	3.3246939	2147	3.3318320	2182	3.3388547	2217	3.3457657
2113	3.3248995	2148	3.3320343	2183	3.3390537	2218	2.3459615
2114	3.3251050	2149	3.3322364	2184	3.3392526	2219	3.3461573
2115	3.3253104	2150	3.3324385	2185	3.3394514	2220	3.3463530
2116	3.3255157	2151	3.3326404	2186	3.3396501	2221	3.3465486
2117	3.3257209	2152	3.3328423	2187	3.3398488	2222	3.3467441
2118	3.3259260	2153	3.3330440	2188	3.3400473	2223	3.3469395
2119	3.3261310	2154	3.3332457	2189	3.3402458	2224	3.3471348
2120	3.3263359	2155	3.3334473	2190	3.3404441	2225	3.3473300
2121	3.3265407	2156	3.3336488	2191	3.3406424	2226	3.3475252
2122	3.3267454	2157	3.3338501	2192	3.3408405	2227	3.3477202
2123	3.3269500	2158	3.3340514	2193	4.3410386	2228	3.3479152
2124	3.3271545	2159	3.3342526	2194	3.3412366	2229	3.3481101
2125	3.3273589	2160	3.3344537	2195	3.3414345	2230	3.3483049
2126	3.3275633	2161	3.3346548	2196	3.3416323	2231	3.3484996
2127	3.3277675	2162	3.3348557	2197	3.3418301	2232	3.3486942
2128	3.3279716	2163	3.3350565	2198	3.3420277	2233	3.3488887
2129	3.3281757	2164	3.3352572	2199	3.3422252	2234	3.3490832
2130	3.3283796	2165	3.3354579	2200	3.3424227	2235	3.3492775
2131	3.3285834	2166	3.3356585	2201	3.3426200	2236	3.3494718
2132	3.3287872	2167	3.3358589	2202	3.3428173	2237	3.3496660
2133	3.3289909	2168	3.3360593	2203	3.3430145	2238	3.3498601
2134	3.3291944	2169	3.3362506	2294	3.3432116	2239	3.3500541
2135	3.3293979	2170	3.3364597	2205	3.3434086	2240	3.3502480

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
2521	3.4015728	2556	3.4075608	2591	3.4134674	2626	3.4192947
2522	3.4017451	2557	3.4077307	2592	3.4136350	2627	3.4194601
2523	3.4019173	2558	3.4079005	2593	3.4138025	2628	3.4196254
2524	3.4020893	2559	3.4080703	2594	3.4139700	2629	3.4197906
2525	3.4022614	2560	3.4082400	2595	3.4141374	2630	3.4199557
2526	3.4024333	2561	3.4084096	2596	3.4143047	2631	3.4201208
2527	3.4026052	2562	3.4085791	2597	3.4144719	2632	3.4202859
2528	3.4027771	2563	3.4087486	2598	3.4146391	2633	3.4204509
2529	3 4029488	2564	3.4089180	2599	3.4148063	2634	3.4206158
2530	3.4031205	2565	3.4090874	2600	3.4149733	2635	3.4207806
2531	3.4032921	2566	3.4092567	2601	3.4151404	2636	3.4209454
2532	3.4034637	2567	3.4094259	2602	3.4153073	2637	3.4211101
2533	3.4036352	2568	3.4095950	2603	3.4154742	2638	3.4212748
2534	3.4038066	2569	3.4097641	2604	3.4156410	2639	3.4214394
2535	3.4039780	2570	3.4099331	2605	3.4158078	2640	3.4216039
2536	3.4041492	2571	3.4101021	2606	3.4159744	2641	3.4217684
2537	3.4043205	2572	3.4102710	2607	3.4161410	2642	3.4219328
2538	3.4044916	2573	3.4104398	2608	3.4163076	2643	3.4220972
2539	3.4046627	2574	3.4106085	2609	3.4164741	2644	3.4222614
2540	3.4048337	2575	3.4107771	2610	3.4166405	2645	3.3224257
2541	3.4050047	2576	3.4109459	2611	3.4168069	2646	3.4225898
2542	3.4051755	2577	3.4111144	2612	3.4169732	2647	3.4227539
2543	3.4053463	2578	3.4112829	2613	3.4171394	2648	3.4229180
2544	3.4055171	2579	3.4114513	2614	3.4173056	2649	3.4230820
2545	3.4056878	2580	3.4116197	2615	3.4174717	2650	3.4232459
2546	3.4058584	2581	3.4117880	2616	3.4176377	2651	3.4234097
2547	3.4060289	2582	3.4119562	2617	3.4178037	2652	3.4235735
2548	3.4061994	2583	3.4121244	2618	3.4179696	2653	3.4237372
2549	3.4063698	2584	3.4122925	2619	3.4181355	2654	3.4239009
2550	3.4065402	2585	3.4124605	2620	3.4183013	2655	3.4240645
2551	3.4067105	2586	3.4126285	2621	3.4184670	2656	3.4242281
2552	3.4068807	2587	3.4127964	2622	3.4186327	2657	3.4243916
2553	3.4070508	2588	3.4129642	2623	3.4187983	2658	3.4245550
2554	3.4072209	2589	3.4131320	2624	3.4189638	2659	3.424718
2555	3.4073909	2590	3.4132998	2625	3.4191293	2660	3.4248816

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
2381	3.3767594	2416	3.3830969	2451	3.3893433	2486	3.3955011
2382	3.3769418	2417	3.3832766	2452	3.3895205	2487	3.3956758
2383	3.3771240	2418	3.3834563	2453	3.3896975	2488	3.3958504
2384	3.3773062	2419	3.3836359	2454	3.3898746	2489	3.3960249
2385	3.3774884	2420	3.3838154	2455	3.3900515	2490	3.3961993
2386	3.3776704	2421	3.3839948	2456	3.3902284	2491	3.3963737
2387	3.3778524	2422	3.3841741	2457	3.3904052	2492	3.3965480
2388	3.3780343	2423	3.3843534	2458	3.3905819	2493	3.3967223
2389	3.3782161	2424	3.3845326	2459	3.3907585	2494	3.3968964
2390	3.3783979	2425	3.3847117	2460	3.3909351	2495	3.3970705
2391	3.3785796	2426	3.3848908	2461	3.3911116	2496	3.3972446
2392	3.3787612	2427	3.3850698	2462	3.3912880	2497	3.3974185
2393	3.3789427	2428	3.3852487	2463	3.3914644	2498	3.3975924
2394	3.3791241	2429	3.3854275	2464	3.3916407	2499	3.3977662
2395	3.3793055	2430	3.3856063	2465	3.3918169	2500	3.3979400
2396	3.3794868	2431	3.3857850	2466	3.3919931	2501	3.3981137
2397	3.3796680	2432	3.3859636	2467	3.3921691	2502	3.3982873
2398	3.3798492	2433	3.3861421	2468	3.3923452	2503	3.3984608
2399	3.3800302	2434	3.3863206	2469	3.3925211	2504	3.3986343
2400	3.3802112	2435	3.3864990	2470	3.3926969	2505	3.3988077
2401	3.3803922	2436	3.3866773	2471	3.3928727	2506	3.3989811
2402	3.3805730	2437	3.3868555	2472	3.3930485	2507	3.3991543
2403	3.3807538	2438	3.3870337	2473	3.3932241	2508	3.3993275
2404	3.3809345	2439	3.3872118	2474	3.3933997	2509	3.3995005
2405	3.3811151	2440	3.3873898	2475	3.3935752	2510	3.3996737
2406	3.3812956	2441	3.3875678	2476	3.3937506	1511	3.3998467
2409	3.3814761	2442	3.3877457	2477	3.3939260	2512	3.4000196
2408	3.3816565	2443	3.3879235	2478	3.3941013	2513	3.4001925
2409	3.3818368	2444	3.3881012	2479	3.3942765	2514	3.4003653
2410	3.3820170	2445	3.3882789	2480	3.3944517	2515	3.4005380
2411	3.3821972	2446	3.3884565	2481	3.3946268	2516	3.4007106
2412	3.3823773	2447	3.3886340	2482	3.3948018	2517	3.4008832
2413	3.3825573	2448	3.3888114	2483	3.3949767	2518	3.4010557
2414	3.3827373	2449	3.3889888	2484	3.3951516	2519	3.4012282
2415	3.3829171	2450	3.3891661	2485	3.3953264	2520	3.4014005

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
2801	3.4473131	2836	3.4527062	2871	3.4580332	2906	3.4632956
2802	3.4474681	2837	3.4528593	2872	3.4581844	2907	3.4634450
2803	3.4476231	2838	3.4530124	2873	3.4583356	2908	3.4635944
2804	3.4477780	2839	3.4531654	2874	3.4584868	2909	3.4637437
2805	3.4479325	2840	3.4533183	2875	3.4586378	2910	3.4638930
2806	3.4480877	2841	3.4534712	2876	3.4587889	2911	3.4640422
2807	3.4482424	2842	3.4536241	2877	3.4589399	2912	3.4641914
2808	3.4483971	2843	3.4537769	2878	3.4590908	2913	3.4643405
2809	3.4485517	2844	3.4539296	2879	3.4592417	2914	3.4644895
2810	3.4487063	2845	3.4540823	2880	3.4593925	2915	3.4646386
2811	3.4488608	2846	3.4542349	2881	3.4595433	2916	3.4647875
2812	3.4490153	2847	3.4543875	2882	3.4596940	2917	3.4649364
2813	3.4491697	2848	3.4545400	2883	3.4598446	2918	3.4650853
2814	3.4493241	2849	3.4546924	2884	3.4599953	2919	3.4652341
2815	3.4494784	2850	3.4548449	2885	3.4601458	2920	3.4653828
2816	3.4496326	2851	3.4557582	2886	3.4602963	2921	3.4655316
2817	3.4497868	2852	3.4551495	2887	3.4604468	2922	3.4656802
2818	3.4499410	2853	3.4553018	2888	3.4605972	2923	3.4658288
2819	3.4500951	2854	3.4554540	2889	3.4607475	2924	3.4659775
2820	3.4502491	2855	3.4556061	2890	3.4608978	2925	3.4661259
2821	3.4504031	2856	3.4557582	2891	3.4610481	2926	3.4662743
2822	3.4505570	2857	3.4559102	2892	3.4611983	2927	3.4664227
2823	3.4507109	2858	3.4560622	2893	3.4613484	2928	3.4665711
2824	3.4508647	2859	3.4562142	2894	3.4614985	2929	3.4667194
2825	3.4510184	2860	3.4563660	2895	3.4616486	2930	3.4668676
2826	3.4511721	2861	3.4565179	2896	3.4617986	2931	3.4670158
2827	3.4513258	2862	3.4566696	2897	3.4619485	2932	3.4671640
2828	3.4514794	2863	3.4568213	2898	3.4620984	2933	3.4673120
2829	3.4516329	2864	3.4569730	2899	3.4622482	2934	3.4674601
2830	3.4517864	2865	3.4571246	2900	3.4623980	2935	3.4676081
2831	3.4519399	2866	3.4572762	2901	3.4625477	2936	3.4677560
2832	3.4520932	2867	3.4574276	2902	3.4626974	2937	3.4679039
2833	3.4522466	2868	3.4575791	2903	3.4628470	2938	3.4680518
2834	3.4523998	2869	3.4577305	2904	3.4629966	2939	3.4681996
2835	3.4525531	2870	3.4578819	2905	3.4631461	2940	3.4683473

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
2661	3.4250449	2696	3.4307199	2731	3.4363217	2766	3.4418522
2662	3.4252080	2697	3.4308809	2732	3.4364807	2767	3.4420092
2663	3.4253712	2698	3.4310419	2733	3.4366396	2768	3.4421661
2664	3.4255342	2699	3.4312029	2734	3.4367985	2769	3.4423229
2665	3.4256972	2700	3.4313638	2735	3.4369573	2770	3.4424798
2666	3.4258601	2701	3.4315246	2736	3.4371161	2771	3.4426365
2667	3.4260230	2702	3.4316853	2737	3.4372748	2772	3.4427932
2668	3.4261858	2703	3.4318460	2738	3.4374334	2773	3.4429499
2669	3.4263486	2704	3.4320066	2739	3.4375920	2774	3.4431065
2670	3.4265113	2705	3.4321673	2740	3.4377506	2775	3.4432630
2671	3.4266739	2706	3.4323278	2741	3.4379090	2776	3.4434195
2672	3.4268365	2707	3.4324883	2742	3.4380674	2777	3.4435759
2673	3.4269990	2708	3.4326487	2743	3.4382258	2778	3.4437322
2674	3.4271614	2709	3.4328090	2744	3.4383841	2779	3.4438885
2675	3.4273238	2710	3.4329693	2745	3.4385423	2780	3.4440448
2676	3.4274861	2711	3.4331295	2746	3.4387005	2781	3.4442010
2677	3.4276484	2712	3.4332897	2747	3.4388587	2782	3.4443571
2678	3.4278106	2713	3.4334498	2748	3.4390167	2783	3.4445132
2679	3.4279727	2714	3.4336098	2749	3.4391747	2784	3.4446692
2680	3.4281348	2715	3.4337698	2750	3.4393327	2785	3.4448252
2681	3.4282968	2716	3.4339298	2751	3.4394906	2786	3.4449811
2682	3.4284588	2717	3.4340896	2752	3.4396484	2787	3.4451370
2683	3.4286207	2718	3.4342494	2753	3.4398062	2788	3.4452928
2684	3.4287825	2719	3.4344092	2754	3.4399639	2789	3.4454485
2685	3.4289442	2720	3.4345689	2755	3.4401216	2790	3.4456042
2686	3.4291060	2721	3.4347285	2756	3.4402792	2791	3.4457598
2687	3.4292677	2722	3.4348881	2757	3.4404368	2792	3.4459154
2688	3.4294293	2723	3.4350476	2758	3.4405943	2793	3.4460709
2689	3.4295908	2724	3.4352071	2759	3.4407517	2794	3.4462264
2690	3.4297522	2725	3.4353665	2760	3.4409091	2795	3.4463818
2691	3.4299137	2726	3.4355258	2761	3.4410664	2796	3.4465371
2692	3.4300751	2727	3.4356851	2762	3.4412237	2797	3.4466925
2693	3.4302364	2728	3.4358444	2763	3.4413809	2798	3.4468477
2694	3.4303976	2729	3.4360035	2764	3.4415380	2799	3.4470029
2695	3.4305588	2730	3.4361626	2765	3.4416951	2800	3.4471580

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
3081	3.4886917	3116	3.4935974	3151	3.4984484	3186	3.5032458
3082	3.4888326	3117	3.4937368	3152	3.4985862	3187	3.5033821
3083	3.4889735	3118	3.4938761	3153	3.4987240	3188	3.5035183
3084	3.4891144	3119	3.4940154	3154	3.4988617	3189	3.5036545
3085	3.4892552	3120	3.4941546	3155	3.4989994	3190	3.5037907
3086	3.4893959	3121	3.4942938	3156	3.4991370	3191	3.5039268
3087	3.4895366	3122	3.4944329	3157	3.4992746	3192	3.5040629
3088	3.4896773	3123	3.4945720	3158	3.4994121	3193	3.5041989
3089	3.4898179	3124	3.4947110	3159	3.4995496	3194	3.5043349
3090	3.4899585	3125	3.4948500	3160	3.4996871	3195	3.5044709
3091	3.4900990	3126	3.4949890	3161	3.4998245	3196	3.5046068
3092	3.4902395	3127	3.4951279	3162	3.4999619	3197	3.5047426
3093	3.4903799	3128	3.4952667	3163	3.5000992	3198	3.5048785
3094	3.4905203	3129	3.4954056	3164	3.5002365	3199	3.5050142
3095	3.4906607	3130	3.4955443	3165	3.5003737	3200	3.5051500
3096	3.4908009	3131	3.4956831	3166	3.5005109	3201	3.5052857
3097	3.4909412	3132	3.4958218	3167	3.5006481	3202	3.5054213
3098	3.4910814	3133	3.4959604	3168	3.5007852	3203	3.5055569
3099	3.4912216	3134	3.4960990	3169	3.5009222	3204	3.5056925
3100	3.4913617	3135	3.4962375	3170	3.5010593	3205	3.5058280
3101	3.4915018	3136	3.4963761	3171	3.5011962	3206	3.5059635
3102	3.4916418	3137	3.4965145	3172	3.5013332	3207	3.5060990
3103	3.4917818	3138	3.4966529	3173	3.5014701	3208	3.5062344
3104	3.4919217	3139	3.4967913	3174	3.5016069	3209	3.5063697
3105	3.4920616	3140	3.4969296	3175	3.5017437	3210	3.5065090
3106	3.4922014	3141	3.4970679	3176	3.5018805	3211	3.5066403
3107	3.4923413	3142	3.4972062	3177	3.5020172	3212	3.5067755
3108	3.4924810	3143	3.4973444	3178	3.5021539	3213	3.5069107
3109	3.4926207	3144	3.4974825	3179	3.5022905	3214	3.5070459
3110	3.4927604	3145	3.4976206	3180	3.5024271	3215	3.5071810
3111	3.4929000	3146	3.4977587	3181	3.5025637	3216	3.5073160
3112	3.4930396	3147	3.4978967	3182	3.5027001	3217	3.5074511
3113	3.4931791	3148	3.4980347	3183	3.5028366	3218	3.5075860
3114	3.4933186	3149	3.4981727	3184	3.5029731	3219	3.5077210
3115	3.4934580	3150	3.4983106	3185	3.5031094	3220	3.5078559

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
2941	3.4684950	2976	3.4736329	3011	3.4787108	3046	3.4837299
2942	3.4686427	2977	3.4737788	3012	3.4788550	3047	3.4838725
2943	3.4687903	2978	3.4739247	3013	3.4789991	3048	3.4840150
2944	3.4689378	2979	3.4740705	3014	3.4791432	3049	3.4841574
2945	3.4690853	2980	3.4742163	3015	3.4792873	3050	3.4842998
2946	3.4692327	2981	3.4743620	3016	3.4794313	3051	3.4844422
2947	3.4693801	2982	3.4745076	3017	3.4795753	3052	3.4845845
2948	3.4695275	2983	3.4746533	3018	3.4797192	3053	3.4847268
2949	3.4696748	2984	3.5747988	3019	3.4798631	3054	3.4848690
2950	3.4698220	2985	3.4749443	3020	3.4800069	3055	3.4850112
2951	3.4699692	2986	3.4750898	3021	3.4801507	3056	3.4851533
2952	3.4701163	2987	3.4752352	3022	3.4802945	3057	3.4852954
2953	3.4702634	2988	3.4753806	3023	3.4804381	3058	3.4854375
2954	3.4704105	2989	3.4755259	3024	3.4805818	3059	3.4855795
2955	3.4705575	2990	3.4756712	3025	3.4807254	3060	3.4857214
2956	3.4707044	2991	3.4758164	3026	3.4808689	3061	3.4858633
2957	3.4708513	2992	3.4759616	3027	3.4810124	3062	3.4860052
2958	3.4709982	2993	3.4761067	3028	3.4811559	3063	3.4861470
2959	3.4711450	2994	3.4762518	3029	3.4812993	3064	3.4862888
2960	3.4712917	2995	3.4763968	3030	3.4814426	3065	3.4864305
2961	3.4714384	2996	3.4765418	3031	3.4815859	3066	3.4865721
2962	3.4715852	2997	3.4766867	3032	3.4817292	3067	3.4867138
2963	3.4717317	2998	3.4768316	3033	3.4818724	3068	3.4868554
2964	3.4718782	2999	3.4769765	3034	3.4820156	3069	3.4869969
2965	3.4720247	3000	3.4771212	3035	3.4821587	3070	3.4871384
2966	3.4721711	3001	3.4772660	3036	3.4823018	3071	3.4872798
2967	3.4723175	3002	3.4774107	3037	3.4824448	3072	3.4874212
2968	3.4724639	3003	3.4775553	3038	3.4825878	3073	3.4875626
2969	3.4726102	3004	3.4776999	3039	3.4827307	3074	3.4877039
2970	3.4727564	3005	3.4778445	3040	3.4828736	3075	3.4878451
2971	3.4729027	3006	3.4779890	3041	3.4830164	3076	3.4879863
2972	3.4730488	3007	3.4781334	3042	3.4831592	3077	3.4881275
2973	3.4731949	3008	3.4782778	3043	3.4833019	3078	3.4882686
2974	3.4733410	3009	3.4784222	3044	3.4834446	3079	3.4884097
2975	3.4734870	3010	3.4785665	3045	3.4835873	3080	3.4885507

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
3361	3.5264685	3396	3.5309677	3431	3.5354207	3466	3.5398286
3362	3.5265977	3397	3.5310955	3432	3.5355473	3457	3.5399538
3363	3.5267259	3398	3.5312234	3433	3.5356738	3468	3.5400791
3364	3.5268560	3399	3.5313512	3434	3.5358008	3459	3.5402043
3365	3.5269851	3400	3.5314789	3435	3.5359267	2470	3.5403295
3366	3.5271141	3401	3.5316066	3436	3.5360532	3471	3.5404546
3367	3.5272431	3402	3.5317343	3437	3.5361795	3472	3.5405797
3368	3.5273721	3403	3.5318619	3438	3.5363059	3473	3.5407048
3369	3 5275010	3404	3.5319895	3439	3.5364322	3474	3.5408296
3370	3.5276299	3405	3.5321171	3440	3.5365584	3475	3.5409548
3371	3.5277588	3406	3.5322446	3441	3.5366847	3476	3.5410798
3372	3.5278876	3407	3.5323721	3442	3.5368109	3477	3.5412047
3373	3.5280163	3408	3.5324996	3443	3.5369370	3478	3.5413296
3374	3.5281451	3409	3.5326270	3444	3.5370631	3479	3.5414544
3375	3.5282738	3410	3.5327544	3445	3.5371892	3480	3.5415792
3376	3.5284024	3411	3.5328817	3446	3.5373153	3481	3.5417040
3377	3.5285311	3412	3.5330090	3447	3.5374413	3482	3.5418288
3378	3.5286596	3413	3.5331363	3448	3.5375672	3483	3.5419535
3379	3.5287882	3414	3.5332635	3449	3.5376932	3484	3.5420781
3380	3.5289167	3415	3.5333907	3450	3.5378191	3485	3.5422028
3381	3.5290452	3416	3.5335179	3451	3.5379450	3486	3.5423274
3382	3.5291736	3417	3.5336450	3452	3.5380708	3487	3.5424519
3383	3.5293020	3418	3.5337721	3453	3.5381966	3488	3.5425765
3384	3.5294303	3419	3.5338991	3454	3.5383223	3489	3.5427010
3385	3.5295587	2420	3.5340261	3455	3.5384481	3490	3.5428254
3386	3.5296869	3421	3.5341531	3456	3.5385737	3491	3.5429498
3387	3.5298152	3422	3.5342800	3457	3.5386994	3492	3.5430742
3388	3.5299434	3423	3.5344069	3458	3.5388250	3493	3.5431986
3389	3.5300716	3424	3.5345338	3459	3.5389506	3494	3.5433229
3390	3.5301997	3425	3.5346606	3460	3.5390761	3495	3.5434472
3391	3.5303278	3426	3.5347874	3461	3.5392016	3496	3.5435714
3392	3.5304558	3427	3.5349141	3462	3.5393271	3497	3.5436956
3393	3.5305839	3428	3.5350408	3463	3.5394525	3498	3.5438198
3394	3.5307118	3429	3.5351675	3464	3.5395779	3499	3.5439439
3395	3.5308398	3430	3.5352941	3465	3.5397032	3500	3.5440630

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
3221	3.5079907	3256	3.5126844	3291	3.5173279	3326	3.5219222
3222	3.5081255	3257	3.5128178	3292	3.5174598	3327	3.5220528
3223	3.5082603	3258	3.5129511	3293	3.5175917	3328	3.5221833
3224	3.5083950	3259	3.5130841	3294	3.5177236	3329	3.5223138
3225	3.5085297	3260	3.5132176	3295	3.5178554	3330	3.5224442
3226	3.5086644	3261	3.5133508	3296	3.5179872	3331	3.5225746
3227	3.5087990	3262	3.5134840	3297	3.5181189	3332	3.5227050
3228	3.5089335	3263	3.5136171	3298	3.5182506	3333	3.5228353
3229	3.5090680	3264	3.5137501	3299	3.5183823	3334	3.5229656
3230	3.5092025	3265	3.5138832	3300	3.5185139	3335	3.5230958
3231	3.5093370	3266	3.5140162	3301	3.5186455	3336	3.5232260
3232	3.5094713	3267	3.5141491	3302	3.5187771	3337	3.5233562
3233	3.5096057	3268	3.5142820	3303	3.5189086	3338	3.5234863
3234	3.5097400	3269	3.5144149	3304	3.5190400	3339	3.5236164
3235	3.5098743	3270	3.5145478	3305	3.5191715	3340	3.5237465
3236	3.5100085	3271	3.5146805	3306	3.5193028	3341	3.5238765
3237	3.5101427	3272	3.5148133	3307	3.5194342	3342	3.5240064
3238	3.5102768	3273	3.5149460	3308	3.5195655	3343	3.5241364
3239	3.5104109	3274	3.5150787	3309	3.5196968	3344	3.5242663
3240	3.5105450	3275	3.5152113	3310	3.5198280	3345	3.5243961
3241	3.5106790	3276	3.5153439	3311	3.5199592	3346	3.5245259
3242	3.5108130	3277	3.5154764	3312	3.5200903	3347	3.5246557
3243	3.5109469	3278	3.5156089	3313	3.5202214	3348	3.5247854
3244	3.5110808	3279	3.5157414	3314	3.5203525	3349	3.5249151
3245	3.5112147	3280	3.5158738	3315	3.5204835	3350	3.5250448
3246	3.5113485	3281	3.5160062	3316	3.5206145	3351	3.5251744
3247	3.5114823	3282	3.5161386	3317	3.5207455	3352	3.5253040
3248	3.5116160	3283	3.5162709	3318	3.5208764	3353	3.5254335
3249	3.5117497	3284	3.5164031	3319	3.5210073	3354	3.5255631
3250	3.5118834	3285	3.5165354	3320	3.5211381	3355	3.5256925
3251	3.5120170	3286	3.5166676	3321	3.5212689	3356	3.5258219
3252	3.5121505	3287	3.5167997	3322	3.5213996	3357	3.5259513
3253	3.5122841	3288	3.5169318	3323	3.5215303	3358	3.5260806
3254	3.5124175	3289	3.5170639	3324	3.5216610	3359	3.5262100
3255	3.5125510	3290	3.5171959	3325	3.5217916	3360	3.5263393

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
3641	3.5612207	3676	3.5653755	3711	3.5694910	3746	3.5735678
3642	3.5613399	3677	3.5654936	3712	3.5696080	3747	3.5736837
3643	3.5614592	3678	3.5656117	3713	3.5697249	3748	3.5737996
3644	3.5615784	3679	3.5657298	3714	3.5698419	3749	3.5739154
3645	3.5616975	3680	3.5658478	3715	3.5699588	3750	3.5740313
3646	3.5618167	3681	3.5659658	3716	3.5700757	3751	3.5741471
3647	3.5619358	3682	3.5660838	3717	3.5701926	3752	3.5742628
3648	3.5620548	3683	3.5662017	3718	3.5703094	3753	3.5743786
3649	3.5621739	3684	3.5663196	3719	3.5704262	3754	3.5744943
3650	3.5622929	3685	3.5664375	3720	3.5705429	3755	3.5746099
3651	3.5624118	3686	3.5665553	3721	3.5706597	3756	3.5747256
3652	3.5625308	3687	3.5666731	3722	3.5707764	3757	3.5748412
3653	3.5626497	3688	3.5667909	3723	3.5708930	3758	3.5749568
3654	3.5627685	3689	3.5669087	3724	3.5710097	3759	3.5750723
3655	3.5628874	3690	3.5670264	3725	3.5711263	3760	3.5751878
3656	3.5630062	3691	3.5671440	3726	3.5712428	3761	3.5753033
3657	3.5631250	3692	3.5672617	3727	3.5713594	3762	3.5754188
3658	3.5632437	3693	3.5673793	3728	3.5714759	3763	3.5755342
3659	3.5633624	3694	3.5674969	3729	3.5715924	3764	3.5756496
3660	3.5634811	3695	3.5676144	3730	3.5717087	3765	3.5757650
3661	3.5635997	3696	3.5677320	3731	3.5718252	3766	3.5758803
3662	3.5637183	3697	3.5678494	3732	3.5719416	3767	3.5759956
3663	3.5638369	3698	3.5679669	3733	3.5720580	3768	3.5761109
3664	3.5639555	3699	3.5680843	3734	3.5721743	3769	3.5762261
3665	3.5640740	3700	3.5682017	3735	3.5722906	3770	3.5763413
3666	3.5641925	3701	3.5683192	3736	3.5724069	3771	3.5764565
3667	3.5643109	3702	3.5684364	3737	3.5725231	3772	3.5765717
3668	3.5644293	3703	3.5685537	3738	3.5726393	3773	3.5766868
3669	3.5645477	3704	3.5686710	3739	3.5727555	3774	3.5768019
3670	3.5646661	3705	3.5687882	3740	3.5728716	3775	3.5769169
3671	3.5647844	3706	3.5689054	3741	3.5729877	3776	3.5770321
3672	3.5649027	3707	3.5690226	3742	3.5731038	3777	3.5771470
3673	3.5650209	3708	3.5691397	3743	3.5732198	3778	3.5772620
3674	3.5651392	3709	3.5692568	3744	3.5733358	3779	3.5773769
3675	3.5652573	3710	3.5693739	3745	3.5734518	3780	3.5774917

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
3501	3.5441921	3536	3.5485123	3571	3.5527898	3606	3.5570257
3502	3.5443161	3537	3.5486351	3572	3.5529114	3607	3.5571461
3503	3.5444401	3538	3.5487578	3573	3.5530330	3608	3.5572665
3504	3.5445641	3539	3.5488806	3574	3.5531545	3609	3.5573869
3505	3.5446880	3540	3.5490033	3575	3.5532760	3610	3.5575072
3506	3.5448119	3541	3.5491259	3576	3.5533975	3611	3.5576275
3507	3.5449358	3542	3.5492486	3577	3.5535189	3612	3.5577477
3508	3.5450596	3543	3.5493712	3578	3.5536403	3613	3.5578680
3509	3.5451834	3544	3.5494937	3579	3.5537617	3614	3.5579881
3510	3.5453071	3545	3.5496162	3580	3.5538830	3615	3.5581083
3511	3.5454308	3546	3.5497387	3581	3.5540043	3616	3.5582284
3512	3.5455545	3547	3.5498612	3582	3.5541256	3617	3.5583485
3513	3.5456781	3548	3.5499836	3583	3.5542468	3618	3.5584686
3514	3.5458017	3549	3.5501060	3584	3.5543680	3619	3.5585886
3515	3.5459253	3550	3.5502283	3585	3.5544892	3620	3.5587086
3516	3.5460489	3551	3.5503507	3586	3.5546103	3621	3.5588285
3517	3.5461724	3552	3.5504730	3587	3.5547314	3622	3.5589484
3518	3.5462958	3553	3.5505952	3588	3.5548524	3623	3.5590683
3519	3.5464193	3554	3.5507174	3589	3.5549735	3624	3.5591882
3520	3.5465427	3555	3.5508396	3590	3.5550944	3625	3.5593080
3521	3.5466660	3556	3.5509618	3591	3.5552154	3626	3.5594278
3522	3.5467894	3557	3.5510839	3592	3.5553363	3627	3.5595476
3523	3.5469126	3558	5.5512059	3593	3.5554572	3628	3.5596673
3524	3.5470359	3559	3.5513280	3594	3.5555781	3629	3.5597870
3525	3.5471591	3560	3.5514500	3595	3.5556989	3630	3.5599066
3526	3.5472823	3561	3.5515720	3596	3.5558197	3631	3.5600262
3527	3.5474055	3562	3.5516939	3597	3.5559404	3632	3.5601458
3528	3.5475286	3563	3.5518158	3598	3.5560612	3633	3.5602654
3529	3.5476517	3564	3.5519377	3599	3.5561818	3634	3.5603849
3530	3.5477748	3565	3.5520595	3600	3.5563025	3635	3.5605044
3531	3.5478977	3566	3.5521813	3601	3.5564231	3636	3.5606339
3532	3.5480207	3567	3.5523031	3602	3.5565437	3637	3.5607433
3533	3.5481436	3568	3.5524248	3603	3.5566643	3638	3.5608627
3534	3.5482665	3569	3.5525465	3604	3.5567848	3639	3.5609820
3535	3.5483894	3570	3.5526682	3605	3.5569053	3640	3.5611014

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
3921	3.5933968	3956	3.5972563	3991	3.6010817	4026	3.6048738
3922	3.5935076	3957	3.5973660	3992	3.6011905	4027	3.6049816
3923	3.5936183	3958	3.5974758	3993	3.6012993	4028	3.6050895
3924	3.5937290	3959	3.5975855	3994	3.6014080	4029	3.6051973
3925	3.5938397	3960	3.5976952	3995	3.6015168	4030	3.6053050
3926	3.5939503	3961	3.5978048	3996	3.6016255	4031	3.6054128
3927	3.5940609	3962	3.5979145	3997	3.6017341	4032	3.6055205
3928	3.5941715	3963	3.5980241	3998	3.6018428	4033	3.6056282
3929	3.5942820	3964	3.5981336	3999	3.6019514	4034	3.6057359
3930	3.5943925	3965	3.5982423	4000	3.6020600	4035	3.6058435
3931	3.5945030	3966	3.5983527	4001	3.6021685	4036	3.6059512
3932	3.5946135	3967	3.5984622	4002	3.6022771	4037	3.6060587
3933	3.5947239	3968	3.5985717	4003	3.6023856	4038	3.6061663
3934	3.5948344	3969	3.5986811	4004	3.6024941	4039	3.6062738
3935	3.5949447	3970	3.5987905	4005	3.6026025	4040	3.6063814
3936	3.5950551	3971	3.5988999	4006	3.6027109	4041	3.6064888
3937	3.5951654	3972	3.5990092	4007	3.6028193	4042	3.6065963
3938	3.5952757	3973	3.5991186	4008	3.6029277	4043	3.6067037
3939	3.5953860	3974	3.5992279	4009	3.6030361	4044	3.6068111
3940	3.5954962	3975	3.5993371	4010	3.6031444	4045	3.6069185
3941	3.5956064	3976	3.5994464	4011	3.6032527	4046	3.6070259
3942	3.5957166	3977	3.5995556	4012	3.6033609	4047	3.6071332
3943	3.5958268	3978	3.5996648	4013	3.6034692	4048	3.6072405
3944	3.5959369	3979	3.5997739	4014	3.6035774	4049	3.6073478
3945	3.5960470	3980	3.5998831	4015	3.6036855	4050	3.6074550
3946	3.5961571	3981	3.5999922	4016	3.6037937	4051	3.6075622
3947	3.5962671	3982	3.6001013	4017	3.6039018	4052	3.6076694
3948	3.5963771	3983	3.6002103	4018	3.6040099	4053	3.6077766
3949	3.5964871	3984	3.6003193	4019	3.6041180	4054	3.6078837
3950	3.5965971	3985	3.6004283	4020	3.6042261	4055	3.6079909
3951	3.5967070	3986	3.6005373	4021	3.6043341	4056	3.6080979
3952	3.5068169	3987	3.6006462	4022	3.6044421	4057	3.6082050
3953	3.5969268	3988	3.6007551	4023	3.6045500	4058	3.6083120
3954	3.5970367	3989	3.6008640	4024	3.6046580	4059	3.6084190
3955	3.5971465	3990	3.6009729	4025	3.6047659	4060	3.6085260

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
3781	3.5776067	3816	3.5816084	3851	3.5855735	3886	3.5895028
3782	3.5777215	3817	3.5817222	3852	3.5856863	3887	3.5896145
3783	3.5778363	3818	3.5818359	3853	3.5857990	3888	3.5897262
3784	3.5779511	3819	3.5819497	3854	3.5859117	3889	3.5898379
3785	3.5780659	3820	3.5820634	3855	3.5860244	3890	3.5899496
3786	3.5781806	3821	3.5821770	3856	3.5861370	3891	3.5900612
3787	3.5782953	3822	3.5822907	3857	3.5362496	3892	3.5901728
3788	3.5784100	3823	3.5824043	3858	3.5863622	3893	3.5902844
3789	3.5785246	3824	3.5825179	3859	3.5864748	3894	3.5903959
3790	3.5786392	3825	3.5826314	3860	3.5865873	3895	3.5905075
3791	3.5787538	3826	3.5827450	3861	3.5866998	3896	3.5906189
3792	3.5788683	3827	3.5828585	3862	3.5868123	3897	3.5907304
3793	3.5789828	3828	3.5829719	3863	3.5869247	3898	3.5908418
3794	3.5790973	3829	3.5830854	3864	3.5870371	3899	3.5909532
3795	3.5792118	3830	3.5831988	3865	3.5871495	3900	3.5910646
3796	3.5793262	3831	3.5833122	3866	3.5872618	3901	3.5911759
3797	3.5794406	3832	3.5834255	3867	3.5873742	3902	3.5912873
3798	3.5795550	3833	3.5835388	3868	3.5874865	3903	3.5913985
3799	3.5796693	3834	3.5836521	3869	3.5875987	3904	3.5915098
3800	3.5797836	3835	3.5837654	3870	3.5877110	3905	3.5916210
3801	3.5798979	3836	3.5838786	3871	3.5878232	3906	3.5917322
3802	3.5800121	3837	3.5839918	3872	3.5879353	3907	3.5918434
3803	3.5801263	3838	3.5841050	3873	3.5880475	3908	3.5919546
3804	3.5802405	3839	3.5842181	3874	3.5881596	3909	3.5920657
3805	3.5803547	3840	3.5843312	3875	3.5882717	3910	3.5921768
3806	3.5804688	3841	3.5844443	3876	3.5883838	3911	3.5922878
3807	3.5805829	3842	3.5845574	3877	3.5884958	3912	3.5923988
3808	3.5806969	3843	3.5846704	3878	3.5886078	3913	3.5925098
3809	3.5808110	3844	3.5847834	3879	3.5887198	3914	3.5926208
3810	3.5809250	3845	3.5848963	3880	3.5888317	3915	3.5927318
3811	3.5810389	3846	3.5850093	3881	3.5889436	3916	3.5928427
3812	3.5811529	3847	3.5851222	3882	3.5890555	3917	3.5929536
3813	3.5812668	3848	3.5852351	3883	3.5891674	3918	3.5930644
3814	3.5813807	3849	3.5853479	3884	3.5892792	3919	3.5931753
3815	3.5814945	3850	3.5854607	3885	3.5893910	3920	3.5932861

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
4201	3.6233527	4236	3.6269559	4271	3.6305296	4306	3.6340740
4202	3.6234560	4237	3.6270585	4272	3.6306312	4307	3.6341749
4203	3.6235594	4238	3.6271610	4273	3.6307329	4308	3.6342757
4204	3.6236627	4239	3.6272634	4274	3.6308345	4309	3.6343765
4205	3.6237660	4240	3.6273659	4275	3.6309361	4310	3.6344773
4206	3.6238693	4241	3.6274683	4276	3.6310377	4311	3.6345780
4207	3.6239725	4242	3.6275706	4277	3.6311392	4312	3.6346788
4208	3.6240757	4243	3.6276730	4278	3.6312408	4313	3.6347795
4209	3.6241789	4244	3.6277754	4279	3.6313423	4314	3.6348801
4210	3.6242821	4245	3.6278777	4280	3.6314438	4315	3.6349808
4211	3.6243852	4246	3.6279800	4281	3.6315452	4316	3.6350814
4212	3.6244883	4247	3.6280823	4282	3.6316467	4317	3.6351820
4213	3.6245915	4248	3.6281845	4283	3.6317481	4318	3.6352826
4214	3.6246945	4249	3.6282867	4284	3.6318495	4319	3.6353832
4215	3.6247976	4250	3.6283889	4285	3.6319508	4320	3.6354837
4216	3.6249006	4251	3.6284911	4286	3.6320522	4321	3.6355843
4217	3.6250036	4252	3.6285933	4287	3.6321535	4322	3.6356848
4218	3.6251066	4253	3.6286954	4288	3.6322548	4323	3.6357852
4219	3.6252095	4254	3.6287975	4289	3.6323560	4324	3.6358857
4220	3.6253124	4255	3.6288996	4290	3.6324573	4325	3.6359861
4221	3.6254153	4256	3.6290016	4291	3.6325585	4326	3.6360865
4222	3.6255182	4257	3.6291036	4292	3.6326597	4327	3.6361869
4223	3.6256211	4258	3.6292057	4293	3.6327609	4328	3.6362872
4224	3.6257239	4259	3.6293076	4294	3.6328620	4329	3.6363876
4225	3.6258267	4260	3.6294096	4295	3.6329632	4330	3.6364879
4226	3.6259295	4261	3.6295115	4296	3.6330643	4331	3.6365882
4227	3.6260322	4262	3.6296134	4297	3.6331653	4332	3.6366884
4228	3.6261350	4263	3.6297153	4298	3.6332664	4333	3.6367887
4229	3.6262377	4264	3.6298172	4299	3.6333674	4334	3.6368889
4230	3.6263404	4265	3.6299190	4300	3.6334685	4335	3.6369891
4231	3.6264430	4266	3.6300208	4301	3.6335694	4336	3.6370893
4232	3.6265457	4267	3.6301226	4302	3.6336704	4337	3.6371894
4233	3.6266483	4268	3.6302244	4303	3.6337713	4338	3.6372895
4234	3.6267509	4269	3.6303262	4304	3.6338723	4339	3.6373896
4235	3.6268534	4270	3.6304279	4305	3.6339732	4340	3.6374897

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
4061	3.6086330	4096	3.6123599	4131	3.6160552	4166	3.6197193
4062	3.6087399	4097	3.6124660	4132	3.6161603	4167	3.6198235
4063	3.6088468	4098	3.6125720	4133	3.6162654	4168	3.6199277
4064	3.6089537	4099	3.6126779	4134	3.6163705	4169	3.6200319
4065	3.6090605	4100	3.6127839	4135	3.6164755	4170	3.6201360
4066	3.6091674	4101	3.6128898	4136	3.6165805	4171	3.6202402
4067	3.6092742	4102	3.6129957	4137	3.6166855	4172	3.6203443
4068	3.6093809	4103	3.6131015	4138	3.6167905	4173	3.6204484
4069	3.6094877	4104	3.6132073	4139	3.6168954	4174	3.6205524
4070	3.6095944	4105	3.6133132	4140	3.6170003	4175	3.6206565
4071	3.6097011	4106	3.6134189	4141	3.6171052	4176	3.6207605
4072	3.6098078	4107	3.6135247	4142	3.6172101	4177	3.6208645
4073	3.6099144	4108	3.6136304	4143	3.6173149	4178	3.6209684
4074	3.6100210	4109	3.6137361	4144	3.6174197	4179	3.6210724
4075	3.6101276	4110	3.6138418	4145	3.6175245	4180	3.6211763
4076	3.6102342	4111	3.6139475	4146	3.6176293	4181	3.6212802
4077	3.6103407	4112	3.6140531	4147	3.6177340	4182	3.6213840
4078	3.6104472	4113	3.6141587	4148	3.6178387	4183	3.6214879
4079	3.6105537	4114	3.6142642	4149	3.6179434	4148	3.6215917
4080	3.6106602	4115	3.6143698	4150	3.6180481	4185	3.6216955
4081	3.6107666	4116	3.6144754	4151	3.6181527	4186	3.6217992
4082	3.6108730	4117	3.6145809	4152	3.6182573	4187	3.6219030
4083	3.6109794	4118	3.6146863	4153	3.6183619	4188	3.6220067
4084	3.6110857	4119	3.6147918	4154	3.6184665	4189	3.6221104
4085	3.6111921	4120	3.6148972	4155	3.6185710	4190	3.6222140
4086	3.6112984	4121	3.6150026	4156	3.6186755	4191	3.6223177
4087	3.6114046	4122	3.6151080	4157	3.6187800	4192	3.6224213
4088	3.6115109	4123	3.6152133	4158	3.6188845	4193	3.6225249
4089	3.6116171	4124	3.6153187	4159	3.6189889	4194	3.6226284
4090	3.6117233	4125	3.6154240	4160	3.6190933	4195	3.6227320
4091	3.6118295	4126	3.6155292	4161	3.6191977	4196	3.6228355
4092	3.6119356	4127	3.6156345	4162	3.6193021	4197	3.6229390
4093	3.6120417	4128	3.6157397	4163	3.6194064	4198	3.6230424
4094	3.6121478	4129	3.6158449	4164	3.6195107	4199	3.6231459
4095	3.6122535	4130	3.6159501	4165	3.6196150	4200	3.6232493

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
4481	3.6513750	4516	3.6547539	4551	3.6581068	4586	3.6614340
4482	3.6514719	4517	3.6548501	4552	3.6582023	4587	3.6615287
4483	3.6515687	4518	3.6549462	4553	3.6582976	4588	3.6616234
4484	3.6516656	4519	3.6550423	4554	3.6583930	4589	3.6617181
4485	3.6517624	4520	3.6551384	4555	3.6584884	4590	3.6618127
4486	3.6518593	4521	3.6552345	4556	3.6585837	4591	3.6619073
4487	3.6519561	4522	3.6553305	4557	3.6586790	4592	3.6620019
4488	3.6520528	4523	3.6554266	4558	3.6587743	4593	3.6620964
4489	3.6521495	4524	3.6555226	4559	3.6588696	4594	3.6621910
4490	3.6522463	4525	3.6556186	4560	3.6589648	4595	3.6622855
4491	3.6523430	4526	3.6557145	4561	3.6590601	4596	3.6623800
4492	3.6524397	4527	3.6558105	4562	3.6591553	4597	3.6624745
4493	3.6525364	4528	3.6559064	4563	3.6592505	4598	3.6625690
4494	3.6526331	4529	3.6560023	4564	3.6593456	4599	3.6626634
4495	3.6527297	4530	3.6560982	4565	3.6594408	4600	3.6627578
4496	3.6528263	4531	3.6561941	4566	3.6595359	4601	3.6628523
4497	3.6529229	4532	3.6562899	4567	3.6596310	4602	3.6629466
4498	3.6530195	4533	3.6563857	4568	3.6597261	4603	3.6630410
4499	3.6531160	4534	3.6564815	4569	3.6598212	4604	3.6631353
4500	3.6532125	4535	3.6565773	4570	3.6599162	4605	3.6632296
4501	3.6533090	4536	3.6566730	4571	3.6600112	4606	3.6633239
4502	3.6534055	4537	3.6567688	4572	3.6601062	4607	3.6634182
4503	3.6535019	4538	3.6568645	4573	3.6602012	4608	3.6635125
4504	3.6535984	4539	3.6569690	4574	3.6602962	4609	3.6636067
4505	3.6536948	4540	3.6570558	4575	3.6603911	4610	3.6637009
4506	3.6537912	4541	3.6571515	4576	3.6604860	4611	3.6637951
4507	3.6538876	4542	3.6572471	4577	3.6605809	4612	3.6638893
4508	3.6539839	4543	3.6573427	4578	3.6606758	4613	3.6639835
4509	3.6540802	4544	3.6574383	4579	3.6607706	4614	3.6640776
4510	3.6541765	4545	3.6575339	4580	3.6608655	4615	3.6641717
4511	3.6542728	4546	3.6576294	4581	3.6609603	4616	3.6642658
4512	3.6543691	4547	3.6577250	4582	3.6610551	4617	3.6643599
4513	3.6544653	4548	3.6578205	4583	3.6611499	4618	3.6644539
4514	3.6545616	4549	3.6579159	4584	3.6612445	4619	3.6645480
4515	3.6546578	4550	3.6580114	4585	3.6613393	4620	3.6646420

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
4341	3.6375898	4376	3.6410773	4411	3.6445371	4446	3.6479695
4342	3.6376898	4377	3.6411765	4412	3.6446355	4447	3.6480671
4343	3.6377898	4378	3.6412758	4413	3.6447339	4448	3.6481648
4344	3.6378898	4379	3.6413749	4414	3.6448323	4449	3.6482624
4345	3.6379898	4380	3.6414741	4415	3.6449307	4450	3.6483600
4346	3.6380897	4381	3.6415733	4416	3.6450291	4451	3.6484576
4347	3.6381896	4382	3.6416724	4417	3.6451274	4452	3.6485552
4348	3.6382895	4383	3.6417715	4418	3.6452257	4453	3.6486527
4349	3.6383894	4384	3.6418705	4419	3.6453240	4454	3.6487502
4350	3.6384893	4385	3.6419695	4420	3.6454223	4455	3.6488477
4351	3.6385891	4386	3.6420685	4421	3.6455205	4456	3.6489452
4352	3.6386889	4387	3.6421675	4422	3.6456187	4457	3.6490426
4353	3.6387887	4388	3.6422666	4423	3.6457169	4458	3.6491401
4354	3.6388884	4389	3.6423656	4424	3.6458151	4459	3.6492375
4355	3.6389882	4390	3.6424645	4425	3.6459133	4460	3.6493349
4356	3.6390879	4391	3.6425634	4426	3.6460114	4461	3.6494322
4357	3.6391878	4392	3.6426623	4427	3.6461095	4462	3.6495296
4358	3.6392872	4393	3.6427612	4428	3.6462076	4463	3.6496269
4359	3.6393869	4394	3.6428601	4429	3.6463057	4464	3.6497242
4360	3.6394865	4395	3.6429589	4430	3.6464037	4465	3.6498215
4361	3.6395861	4396	3.6430576	4431	3.6465017	4466	3.6499187
4362	3.6396857	4397	3.6431565	4432	3.6465997	4467	3.6500160
4363	3.6397852	4398	3.6432552	4433	3.6466977	4468	3.6501132
4364	3.6398847	4399	3.6433540	4434	3.6467957	4469	3.6502104
4365	3.6399842	4400	3.6434527	4435	3.6468936	4470	3.6503075
4366	3.6400837	4401	3.6435514	4436	3.6469915	4471	3.6504047
4367	3.6401832	4402	3.6436500	4437	3.6470894	4472	3.6505018
4368	3.6402826	4403	3.6437487	4438	3.6471873	4473	3.6505989
4369	3.6403820	4404	3.6438473	4439	3.6472851	4474	3.6506960
4370	3.6404814	4405	3.6439459	4440	3.6473830	4475	3.6507930
4371	3.6405808	4406	3.6440445	4441	3.6474808	4476	3.6508901
4372	3.6406802	4407	3.6441430	4442	3.6475785	4477	3.6509871
4373	3.6407795	4408	3.6442416	4443	3.6476763	4478	3.6510841
4374	3.6408788	4409	3.6443401	4444	3.6477740	4479	3.6511811
4375	3.6409781	4410	3.6444386	4445	3.6478718	4480	3.6512780

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
4761	3.6776982	4796	3.6808792	4831	3.6840370	4866	3.6871721
4762	3.6777894	4797	3.6809697	4832	3.6841269	4867	3.6872613
4763	3.6778806	4798	3.6810502	4833	3.6842168	4868	3.6873506
4764	3.6779718	4799	3.6811507	4834	3.6843056	4869	3.6874398
4765	3.6780620	4800	3.6812412	4835	3.6843965	4870	3.6875290
4766	3.6781540	4801	3.6813317	4836	3.6844863	4871	3.6876181
4767	3.6782452	4802	3.6814222	4837	3.6845761	4872	3.6877073
4768	3.6783362	4803	3.6815126	4838	3.6846659	4873	3.6877964
4769	3.6784273	4804	3.6816030	4839	3.6847556	4874	3.6878855
4770	3.6785184	4805	3.6816934	4840	3.6848454	4875	3.6879746
4771	3.6786094	4806	3.6817838	4841	3.6849351	4876	3.6880637
4772	3.6787004	4807	3.6818742	4842	3.6850248	4877	3.6881528
4773	3.6787914	4808	3.6819645	4843	3.6851145	4878	3.6882418
4774	3.6788824	4809	3.6820548	4844	3.6852041	4879	3.6883308
4775	3.6789734	4810	3.6821451	4845	3.6852938	4880	3.6884198
4776	3.6790643	4811	3.6822354	4846	3.6853834	4881	3.6885088
4777	3.6791552	4812	3.6823256	4847	3.6854730	4882	3.6885978
4778	3.6792461	4813	3.6824159	4848	3.6855626	4883	3.6886867
4779	3.6793370	4814	3.6825061	4849	3.6856522	4884	3.6887756
4780	3.6794279	4815	3.6825963	4850	3.6857417	4885	3.6888646
4781	3.6795187	4816	3.6826865	4851	3.6858313	4886	3.6889535
4782	3.6796096	4817	3.6827766	4852	3.6859208	4887	3.6890423
4783	3.6797004	4818	3.6828668	4853	3.6860103	4888	3.6891312
4784	3.6797912	4819	3.6829569	4854	3.6860998	4889	3.6892200
4785	3.6798819	4820	3.6830470	4855	3.6861892	4890	3.6893089
4786	3.6799727	4821	3.6831371	4856	3.6862787	4891	3.6893977
4787	3.6800634	4822	3.6832272	4857	3.6863681	4892	3.6894864
4788	3.6801541	4823	3.6833173	4858	3.6864575	4893	3.6895752
4789	3.6802448	4824	3.6834073	4859	3.6865469	4894	3.6896640
4790	3.6803355	4825	3.6834973	4860	3.6866363	4895	3.6897527
4791	3.6804262	4826	3.6835873	4861	3.6867256	4896	3.6898414
4792	3.6805168	4827	3.6836773	4862	3.6868149	4897	3.6899301
4793	3.6806074	4828	3.6837673	4863	3.6869043	4898	3.6900188
4794	3.6806980	4829	3.6838572	4864	3.6869936	4899	3.6901074
4795	3.6807886	4830	3.6839471	4865	3.6870028	4900	3.6901961

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
4621	3.6647360	4656	3.6680130	4691	3.6712654	4726	3.6744937
4622	3.6648299	4657	3.6681052	4692	3.6713580	4727	3.6745856
4623	3.6649239	4658	3.6681995	4693	3.6714505	4728	3.6746775
4624	3.6650175	4659	3.6682927	4694	3.6715431	4729	3.6747693
4625	3.6651117	4660	3.6683859	4695	3.6716356	4730	3.6748611
4626	3.6652056	4661	3.6684791	4696	3.6717281	4731	3.6749529
4627	3.6652995	4662	3.6685723	4697	3.6718205	4732	3.6750447
4628	3.6653933	4663	3.6686654	4698	3.6719130	4733	3.6751365
4629	3.6654873	4664	3.6687585	4699	3.6720054	4734	3.6752283
4630	3.6655810	4665	3.6688516	4700	3.6720979	4735	3.6753200
4631	3.6656748	4666	3.6689447	4701	3.6721903	4736	3.6754117
4632	3.6657685	4667	3.6690378	4702	3.6722826	4737	3.6755034
4633	3.6658623	4668	3.6691308	4703	3.6723750	4738	3.6755951
4634	3.6659560	4669	3.6692239	4704	3.6724673	4739	3.6756867
4635	3.6660497	4670	3.6693169	4705	3.6725596	4740	3.6757783
4636	3.6661434	4671	3.6694099	4706	3.6726519	4741	3.6758700
4637	3.6662371	4672	3.6695028	4707	3.6727442	4742	3.6759615
4638	3.6663307	4673	3.6695958	4708	3.6728365	4743	3.6760531
4639	3.6664244	4674	3.6696887	4709	3.6729287	4744	3.6761447
4640	3.6665180	4675	3.6697816	4710	3.6730209	4745	3.6762362
4641	3.6666116	4676	3.6698745	4711	3.6731131	4746	3.6763277
4642	3.6667051	4677	3.6699674	4712	3.6732053	4747	3.6764192
4643	3.6667987	4678	3.6700602	4713	3.6732974	4748	3.6765106
4644	3.6668922	4679	3.6701530	4714	3.6733896	4749	3.6766022
4645	3.6669857	4680	3.6702459	4715	3.6734817	4750	3.6766936
4646	3.6670792	4681	3.6703386	4716	3.6735738	4751	3.6767850
4647	3.6671727	4682	3.6704314	4717	3.6736659	4752	3.6768764
4648	3.6672661	4683	3.6705242	4718	3.6737579	4753	3.6769678
4649	3.6673595	4684	3.6706169	4719	3.6738500	4754	3.6770592
4650	3.6674530	4685	3.6707096	4720	3.6739420	4755	3.6771505
4651	3.6675463	4686	3.6708023	4721	3.6740340	4756	3.6772418
4652	3.6676397	4687	3.6708950	4722	3.6741260	4757	3.6773332
4653	3.6677331	4688	3.6709876	4723	3.6742179	4758	3.6774244
4654	3.6678264	4689	3.6710802	4724	3.6743099	4759	3.6775157
4655	3.6679197	4690	3.6711728	4725	3.6744018	4760	3.6776069

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
5041	3.7025167	5076	3.7055216	5111	3.7085059	5146	3.7114698
5042	3.7026028	5077	3.7056072	5112	3.7085908	5147	3.7115542
5043	3.7026890	5078	3.7056927	5113	3.7086758	5148	3.7116385
5044	3.7027751	5079	3.7057782	5114	3.7087607	5149	3.7117229
5045	3.7028612	5080	3.7058637	5115	3.7088456	5150	3.7118072
5046	3.7029472	5081	3.7059492	5116	3.7089305	5151	3.7118915
5047	3.7030333	5082	3.7060347	5117	3.7090154	5152	3.7119759
5048	3.7031193	5083	3.7061201	5118	3.7091003	5153	3.7120601
5049	3.7032054	5084	3.7062055	5119	3.7091851	5154	3.7121444
5050	3.7032914	5085	3.7062910	5120	3.7092700	5155	3.7128287
5051	3.7033774	5086	3.7063764	5121	3.7093548	5156	3.7123129
5052	3.7034633	5087	3.7064617	5122	3.7094396	5157	3.7123971
5053	3.7035493	5088	3.7065471	5123	3.7095244	5158	3.7124813
5054	3.7036352	5089	3.7066324	5124	3.7096091	5159	3.7125655
5055	3.7037212	5090	3.7067178	5125	3.7096939	5160	3.7126497
5056	3.7038071	5091	3.7068030	5126	3.7097786	5161	3.7127339
5057	3.7038929	5092	3.7068884	5127	3.7098633	5162	3.7128180
5058	3.7039788	5093	3.7069737	5128	3.7099480	5163	3.7129021
5059	3.7040647	5094	3.7070589	5129	3.7100327	5164	3.7129862
5060	3.7041505	5095	3.7071442	5130	3.7101174	5165	3.7130703
5061	3.7042363	5096	3.7072294	5131	3.7102020	5166	3.7131544
5062	3.7043221	5097	3.7073146	5132	3.7102866	5167	3.7132385
5063	3.7044079	5098	3.7073998	5133	3.7103713	5168	3.7133225
5064	3.7044937	5099	3.7074850	5134	3.7104559	5169	3.7134065
5065	3.7045794	5100	3.7075702	5135	3.7105404	5170	3.7134905
5066	3.7046652	5101	3.7076553	5136	3.7106250	5171	3.7135745
5067	3.7047509	5102	3.7077405	5137	3.7107096	5172	3.7136585
5068	3.7048366	5103	3.7078256	5138	3.7107941	5173	3.7137425
5069	3.7049223	5104	3.7079107	5139	3.7108786	5174	3.7138264
5070	3.7050080	5105	3.7079957	5140	3.7109631	5175	3.7139104
5071	3.7050936	5106	3.7080808	5141	3.7110476	5176	3.7139943
5072	3.7051792	5107	3.7081659	5142	3.7111321	5177	3.7140782
5073	3.7052649	5108	3.7082509	5143	3.7112165	5178	3.7141620
5074	3.7053505	5109	3.7083359	5144	3.7113010	5179	3.7142459
5075	3.7054360	5110	3.7084209	5145	3.7113854	5180	3.7143298

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
4901	3.6902847	4936	3.6933752	4971	3.6964438	5006	3.6994908
4902	3.6903733	4937	3.6934631	4972	3.6965311	5007	3.6995776
4903	3.6904619	4938	3.6935511	4973	3.6966185	5008	3.6996643
4904	3.6905505	4939	3.6936390	4974	3.6967058	5009	3.6997510
4905	3.6906390	4940	3.6937269	4975	3.6967931	5010	3.6998377
4906	3.6907275	4941	3.6938148	4976	3.6968804	5011	3.6999244
4907	3.6908161	4942	3.6939027	4977	3.6969576	5012	3.7000111
4908	3.6909046	4943	3.6939906	4978	3.6970549	5013	3.7000977
4909	3.6909930	4944	3.6940785	4979	3.6971421	5014	3.7001843
4910	3.6910815	4945	3.6941663	4980	3.6972293	5015	3.7002709
4911	3.6911699	4946	3.6942541	4981	3.6973165	5016	3.7003575
4912	3.6912584	4947	3.6943419	4982	3.6974037	5017	3.7004441
4913	3.6913467	4948	3.6944297	4983	3.6974909	5018	3.7005307
4914	3.6914352	4949	3.6945174	4984	3.6975780	5019	3.7006172
4915	3.6915235	4950	3.6946052	4985	3.6976652	5020	3.7007037
4916	3.6916119	4951	3.6946929	4986	3.6977523	5021	3.7007902
4917	3.6917002	4952	3.6947806	4987	3.6978394	5022	3.7008767
4918	3.6917885	4953	3.6948683	4988	3.6979264	5023	3.7009632
4919	2.6918768	4954	3.6949560	4989	3.6980135	5024	3.7010496
4920	3.6919651	4955	3.6950437	4990	3.6981005	5025	3.7011361
4921	3.6920534	4956	3.6951313	4991	3.6981876	5026	3.7012225
4922	3.6921416	4957	3.6952189	4992	3.6982746	5027	3.7013089
4923	3.6922298	4958	3.6953065	4993	3.6983616	5028	3.7013952
4924	3.6923180	4959	3.6953941	4994	3.6984485	5029	3.7014816
4925	3.6924062	4960	3.6954817	4995	3.6985355	5030	3.7015680
4926	3.6924944	4961	3.6955692	4996	3.6986224	5031	3.7016543
4927	3.6925825	4962	3.6956568	4997	3.6987093	5032	3.7017406
4928	5.6926707	4963	3.6957443	4998	3.6987963	5033	3.7018269
4929	3.6927588	4964	3.6958318	4999	3.6988831	5034	3.7019132
4930	3.6928469	9965	3.6959193	5000	3.6989700	5035	3.7019995
4931	3.6929350	4966	3.6960067	5001	3.6990569	5036	3.7020857
4932	3.6930231	4967	3.6960942	5002	3.6991437	5037	3.7021719
4933	3.6931111	4968	3.6961816	5003	3.6992305	5038	3.7022582
4934	3.6931991	4969	3.6962690	5004	3.6993173	5039	3.7023444
4935	3.6932872	4970	3.6963564	5005	3.6994041	5040	3.7024305

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
5321	3.7259933	5356	3.7288406	5391	3.7316693	5426	3.7344798
5322	3.7260749	5357	3.7289216	5392	3.7317499	5427	3.7345598
5323	3.7261565	5358	3.7290027	5393	3.7318304	5428	3.7346398
5324	3.7262380	5359	3.7290838	5394	3.7319109	5429	3.7347198
5325	3.7263196	5360	3.7291648	5395	3.7319914	5430	3.7347998
5326	3.7264012	5361	3.7292458	5396	3.7320719	5431	3.7348798
5327	3.7264827	5362	3.7293268	5397	3.7321524	5432	3.7349598
5328	3.7265642	5363	3.7294078	5398	3.7322329	5433	3.7350397
5329	3.7266457	5364	3.7294888	5399	3.7323133	5434	3.7351196
5330	3.7267272	5365	3.7295697	5400	3.7323938	5435	3.7351995
5331	3.7268087	5366	3.7296507	5401	3.7324742	5436	3.7352794
5332	3.7268901	5367	3.7297316	5402	3.7325546	5437	3.7353593
5333	3.7269716	5368	3.7298125	5403	3.7326350	5438	3.7354392
5334	3.7270531	5369	3.7298934	5404	3.7327153	5439	3.7355191
5335	3.7271344	5370	3.7299743	5405	3.7327957	5440	3.7355989
5336	3.7272158	5371	3.7300551	5406	3.7328760	5441	3.7356787
5337	3.7272972	5372	3.7301360	5407	3.7329564	5442	3.7357585
5338	3.7273786	5373	3.7302168	5408	3.7330367	5443	3.7358383
5339	3.7274599	5374	3.7302977	5409	3.7331170	5444	3.7359181
5340	3.7275413	5375	3.7303785	5410	3.7331973	5445	3.7359979
5341	3.7276226	5376	3.7304593	5411	3.7332775	5446	3.7360776
5342	3.7277039	5377	3.7305400	5412	3.7333578	5447	3.7361574
5343	3.7277852	5378	3.7306208	5413	3.7334380	5448	3.7362371
5344	3.7278664	5379	3.7307015	5414	3.7335182	5449	3.7363168
5345	3.7279477	5380	3.7307823	5415	3.7335985	5450	3.7363965
5346	3.7280290	5381	3.7308630	5416	3.7336787	5451	3.7364762
5347	3.7281101	5382	3.7309437	5417	3.7337588	5452	3.7365558
5348	3.7281914	5383	3.7310244	5418	3.7338390	5453	3.7366355
5349	3.7282726	5384	3.7311051	5419	3.7339191	5454	3.7367151
5350	3.7283538	5385	3.7311857	5420	3.7339993	5455	3.7367948
5351	3.7284349	5386	3.7312663	5421	3.7340794	5456	3.7368744
5352	3.7285161	5387	3.7313470	5422	3.7341595	5457	3.7369540
5353	3.7285972	5388	3.7314276	5423	3.7342396	5458	3.7370335
5354	3.7286784	5389	3.7315082	5424	3.7343197	5459	3.7371131
5355	3.7287595	5390	3.7315888	5425	3.7343997	5460	3.7371926

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm*
5181	3.7144136	5216	3.7173376	5251	3.7202420	5286	3.7231272
5182	3.7144974	5217	3.7174208	5252	3.7203247	5287	3.7232093
5183	3.7145812	5218	3.7175041	5253	3.7204074	5288	3.7232914
5184	3.7146650	5219	3.7175873	5254	3.7204901	5289	3.7233736
5185	3.7147488	5220	3.7176705	5255	3.7205727	5290	3.7234557
5186	3.7148325	5221	3.7177537	5256	3.7206554	5291	3.7235378
5187	3.7149162	5222	3.7178369	5257	3.7207380	5292	3.7236198
5188	3.7150000	5223	3.7179200	5258	3.7208206	5293	3.7237019
5189	3.7150837	5224	3.7180032	5259	3.7209032	5294	3.7237839
5190	3.7151674	5225	3.7180863	5262	3.7209857	5295	3.7238660
5191	3.7152510	5226	3.7181694	5261	3.7210683	5296	3.7239480
5192	3.7153347	5227	3.7182525	5262	3.7211508	5297	3.7240300
5193	3.7154183	5228	3.7183356	5263	3.7212334	5298	3.7241120
5194	3.7155019	5229	3.7184186	5264	3.7213159	5299	3.7241939
5195	3.7155856	5230	3.7185017	5265	3.7213984	5300	3.7242759
5196	3.7156691	5231	3.7185847	5266	3.7214809	5301	3.7243578
5197	3.7157527	5232	3.7186677	5267	3.7215633	5302	3.7244397
5198	3.7158363	5233	3.7187507	5268	3.7216458	5303	3.7245216
5199	3.7159198	5234	3.7188337	5269	3.7217282	5304	3.7246035
5200	3.7160033	5235	3.7189167	5270	3.7218106	5305	3.7246854
5201	3.7160869	5236	3.7189996	5271	3.7218930	5306	3.7247672
5202	3.7161703	5237	3.7190826	5272	3.7219754	5307	3.7248491
5203	3.7162538	5238	3.7191655	5273	3.7220578	5308	3.7249309
5204	3.7163373	5239	3.7192484	5274	3.7221401	5309	3.7250127
5205	3.7164207	5240	3.7193313	5275	3.7222225	5310	3.7250945
5206	3.7165042	5241	3.7194142	5276	3.7223048	5311	3.7251763
5207	3.7165876	5242	3.7194970	5277	3.7223871	5312	3.7252581
5208	3.7166710	5243	3.7195799	5278	3.7224694	5313	3.7253398
5209	3.7167544	5244	3.7196627	5279	3.7225517	5314	3.7254215
5210	3.7168377	5245	3.7197455	5280	3.7226339	5315	3.7255033
5211	3.7169211	5246	3.7198283	5281	3.7227162	5316	3.7255850
5212	3.7170044	5247	3.7199111	5282	3.7227984	5317	3.7256667
5213	3.7170877	5248	3.7199938	5283	3.7228806	5318	3.7257483
5214	3.7171710	5249	3.7200766	5284	3.7229628	5319	3.7258300
5215	3.7172543	5250	3.7201593	5285	3.7230450	5320	3.7259116

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
5601	3.7482656	5636	3.7509709	5671	3.7536596	5706	3.7563318
5602	3.7483431	5637	3.7510480	5672	3.7537362	5707	3.7564079
5603	3.7484206	5638	3.7511251	5673	3.7538128	5708	3.7564840
5604	3.7484981	5639	3.7512021	5674	3.7538893	5709	3.7565600
5605	3.7485756	5640	3.7512791	5675	3.7539659	5710	3.7566361
5606	3.7486531	5641	3.7513561	5676	3.7540424	5711	3.7567122
5607	3.7487306	5642	3.7514331	5677	3.7541189	5712	3.7567882
5608	3.7488080	5643	3.7515100	5678	3.7541954	5713	3.7568642
5609	3.7488854	5644	3.7515870	5679	3.7542719	5714	3.7569402
5610	3.7489629	5645	3.7516639	5680	3.7543483	5715	3.7570162
5611	3.7490403	5646	3.7517409	5681	3.7544248	5716	3.7570922
5612	3.7491177	5647	3.7518178	5682	3.7545012	5717	3.7571682
5613	3.7491950	5648	3.7518947	5683	3.7545777	5718	3.7572441
5614	3.7492724	5649	3.7519716	5684	3.7546541	5719	3.7573201
5615	3.7493498	5650	3.7520484	5685	3.7547305	5720	3.7573960
5616	3.7494271	5651	3.7521253	5686	3.7548069	5721	3.7574719
5617	3.7495044	5652	3.7522022	5687	3.7548832	5722	3.7575479
5618	3.7495817	5653	3.7522790	5688	3.7549596	5723	3.7576237
5619	3.7496590	5654	3.7523558	5689	3.7550359	5724	3.7576996
5620	3.7497363	5655	3.7524326	5690	3.7551123	5725	3.7577755
5621	3.7498136	5656	3.7525094	5691	3.7551886	5726	3.7578513
5622	3.7498908	5657	3.7525862	5692	3.7552649	5727	3.7579272
5623	3.7499681	5658	3.7526629	5693	3.7553412	5728	3.7580030
5624	3.7500453	5659	3.7527397	5694	3.7554175	5729	3.7580788
5625	3.7501225	5660	3.7528164	5695	3.7554937	5730	3.7581546
5626	3.7501997	5661	3.7528932	5696	3.7555700	5731	3.7582304
5627	3.7502769	5662	3.7529699	5697	3.7556462	5732	3.7583062
5628	3.7503541	5663	3.7530466	5698	3.7557224	5733	3.7583819
5629	3.7504312	5664	3.7531232	5699	3.7557987	5734	3.7584577
5630	3.7505084	5665	3.7531999	5700	3.7558749	5735	3.7585334
5631	3.7505855	5666	3.7532766	5701	3.7559510	5736	3.7586091
5632	3.7506626	5667	3.7533532	5702	3.7560273	5737	3.7586848
5633	3.7507398	5668	3.7534298	5703	3.7561034	5738	3.7587605
5634	3.7508168	5669	3.7535065	5704	3.7561795	5739	3.7588362
5635	3.7508939	5670	3.7535831	5705	3.7562556	5740	3.7589119

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
5461	3.7372722	5496	3.7400467	5531	3.7428037	5566	3.7455432
5462	3.7373517	5497	3.7401257	5532	3.7428822	5567	3.7456212
5463	3.7374312	5498	3.7402047	5533	3.7429607	5568	3.7456992
5464	3.7375107	5499	3.7402837	5534	3.7430392	5569	3.7457772
5465	3.7375902	5500	3.7403627	5535	3.7431176	5570	3.7458552
5466	3.7376696	5501	3.7404416	5536	3.7431961	5571	3.7459332
5467	3.7377491	5502	3.7405205	5537	3.7432745	5572	3.7460111
5468	3.7378285	5503	3.7405995	5538	3.7433530	5573	3.7460890
5469	3.7379079	5504	3.7406784	5539	3.7434314	5574	3.7461670
5470	3.7379873	5505	3.7407573	5540	3.7435098	5575	3.7462449
5471	3.7380667	5506	3.7408362	5541	3.7435881	5576	3.7463228
5472	3.7381461	5507	3.7409151	5542	3.7436665	5577	3.7464006
5473	3.7382254	5508	3.7409939	5543	3.7437449	5578	3.7464785
5474	3.7383048	5509	3.7410728	5544	3.7438232	5579	3.7465564
5475	3.7383841	5510	3.7411516	5545	3.7439015	5580	3.7466342
5476	3.7384634	5511	3.7412304	5546	3.7439799	5581	3.7467120
5477	3.7385427	5512	3.7413092	5547	3.7440582	5582	3.7467898
5478	3.7386220	5513	3.7413880	5548	3.7441365	5583	3.7468676
5479	3.7387013	5514	3.7414668	5549	3.7442147	5584	3.7469454
5480	3.7387806	5515	3.7415455	5550	3.7442930	5585	3.7470232
5481	3.7388598	5516	3.7416243	5551	3.7443712	5586	3.7471009
5482	3.7389390	5517	3.7417030	5552	3.7444495	5587	3.7471787
5483	3.7390182	5518	3.7417817	5553	3.7445277	5588	3.7472564
5484	3.7390974	5519	3.7418604	5554	3.7446059	5589	3.7473341
5485	3.7391766	5520	3.7419391	5555	3.7446841	5590	3.7474118
5486	3.7392558	5521	3.7420177	5556	3.7447622	5591	3.7474895
5487	3.7393350	5522	3.7420964	5557	3.7448404	5592	3.7475672
5488	3.7394141	5523	3.7421750	5558	3.7449185	5593	3.7476448
5489	3.7394932	5524	3.7422537	5559	3.7449967	5594	3.7477225
5490	3.7395723	5525	3.7423323	5560	3.7450748	5595	3.7478001
5491	3.7396514	5526	3.7424109	5561	3.7451529	5596	3.7478778
5492	3.7397305	5527	3.7424895	5562	3.7452310	5597	3.7479553
5493	3.7398096	5528	3.7425680	5563	3.7453091	5598	3.7480329
5494	3.7398886	5529	3.7426466	5564	3.7453871	5599	3.7481105
5495	3.7399677	5530	3.7427251	5565	3.7454652	5600	3.7481880

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
5881	3.7694512	5916	3.7720282	5951	3.7745899	5986	3.7771367
5882	3.7695250	5917	3.7721016	5952	3.7746629	5987	3.7772093
5883	3.7695988	5918	3.7721750	5953	3.7747359	5988	3.7772818
5884	3.7696727	5919	3.7722483	5954	3.7748088	5989	3.7773543
5885	3.7697465	5920	3.7723217	5955	3.7748818	5990	3.7774268
5886	3.7698203	5921	3.7723951	5956	3.7749547	5991	3.7774993
5887	3.7698940	5922	3.7724684	5957	3.7750276	5992	3.7775718
5888	3.7699678	5923	3.7725417	5958	3.7751005	5993	3.7776443
5889	3.7700416	5924	3.7726150	5959	3.7751734	5994	3.7777167
5890	3.7701153	5925	3.7726884	5960	3.7752463	5995	3.7777892
5891	3.7701890	5926	3.7727616	5961	3.7753191	5996	3.7778616
5892	3.7702627	5927	3.7728349	5962	3.7753920	5997	3.7779340
5893	3.7703364	5928	3.7729082	5963	3.7754648	5998	3.7780065
5894	3.7704101	5929	3.7729814	5964	3.7755376	5999	3.7780789
5895	3.7704838	5930	3.7730547	5965	3.7756104	6000	3.7781513
5896	3.7705575	5931	3.7731279	5966	3.7756832	6001	3.7782236
5897	3.7706311	5932	3.7732011	5967	3.7757560	6002	3.7782960
5898	3.7707048	5933	3.7732743	5968	3.7758288	6003	3.7783683
5899	3.7707784	5934	3.7733475	5969	3.7759016	6004	3.7784407
5900	3.7708520	5935	3.7734207	5970	3.7759743	6005	3.7785130
5901	3.7709256	5936	3.7734939	5971	3.7760471	6006	3.7785853
5902	3.7709992	5937	3.7735670	5972	3.7761198	6007	3.7786576
5903	3.7710728	5938	3.7736402	5973	3.7761925	6008	3.7787299
5904	3.7711463	5939	3.7737133	5974	3.7762652	6009	3.7788022
5905	3.7712199	5940	3.7737864	5975	3.7763379	6010	3.7788745
5906	3.7712934	5941	3.7738596	5976	3.7764106	6011	3.7789467
5907	3.7713670	5942	3.7739326	5977	3.7764833	6012	3.7790190
5908	3.7714405	5943	3.7740057	5978	3.7765559	6013	3.7790912
5909	3.7715140	5944	3.7740788	5979	3.7766286	6014	3.7791634
5910	3.7715875	5945	3.7741519	5980	3.7767012	6015	3.7792356
5911	3.7716610	5946	3.7742249	5981	3.7767738	6016	3.7793078
5912	3.7717344	5947	3.7742979	5982	3.7768464	6017	3.7793800
5913	3.7718079	5948	3.7743710	5983	3.7769190	6018	3.7794522
5914	3.7718813	5949	3.7744440	5984	3.7769916	6019	3.7795243
5915	3.7719547	5950	3.7745170	5985	3.7770642	6020	3.7795963

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
5741	3.7589875	5776	3.7616272	5811	3.7642509	5846	3.7668588
5742	3.7590632	5777	3.7517024	5812	3.7643256	5847	3.7669331
5743	3.7591388	5778	3.7517775	5813	3.7644003	5848	3.7670074
5744	3.7592144	5779	3.7518527	5814	3.7644750	5849	3.7670815
5745	3.7592900	5780	3.7619278	5815	3.7645497	5850	3.7671559
5746	3.7593650	5781	3.7620030	5816	3.7646244	5851	3.7672301
5747	3.7594412	5782	3.7620781	5817	3.7646991	5852	3.7673043
5748	3.7595168	5783	3.7621532	5818	3.7647737	5853	3.7673785
5749	3.7595923	5784	3.7622283	5819	3.7648484	5854	3.7674527
5750	3.7596678	5785	3.7623034	5820	3.7649230	5855	3.7675269
5751	3.7597434	5786	3.7623784	5821	3.7649976	5856	3.7676011
5752	3.7598189	5787	3.7624535	5822	3.7650722	5857	3.7676752
5753	3.7598944	5788	3.7525285	5823	3.7651468	5858	3.7677494
5754	3.7599699	5789	3.7526035	5824	3.7652214	5859	3.7678235
5755	3.7600453	5790	3.7626785	5825	3.7652959	5860	3.7678976
5756	3.7601208	5791	3.7627536	5826	3.7653705	5861	3.7679717
5757	3.7601962	5792	3.7628286	5827	3.7654450	5862	3.7680458
5758	3.7602717	5793	3.7629035	5828	3.7655195	5863	3.7681199
5759	3.7603471	5794	3.7629785	5829	3.7655941	5864	3.7681940
5760	3.7604225	5795	3.7630534	5830	3.7656686	5865	3.7682680
5761	3.7604979	5796	3.7631284	5831	3.7657430	5866	3.7683[illegible]21
5762	3.7605733	5797	3.7632033	5832	3.7658175	5867	3.7684161
5763	3.7606486	5798	3.7632782	5833	3.7658920	5868	3.7684901
5764	3.7607240	5799	3.7633531	5834	3.7659664	5869	3.7685641
5765	3.7607993	5800	3.7634280	5835	3.7660409	5870	3.7686381
5766	3.7608746	5801	3.7635029	5836	3.7661153	5871	3.7687121
5767	3.7609500	5802	3.7635777	5837	3.7661897	5872	3.7687860
5768	3.7610253	5803	3.7636526	5838	3.7662642	5873	3.7688600
5769	3.7611005	5804	3.7637274	5839	3.7663385	5874	3.7689339
5770	3.7611758	5805	3.7638022	5840	3.7664128	5875	3.7690079
5771	3.7612511	5806	3.7638770	5841	3.7664872	5876	3.7690818
5772	3.7613263	5807	3.7639518	5842	3.7665616	5877	3.7691557
5773	3.7614016	5808	3.7640266	5843	3.7666359	5878	3.7692296
5774	3.7614768	5809	3.7641014	5844	3.7667102	5879	3.7693035
5775	3.7615520	5810	3.7641761	5845	3.7667845	5880	3.7693773

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
6441	3.8089533	6476	3.8113068	6511	3.8136477	6546	3.8159760
6442	3.8090207	6477	3.8113739	6512	3.8137144	6547	3.8160423
6443	3.8090881	6478	3.8114409	6513	3.8137811	6548	3.8161087
6444	3.8091555	6479	3.8115080	6514	3.8138478	6549	3.8161750
6445	3.8092229	6480	3.8115750	6515	3.8139144	6550	3.8162413
6446	3.8092903	6481	3.8116420	6516	3.8139811	6551	3.8163076
6447	3.8093577	6482	3.8117090	6517	3.8140477	6552	3.8163739
6448	3.8094250	6483	3.8117760	6518	3.8141144	6553	3.8164402
6449	3.8094924	6484	3.8118430	6519	3.8141810	6554	3.8165064
6450	3.8095597	6485	3.8119100	6520	3.8142476	6555	3.8165726
6451	3.8096270	6486	3.8119769	6521	3.8143142	6556	3.8166389
6452	3.8096944	6487	3.8120439	6522	3.8143808	6557	3.8167052
6453	3.8097617	6488	3.8121108	6523	3.8144474	6558	3.8167714
6454	3.8098290	6489	3.8121778	6524	3.8145140	6559	3.8168376
6455	3.8098962	6490	3.8122447	6525	3.8145805	6560	3.8169038
6456	3.8099635	6491	3.8123116	6526	3.8146471	6561	3.8169700
6457	3.8100308	6492	3.8123785	6527	3.8147136	6562	3.8170362
6458	3.8100980	6493	3.8124454	6528	3.8147801	6563	3.8171024
6459	3.8101653	6494	3.8125123	6529	3.8148467	6564	3.8171686
6460	3.8102325	6495	3.8125792	6530	3.8149132	6565	3.8172347
6461	3.8102997	6496	3.8126460	6531	3.8149797	6566	3.8173009
6462	3.8103670	6497	3.8127129	6532	3.8150462	6567	3.8173670
6463	3.8104342	6498	3.8127797	6533	3.8151127	6568	3.8174331
6464	3.8105013	6499	3.8128465	6534	3.8151791	6569	3.8174993
6465	3.8105685	6500	3.8129134	6535	3.8152456	6570	3.8175654
6466	3.8106357	6501	3.8129802	6536	3.8153120	6571	3.8176315
6467	3.8107029	6502	3.8130470	6537	3.8153785	6572	3.8176976
6468	3.8107700	6503	3.8131138	6538	3.8154449	6573	3.8177636
6469	3.8108371	6504	3.8131805	6539	3.8155113	6574	3.8178297
6470	3.8009043	6505	3.8132473	6540	3.8155777	6575	3.8178958
6471	3.8109714	6506	3.8133141	6541	3.8156441	6576	3.8179618
6472	3.8110385	6507	3.8133808	6542	3.8157105	6577	3.8180278
6473	3.8111056	6508	3.8134475	6543	3.8157769	6578	3.8180939
6474	3.8111727	6509	3.8135143	6544	3.8158433	6579	3.8181599
6475	3.8112398	6510	3.8135810	6545	3.8159096	6580	3.8182259

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
6301	3.7994095	6336	3.8018152	6371	3.8042076	6405	3.8065869
6302	3.7994784	6337	3.8018837	6372	3.8042758	6407	3.8066547
6303	3.7995473	6338	3.8019522	6373	3.8043439	6408	3.8067225
6304	3.7996162	6339	3.0020208	6374	3.8044121	6409	3.8067903
6305	3.7996851	6340	3.8020893	6375	3 8044802	6410	3.8068580
6306	3.7997540	6341	3.8021578	6376	3.8045483	6411	3.8069258
6307	3.7998228	6342	3.8022262	6377	3.8046164	6412	3.8069935
6308	3.7998917	6343	3.8022947	6378	3.8046845	6413	3.8070612
6309	3.7999605	6344	3.8023632	6379	3.8047526	6414	3.8071290
6310	3.8000294	6345	3.8024316	6380	3.8048207	6415	3.8071967
6311	3.8000982	6346	3.8025001	6381	3.8048887	6416	3.8072643
6312	3.8001670	6347	3.8025685	6382	3.8049568	6417	3.8073320
6313	3.8002358	6348	3.8026369	6383	3.8050248	6418	3.8073997
6314	3.8003046	6349	3.8027053	6384	3.8050929	6419	3.8074674
6315	3.8003734	6350	3.8027737	6385	3.8051609	6420	3.8075350
6316	3.8004421	6351	3.8028421	6386	3.8052289	6421	3.8076027
6317	3.8005109	6352	3.8029105	6387	3.8052969	6422	3.8076703
6318	3.8005796	6353	3.8029789	6388	3.8053649	6423	3.8077379
6319	3.8006484	6354	3.8030472	6389	3.8054329	6424	3.8078055
6320	3.8007171	6355	3.8031156	6390	3.8055009	6425	3.8078731
6321	3.8007858	6356	3.8031839	6391	3.8055688	6426	3.8079407
6322	3.8008545	6357	3.8032522	6392	3.8056368	6427	3.8080083
6323	3.8009232	6358	3.8033205	6393	3.8057047	6428	3.8080759
6324	3.8009919	6359	3.8033888	6394	3.8057726	6429	3.8081434
6325	3.8010605	6360	3.8034571	6395	3.8058405	6430	3.8082110
6326	3.8011292	6361	3.8035254	6396	3.8059085	6431	3.8082785
6327	3.8011978	6362	3.8035937	6397	3.8059763	6432	3.8083460
6328	3.8012665	6363	3.8036619	6398	3.8060442	6433	3.8084136
6329	3.8013351	6364	3.8037302	6399	3.8061121	6434	3.8084811
6330	3.8014037	6365	3.8037984	6400	3.8061800	6435	3.8085485
6331	3.8014723	6366	3.8038666	6401	3.8062478	6436	3.8086160
6332	3.8015409	6367	3.8039348	6402	3.8063157	6437	3.8086835
6333	3.8016095	6368	3.8040031	6403	3.8063835	6438	3.8087510
6334	3.8016781	6369	3.8040712	6404	3.8064513	6439	3.8088184
6335	3.8017466	6370	3.8041394	6405	3.8065191	6440	3.8088859

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
6721	3.8274339	6756	3.8296896	6791	3.8319337	6826	3.8341663
6722	3.8274985	6757	3.8297539	6792	3.8319977	6827	3.8342299
6723	3.8275631	6758	3.8298182	6793	3.8320616	6828	3.8342935
6724	3.8276277	6759	3.8298824	6794	3.8321255	6829	3.8343571
6725	3.8276923	6760	3.8299467	6795	3.8521895	6830	3.8341207
6726	3.8277569	6761	3.8300109	6796	3.8322534	6831	3.8344843
6727	3.8278214	6762	3.8300752	6797	3.8323173	6832	3.8345479
6728	3.8278860	6763	3.8300394	6798	3.8323812	6833	3.8346114
6729	3.8279505	6764	3.8302036	6799	3.8324450	6834	3.8346750
6730	3.8280151	6765	3.8302674	6800	3.8325089	6835	3.8347385
6731	3.8280796	6766	3.8303328	6801	3.8325728	6836	3.8348021
6732	3.8281441	6767	3.8303962	6802	3.8326366	6837	3.8348656
6733	3.8282086	6768	3.8304603	6803	3.8327005	6838	3.8349291
6734	3.8282731	6769	3.8305245	6804	3.8327643	6839	3.8349926
6735	3.8283376	6770	3.3301394	6805	3.8328281	6840	3.8350561
6736	3.8284022	6771	3.8306528	6806	3.8328919	6841	3.8351196
6737	3.8284665	6772	3.8307169	6807	3.8329558	6842	3.8351831
6738	3.8285310	6773	3.8307811	6808	3.8330195	6843	3.8352465
6739	3.8285955	6774	3.8308452	6809	3.8330833	6844	3.8353100
6740	3.8286599	6775	3.8309093	6810	3.8331471	6845	3.8353735
6741	3.8287243	6776	3.8309734	6811	3.8332109	6846	3.8354369
6742	3.8287887	6777	3.8310375	6812	3.8332746	6847	3.8355003
6743	3.8288532	6778	3.8311016	6813	3.8333384	6848	3.8355638
6744	3.8289176	6779	3.8311656	6814	3.8334021	6849	3.8356272
6745	3.8289820	6780	3.8312297	6815	3.8334659	6850	3.8356906
6746	3.8290463	6781	3.8312937	6816	3.8335296	6851	3.8357540
6747	3.8291107	6782	3.8313578	6817	3.8335933	6852	3.8358174
6748	3.8291751	6783	3.8314218	6818	3.8336570	6853	3.8358807
6749	3.8292394	6784	3.8314858	6819	3.8337207	6854	3.8359441
6750	3.8293038	6785	3.8315499	6820	3.8337844	6855	3.8360075
6751	3.8293681	6786	3.8316139	6821	3.8338480	6856	3.8360708
6752	3.8294324	6787	3.8316778	6822	3.8339117	6857	3.8361341
6753	3.8294967	6788	3.8317418	6823	3.8339754	6858	3.8361975
6754	3.8295611	6789	3.8318058	6824	3.8340390	6859	3.8362608
6755	3.8296254	6790	3.8318698	6825	3.8341027	6860	3.8363241

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
6581	3.8182919	6616	3.8205955	6651	3.8228869	6686	3.8251664
6582	3.8183579	6617	3.8206611	6652	3.8229522	6687	3.8252313
6583	3.8184239	6618	3.8207268	6653	3.8230175	6688	3.8252963
6584	3.8184898	6619	3.8207924	6654	3.8220838	6689	3.8253612
6585	3.8185558	6620	3.8208580	6655	3.8231481	6690	3.8254261
6586	3.8186217	6621	3.8209236	6656	3.8232133	6691	3.8254910
6587	3.8186877	6622	3.8209892	6657	3.8232786	6692	3.8255559
6588	3.8187536	6623	3.8210548	6658	3.8233438	6693	3.8256208
6589	3.8188195	6624	3.8211205	6659	3.8234090	6694	3.8256857
6590	3.8188854	6625	3.8211859	6660	3.8234742	6695	3.8257506
6591	3.8189513	6626	3.8212514	6661	3.8235394	6696	3.8258154
6592	3.8190172	6627	3.8213170	6662	3.8236046	6697	3.8258803
6593	3.8190831	6628	3.8213825	6663	3.8236698	6698	3.8259451
6594	3.8191489	6629	3.8214480	6664	3.8237350	6699	3.8260100
6595	3.8192148	6630	3.8215135	6665	3.8238002	6700	3.8260748
6596	3.8192806	6631	3.8215790	6666	3.8238653	6701	3.8261396
6597	3.8193465	6632	3.8216445	6667	3.8239305	6702	3.8262044
6598	3.8194123	6633	3.8217100	6668	3.8239956	6703	3.8202692
6599	3.8194781	6634	3.8217755	6669	3.8240607	6704	3.8263340
6500	3.8195439	6635	3.8218409	6670	3.8241258	6705	3.8263988
6601	3.8196097	6636	3.8219064	6671	3.8241909	6706	3.8264635
6602	3.8196755	6637	3.8219718	6672	3.8242560	6707	3.8265283
6603	3.8197413	6638	3.8220372	6673	3.8243211	6708	3.8265932
6604	3.8198071	6639	3.8221027	6674	3.8243862	6709	3.8266578
6605	3.8198728	6640	3.8221681	6675	3.8244513	6710	3.8267225
6606	3.8199386	6641	3.8222335	6676	3.8245163	6711	3.8267872
6607	3.8200043	6642	3.8322989	6677	3.8245814	6712	3.8268519
6608	3.8200700	6643	3.8223643	6678	3.8246464	6713	3.8269166
6609	3.8201358	6644	2.8224296	6679	3.8247114	6714	3.8269813
6610	3.8202015	6645	3.8224950	6680	3.8247765	6715	3.8270460
6611	3.8202672	6646	3.8225603	6681	3.8248415	6716	3.8271107
6612	3.8203328	6647	3.8226257	6682	3.8249065	6717	3.8271753
6613	3.8203985	6648	3.8226910	6683	3.8249715	6718	3.8272400
6614	3.8204642	6649	3.8227563	6684	3.8250364	6719	3.8273046
6615	3.8205298	6650	3.8228216	6685	3.8251014	6720	3.8273693

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
7001	3.8451601	7036	3.8473258	7071	3.8494808	7106	3.8516252
7002	3.8452221	7037	3.8473876	7072	3.8495423	7107	3.8516863
7003	3.8452841	7038	3.8474493	7073	3.8496037	7108	3.8517474
7004	3.8453461	7039	3.8475110	7074	3.8496651	7109	3.8518085
7005	3.8454081	7040	3.8475727	7075	3.8497264	7110	3.8518696
7006	3.8454701	7041	3.8476343	7076	3.8497878	7111	3.8519307
7007	3.8455321	7042	3.8476960	7077	3.8498492	7112	3.8519917
7008	3.8455941	7043	3.8477577	7078	3.8499106	7113	3.8520528
7009	3.8456561	7044	3.8478193	7079	3.8499719	7114	3.8521139
7010	3.8457180	7045	3.8478810	7080	3.8500333	7115	3.8521749
7011	3.8457800	7046	3.8479426	7081	3.8500946	7116	3.8522359
7012	3.8458419	7047	3.8480043	7082	3.8501559	7117	3.8522970
7013	3.8459038	7048	3.8480659	7083	3.8502172	7118	3.8523580
7014	3.8459658	7049	3.8481275	7084	3.8502786	7119	3.8524190
7015	3.8460277	7050	3.8481891	7085	3.8503399	7120	3.8524800
7016	3.8460896	7051	3.8482507	7086	3.8504011	7121	3.8525410
7017	3.8461515	7052	3.8483123	7087	3.8504624	7122	3.8526020
7018	3.8462134	7053	3.8483739	7088	3.8505237	7123	3.8526629
7019	3.8462752	7054	3.8484355	7089	3.8505850	7124	3.8527239
7020	3.8463371	7055	3.8484970	7090	3.8506462	7125	3.8527849
7021	3.8463990	7056	3.8485586	7091	3.8507075	7126	3.8528458
7022	3.8464608	7057	3.8486201	7092	3.8507687	7127	3.8529068
7023	3.8465227	7058	3.8486817	7093	3.8508300	7128	3.8529677
7024	3.8465845	7059	3.8487472	7094	3.8508912	7129	3.8530286
7025	3.8466463	7060	3.8488087	7095	3.8509524	7130	3.8530895
7026	3.8467081	7061	3.8488662	7096	3.8510136	7131	3.8531504
7027	3.8467700	7062	3.8489277	7097	3.8510748	7132	3.8532113
7028	3.8468318	7063	3.8489892	7098	3.8511360	7133	3.8532722
7029	3.8468935	7064	3.8490507	7099	3.8511972	7134	3.8533331
7030	3.8469553	7065	3.8491122	7100	3.8512583	7135	3.8533940
7031	3.8470171	7066	3.8491736	7101	3.8513195	7136	3.8534548
7032	3.8470789	7067	3.8492351	7102	3.8513807	7137	3.8535157
7033	3.8471406	7068	3.8492965	7103	3.8514418	7138	3.8535765
7034	3.8472024	7069	3.8493580	7104	3.8515030	7139	3.8536374
7035	3.8472641	7070	3.8494194	7105	3.8515641	7140	3.8536982

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
6861	3.8363874	6896	3.8385973	6931	3.8407959	6966	3.8429835
6862	3.8364507	6897	3.8386602	6932	3.8408586	6967	3.8430458
6863	3.8365140	6898	3.8387232	6933	3.8409212	6968	3.8431081
6864	3.8365773	6899	3.8387861	6934	3.8409838	6969	3.8431705
6865	3.8366405	6900	3.8388491	6935	3.8410465	6970	3.8432328
6866	3.8367038	6901	3.8389120	6936	3.8411091	6971	3.8432951
6867	3.8367670	6902	3.8389750	6937	3.8411717	6972	3.8433574
6868	3.8368303	6903	3.8390379	6938	3.8412343	6973	3.8434197
6869	3.8368935	6904	3.8391008	6939	3.8412969	6974	3.8434819
6870	3.8369567	6905	3.8391637	6940	3.8413595	6975	3.8435442
6871	3.8370199	6906	3.8392266	6941	3.8414220	6976	3.8436065
6872	3.8370832	6907	3.8392895	6942	3.8414846	6977	3.8436687
6873	3.8371463	6908	3.8393523	6943	3.8415472	6978	3.8437310
6874	3.8372095	6909	3.8394152	6944	3.8416097	6979	3.8437932
6875	3.8372727	6910	3.8394780	6945	3.8416722	6980	3.8438554
6876	3.8373359	6911	3.8395409	6946	3.8417348	6981	3.8439176
6877	3.8373990	6912	3.8396037	6947	3.8417973	6982	3.8439798
6878	3.8374622	6913	3.8396666	6948	3.8418598	6983	3.8440420
6879	3.8375253	6914	3.8397294	6949	3.8419223	6984	3.8441042
6880	3.8375884	6915	3.8397922	6950	3.8419848	6985	3.8441664
6881	3.8376516	6916	3.8398550	6951	3.8420473	6986	3.8442286
6882	3.8377147	6917	3.8399178	6952	3.8421098	6987	3.8442907
6883	3.8377778	6918	3.8399806	6953	3.8421722	6988	3.8443529
6884	3.8378409	6919	3.8400433	6954	3.8422347	6989	3.8444150
6885	3.8379039	6920	3.8401061	6955	3.8422971	6990	3.8444772
6886	3.8379670	6921	3.8401684	6956	3.8423596	6991	3.8445393
6887	3.8380301	6922	3.8402316	6957	3.8424220	6992	3.8446014
6888	3.8380931	6923	3.8402943	6958	3.8424844	6993	3.8446635
6889	3.8381562	6924	3.8403571	6959	3.8425468	6994	3.8447256
6890	3.8382192	6925	3.8404198	6960	3.8426092	6995	3.8447877
6891	3.8382822	6926	3.8404825	6961	3.8426716	6996	3.8448498
6892	3.8383453	6927	3.8405452	6962	3.8427340	6997	3.8449119
6893	3.8384083	6928	3.8406079	6963	3.8427964	6998	3.8449739
6894	3.8384713	6929	3.8406706	6964	3.8428588	6999	3.8450360
6895	3.8385343	6930	3.8407332	6965	3.8429211	7000	3.8450980

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
7281	3.8621910	7316	3.8642737	7351	3.8663464	7386	3.8684093
7282	3.8622507	7317	3.8643331	7352	3.8664055	7387	3.8684681
7283	3.8623103	7318	3.8643924	7353	3.8664646	7388	3.8685269
7284	3.8623699	7319	3.8644517	7354	3.8665236	7389	3.8685857
7285	3.8624296	7320	3.8645111	7355	3.8665827	7390	3.8686444
7286	3.8624892	7321	3.8645704	7356	3.8666417	7391	3.8687032
7287	3.8625488	7322	3.8646297	7357	3.8667008	7392	3.8687620
7288	3.8626084	7323	3.8646890	7358	3.8667598	7393	3.8688207
7289	3.8626679	7324	3.8647483	7359	3.8668188	7394	3.8688794
7290	3.8627275	7325	3.8648076	7360	3.8668778	7395	3.8689382
7291	3.8627871	7326	3.8648669	7361	3.8669368	7396	3.8689969
7292	3.8628467	7327	3.8649262	7362	3.8669958	7397	3.8690556
7293	3.8629062	7328	3.8649855	7363	3.8670547	7398	3.8691143
7294	3.8629658	7329	3.8650447	7364	3.8671138	7399	3.8691730
7295	3.8630253	7330	3.8651040	7365	3.8671728	7400	3.8692317
7296	3.8630848	7331	3.8651632	7366	3.8672317	7401	3.8692904
7297	3.8631443	7332	3.8652225	7367	3.8672907	7402	3.8693491
7298	3.8632039	7333	3.8652817	7368	3.8673496	7403	3.8694077
7299	3.8632634	7334	3.8653409	7369	3.8674086	7404	3.8694664
7300	3.8633229	7335	3.8654001	7370	3.8674675	7405	3.8695251
7301	3.8633823	7336	3.8654593	7371	3.8675264	7406	3.8695837
7302	3.8634418	7337	3.8655185	7372	3.8675853	7407	3.8696423
7303	3.8635013	7338	3.8655777	7373	3.8676442	7408	3.8697010
7304	3.8635608	7339	3.8656369	7374	3.8677031	7409	3.8697596
7305	3.8636202	7340	3.8656961	7375	3.8677620	7410	3.8698182
7306	3.8636797	7341	3.8657552	7376	3.8678209	7411	3.8698768
7307	3.8637391	7342	3.8658144	7377	3.8678798	7412	3.8699354
7308	3.8637985	7343	3.8658735	7378	3.8679387	7413	3.8699940
7309	3.8638580	7344	3.8659327	7379	3.8679975	7414	3.8700526
7310	3.8639174	7345	3.8659918	7380	3.8680564	7415	3.8701112
7311	3.8639768	7346	3.8660509	7381	3.8681152	7416	3.8701697
7312	3.8640362	7347	3.8661100	7382	3.8681740	7417	3.8702283
7313	3.8640956	7348	3.8661691	7383	3.8682329	7418	3.8702868
7314	3.8641550	7349	3.8662282	7384	3.8682917	7419	3.8703454
7315	3.8642143	7350	3.8662873	7385	3.8683505	7420	3.8704039

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
7141	3.8537590	7176	3.8558824	7211	3.8579955	7246	3.8600983
7142	3.8538198	7177	3.8559429	7212	3.8580557	7247	3.8601583
7143	3.8538806	7178	3.8560035	7213	3.8581159	7248	3.8602183
7144	3.8539414	7179	3.8560640	7214	3.8581761	7249	3.8602781
7145	3.8540022	7180	3.8561244	7215	3.8582363	7250	3.8603380
7146	3.8540630	7181	3.8561849	7216	3.8582965	7251	3.8603979
7147	3.8541238	7182	3.8562454	7217	3.8583567	7252	3.8604578
7148	3.8541845	7183	3.8563059	7218	3.8584169	7253	3.8605177
7149	3.8542453	7184	3.8563663	7219	3.8584770	7254	3.8605776
7150	3.8543060	7185	3.8564268	7220	3.8585372	7255	3.8606374
7151	3.8543668	7186	3.8564872	7221	3.8585973	7256	3.8606973
7152	3.8544275	7187	3.8565476	7222	3.8586575	7257	3.8607571
7153	3.8544882	7188	3.8566081	7223	3.8587176	7258	3.8608170
7154	3.8545489	7189	3.8566685	7224	3.8587777	7259	3.8608768
7155	3.8546096	7190	3.8567289	7225	3.8588379	7260	3.8609366
7156	3.8546703	7191	3.8567893	7226	3.8588980	7261	3.8609964
7157	3.8547310	7192	3.8568497	7227	3.8589581	7262	3.8610562
7158	3.8547917	7193	3.8569101	7228	3.8590181	7263	3.8611160
7159	3.8548524	7194	3.8569704	7229	3.8590782	7264	3.8611758
7160	3.8549130	7195	3.8570308	7230	3.8591383	7265	3.8612356
7161	3.8549737	7196	3.8570912	7231	3.8591984	7266	3.8612954
7162	3.8550343	7197	3.8571515	7232	3.8592584	7267	3.8613552
7163	3.8550949	7198	3.8572118	7233	3.8593185	7268	3.8614149
7164	3.8551556	7199	3.8572722	7234	3.8593785	7269	3.8614747
7165	3.8552162	7200	3.8573325	7235	3.8594385	7270	3.8615344
7166	3.8552768	7201	3.8573928	7236	3.8594986	7271	3.8615941
7167	3.8553374	7202	3.8574531	7237	3.8595586	7272	3.8616539
7168	3.8553980	7203	3.8575134	7238	3.8596186	7273	3.8617136
7169	3.8554586	7204	3.8575737	7239	3.8596786	7274	3.8617733
7170	3.8555192	7205	3.8576340	7240	3.8597386	7275	3.8618330
7171	3.8555797	7206	3.8576943	7241	3.8597985	7276	3.8618927
7172	3.8556403	7207	3.8577545	7242	3.8598585	7277	3.8619524
7173	3.8557008	7208	3.8578148	7243	3.8599185	7278	3.8620120
7174	3.8557614	7209	3.8578750	7244	3.8599784	7279	3.8620717
7175	3.8558219	7210	3.8579353	7245	3.8600384	7280	3.8621314

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
7561	3.8785792	7596	3.8805850	7631	3.8825815	7666	3.8845688
7562	3.8786367	7597	3.8806421	7632	3.8826384	7667	3.8846255
7563	3.8786941	7598	3.8806993	7633	3.8826953	7668	3.8846821
7564	3.8787515	7599	3.8807564	7634	3.8827522	7669	3.8847387
7565	3.8788089	7600	3.8808136	7635	3.8828090	7670	3.8847954
7566	3.8788663	7601	3.8808707	7636	3.8828659	7671	3.8848520
7567	3.8789237	7602	3.8809279	7637	3.8829228	7672	3.8849086
7568	3.8789811	7603	3.8809850	7638	3.8829797	7673	3.8849652
7569	3.8790385	7604	3.8810421	7639	3.8830365	7674	3.8850218
7570	3.8790959	7605	3.8810992	7640	3.8830934	7675	3.8850784
7571	3.8791532	7606	3.8811563	7641	3.8831502	7676	3.8851350
7572	3.8792106	7607	3.8812134	7642	3.8832070	7677	3.8851915
7573	3.8792686	7608	3.8812705	7643	3.8832639	7678	3.8852481
7574	3.8793253	7609	3.8813276	7644	3.8833207	7679	3.8853047
7575	3.8793826	7610	3.8813847	7645	3.8833775	7680	3.8853612
7576	3.8794400	7611	3.8814417	7646	3.8834343	7681	3.8854178
7577	3.8794973	7612	3.8814988	7647	3.8834911	7682	3.8854743
7578	3.8795546	7613	3.8815558	7648	3.8835479	7683	3.8855308
7579	3.8796119	7614	3.8816129	7649	3.8836047	7684	3.8855874
7580	3.8796692	7615	3.8816699	7650	3.8836614	7685	3.8856439
7581	3.8797265	7616	3.8817269	7651	3.8837182	7686	3.8857004
7582	3.8797838	7617	3.8817840	7652	3.8837750	7687	3.8857569
7583	3.8798411	7618	3.8818410	7653	3.8838317	7688	3.8858134
7584	3.8798983	7619	3.8818980	7654	3.8838885	7689	3.8858699
7585	3.8799556	7620	3.8819550	7655	3.8839452	7690	3.8859263
7586	3.8800128	7621	3.8820120	7656	3.8840019	7691	3.8859828
7587	3.8800701	7622	3.8820689	7657	3.8840586	7692	3.8860393
7588	3.8801273	7623	3.8821259	7658	3.8841154	7693	3.8860957
7589	3.8801846	7624	3.8821829	7659	3.8841721	7694	3.8861522
7590	3.8802418	7625	3.8822398	7660	3.8842288	7695	3.8862086
7591	3.8802990	7626	3.8822968	7661	3.8842855	7696	3.8862651
7592	3.8803562	7627	3.8823537	7662	3.8843421	7697	3.8863215
7593	3.8804134	7628	3.8824107	7663	3.8843988	7698	3.8863779
7594	3.8804706	7629	3.8824676	7664	3.8844555	7699	3.8864343
7595	3.8805278	7630	3.8825245	7665	3.8845122	7700	3.8864907

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
7701	3.8865471	7736	3.8885165	7771	3.8904769	7806	3.8924285
7702	3.8866035	7737	3.8885726	7772	3.8905328	7807	3.8924842
7703	3.8866599	7738	3.8886287	7773	3.8905887	7808	3.8925398
7704	3.8867163	7739	3.8886848	7774	3.8906445	7809	3.8925954
7705	3.8867726	7740	3.8887410	7775	3.8907004	7810	3.8926510
7706	3.8868290	7741	3.8887971	7776	3.8907562	7811	3.8927066
7707	3.8868854	7742	3.8888531	7777	3.8908120	7812	3.8927622
7708	3.8869417	7743	3.8889092	7778	3.8908679	7813	3.8928178
7709	3.8869980	7744	3.8889653	7779	3.8909238	7814	3.8928734
7710	3.8870544	7745	3.8890214	7780	3.8909796	7815	3.8929290
7711	3.8871107	7746	3.8890775	7781	3.8910354	7816	3.8929846
7712	3.8871670	7747	3.8891336	7782	3.8910912	7817	3.8930401
7713	3.8872233	7748	3.8891896	7783	3.8911470	7818	3.8930957
7714	3.8872796	7749	3.8892457	7784	3.8912028	7819	3.8931512
7715	3.8873359	7750	3.8893017	7785	3.8912586	7820	3.8932068
7716	3.8873922	7751	3.8893577	7786	3.8913144	7821	3.8932623
7717	3.8874485	7752	3.8894138	7787	3.8913702	7822	3.8933178
7718	3.8875048	7753	3.8894698	7788	3.8914259	7823	3.8933733
7719	3.8875610	7754	3.8895258	7789	3.8914817	7824	3.8934288
7720	3.8876173	7755	3.3895818	7790	3.8915375	7825	3.8934843
7721	3.8876736	7756	3.8896378	7791	3.8915932	7826	3.8935398
7722	3.8877298	7757	3.8896938	7792	3.8916489	7827	3.8935953
7723	3 8877860	7758	3.8897498	7793	3.8917047	7828	3.8936508
7724	3.8878423	7759	3.8898058	7794	3.8917604	7829	3.8937063
7725	3.8878985	7760	3.8898617	7795	3.8918161	7830	3.8937618
7726	3.8879547	7761	3.8899177	7796	3.8918718	7831	3.8938172
7727	3.8880109	7762	3.8899736	7797	3.8919275	7832	3.8938727
7728	3.8880671	7763	3.8900296	7798	3.8919832	7833	3.8939281
7729	3.8881233	7764	3.8900855	7799	3.8920389	7834	3.8939836
7730	3.8881795	7765	3.8901415	7800	3.8920946	7835	3.8940390
7731	3.8882357	7766	3.8901974	7801	3.8921503	7836	3.8940944
7732	3.8882918	7767	3.8902533	7802	3.8922059	7837	3.8941498
7733	3.8883480	7768	3.8903092	7803	3.8922616	7838	3.8942053
7734	3.8884042	7769	3.8903651	7804	3.8923173	7839	3.8942607
7735	3.8884603	7770	3.8904210	7805	3.8923729	7840	3.8943161

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
7841	3.8943715	7876	3.8963058	7911	3.8982314	7946	3.9001486
7842	3.8944268	7877	3.8963608	7912	3.8982863	7947	3.9002032
7843	3.8944822	7878	3.8964160	7913	3.8983412	7948	3.9002579
7844	3.8945376	7779	3.8964711	7914	3.8983960	7949	3.9003125
7845	3.8945929	7880	3.8965262	7915	3.8984509	7950	3.9003671
7846	3.8946483	7881	3.8965813	7916	3.8985058	7951	3.9004218
7847	3.8947037	7882	3.8966364	7917	3.8985606	7952	3.9004764
7848	3.8947590	7883	3.8966915	7918	3.8986155	7953	3.9005310
7849	3.8948143	7884	3.8967466	7919	3.8986703	7954	3.9005856
7850	3.8948697	7885	3.8968017	7920	3.8987252	7955	3.8006402
7851	3.8949250	7886	3.8968568	7921	3.8987800	7956	3.9006948
7852	3.8949803	7887	3.8969118	7922	3.8988348	7957	3.9007494
7853	3.8950356	7888	3.8969669	7923	3.8988897	7958	3.9008039
7854	3.8950909	7889	3.8970220	7924	3.8989445	7959	3.9008585
7855	3.8951462	7890	3.8970770	7925	3.8989993	7960	3.9009131
7856	3.8952015	7891	3.8971320	7926	3.8990541	7961	3.9009676
7857	3.8952568	7892	3.8971871	7927	3.8991089	7962	3.9010222
7858	3.8953120	7893	3.8972421	7928	3.8991636	7963	3.9010767
7859	3.8953673	7894	3.8972971	7929	3.8992184	7964	3.9011313
7860	3.8954225	7895	3.8973521	7930	3.8992732	7965	3.9011858
7861	3.8954778	7896	3.8974071	7931	3.8993279	7966	3.9012403
7862	3.8955330	7897	3.8974621	7932	3.8993827	7967	3.9012948
7863	3.8955883	7898	3.8975171	7933	3.8994375	7968	3.9013493
7864	3.8956435	7899	3.8975721	7934	3.8994922	7969	3.9014038
7865	3.8956987	7900	3.8976271	7935	3.8995469	7970	3.9014583
7866	3.8957539	7901	3.8976821	7936	3.8996017	7971	3.9015128
7867	3.8958091	7902	3.8977370	7937	3.8996564	7972	3.9015673
7868	3.8958643	7903	3.8977920	7938	8.8997111	7973	3.9016218
7869	3.8959195	7904	3.8978469	7939	3.8997658	7974	3.9016762
7870	3.8959747	7905	3.8979019	7940	8.8998205	7975	3.9017307
7871	3.8960299	7906	3.8979568	7941	3.8998752	7976	3.9017851
7872	3.8960851	7907	3.8980117	7942	3.8999299	7977	3.9018396
7873	3.8961403	7908	3.8980667	7943	3.8999846	7978	3.9018940
7874	3.8961954	7909	3.8981216	7944	3.9000392	7979	3.9019485
7875	3.8962506	7910	3.8981765	7945	3.9000939	7980	3.9020029

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
7981	3.9020573	8016	3.9039577	8051	3.9058498	8086	3.9077337
7982	3.9021117	8017	3.9040119	8052	3.9059038	8087	3.9077874
7983	3.9021661	8018	3.9040661	8053	3.9059577	8088	3.9078411
7984	3.9022205	8019	3.9041202	8054	3.9060116	8089	3.9078948
7985	3.9022749	8020	3.9041744	8055	3.9060656	8090	3.9079485
7986	3.9023293	8021	3.9042285	8056	3.9061195	8091	3.9080022
7987	3.9023837	8022	3.9042827	8057	3.9061734	8092	3.9080559
7988	3.9024381	8023	3.9043368	8058	3.9062273	8093	3.9081095
7989	3.9024924	8024	3.9043909	8059	3.9062812	8094	3.9081632
7990	3.9025468	8025	3.9044450	8060	3.9063351	8095	3.9082169
7991	3.9026011	8026	3.9044992	8061	3.9063889	8096	3.9082705
7992	3.9026555	8027	3.9045533	8062	3.9064428	8097	3.9083241
7993	3.9027098	8028	3.9046074	8063	3.9064967	8098	3.9083778
7994	3.9027641	8029	3.9046615	8064	3.9065505	8099	3.9084314
7995	3.9028185	8030	3.9047155	8065	3.9066044	8100	3.9084850
7996	3.9028728	8031	3.9047696	8066	3.9066582	8101	3.9085386
7997	3.9029271	8032	3.9048237	8067	3.9067121	8102	3.9085922
7998	3.9029814	8033	3.9048778	8068	3.9067659	8103	3.9086458
7999	3.9030357	8034	3.9049318	8069	3.9068197	8104	3.9086994
8000	3.9030900	8035	3.9049859	8070	3.9068735	8105	3.9087530
8001	3.9031443	8036	3.9050399	8071	3.9069273	8106	3.9088066
8002	3.9031985	8037	3.9050940	8072	3.9069812	8107	3.9088602
8003	3.9032528	8038	3.9051480	8073	3.9070350	8108	3.9089137
8004	3.9033071	8039	3.9052020	8074	3.9070888	8109	3.9089673
8005	3.9033613	8040	3.9052560	8075	3.9071425	8110	3.9090209
8001	3.9034156	8041	3.9053101	8076	3.9071963	8111	3.9090744
8007	3.9034698	8042	3.9053641	8077	3.9072501	8112	3.9091279
8008	3.9035241	8043	3.9054181	8078	3.9073038	8113	3.9091815
8009	3.9035783	8044	3.9054721	8079	3.9073576	8114	3.9092350
8010	3.9036325	8045	3.9055261	8080	3.9074114	8115	3.9092885
8011	3.9036867	8046	3.9055801	8081	3.9074651	8116	3.9093420
8012	3.9037409	8047	3.9056341	8082	3.9975188	8117	3.9093955
8013	3.9037951	8048	3.9056880	8083	3.9075726	8118	3.9094490
8014	3.9038493	8049	3.9057420	8084	3.9076263	8119	3.9095025
8015	3.9039035	8050	3.9057960	8085	3.9076800	8120	3.9095560

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
8121	3.9096095	8156	3.9114772	8191	3.9133369	8226	3.9151887
8122	3.9096630	8157	3.9115305	8192	3.9133899	8227	3.9152415
8123	3.9097165	8158	3.9115837	8193	3.9134430	8228	3.9152943
8124	3.9097699	8159	3.9116369	8194	3.9134960	8229	3.9153471
8125	3.9098234	8160	3.9116902	8195	3.9135490	8230	3.9153998
8126	3.9098768	8161	3.9117434	8196	3.9136019	8231	3.9154526
8127	3.9099303	8162	3.9117966	8197	3.9136549	8232	3.9155054
8128	3.9099837	8163	3.9118498	8198	3.9137079	8233	3.9155581
8129	3.9100371	8164	3.9119030	8199	3.9137609	8234	3.9156109
8130	3.9100905	8165	3.9119562	8200	3.9138139	8235	3.9156636
8131	3.9101440	8166	3.9120094	8201	3.9138668	8236	3.9157163
8132	3.9101974	8167	3.9120626	8202	3.9139198	8237	3.9157691
8133	3.9102508	8168	3.9121157	8203	3.9139727	8238	3.9158218
8134	3.9103042	8169	3.9121689	8204	3.9140257	8239	3.9158745
8135	3.9103576	8170	3.9122220	8205	3.9140786	8240	3.9159272
8136	3.9104109	8171	3.9122752	8206	3.9141315	8241	3.9159799
8137	3.9104643	8172	3.9123234	8207	3.9141844	8242	3.9160326
8138	3.9105177	8173	3.9123815	8208	3.9142373	8243	3.9160853
8139	3.9105710	8174	3.9124346	8209	3.9142903	8244	3.9161380
8140	3.9106244	8175	3.9124878	8210	3.9143432	8245	3.9161907
8141	3.9106778	8176	3.9125409	8211	3.9143961	8246	3.9162433
8142	3.9107311	8177	3.9125940	8212	3.9144489	8247	3.9162960
8143	3.9107844	8178	3.9126471	8213	3.9145018	8248	3.9163487
8144	3.9108378	8179	3.9127002	8214	3.9145547	8249	3.9164013
8145	3.9108911	8180	3.9127533	8215	3.9146076	8250	3.9164539
8146	3.9109444	8181	3.9128064	8216	3.9146604	8251	3.9165066
8147	3.9109977	8182	3.9128595	8217	3.9147133	8252	3.9165592
8148	3.9110510	8183	3.9129126	8218	3.9147661	8253	3.9166118
8149	3.9111043	8184	3.9129656	8219	3.9148190	8254	3.9166645
8150	3.9111576	8185	3.9130187	8220	3.9148718	8255	3.9167171
8151	3.9112109	8186	3.9130717	8221	3.9149246	8256	3.9167697
8152	3.9112642	8187	3.9131248	8222	3.9149775	8257	3.9168223
8153	3.9113174	8188	3.9131778	8223	3.9150303	8258	3.9168749
8154	3.9113707	8189	3.9132309	8224	3.9150831	8259	3.9169275
8155	3.9114240	8190	3.9132839	8225	3.9151359	8260	3.9169800

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
8261	3.9170326	8296	3.9188687	8331	3.9296971	8366	3.9225179
8262	3.9170852	8297	3.9189211	8332	3.9207493	8367	3.9225698
8263	3.9171378	8298	3.9189734	8333	3.9208014	8368	3.9226217
8264	3.9171903	8299	3.9190258	8334	3.9208535	8369	3.9226736
8265	3.9172429	8300	3.9190781	8335	3.9209056	8370	3.9227255
8266	3.9172954	8301	3.9191304	8336	3.9209577	8371	3.9227773
8267	3.9173479	8302	3.9191827	8337	3.9210098	8372	3.9228292
8268	3.7174005	8303	3.9192350	8338	3.9210619	8373	3.9228811
8269	3.9174530	8304	3.9192873	8339	3.9211140	8374	3.9229330
8270	3.9175055	8305	3.9193396	8340	3.9211661	8375	3.9229848
8271	3.9175580	8306	3.9193919	8341	3.9212181	8376	3.9230367
8272	3.9176105	8307	3.9194442	8342	3.9212701	8377	3.9230885
8273	3.9176630	8308	3.9194965	8343	3.9213222	8378	3.9231404
8274	3.9177155	8309	3.9195488	8344	3.9213743	8379	3.9231922
8275	3.9177680	8310	3.9196010	8345	3.9214263	8380	3.9232440
8276	3.9178205	8311	3.9196533	8346	3.9214784	8381	3.9232958
8277	3.9178730	8312	3.9197055	8347	3.9215304	8382	3.9233477
8278	3.9179254	8313	3.9197578	8348	3.9215824	8383	3.9233995
8279	3.9179779	8314	3.9198100	8349	3.9216345	8384	3.9234513
8280	3.9180303	8315	3.9198623	8350	3.9216865	8385	3.9235031
8281	3.9180828	8316	3.9199145	8351	3.9217385	8386	3.9235549
8282	3.9181352	8317	3.9199667	8352	3.9217905	8387	3.9236066
8283	3.9181877	8318	3.9200189	8353	3.9218425	8388	3.9236584
8284	3.9182401	8319	3.9200711	8354	3.9218945	8389	3.9237102
8285	3.9182925	8320	3.9201233	8355	3.9219465	8390	3.9237620
8286	3.9183449	8321	3.9201755	8356	3.9219984	8391	3.9238137
8287	3.9183973	8322	3.9202277	8357	3.9220504	8392	3.9238655
8288	3.9184497	8323	3.9202799	8358	3.9221024	8393	3.9239172
8289	3.9185021	8324	3.9203321	8359	3.9221543	8394	3.9239690
8290	3.9185545	8325	3.9203842	8360	3.9222063	8395	3.9240207
8291	3.9186069	8326	3.9204364	8361	3.9222582	8396	3.9240724
8292	3.9186593	8327	3.9204886	8362	3.9223102	8397	3.9241242
8293	3.9187117	8328	3.9205407	8363	3.9223621	8398	3.9241759
8294	3.9187640	8329	3.9205929	8364	3.9224140	8399	3.9242276
8295	3.9188164	8330	3.9206450	8365	3.9224659	8400	3.9242793

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
8401	3.9243310	8436	3.9261366	8471	3.9279347	8506	3.9297254
8402	3.9243827	8437	3.9261880	8472	3.9279859	8507	3.9297764
8403	3.9244344	8438	3.9262395	8473	3.9280372	8508	3.9298275
8404	3.9244860	8439	3.9262910	8474	3.9280885	8509	3.9298785
8405	3.9245377	8440	3.9263424	8475	3.9281397	8510	3.9299296
8406	3.9245894	8441	3.9263939	8476	3.9281909	8511	3.9299806
8407	3.9246410	8442	3.9264453	8477	3.9282422	8512	3.9300316
8408	3.9246927	8443	3.9264968	8478	3.9282934	8513	3.9300826
8409	3.9247444	8444	3.9265482	8479	3.9283446	8514	3.9301336
8410	3.9247960	8445	3.9265997	8480	3.9283959	8515	3.9301847
8411	3.9248476	8446	3.9266511	8481	3.9284471	8516	3.9302357
8412	3.9248993	8447	3.9267025	8482	3.9284983	8517	3.9302866
8413	3.9249509	8448	3.9267539	8483	3.9285495	8518	3.9303376
8414	3.9250025	8449	3.9268053	8484	3.9286007	8519	3.9303886
8415	3.9250541	8450	3.9268567	8485	3.9286518	8520	3.9304396
8416	3.9251057	8451	3.9269081	8486	3.9287030	8521	3.9304906
8417	3.9251573	8452	3.9269595	8487	3.9287542	8522	3.9305415
8418	3.9252089	8453	3.9270109	8488	3.9288054	8523	3.9305925
8419	3.9252605	8454	3.9270622	8489	3.9288565	8524	3.9306434
8420	3.9253121	8455	3.9271136	8490	3.9289077	8525	3.9306944
8421	3.9253637	8456	3.9271650	8491	3.9289588	8526	3.9307453
8422	3.9254152	8457	3.9272163	8492	3.9290100	8527	3.6307963
8423	3.9254668	8458	3.9272677	8493	3.9290611	8528	3.9308472
8424	3.9255184	8459	3.9273190	8494	3.9291123	8529	3.9308981
8425	3.9255699	8460	3.9273704	8495	3.9291634	8530	3.9309490
8426	3.9256215	8461	3.9274217	8496	3.9292145	8531	3.9309999
8427	3.9256730	8462	3.9274730	8497	3.9292656	8532	3.9310508
8428	3.9257245	8463	3.9275243	8498	3.9293167	8533	3.9311017
8429	3.9257761	8464	3.9275757	8499	3.9293678	8534	3.9311526
8430	3.9258276	8465	3.9276270	8500	3.9294189	8535	3.9312035
8431	3.9258791	8466	3.9276783	8501	3.9294700	8536	3.9312544
8432	3.9259306	8467	3.9277296	8502	3.9295211	8537	3.9313053
8433	3.9259821	8468	3.9277808	8503	3.9295722	8538	3.9313561
8434	3.9260336	8469	3.9278321	8504	3.9296233	8539	3.9314070
8435	3.9260851	8470	3.9278834	8505	3.9296743	8540	3.9314579

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
8541	3.9315087	8576	3.9332848	8611	3.9350536	8646	3.9368182
8542	3.9315596	8577	3.9333354	8612	3.9351040	8647	3.9368655
8543	3.9316104	8578	3.9333860	8613	3.9351544	8648	3.9369157
8544	3.9316612	8579	3.9334367	8614	3.9352049	8649	3.9369659
8545	3.9317121	8580	3.9334873	8615	3.9352553	8650	3.9370161
8546	3.9317629	8581	3.9335379	8616	3.9353057	8651	3.9370663
8547	3.9318137	8582	3.9335885	8617	3.9353561	8652	3.9371165
8548	3.9318645	8583	3.9336392	8618	3.9354065	8653	3.9371667
8549	3.9319153	8584	3.9336897	8619	3.9354569	8654	3.9372169
8550	3.9319661	8585	3.9337403	8620	3.9355073	8655	3.9372671
8551	3.9320169	8586	3.9337909	8621	3.9355576	8656	3.9373172
8552	3.9320677	8587	3.9338415	8622	3.9356080	8657	3.9373674
8553	3.9321185	8588	3.9338920	8623	3.9356584	8658	3.9374176
8554	3.9321692	8589	3.9339426	8624	3.9357087	8659	3.9374677
8555	3.9322200	8590	3.9339932	8625	3.9357591	8660	3.9375179
8556	3.9322708	8591	3.9340437	8626	3.9358095	8661	3.9375680
8557	3.9323215	8592	3.9340943	8627	3.9358598	8662	3.9376182
8558	3.9323723	8593	3.9341448	8628	3.9359101	8663	3.9376683
8559	3.9324230	8594	3.9341953	8629	3.9359605	8664	3.9377184
8560	3.9324738	8595	3.9342459	8630	3.9360108	8665	3.9377686
8561	3.9325245	8596	3.9342964	8631	3.9360611	8666	3.9378187
8562	3.9325752	8597	3.9343469	8632	3.9361114	8667	3.9378688
8563	3.9326259	8598	3.9343974	8633	3.9361617	8668	3.9379189
8564	3.9326767	8599	3.9344479	8634	3.9362120	8669	3.9379690
8565	3.9327274	8600	3.9344984	8635	3.9362623	8670	3.9380191
8566	3.9327781	8601	3.9345489	8636	3.9363126	8671	3.9380692
8567	3.9328288	8602	3.9345994	8637	3.9363629	8672	3.9381193
8568	3.9328795	8603	3.9346499	8638	3.9364132	8673	3.9381693
8569	3.9329301	8604	3.9347004	8639	3.9364635	8674	3.9382194
8570	3.9329808	8605	3.9347509	8640	3.9365137	8675	3.9382695
8571	3.9330315	8606	3.9348013	8641	3.9365640	8676	3.9383195
8572	3.9330822	8607	3.9348518	8642	3.9366143	8677	3.9383696
8573	3.9331328	8608	3.9349022	8643	3.9366645	8678	3.9384196
8574	3.9331835	8609	3.9349527	8644	3.9367148	8679	3.9384697
8575	3.9332341	8610	3.9350032	8645	3.9367650	8680	3.9385197

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
8681	3.9385698	8716	3.9403172	8751	3.9420577	8786	3.9437912
8682	3.9386198	8717	3.9403670	8752	3.9421073	8787	3.9438406
8683	3.9386698	8718	3.9404169	8753	3.9421569	8788	3.9438900
8684	3.9387198	8719	3.9404667	8754	3.9422065	8789	3.9439395
8685	3.9387698	8720	3.9405165	8755	3.9422561	8790	3.9439889
8686	3.9388198	8721	3.9405663	8756	3.9423058	8791	3.9440383
8687	3.9388698	8722	3.9406161	8757	3.9423553	8792	3.9440877
8688	3.9389198	8723	3.9406659	8758	3.9424049	8793	3.9441371
8689	3.9389698	8724	3.9407157	8759	3.9424545	8794	3.9441865
8690	3.9390198	8725	3.9407654	8760	3.9425041	8795	3.9442358
8691	3.9390697	8726	3.9408152	8761	3.9425537	8796	3.9442852
8692	3.9391197	8727	3.9408650	8762	3.9426032	8797	3.9443346
8693	3.9391697	8728	3.9409147	8763	3.9426528	8798	3.6443840
8694	3.9392196	8729	3.9409645	8764	3.9427024	8799	3.9444333
8695	3.9392696	8730	3.9410142	8765	3.9427519	8800	3.9444827
8696	3.9393195	8731	3.9410640	8766	3.9428015	8801	3.9445320
8697	3.9393695	8732	3.9411137	8767	3.9428510	8802	3.9445814
8698	3.9394194	8733	3.9411635	8768	3.9429005	8803	3.9446307
8699	3.9394693	8734	3.9412132	8769	3.9429501	8804	3.9446800
8700	3.9395193	8735	3.9412629	8770	3.9429996	8805	3.9447294
8701	3.9395692	8736	3.9413126	8771	3.9430491	8806	3.9447787
8702	3.9396191	8737	3.9413623	8772	3.9430986	8807	3.9448280
8703	3.9396690	8738	3.9414120	8773	3.9431481	8808	3.6448773
8704	3.9397189	8739	3.9414617	8774	3.9431976	8809	3.9449266
8705	3.9397688	8740	3.9415114	8775	3.9432471	8810	3.6449759
8706	3.9398187	8741	3.9415611	8776	8.9432966	8811	3.9450252
8707	3.9398685	8742	3.9416108	8777	3.9433461	8812	3.9450745
8708	3.9399184	8743	3.9416605	8778	3.9433956	8813	3.9451238
8709	3.9399683	8744	3.9417101	8779	3.9434450	8814	3.9451730
8710	3.9400182	8745	3.9417598	8780	3.9434945	8815	3.9452223
8711	3.9400680	8746	3.9418095	8781	3.9435440	8816	3.9452716
8712	3.9401179	8747	3.9418591	8782	3.9435934	8817	3.9453208
8713	3.9401677	8748	3.9419088	8783	3.9436429	8818	3.9453701
8714	3.9402176	8749	3.9419584	8784	3.9436923	8819	3.9454193
8715	3.9402674	8750	3.9420081	8785	3.9437418	8820	3.9454686

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
8821	3.9455178	8856	3.9472376	8891	3.9489506	8926	3.9506569
8822	3.9455671	8857	3.9472866	8892	3.9489994	8927	3.9507055
8823	3.9456163	8858	3.9473357	8893	3.9490483	8928	3.9507542
8824	3.9456655	8859	3.9473847	8894	3.9490971	8929	3.9508028
8825	3.9457147	8860	3.9474337	8895	3.9491460	8930	3.9508515
8826	3.9457639	8861	3.9474827	8896	3.9491948	8931	3.9509001
8827	3.9458131	8862	3.9475317	8897	3.9492436	8932	3.9509487
8828	3.9458623	8863	3.9475807	8898	3.9492924	8933	3.9509973
8829	3.9459115	8864	3.9476297	8899	3.9493412	8934	3.9510459
8830	3.9459607	8865	3.9476787	8900	3.9493900	8935	3.9510946
8831	3.9460099	8866	3.9477277	8901	3.9494388	8936	3.9511432
8832	3.9460591	8867	3.9477767	8902	3.9494876	8937	3.9511918
8833	3.9461082	8868	3.9478257	8903	3.9495364	8938	3.9512404
8834	3.9461574	8869	3.9478747	8904	3.9495851	8939	3.9512889
8835	3.9462066	8870	3.9479236	8905	3.9496339	8940	3.9513375
8836	3.9462557	8871	3.9479726	8906	3.9496827	8941	3.9513861
8837	3.9463048	8872	3.9480215	8907	3.9497314	8942	3.9514347
8838	3.9463540	8873	3.9480705	8908	3.9497802	8943	3.9514832
8839	3.9464031	8874	3.9481194	8909	3.9498290	8944	3.9515318
8840	3.9464523	8875	3.9481684	8910	3.9498777	8945	3.9515803
8841	3.9465014	8876	3.9482173	8911	3.9499264	8946	3.9516289
8842	3.9465505	8877	3.9482662	8912	3.9499752	8947	3.9516774
8843	3.9465996	8878	3.9483151	8913	3.9500239	8948	3.9517260
8844	3.9466487	8879	3.9483641	8914	3.9500726	8949	3.9517745
8845	3.9466978	8880	3.9484130	8915	3.9501213	8950	3.9518230
8846	3.9467469	8881	3.9484619	8916	3.9501701	8951	3.9518716
8847	3.9467960	8882	3.9485108	8917	3.9502188	8952	3.9519201
8848	3.9468451	8883	3.9485597	8918	3.9502675	8953	3.9519686
8849	3.9468942	8884	3.9486085	8919	3.9503162	8954	3.9520171
8850	3.9469433	8885	3.9486574	8920	3.9503649	8955	3.9520656
8851	3.9469923	8886	3.9487063	8921	3.9504135	8956	3.9521141
8852	3.9470414	8887	3.9487552	8922	3.9504622	8957	3.9521626
8853	3.9470905	8888	3.9488040	8923	3.9505109	8958	3.9522111
8854	3.9471395	8889	3.9488529	8924	3.9505596	8959	3.9522595
8855	3.9471886	8890	3.9489018	8925	3.9506082	8960	3.9523080

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
8961	3.9523565	8996	3.9540494	9031	3.9557358	9066	3.9574157
8962	3.9524049	8997	3.9540977	9032	3.9557939	9067	3.9574636
8963	3.9524534	8998	3.9541460	9033	3.9558320	9068	3.9575115
8964	3.9525018	8999	3.9541943	9034	3.9558800	9069	3.9575594
8965	3.9525503	9000	3.9542425	9035	3.9559282	9070	3.9576073
8966	3.9525987	9001	3.9542908	9036	3.9559762	9071	3.9576552
8967	3.9526472	9002	3.9543390	9037	3.9560243	9072	3.9577030
8968	3.9526956	9003	3.9543872	9038	3.9560723	9073	3.9577509
8969	3.9527440	9004	3.9544355	9039	3.9561204	9074	3.9577988
8970	3.9527924	9005	3.9544837	9040	3.9561684	9075	3.9578466
8971	3.9528409	9006	3.9545319	9041	3.9562165	9076	3.9578945
8972	3.9528893	9007	3.9545802	9042	3.9562645	9077	3.9579423
8973	3.9529377	9008	3.9546284	9043	3.9563125	9078	3.9579902
8974	3.9529861	9009	3.9546766	9044	3.9563605	9079	3.9580380
8975	3.9530345	9010	3.9547248	9045	3.9564686	9080	3.9580858
8976	3.9530828	9011	3.9547730	9046	3.9564566	9081	3.9581337
8977	3.9531312	9012	3.9548212	9047	3.9565046	9082	3.9581815
8978	3.9531796	9013	3.9548694	9048	3.9565526	9083	3.9582294
8979	3.9532280	9014	3.9549176	9049	3.9566006	9084	3.9582771
8980	3.9532763	9015	3.9549657	9050	3.9566486	9085	3.9583249
8981	3.9533247	9016	3.9550139	9051	3.9566966	9086	3.9583727
8982	3.9533730	9017	3.9550621	9052	3.9567445	9087	3.9584205
8983	3.9534214	9018	3.9551102	9053	3.9567925	9088	3.9584683
8984	3.9534697	9019	3.9551584	9054	3.9568405	9089	3.9585161
8985	3.9535181	9020	3.9552065	9055	3.9568885	9090	3.9585639
8986	3.9535664	9021	3.9552547	9056	3.9569364	9091	3.9586117
8987	3.9536147	9022	3.9553028	9057	3.9569844	9092	3.9586594
8988	3.9536631	9023	3.9553510	9058	3.9570323	9093	3.9587072
8989	3.9537114	9024	3.9553991	9059	3.9570803	9094	3.9587549
8990	3.9537597	9025	3.9554472	9060	3.9571282	9095	3.9588027
8991	3.9538080	9026	3.9554953	9061	3.9571761	9096	3.9588505
8992	3.9538563	9027	3.9555434	9062	3.9572241	9097	3.9588982
8993	3.9539046	9028	3.9555915	9063	3.9592720	9098	3.9589459
8994	3.9539529	9029	3.9556397	9064	3.9573199	9099	3.9589937
8995	3.9540012	9030	3.9556877	9065	3.9573678	9100	3.9590414

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
9101	3.9590891	9136	3.9607561	9171	3.9624167	9206	3.9640710
9102	3.9591368	9137	3.9608036	9172	3.9624640	9207	3.9641181
9103	3.9591845	9138	3.9608512	9173	3.9625114	9208	3 9641653
9104	3.9592322	9139	3.9608987	9174	3.9625587	9209	3.9642125
9105	3.9592799	9140	3.9609462	9175	3.9626061	9210	3.9642596
9106	3.9593276	9141	3.9609937	9176	3.9626534	9211	3.9643068
9107	3.9593753	9142	3.9610412	9177	3.9627007	9212	3.9643539
9108	3.9594230	9143	3.9610887	9178	3.9627481	9213	3.9644011
9109	3.9594707	9144	3.9611362	9179	3.9627954	9214	3.9644482
9110	3.9595184	9145	3.9611837	9180	3.9628427	9215	3.9644953
9111	3.9595660	9146	3.9612312	9181	3.9628900	9216	3.9645425
9112	3.9596137	9147	3.9612787	9182	3.9629373	9217	3.9645896
9113	3.9596614	9148	3.9613262	9183	3.9629846	9218	3.9646367
9114	3.9597090	9149	3.9613736	9184	3.9630319	9219	3.9646838
9115	3.9597567	9150	3.9614211	9185	3.9630792	9220	3.9647309
9116	3.9598043	9151	3.9614686	9186	3.9631264	9221	3.9647780
9117	3.9598520	9152	3.9615160	9187	3.9631737	9222	3.9648251
9118	3.9598996	9153	3.9615635	9188	3.9632210	9223	3.9648722
9119	3.9599472	9154	3.9616109	9189	3.9632683	9224	3.9649193
9120	3.9599948	9155	3.9616583	9190	3.9633155	9225	3.9649664
9121	3.9600425	9156	3.9617058	9191	3.9633628	9226	3.9650134
9122	3.9600901	9157	3.9617532	9192	3.9634100	9227	3.9650605
9123	3.9601377	9158	3.9618006	9193	3.9634573	9228	3.9651076
9124	3.9601853	9159	3.9618481	9194	3.9635045	9229	3.9651546
9125	3.9602329	9160	3.9618955	9195	3.9635517	9230	3.9652017
9126	3.9602805	9161	3.9619429	9196	3.9635990	9231	3.9652488
9127	3.9603280	9162	3.9619903	9197	3.9636462	9232	3.9652958
9128	3.9603756	9163	3.9620377	9198	3.9636934	9233	3.9653428
9129	3.9604232	9164	3.9620851	9195	3.9637406	9234	3.9653899
9130	3.9604708	9165	3.9621325	9200	3.9637878	9235	3.9654369
9131	3.9605183	9166	3.9621795	9201	3.9638350	9236	3.9654839
9132	3.9605659	9167	3.9622272	9202	3.9638822	9237	3.9655309
9133	3.9606135	9168	3.9622746	9203	3.9639294	9238	3.9655780
9134	3.9606610	9169	3.9623220	9204	3.9939766	9239	3.9656250
9135	3.9607086	9170	3.9623693	9205	3.9640238	9240	3.9656720

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm.*
9241	3.9657190	9276	3.9673607	9311	3.9689963	9346	3.9706258
9242	3.9657660	9277	3.9674076	9312	3.9690430	9347	3.9706722
9243	3.9658130	9278	3.9674544	9313	3.9690895	9348	3.9707183
9244	3.9658599	9279	3.9675012	9314	3.9691362	9349	3.9707652
9245	3.9659069	9280	3.9675480	9315	3.9691829	9350	3.9708116
9246	3.9659539	9281	3.9675948	9316	3.9692295	9351	3.9708581
9247	3.9660009	9282	3.9676416	9317	3.9692761	9352	3.9709045
9248	3.9660478	9283	3.9676883	9318	3.9693227	9353	3.9709509
9249	3.9660948	9284	3.9677351	9319	3.9693693	9354	3.9709974
9250	3.9661417	9285	3.9677819	9320	3.9694159	9355	3.9710438
9251	3.9661887	9286	3.9678287	9321	3.9694625	9356	3.9710902
9252	3.9662356	9287	3.9678754	9322	3.9695091	9357	3.9711366
9253	3.9662826	9288	3.9679222	9323	3.9695557	9358	3.9711830
9254	3.9663295	9289	3.9679690	9324	3.9696023	9359	3.9712294
9255	3.9663764	9290	3.9680157	9325	3.9696488	9360	3.9712758
9256	3.9664233	9291	3.9680625	9326	3.9696954	9361	3.9713222
9257	3.9664703	9292	3.9681092	9327	3.9697420	9362	3.9713686
9258	3.9665172	9293	3.9681559	9328	3.9697885	9363	3.9714150
9259	3.9665641	9294	3.9682027	9329	3.9698351	9364	3.9714614
9260	3.9666110	9295	3.9682494	9330	3.9698816	9365	3.9715078
9261	3.9666579	9296	3.9682961	9331	3.9699282	9366	3.9715542
9262	3.9667048	9297	3.9683428	9332	3.9699747	9367	3.9716005
9263	3.9667517	9298	3.9683895	9333	3.9700213	9368	3.9716469
9264	3.9667985	9299	3.9684362	9334	3.9700678	9369	3.9716932
9265	3.9668454	9300	3.9684829	9335	3.9701143	9370	3.9717396
9266	3.9668923	9301	3.9685296	9336	3.9701608	9371	3.9717859
9267	3.9669392	9302	3.9685763	9337	3.9702074	9372	3.9718323
9268	3.9669860	9303	3.9686230	9338	3.9702539	9373	3.9718786
9269	3.9670329	9304	3.9686697	9339	3.9703004	9374	3.9719249
9270	3.9670797	9305	3.9687164	9340	3.9703469	9375	3.9719713
9271	3.9671260	9306	3.9687630	9341	3.9703934	9376	3.9720176
9272	3.9671734	9307	3.9688097	9342	3.9704399	9377	3.6720639
9273	3.9672203	9308	3.9688564	9343	3.9704863	9378	3.9721102
9274	3.9672671	9309	3.9689030	9344	3.9705328	9379	3.9721565
9275	3.9673139	9310	3.9689497	9345	3.9705793	9380	3.9722028

Num	Logarithm.	Num	Logarithm.	Num	Logarithm.	Num	Logarithm.
9381	3.9722491	9416	3.9738665	9451	3.9754778	9486	3.9770831
9382	3.9722954	9417	3.9739126	9452	3.9755237	9487	3.9771289
9383	3.9723417	9418	3.9739587	9453	3.9755697	9488	3.9771747
9384	3.9723880	9419	3.9740048	9454	3.9756156	9489	3.9772204
9385	3.9724343	9420	3.9740509	9455	3.9756615	9490	3.9772662
9386	3.9724805	9421	3.9740970	9456	3.6757075	9491	3.9773120
9387	3.9725268	9422	3.9741431	9457	3.9757534	9492	3.9773578
9388	3.9725731	9423	3.9741892	9458	3.9757993	9493	3.9774035
9389	3.9726193	9424	3.9742353	9459	3.9758452	9494	3.9774492
9390	3.9726656	9425	3.9742814	9460	3.9758911	9495	3.9774950
9391	3.9727118	9426	3.9743274	9461	3.9759370	9496	3.9775407
9392	3 9727581	9427	3.9743735	9462	3.9759829	9497	3.9775864
9393	3.9728043	9428	3.9744196	9463	3.9760288	9498	3.9776322
9394	3.9728506	9429	3.9744656	9464	3.9760747	9499	3.9776779
9395	3.9728968	9430	3.0745117	9465	3.9761206	9500	3.9777236
9396	3.9729430	9431	3.9745577	9466	3.9761665	9501	3.9777693
9397	3.9729892	9432	3.9746038	9467	3.9762124	9502	3.9778150
9398	3.9730354	9433	3.9746498	9468	3.9762582	9503	3.9778607
9399	3.9730816	9434	3.9746959	9469	3.9763041	9504	3.9779064
9400	3.9731278	9435	3.9747419	9470	3.9763500	9505	3.9779521
9401	3.9731741	9436	3.9747879	9471	3.9763958	9506	3.9779978
9402	3.9732202	9437	3.9748340	9472	3.9764417	9507	3.9780435
9403	3.9732664	9438	3.9748800	9473	3.9764875	9508	3.9780892
9404	3.9733126	9439	3.9749260	9474	3.9765334	9509	3.9781348
9405	3.9733588	9440	3.9749720	9475	3.9765792	9510	3.9781805
9406	3.9734050	9441	3.9750180	9476	3.9766251	9511	3.9782262
9407	3.9734511	9442	3.9750640	9477	3.9766709	9512	3.9782718
9408	3.9734973	9443	3.9751100	9478	3.9767167	9513	3.9783175
9409	3.9735435	9444	3.9751560	9479	3.9767625	9514	3.9783631
9410	3.9735896	9445	3.9752020	9480	3.9768083	9515	3.9784088
9411	3.9736358	9446	3.9752479	9481	3.9768541	9516	3.9784544
9412	3.9736819	9447	3.9752939	9482	3.9768999	9517	3.9785001
9413	3.9737281	9448	3.9753399	9483	3.9769457	9518	3.9785457
9414	3.9737742	9449	3.9753858	9484	3.9769915	9519	3.9785913
9415	3.9738203	9450	3.9754318	9485	3.9770373	9520	3.9786369

Num	Logarithm.	Num	Logarithm	Num	Logarithm	Num	Logarithm.
9521	3.9786826	9556	3.9802761	9591	3.9818639	9626	3.9834459
9522	3.9787282	9557	3.9803216	9592	3.9819092	9627	3.9834910
9523	3.9787738	9558	3.9803670	9593	3.9819544	9628	3.9835361
9524	3.9788194	9559	3.9804125	9594	3.9819997	9629	3.9835812
9525	3.9788650	9560	3.9804579	9595	3.9820450	9630	3.9836263
9526	3.9789106	9561	3.9805033	9596	3.9820902	9631	3.9836714
9527	3.978956[illegible]	9562	3.9805487	9597	3.9821355	9632	3.9837165
9528	3.9790017	9563	3.9805942	9598	3.9821807	9633	3.9837616
9529	3.9790473	9564	3.9806396	9599	3.9822260	9634	3.9838066
9530	3.9790929	9565	3.9806850	9600	3.9822712	9635	3.9838517
9531	3.9791385	9566	3.9807304	9601	3.9823165	9636	3.9838968
9532	3.9791840	9567	3.9807758	9602	3 9823617	9637	3.9839419
9533	3.9792296	9568	3.9808212	9603	3.9824069	9638	3.9839869
9534	3.9792751	9569	3.9808666	9604	3.9824522	9639	3.9840320
9535	3.9793207	9570	3.9809119	9605	3.9824974	9640	3.9840770
9536	3.9793662	9571	3.9809573	9606	3.9825426	9641	3.9841221
9537	3.9794118	9572	3.9810027	9607	3.9825878	9642	3.9841671
9538	3.9794573	9573	3.9810481	9608	3.9826330	9643	3.9842122
9539	3.9795028	9574	3.9810934	9609	3.9826782	9644	3.9842572
9540	3.9795484	9575	3.9811388	9610	3.9827234	9645	3.9843022
9541	3.9795939	9576	3.9811841	9611	3.9827686	9646	3.9843473
9542	3.9796394	9577	3.9812295	9612	3.9828138	9647	3.9843923
9543	3.9796849	9578	3.9812748	9613	3.9828589	9648	3.9844373
9544	3.9797304	9579	3.9813202	9614	3.9829041	9649	3.9844823
9545	3.9797759	9580	3.9813655	9615	3.9829493	9650	3 9845273
9546	3.9798214	9581	3.9814108	9616	3.9829945	9651	3.9845723
9547	3.9798669	9582	3.9814562	9617	3.9830396	9652	3.9846173
9548	3.9799124	9583	3.9815015	9618	3.9830848	9653	3.9846623
9549	3.9799579	9584	3.9815468	9619	3.9831299	9654	3.9047073
9550	3.9800034	9585	3.9815921	9620	3.9831751	9655	3.9847523
9551	3.9800488	9586	3.9816374	9621	3.9832202	9656	3.9847973
9552	3.9800943	9587	3.9816827	9622	3.9832654	9657	3.9848422
9553	3.9801398	9588	3.9817280	9623	3.9833105	9658	3.9848872
9554	3.9801852	9589	3.9817733	9624	3.9833556	9659	3.9849322
9555	3.9802307	9590	3.9818186	9625	3.9834007	9660	3.9849771

Num	Logarithm	Num	Logarithm.	Num	Logarithm.	Num	Logarithm
9661	3.9850221	9696	3.9865920	9731	3.9881575	9766	3.9897167
9662	3.9850670	9697	3.9866374	9732	3.9882021	9767	3.9897612
9663	3.9851120	9698	3.9866822	9733	3.9882467	9768	3.9898056
9664	3.9851569	9699	3.9867270	9734	3.9882913	9769	3.9898501
9665	3.9852019	9700	3.9867717	9735	3.9883360	9770	3.9898946
9666	3.9852468	9701	3.9868165	9736	3.9883806	9771	3.9899390
9667	3.9852917	9702	3.9868613	9737	3.9884252	9772	3.9899835
9668	3.9853366	9703	3.9869060	9738	3.9884698	9773	3.9900279
9669	3.9853816	9704	3.9869508	9739	3.9885144	9774	3.9900723
9670	3.9854265	9705	3.9869955	9740	3.9885590	9775	3.9901168
9671	3.9854714	9706	3.9870403	9741	3.9886035	9776	3.9901612
9672	3.9855163	9707	3.9870850	9742	3.9886481	9777	3.9902056
9673	3.9855612	9708	3.9871298	9743	3.9886927	9778	3.9902500
9674	3.9856061	9709	3.9871745	9744	3.9887373	9779	3.9902944
9675	3.9856510	9710	3.9872192	9745	3.9887818	9780	3.9903389
9676	3.9856959	9711	3.9872640	9746	3.9888264	9781	3.9903833
9677	3.9857407	9712	3.9873087	9747	3.9888710	9782	3.9904277
9678	3.9857856	9713	3.9873534	9748	3.9889155	9783	3.9904721
9679	3.9858305	9714	3.9873981	9749	3.9889601	9784	3.9905164
9680	3.9858754	9715	3.9874428	9750	3.9890046	9785	3.9905608
9681	3.9859202	9716	3.9874875	9751	3.9890492	9786	3.9906052
9682	3.9859651	9717	3.9875322	9752	3.9890937	9787	3.9906496
9683	3.9860099	9718	3.9875769	9753	3.9891382	9788	3.9906940
9684	3.9860548	9719	3.9876216	9754	3.9891828	9789	3.9907383
9685	3.9860996	9720	3.9876663	9755	3.9892273	9790	3.9907827
9686	3.9861455	9721	3.9877109	9756	3.9892718	9791	3.9908270
9687	3.9861893	9722	3.9877556	9757	3.9093163	9792	3.9908714
9688	3.9862341	9723	3.9878003	9758	3.9893608	9793	3.9909158
9689	3.9862790	9724	3.9878449	9759	3.9894053	9794	3.9909601
9690	3.9863238	9725	3.9878896	9760	3.9894498	9795	3.9910044
9691	3.9863686	9726	3.9879343	9761	3.9894943	9796	3.9910488
9692	3.9864134	9727	3.9879789	9762	3.9895388	9797	3.9910931
9693	3.9864582	9728	3.9880236	9763	3.9895833	9798	3.9911374
9694	3.9865030	9729	3.9880682	9764	3.9896278	9799	3.9911818
9695	3.9865478	9730	3.9881128	9765	3.9896722	9800	3.9912261

Num	Logarithm.	Nun	Logarithm.	Num	Logarithm.	Nun	Logarithm.
9801	3.9912704	9836	3.9928185	9871	3.9943612	9906	3.9958983
9802	3.9913147	9837	3.9928627	9872	3.9944051	9907	3.9959422
9803	3.9913590	9838	3.9929068	9873	3.9944491	9908	3.9959860
9804	3.9914033	9839	3.9929510	9874	3.9944931	9909	3 9960298
9805	3.9914476	9840	3.9929951	9875	3.9945371	9910	3.9960737
9806	3.9914919	9841	3.9930392	9876	3.9945811	9911	3.9961175
9807	3.9915362	9842	3.9930834	9877	3.9946251	9912	3.9961613
9808	3.9915805	9843	3.9931275	9878	3.9946690	9913	3.9962051
9809	3.9916247	9844	3.9931716	9879	3.9947130	9914	3.9962489
9810	3.9916690	9845	3 9932157	9880	3.9947569	9915	3.9962927
9811	3 9917133	9846	3.9932598	9881	3.9948009	9916	3.9963365
9812	3.9917575	9847	3.9933039	9882	3.9948448	9917	3.9963803
9813	3.9918018	9848	3.9933480	9883	3.9948888	9918	3.9964241
9814	3.9918461	9849	3.9933921	9884	3.9949327	9919	3.9964679
9815	3.9918903	9850	3.9934362	9885	3.9949767	9920	3 9965117
9816	3.9919345	9851	3.9934803	9886	3.9950206	9921	3.9965554
9817	3.9919788	9852	3.9935244	9887	3.9950645	9922	3.9965992
9818	3.9920230	9853	3.9935685	9888	3.9951085	9923	3.9966430
9819	3.9920673	9854	3.9936126	9889	3.9951524	9924	3.9966868
9820	3.9921115	9855	3.9936566	9890	3.9951963	9925	3.9967305
9821	3.9921557	9856	3.9937007	9891	3.9952402	9926	3.9967743
9822	3.9921999	9857	3.9937448	9892	3.9952841	9927	3.9968180
9823	3.9922441	9858	3 9937888	9893	3.9953280	9928	3.9968618
9824	3.9922884	9859	3 9938329	9894	3.9953719	9929	3.9969055
9825	3.9923326	9860	3.9938769	9895	3.9954158	9930	3.9969492
9826	3.9923768	9861	3.9939210	9896	3.9954597	9931	3.9969930
9827	3 9924210	9862	3.9939650	9897	3.9955036	9932	3.9970367
9828	3.9924651	9863	3.9940090	9898	3.9955474	9933	3.9970804
9829	3.9925093	9864	3.9940531	9899	3.9955913	9934	3.9971242
9830	3.9925535	9865	3.9940971	9900	3.9956352	9935	3.9971679
9831	3.9925977	9866	3.9941411	9901	3.9956791	9936	3.9972116
9832	3.9926419	9867	3.9941851	9902	3.9957229	9937	3.9972553
9833	3.9926860	9868	3.9942291	9903	3.9957668	9938	3.9972990
9834	3.9927302	9869	3.9942731	9904	3.9958106	9939	3.9973427
9835	3.9927744	9870	3 9943172	9905	3.9958545	9940	3.9973864

Num	*Logarithm.*	Num	*Logarithm.*	Num	*Logarithm*	Num	*Logarithm*
9941	3.9974301	9956	3.9980849	9971	3.9987387	9986	3.9993916
9942	3.9974738	9957	3.9981285	9972	3.9987823	9987	3.9994350
9943	3.9975174	9958	3.9981721	9973	3.9988258	9988	3.9994785
9944	3.9975611	9959	3.9982157	9974	3.9988694	9989	3.9995220
9945	3.9976048	9960	3.9982593	9975	3.9989129	9990	3.9995655
9946	3.9976485	9961	3.9983029	9976	3.9989564	9991	3.9996090
9947	3.9976921	9962	3.9983465	9977	3.9990000	9992	3.9996524
9948	3.9977358	9963	3.9983901	9978	3.9990435	9993	3.9996959
9949	3.9977794	9964	3.9984337	9979	3.9990870	9994	3.9997393
9950	3.9978231	9965	3.9984773	9980	3.9991305	9995	3.9997828
9951	3.9978667	9966	3.9985209	9981	3.9991740	9996	3.9998262
9952	3.9979104	9967	3.9985645	9982	3.9992176	9997	3.9998697
9953	3.9979540	9968	3.9986080	9983	3.9992611	9998	3.9999131
9954	3.9979976	9969	3.9986516	9984	3.9993046	9999	3.9999566
9955	3.9980413	9970	3.9986952	9985	3.9993481	10000	4.0000000

A
TRIANGULAR
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Logarithmical:

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A TABLE

OF

Artificial SINES, *TANGENTS*, and the Complements Arithmetical of *Sines*, ſupplying the uſe of *Secants*, the Radius 10.0000000. And to every Degree and Minute of the *Quadrant*.

0	Sine.	SINE Complement.	Tang	TANGENT Complement.		Com. Arithmetic. of Sine	Com. Arith. of Sine Com.
0	0	10.0000000	0	*Infinite*	60	10.0000000	.0000000
1	6.4637261	9.9999999	6.4637261	13.5362739	59	3.5362739	0000000
2	6.7647561	9.9999999	6.7647562	13.2352438	58	3.2352439	0000001
3	6.9408473	9.9999998	6.9408475	13.0591525	57	3.0591527	0000002
4	7.0657860	9.9999997	7.0657863	12.9342137	56	2.9342140	0000003
5	7.1626960	9.9999995	7.1626964	12.8373036	55	2.8373040	0000005
6	7.2418771	9.9999993	7.2418778	12.7581222	54	2.7581229	0000007
7	7.3088239	9.9999991	7.3088247	12.6911752	53	2.6911761	0000009
8	7.3668157	9.9999988	7.3668169	12.6331831	52	2.6331843	.0000012
9	7.4179681	9.9999985	7.4179696	12.5820304	51	2.5820319	0000015
10	7.4637255	9.9999982	7.4637273	12.5362727	50	2.5362745	0000018
11	7.5051181	9.9999978	7.5051203	12.4948797	49	2.4948819	.0000022
12	7.5429065	9.9999974	7.5429091	12.4570909	48	2.4570935	.0000026
13	7.5776684	9.9999969	7.5776715	12.4223285	47	2.4223316	0000031
14	7.6098530	9.9999964	7.6098566	12.3901434	46	2.3901470	.0000036
15	7.6398160	9.9999959	7.6398201	12.3601799	45	2.3601840	.0000041
16	7.6678445	9.9999953	7.6678492	12.3321508	44	2.3321555	.0000047
17	7.6941733	9.9999947	7.6941786	12.3058214	43	2.3058267	0000053
18	7.7189966	9.9999940	7.7190026	12.2809974	42	2.2810034	.0000060
19	7.7424775	9.9999934	7.7424841	12.2575159	41	2.2575225	.0000066
20	7.7647537	9.9999927	7.7647610	12.2352390	40	2.2352463	0000073
21	7.7859427	9.9999919	7.7859508	12.2140492	39	2.2140573	0000081
22	7.8061458	9.9999911	7.8061547	12.1938453	38	2.1938542	.0000089
23	7.8254507	9.9999903	7.8254604	12.1745399	37	2.1745493	0000097
24	7.8439338	9.9999894	7.8439444	12.1560556	36	2.1560662	0000106
25	7.8616623	9.9999885	7.8616738	12.1383262	35	2.1383377	.0000115
26	7.8786953	9.9999870	7.8787077	12.1212923	34	2.1213047	0000124
27	7.8950854	9.9999866	7.8950988	12.1049012	33	2.1049146	0000134
28	7.9108793	9.9999856	7.9108938	12.0891062	32	2.0891207	.0000144
29	7.9261190	9.9999845	7.9261344	12.0738656	31	2.0738810	0000155
30	7.9408419	9.9999835	7.9408584	12.0591416	30	2.0591581	.0000165
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	89		

0	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Aritmetic. of Sine.	Com. Aritm. of Sine Com.
30	7.9408419	9.9999835	7.9408584	12.0591416	30	2.0591581	.0000165
31	7.9550819	9.9999823	7.9550996	12.0449004	29	2.0449181	.0000177
32	7.9688698	9.9999812	7.9688886	12.0311114	28	2.0311302	.0000188
33	7.9822334	9.9999800	7.9822534	12.0177466	27	2.0177666	.0000200
34	7.9951980	9.9999788	7.9952192	12.0047808	26	2.0048020	.0000212
35	8.0077867	9.9999775	8.0078092	11.9921908	25	1.9922133	.0000225
36	8.0200207	9.9999762	8.0200445	11.9799555	24	1.9799793	.0000238
37	8.0319195	9.9999748	8.0319446	11 9680554	23	1.9680805	.0000252
38	8.0435009	9.9999735	8.0435274	11.9564726	22	1.9564991	.0000265
39	8.0547814	9.9999721	8.0548094	11.9451906	21	1.9452186	.0000279
40	8.0657763	9.9999706	8.0658057	11.9341943	20	1.9342237	.0000294
41	8.0764997	9.9999691	8.0765306	11.9234694	19	1.9235003	.0000309
42	8.0869646	9.9999676	8.0869970	11.9130030	18	1.9130354	.0000324
43	8.0971832	9.9999660	8.0972172	11.9027828	17	1.9028168	.0000340
44	8.1071669	9.9999644	8.1072025	11.8927975	16	1.8928331	.0000356
45	8.1169262	9.9999628	8.1169634	11.8830369	15	1.8830738	.0000372
46	8.1264710	9.9999611	8.1265099	11.8734901	14	1.8735290	.0000389
47	8.1358104	9.9999594	8.1358510	11.8641490	13	1.8641896	.0000406
48	8.1449532	9.9999577	8.1449956	11.8550044	12	1.8550468	.0000423
49	8.1539075	9.9999559	8.1539516	11.8460484	11	1.8460925	.0000441
50	8.1626808	9.9999541	8.1627267	11.8372733	10	1.8373192	.0000459
51	8.1712804	9.9999522	8.1713282	11.8286718	9	1.8287196	.0000478
52	8.1797121	9.9999503	8.1797626	11.8202374	8	1.8202871	.0000497
53	8.1879848	9.9999484	8.1880364	11.8119636	7	1.8120152	.0000516
54	8.1961020	9.9999464	8.1961556	11.8038444	6	1.8038980	.0000536
55	8.2040703	9.9999444	8.2041259	11.7958741	5	1.7959297	.0000556
56	8.2118949	9.9999424	8.2119526	11.7880474	4	1.7881051	.0000576
57	8.2195811	9.9999403	8.2196408	11.7803592	3	1.7804189	.0000597
58	8.2271335	9.9999382	8.2271953	11.7728047	2	1.7728665	.0000618
59	8.2345568	9.9999360	8.2346208	11.7653792	1	1.7654432	.0000640
60	8.2418553	9.9999338	8.2419215	11.7580785	0	1.7581447	.0000662
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	89		

1	Sine	SINE Complement.	Sine.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	8.2418553	9.9999338	8.2419215	11.7580785	60	1.7581447	.0000661
1	8.2490332	9.9999316	8.2491015	11.7508985	59	1.7509668	.0000684
2	8.2560943	9.9999294	8.2561649	11.7438351	58	1.7439057	.0000706
3	8.2630424	9.9999271	8.2631153	11.7368847	57	1.7369576	.0000729
4	8.2698810	9.9999247	8.2699563	11.7300437	56	1.7301190	.0000753
5	8.2766136	9.9999224	8.2766912	11.7233088	55	1.7233864	.0000776
6	8.2832434	9.9999200	8.2833234	11.7166766	54	1.7167566	.0000800
7	8.2897734	9.9999175	8.2898559	11.7101441	53	1.7102266	.0000825
8	8.2962067	9.9999150	8.2962917	11.7037083	52	1.7037933	.0000850
9	8.3025460	9.9999125	8.3026335	11.6973665	51	1.6974540	.0000875
10	8.3087941	9.9999100	8.3088842	11.6911158	50	1.6912059	.0000900
11	8.3149536	9.9999074	8.3150462	11.6849538	49	1.6850464	.0000926
12	8.3210269	9.9999047	8.3211221	11.6788779	48	1.6789731	.0000953
13	8.3270163	9.9999021	8.3271143	11.6728857	47	1.6729837	.0000979
14	8.3329243	9.9998994	8.3330249	11.6669751	46	1.6670757	.0001006
15	8.3387529	9.9998966	8.3388563	11.6611437	45	1.6612471	.0001034
16	8.3445043	9.9998939	8.3446105	11.6553895	44	1.6554957	.0001061
17	8.3501805	9.9998911	8.3502895	11.6497105	43	1.6498195	.0001089
18	8.3557835	9.9998882	8.3558953	11.6441047	42	1.6442165	.0001118
19	8.3613150	9.9998853	8.3614297	11.6385703	41	1.6386850	.0001147
20	8.3667769	9.9998824	8.3668945	11.6331055	40	1.6332231	.0001176
21	8.3721710	9.9998794	8.3722915	11.6277085	39	1.6278290	.0001206
22	8.3774988	9.9998764	8.3776223	11.6223777	38	1.6225012	.0001236
23	8.3827620	9.9998734	8.3828886	11.6171114	37	1.6172380	.0001266
24	8.3879622	9.9998703	8.3880918	11.6119082	36	1.6120378	.0001297
25	8.3931008	9.9998672	8.3932336	11.6067664	35	1.6068992	.0001328
26	8.3981792	9.9998641	8.3983152	11.6016848	34	1.6018207	.0001359
27	8.4031990	9.9998609	8.4033381	11.5966619	33	1.5968010	.0001391
28	8.4081614	9.9998577	8.4083037	11.5916963	32	1.5918386	.0001423
29	8.4130676	9.9998544	8.4132132	11.5867868	31	1.5869324	.0001456
30	8.4179190	9.9998512	8.4180679	11.5819321	30	1.5820810	.0001488
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	88		

1	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	8.4179190	9.9998512	8.4180679	11.5819321	30	1.5820810	.0001488
31	8.4227168	9.9998478	8.4228690	11.5771310	29	1.5772832	.0001522
32	8.4274621	9.9998445	8.4276176	11.5723824	28	1.5725379	.0001555
33	8.4321561	9.9998411	8.4323150	11.5676850	27	1.5678439	.0001589
34	8.4367999	9.9998376	8.4369622	11.5630378	26	1.5632001	.0001624
35	8.4413944	9.9998342	8.4415603	11.5584397	25	1.5586056	.0001658
36	8.4459409	9.9998306	8.4461103	11.5538897	24	1.5540591	.0001694
37	8.4504402	9.9998271	8.4506131	11.5493869	23	1.5495598	.0001729
38	8.4548934	9.9998235	8.4550699	11.5449301	22	1.5451066	.0001765
39	8.4593013	9.9998199	8.4594814	11.5405186	21	1.5406987	.0001801
40	8.4636649	9.9998162	8.4638486	11.5361514	20	1.5363351	.0001838
41	8.4679850	9.9998125	8.4681725	11.5318275	19	1.5320150	.0001875
42	8.4722626	9.9998088	8.4724538	11.5275462	18	1.5277374	.0001912
43	8.4764984	9.9998050	8.4766933	11.5233067	17	1.5235016	.0001950
44	8.4806932	9.9998012	8.4808920	11.5191080	16	1.5193068	.0001988
45	8.4848479	9.9997974	8.4850505	11.5149495	15	1.5151521	.0002026
46	8.4889632	9.9997935	8.4891696	11.5108304	14	1.5110368	.0002065
47	8.4930398	9.9997896	8.4932502	11.5067498	13	1.5069602	.0002104
48	8.4970784	9.9997856	8.4972928	11.5027072	12	1.5029216	.0002144
49	8.5010798	9.9997817	8.5012982	11.4987018	11	1.4989202	.0002183
50	8.5050447	9.9997776	8.5052671	11.4947329	10	1.4949553	.0002224
51	8.5089736	9.9997736	8.5092001	11.4907999	9	1.4910264	.0002264
52	8.5128673	9.9997695	8.5130978	11.4869022	8	1.4871327	.0002305
53	8.5167264	9.9997653	8.5169610	11.4830387	7	1.4832736	.0002347
54	8.5205514	9.9997612	8.5207902	11.4792098	6	1.4794486	.0002388
55	8.5243430	9.9997570	8.5245860	11.4754140	5	1.4756570	.0002430
56	8.5281017	9.9997527	8.5283490	11.4716510	4	1.4718983	.0002473
57	8.5318281	9.9997484	8.5320797	11.4679203	3	1.4681719	.0002516
58	8.5355228	9.9997441	8.5357787	11.4642213	2	1.4644782	.0002559
59	8.5391863	9.9997398	8.5394466	11.4605534	1	1.4608137	.0002602
60	8.5428192	9.9997354	8.5430838	11.4569162	0	1.4571808	.0002646
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	88		

2	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	8.5428192	9.9997354	8.5430838	11.4569162	60	1.4571808	.0002646
1	8.5464218	9.9997309	8.5466909	11.4533091	59	1.4535782	.0002691
2	8.5499948	9.9997265	8.5502683	11.4497317	58	1.4500052	.0002735
3	8.5535386	9.9997220	8.5538166	11.4461834	57	1.4464614	.0002790
4	8.5570536	9.9997174	8.5573362	11.4426638	56	1.4429464	.0002826
5	8.5605404	9.9997128	8.5608276	11.4391724	55	1.4394596	.0002872
6	8.5639994	9.9997082	8.5642912	11.4357088	54	1.4360006	.0002918
7	8.5674310	9.9997036	8.5677275	11.4322725	53	1.4325690	.0002964
8	8.5708357	9.9996989	8.5711368	11.4288632	52	1.4291643	.0003011
9	8.5742139	9.9996942	8.5745197	11.4254803	51	1.4257861	.0003058
10	8.5775660	9.9996894	8.5778766	11.4221234	50	1.4224340	.0003106
11	8.5808923	9.9996846	8.5812077	11.4187923	49	1.4191077	.0003154
12	8.5841933	9.9996798	8.5845136	11.4154864	48	1.4158067	.0003202
13	8.5874694	9.9996749	8.5877945	11.4122055	47	1.4125306	.0003251
14	8.5907209	9.9996700	8.5910509	11.4089491	46	1.4092791	.0003300
15	8.5939483	9.9996650	8.5942832	11.4057168	45	1.4060517	.0003350
16	8.5971517	9.9996601	8.5974917	11.4025083	44	1.4028483	.0003399
17	8.6003317	9.9996550	8.6006767	11.3993233	43	1.3996683	.0003450
18	8.6034886	9.9996500	8.6038386	11.3961614	42	1.3965114	.0003500
19	8.6066226	9.9996449	8.6069777	11.3930223	41	1.3933774	.0003551
20	8.6097341	9.9996398	8.6100943	11.3899057	40	1.3902659	.0003602
21	8.6128235	9.9996346	8.6131889	11.3868111	39	1.3871765	.0003654
22	8.6158910	9.9996294	8.6162616	11.3837384	38	1.3841090	.0003706
23	8.6189369	9.9996242	8.6193127	11.3806873	37	1.3810631	.0003758
24	8.6219616	9.9996189	8.6223427	11.3776573	36	1.3780384	.0003811
25	8.6249654	9.9996136	8.6253518	11.3746482	35	1.3750347	.0003864
26	8.6279484	9.9996082	8.6283402	11.3716598	34	1.3720516	.0003918
27	8.6309111	9.9996028	8.6313083	11.3686917	33	1.3690889	.0003972
28	8.6338537	9.9995974	8.6342563	11.3657437	32	1.3661463	.0004026
29	8.6367764	9.9995919	8.6371845	11.3628155	31	1.3632236	.0004081
30	8.6396796	9.9995865	8.6400931	11.3599059	30	1.3603204	.0004135
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	87		

2	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith of Sine Com.
30	8.6396796	9.9995865	8.6400931	11.3599069	30	1.3603204	.0004135
31	8.6425634	9.9995809	8.6429825	11.3570175	29	1.3574366	.0004191
32	8.6454282	9.9995753	8.6458528	11.3541472	28	1.3545718	.0004247
33	8.6482742	9.9995697	8.6487044	11.3512956	27	1.3517258	.0004303
34	8.6511016	9.9995641	8.6515375	11.3484625	26	1.3488984	.0004359
35	8.6539107	9.9995584	8.6543525	11.3456478	25	1.3460893	.0004416
36	8.6567017	9.9995527	8.6571490	11.3428510	24	1.3432983	.0004473
37	8.6594748	9.9995469	8.6599279	11.3400721	23	1.3405252	.0004530
38	8.6622303	9.9995411	8.6626891	11.3373109	22	1.3377697	.0004589
39	8.6649684	9.9995353	8.6654331	11.3345669	21	1.3350316	.0004647
40	8.6676893	9.9995294	8.6681598	11.3318402	20	1.3323107	.0004705
41	8.6703933	9.9995236	8.6708697	11.3291303	19	1.3296068	.0004764
42	8.6730804	9.9995176	8.6735628	11.3264372	18	1.3269196	.0004824
43	8.6757510	9.9995116	8.6762393	11.3237607	17	1.3242490	.0004884
44	8.6784052	9.9995056	8.6788996	11.3211004	16	1.3215948	.0004944
45	8.6810432	9.9994996	8.6815437	11.3184563	15	1.3189567	.0005004
46	8.6836654	9.9994935	8.6841719	11.3158281	14	1.3163346	.0005065
47	8.6862718	9.9994874	8.6867844	11.3132156	13	1.3137282	.0005126
48	8.6888625	9.9994812	8.6893813	11.3106187	12	1.3111375	.0005188
49	8.6914379	9.9994750	8.6919629	11.3080371	11	1.3085621	.0005250
50	8.6939980	9.9994688	8.6945292	11.3054708	10	1.3060019	.0005312
51	8.6965431	9.9994625	8.6970806	11.3029194	9	1.3034569	.0005375
52	8.6990734	9.9994562	8.6996172	11.3003828	8	1.3009266	.0005438
53	8.7015889	9.9994498	8.7021390	11.2978610	7	1.2984111	.0005502
54	8.7040899	9.9994435	8.7046465	11.2953535	6	1.2959101	.0005565
55	8.7065766	9.9994370	8.7071395	11.2928605	5	1.2934234	.0005630
56	8.7090490	9.9994306	8.7096185	11.2903815	4	1.2909510	.0005694
57	8.7115075	9.9994241	8.7120834	11.2879166	3	1.2884925	.0005759
58	8.7139520	9.9994176	8.7145345	11.2854655	2	1.2860480	.0005824
59	8.7163829	9.9994110	8.7169719	11.2830281	1	1.2836171	.0005890
60	8.7188002	9.9994044	8.7193958	11.2806042	0	1.2811998	.0005956
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	87		

3	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	8.7188002	9.9994044	8.7193958	11.2806042	60	1.2811998	.0005956
1	8.7212040	9.9993978	8.7218063	11.2781937	59	1.2787960	.0006022
2	8.7235945	9.9993911	8.7242035	11.2757965	58	1.2764055	.0006089
3	8.7259721	9.9993844	8.7265877	11.2734123	57	1.2740279	.0006156
4	8.7283366	9.9993776	8.7289589	11.2710411	56	1.2716634	.0006224
5	8.7306882	9.9993708	8.7313174	11.2686826	55	1.2693118	.0006292
6	8.7330272	9.9993640	8.7336631	11.2663369	54	1.2669728	.0006360
7	8.7353535	9.9993572	8.7359964	11.2640036	53	1.2646465	.0006428
8	8.7376675	9.9993503	8.7383172	11.2616828	52	1.2623325	.0006497
9	8.7399691	9.9993433	8.7406258	11.2593742	51	1.2600309	.0006567
10	8.7422586	9.9993364	8.7429222	11.2570778	50	1.2577414	.0006636
11	8.7445360	9.9993293	8.7452067	11.2547933	49	1.2554640	.0006707
12	8.7468015	9.9993223	8.7474792	11.2525208	48	1.2531985	.0006777
13	8.7490553	9.9993152	8.7497400	11.2502600	47	1.2509447	.0006848
14	8.7512973	9.9993081	8.7519892	11.2480108	46	1.2487027	.0006919
15	8.7535278	9.9993009	8.7542669	11.2457731	45	1.2464722	.0006991
16	8.7557469	9.9992938	8.7564531	11.2435469	44	1.2442531	.0007060
17	8.7579546	9.9992865	8.7586681	11.2413319	43	1.2420454	.0007135
18	8.7601512	9.9992793	8.7608719	11.2391281	42	1.2398488	.0007207
19	8.7623366	9.9992720	8.7630647	11.2369353	41	1.2376634	.0007280
20	8.7645111	9.9992646	8.7652465	11.2347535	40	1.2354889	.0007354
21	8.7666747	9.9992572	8.7674175	11.2325825	39	1.2333253	.0007428
22	8.7688275	9.9992498	8.7695777	11.2304223	38	1.2311725	.0007502
23	8.7709697	9.9992424	8.7717274	11.2282726	37	1.2290303	.0007576
24	8.7731014	9.9992349	8.7738665	11.2261335	36	1.2268986	.0007651
25	8.7752226	9.9992274	8.7759952	11.2240048	35	1.2247774	.0007726
26	8.7773334	9.9992198	8.7781136	11.2218864	34	1.2226666	.0007802
27	8.7794340	9.9992122	8.7802218	11.2197782	33	1.2205660	.0007878
28	8.7815244	9.9992046	8.7823199	11.2176801	32	1.2184756	.0007954
29	8.7836048	9.9991969	8.7844079	11.2155921	31	1.2163952	.0008031
30	8.7856753	9.9991892	8.7864861	11.2135139	30	1.2143247	.0008108
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	86		

3	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com
30	8.7856753	9.9991892	8.7864861	11.2135139	30	1.2143247	.0008108
31	8.7877359	9.9991815	8.7885544	11.2114456	29	1.2122641	.0008185
32	8.7897867	9.9991737	8.7906130	11.2093870	28	1.2102133	.0008263
33	8.7918278	9.9991659	8.7926620	11.2073380	27	1.2081722	.0008341
34	8.7938594	9.9991580	8.7947014	11 2052986	26	1.2061406	.0008420
35	8.7958814	9.9991501	8.7967313	11.2032687	25	1.2041186	.0008499
36	8.7978941	9.9991422	8.7987519	11.2012481	24	1.2021059	0008578
37	8.7998974	9.9991342	8.8007632	11 1992368	23	1.2001026	.0008658
38	8.8018915	9.9991262	8.8027653	11.1972347	22	1.1981085	.0008738
39	8.8038764	9.9991182	8.8047583	11.1952417	21	1.1961236	0008818
40	8.8058523	9.9991101	8.8067422	11.1932578	20	1.1941477	.0008899
41	8.8078192	9.9991020	8.8087172	11.1912828	19	1.1921808	.0008980
42	8.8097772	9.9990938	8.8106834	11.1893166	18	1.1902228	.0009062
43	8.8117264	9.9990856	8.8126407	11.1873593	17	1.1882736	.0009144
44	8.8136668	9.9990774	8.8145894	11.1854106	16	1.1863332	.0009226
45	8.8155985	9.9990691	8.8165294	11.1834706	15	1.1844015	.0009309
46	8.8175217	9.9990608	8.8184608	11.1815392	14	1.1824783	.0009392
47	8.8194363	9.9990525	8.8203838	11.1796162	13	1.1805637	.0009475
48	8.8213425	9.9990441	8.8222984	11.1777016	12	1.1786575	.0009559
49	8.8232404	9.9990357	8.8242046	11.1757954	11	1.1767596	.0009643
50	8.8251299	9.9990273	8.8261026	11.1738974	10	1.1748701	.0009727
51	8.8270112	9.9990188	8.8279924	11.1720076	9	1.1729888	0009812
52	8.8288844	9.9990103	8.8298741	11.1701259	8	1.1711156	.0009897
53	8.8307[illegible]5	9.9990017	8.8317478	11.1682522	7	1.1692505	.0009983
54	8.8326066	9.9989931	8.8336134	11.1663866	6	1.1673934	.0010069
55	8.8344557	9.9989845	8.8354712	11.1645288	5	1.1655443	.0010155
56	8.8362969	9.9989758	8.8373211	11.1626788	4	1.1637031	.0010242
57	8.8381304	9.9989671	8.8391633	11.1608367	3	1.1618695	.0010329
58	8.8399561	9.9989584	8.8409977	11.1590023	2	1.1600439	.0010416
59	8.8417741	9.9989496	8.8428245	11.1571755	1	1.1582259	'0010504
60	8.8435845	9.9989408	8.8446437	11.1553563	0	1.1564155	.0010592
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	86		

4	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithnetic. of Sine.	Com. Arith. of Sine Com.
0	8.8435845	9.9989408	8.8446437	11.1553563	60	1.1564154	.0000592
1	8.8453874	9.9989319	8.8464554	11.1535446	59	1.1546126	.0010681
2	8.8471827	9.9989230	8.8482597	11.1517403	58	1.1528173	.0010770
3	8.8489707	9.9989141	8.8500566	11.1499434	57	1.1510293	.0010859
4	8.8507512	9.9989052	8.8518461	11.1481539	56	1.1492488	.0010948
5	8.8525245	9.9988962	8.8536283	11.1463717	55	1.1474755	.0011038
6	8.8542905	9.9988871	8.8554034	11.1445966	54	1.1457095	.0011129
7	8.8560493	9.9988780	8.8571713	11.1428287	53	1.1439507	.0011220
8	8.8578010	9.9988689	8.8589321	11.1410679	52	1.1421990	.0011311
9	8.8595457	9.9988598	8.8606859	11.1393141	51	1.1404543	.0011402
10	8.8612833	9.9988506	8.8624326	11.1375673	50	1.1387167	.0011494
11	8.8630139	9.9988414	8.8641725	11.1358275	49	1.1369861	.0011586
12	8.8647376	9.9988321	8.8659055	11.1340944	48	1.1352624	.0011679
13	8.8664545	9.9988228	8.8676317	11.1323683	47	1.1335455	.0011772
14	8.8681646	9.9988135	8.8693511	11.1306489	46	1.1318354	.0011865
15	8.8698680	9.9988041	8.8710638	11.1289362	45	1.1301320	.0011959
16	8.8715646	9 9987947	8.8727699	11.1272301	44	1.1284354	.0012053
17	8.8732546	9.9987853	8.8744694	11.1255306	43	1.1267454	.0012147
18	8.8749381	9.9987758	8.8761623	11.1238377	42	1.1250619	.0012242
19	8.8766150	9.9987663	8.8778487	11.1221513	41	1.1233850	.0012337
20	8.8782854	9.9987567	8.8795286	11.1204714	40	1.1217146	.0012433
21	8.8799493	9.9987471	8.8812022	11.1187978	39	1.1200507	.0012529
22	8.8816069	9.9987375	8.8828694	11.1171306	38	1.1183931	.0012625
23	8.8832581	9.9987278	8.8845303	11.1154697	37	1.1167419	.0012722
24	8.8849031	9.9987181	8.8861850	11.1138150	36	1.1150969	.0012819
25	8.8865418	9.9987084	8.8878334	11.1121666	35	1.1134582	.0012916
26	8.8881743	9.9986986	8.8894757	11.1105243	34	1.1118257	.0013014
27	8.8898007	9.9986888	8.8911119	11.1088881	33	1.1101993	.0013112
28	8.8914209	9.9986790	8.8927420	11.1072580	32	1.1085791	.0013210
29	8.8930351	9.9986691	8.8943660	11.1056340	31	1.1069649	.0013309
30	8.8946433	9.9986591	8.8959842	11.1040158	30	1.1053567	.0013409
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	85		

4	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	8.8946433	9.9986591	8.8959843	11.1040158	30	1.1053567	.0013409
31	8.8962455	9.9986492	8.8975962	11.1024037	29	1.1037545	.0013508
32	8.8978418	9.9986392	8.8992026	11.1007974	28	1.1021582	.0013608
33	8.8994322	9.9986292	8.9008032	11.0991970	27	1.1005678	.0013708
34	8.9010168	9.9986191	8.9023977	11.0976023	26	1.0989832	.0013809
35	8.9025955	9.9986090	8.9039866	11.0960134	25	1.0974045	.0013910
36	8.9041685	9.9985988	8.9055697	11.0944303	24	1.0958315	0014012
37	8.9057358	9.9985886	8.9071472	11.0928528	23	1.0942642	.0014114
38	8.9072975	9.9985784	8.9087190	11.0912810	22	1.0927025	.0014216
39	8.9088535	9.9985682	8.9102853	11.0897147	21	1.0911465	0014318
40	8.9104039	9.9985579	8.9118460	11.0881540	20	1.0895961	.0014421
41	8.9119487	9.9985475	8.9134011	11.0865988	19	1.0880513	.0014525
42	8.9134881	9.9985372	8.9149509	11.0850491	18	1.0865119	.0014628
43	8.9150219	9.9985268	8.9164952	11.0835048	17	1.0849781	.0014732
44	8.9165504	9.9985163	8.9180340	11.0819660	16	1.0834496	.0014837
45	8.9180734	9.9985058	8.9195675	11.0804325	15	1.0819266	.0014942
46	8.9195911	9.9984953	8.9210957	11.0789043	14	1.0804089	0015047
47	8.9211034	9.9984848	8.9226186	11.0773814	13	1.0788966	.0015152
48	8.9226105	9.9984742	8.9241363	11.0758637	12	1.0773895	.0015258
49	8.9241123	9.9984636	8.9256487	11.0743513	11	1.0758877	.0015364
50	8.9256089	9.9984529	8.9271560	11.0728440	10	1.0743911	.0015471
51	8.9271003	9.9984422	8.9286581	11.0713419	9	1.0728997	0015578
52	8.9285866	9.9984315	8.9301552	11.0698448	8	1.0714134	.0015685
53	8.9300678	9.9984207	8.9316471	11.0683529	7	1.0699322	.0015793
54	8.9315439	9.9984099	8.9331340	11.0668660	6	1.0684561	.0015901
55	8.9330150	9.9983990	8.9346160	11.0253840	5	1.0669850	.0016010
56	8.9344811	9.9983881	8.9360929	11.0639071	4	1.0655189	.0016119
57	8.9359422	9.9983772	8.9375650	11.0624350	3	1.0640578	.0016228
58	8.9373983	9.9983663	8.9390321	11.0609679	2	1.0626017	.0016337
59	8.9388496	9.9983553	8.9404944	11.0595056	1	1.0611504	.0016447
60	8.9402960	9.9983442	8.9419518	11.0580482	0	1.0597040	.0016558
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	85		

5	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	8.9402960	9.9983442	8.9419518	11.0580482	60	1.0597040	.0016558
1	8.9417370	9.9983332	8.9434044	11.0565956	59	1.0582624	.0016668
2	8.9431743	9.9983220	8.9448523	11.0551477	58	1.0568257	.0016780
3	8.944606[illegible]	9.9983109	8.9462954	11.0537046	57	1.0553937	.0016891
4	8.946033[illegible]	9.9982997	8.9477338	11.0522662	56	1.0539665	.0017003
5	8.947456[illegible]	9.9982885	8.9491676	11.0508324	55	1.0525439	.0017115
6	8.9488739	9.9982772	8.9505967	11.0494033	54	1.0511261	.0017228
7	8.9502871	9.9982660	8.9520211	11.0479789	53	1.0497129	.0017340
8	8.9516957	9.9982546	8.9534410	11.0465590	52	1.0483043	.0017454
9	8.9530996	9.9982433	8.9548564	11.0451436	51	1.0469004	.0017567
10	8.9544991	9.9982318	8.9562672	11.0437328	50	1.0455009	.0017682
11	8.9558960	9.9982204	8.9576735	11.0423265	49	1.0441060	.0017796
12	8.9572843	9.9982089	8.9590754	11.0409246	48	1.0427157	.0017911
13	8.9586703	9.9981974	8.9604728	11.0395272	47	1.0413297	.0018026
14	8.9600517	9.9981859	8.9618659	11.0381341	46	1.0399483	.0018141
15	8.9614288	9.9981742	8.9632545	11.0367455	45	1.0385712	.0018257
16	8.9628014	9.9981629	8.9646386	11.0353612	44	1.0371986	.0018371
17	8.9641697	9.9981510	8.9660188	11.0339812	43	1.0358303	.0018490
18	8.9655337	9.9981393	8.9673944	11.0326056	42	1.0344663	.0018607
19	8.9668934	9.9981275	8.9687658	11.0312342	41	1.0331066	.0018725
20	8.9682487	9.9981158	8.9701330	11.0298670	40	1.0317513	.0018842
21	8.9695999	9.9981040	8.9714959	11.0285040	39	1.0304001	.0018960
22	8.9709468	9.9980921	8.9728547	11.0271453	38	1.0290532	.0019079
23	8.9722895	9.9980802	8.9742092	11.0257908	37	1.0277105	.0019198
24	8.9736280	9.9980683	8.9755597	11.0244403	36	1.0263720	.0019317
25	8.9749624	9.9980563	8.9769050	11.0230940	35	1.0250376	.0019437
26	8.9762926	9.9980443	8.9782483	11.0217517	34	1.0237074	.0019557
27	8.9776188	9.9980323	8.9795865	11.0204135	33	1.0223812	.0019677
28	8.9789408	9.9980202	8.9809206	11.0190794	32	1.0210592	.0019798
29	8.9802589	9.9980081	8.9822507	11.0177493	31	1.0197411	.0019919
30	8.9815729	9.9979960	8.9835760	11.0164231	30	1.0184271	.0020040
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	84		

5	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-netic. of Sine.	Com. Arith of Sine Com-
30	8.9815729	9.9979960	8.9835769	11.0164231	30	1.0184271	.0020040
31	8.9828826	9.9979838	8.9848991	11.0151009	29	1.0171171	.0020162
32	8.9841889	9.9979716	8.9862173	11.0137827	28	1.0158111	.0020284
33	8.9854910	9.9979593	8.9875317	11.0124683	27	1.0145090	.0020407
34	8.9867891	9.9979470	8.9888421	11.0111579	26	1.0132108	.0020530
35	8.9880834	9.9979347	8.9901487	11.0098513	25	1.0119166	.0020653
36	8.9893737	9.9979223	8.9914514	11.0085486	24	1.0106263	.0020777
37	8.9906602	9.9979099	8.9927503	11.0072497	23	1.0093398	.0020901
38	8.9919429	9.9978975	8.9940454	11.0059546	22	1.0080571	.0021025
39	8.9932217	9.9978850	8.9953367	11.0046633	21	1.0067783	0021150
40	8.9944968	9.9978725	8.9966243	11.0033757	20	1.0055032	.0021275
41	8.9957681	9.9978590	8.9979081	11.0020919	19	1.0042319	.0021410
42	8.9970356	9.9978473	8.9991883	11.0008117	18	1.0029644	.0021527
43	8.9982994	9.9978347	9.0004647	10.9995353	17	1.0017006	.0021653
44	8.9995595	9.9978220	9.0017375	10.9982625	16	1.0004405	.0021780
45	9.0008160	9.9978093	9.0030066	10.9969934	15	0.9991841	.0021907
46	9.0020687	9.9977966	9.0042721	10.9957279	14	0.9979313	.0022034
47	9.0033179	9.9977838	9.0055340	10.9944660	13	0.9966821	.0022162
48	9.0045634	9.9977710	9.0067924	10.9932076	12	0.9954366	.0022290
49	9.0058053	9.9977582	9.0080471	10.9919529	11	0.9941947	.0022418
50	9.0070436	9.9977453	9.0092984	10.9907016	10	0.9929564	.0022547
51	9.0082784	9.9977323	9.0105461	10.9894539	9	0.9917216	.0022677
52	9.0095096	9.9977194	9.0117903	10.9882097	8	0.9904904	.0022806
53	9.0107374	9.9977064	9.0130310	10.9869690	7	0.9892626	.0022936
54	9.0119616	9.9976933	9.0142682	10.9857318	6	0.9880384	.0023067
55	9.0131823	9.9976803	9.0155021	10.9844979	5	0.9868177	.0023197
56	9.0143996	9.9976672	9.0167325	10.9832675	4	0.9856004	.0023328
57	9.0156135	9.9976540	9.0179594	10.9820406	3	0.9843865	.0023460
58	9.0168239	9.9976408	9.0191831	10.9808169	2	0.9831761	.0023592
59	9.0180309	9.9976276	9.0204033	10.9795967	1	0.9819691	.0023724
60	9.0192346	9.9976143	9.0216202	10.9783798	0	0.9807654	.0023857
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	84		

6	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithnetic. of Sine.	Com. Arithn. of Sine Com.
0	9.0192346	9.9976143	9.0216202	10.9783798	60	9.807654	.0023857
1	9.0204348	9.9976011	9.0228338	10.9771662	59	9795652	.0023989
2	9.0216318	9.9975877	9.0240441	10.9759559	58	.9783682	.0024123
3	9.0228254	9.9975743	9.0252510	10.9747490	57	.9771746	.0024257
4	9.0240157	9.9975609	9.0264548	10.9735452	56	.9759843	.0024391
5	9.0252027	9.9975475	9.0276552	10.9723448	55	.9747973	.0024525
6	9.0263865	9.9975340	9.0288524	10.9711476	54	.9736135	.0024660
7	9.0275669	9.9975205	9.0300464	10.9699536	53	.9724331	.0024795
8	9.0287442	9.9975069	9.0312373	10.9687627	52	.9712558	.0024931
9	9.0299182	9.9974933	9.0324249	10.9675751	51	.9700818	.0025067
10	9.0310890	9.9974797	9.0336093	10.9663907	50	.9689110	.0025203
11	9.0322567	9.9974660	9.0347906	10.9652094	49	.9677434	.0025340
12	9.0334212	9.9974523	9.0359688	10.9640312	48	.9665788	.0025477
13	9.0345825	9.9974386	9 0371439	10.9628561	47	.9654175	.0025614
14	9.0357407	9.9974248	9.0383159	10.9616841	46	.9642593	.0025752
15	9.0368958	9.9974110	9.0394848	10.9605152	45	.9631042	.0025890
16	9.0380477	9 9973971	9.0406506	10.9593494	44	.9619523	.0026029
17	9.0391966	9.9973833	9.0418134	10.9581866	43	.9608034	.0026167
18	9.0403424	9.9973693	9.0429731	10.9570269	42	.9596575	.0026307
19	9.0414852	9.9973554	9.0441299	10.9558701	41	.9585148	.0026446
20	9.0426249	9.9973414	9.0452836	10.9547164	40	.9573751	.0026586
21	9.0437616	9.9973273	9.0464343	10.9535657	39	.9562383	.0026727
22	9 0448954	9.9973132	9.0475821	10.9524179	38	.9551046	.0026868
23	9.0460261	9.9972991	9.0487270	10.9512730	37	.9539739	.0027009
24	9.0471538	9.9972850	9.0498689	10.9501311	36	.9528462	.0027150
25	9.0482786	9.9972708	9.0510078	10.9489922	35	.9517214	.0027292
26	9.0494005	9.9972566	9.0521439	10.9478561	34	.9505995	.0027434
27	9.0505194	9.9972423	9.0532771	10.9467229	33	.9494804	.0027577
28	9.0516354	9.9972280	9.0544074	10.9455926	32	.9483646	.0027720
29	9.0527485	9.9972137	9.0555349	10.9444651	31	.9472515	.0027863
30	9.0538588	9.9971993	9.0566595	10.9433405	30	.9461412	.0028007
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	83		

6	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.0538588	9.9971993	9.0566595	10.9433405	30	.946 412	.0028007
31	9.0549661	9.9971849	9.0577813	10.9422180	29	.9450339	.0028151
32	9.0560706	9.9971704	9.0589002	10.9410998	28	.9439294	.0028296
33	9.0571723	9.9971559	9.0600164	10.9399836	27	.9428277	.0028441
34	9.0582711	9.9971414	9.0611297	10.9388703	26	.9417289	.0028586
35	9.0593671	9.9971268	9.0622403	10.9377597	25	.9406328	.0028732
36	9.0604604	9.9971122	9.0633482	10.9366518	24	.9395396	.0028878
37	9.0615509	9.9970976	9.0644533	10.9355467	23	.9384491	.0029024
38	9.0626386	9.9970829	9.0655556	10.9344444	22	.9373614	.0029171
39	9.0637235	9.9970682	9.0666553	10.9333447	21	.9392765	.0029318
40	9.0648057	9.9970535	9.0677522	10.9322478	20	.9351943	.0029465
41	9.0658852	9.9970387	9.0688465	10.9311535	19	.9341148	.0029613
42	9.0669619	9.9970239	9.0699381	10.9300619	18	.9330381	.0029761
43	9.0680360	9.9970090	9.0710270	10.9289730	17	.9319640	.0029910
44	9.0691074	9.9969941	9.0721133	10.9278867	16	.9308926	.0030059
45	9.0701761	9.9969792	9.0731969	10.9268031	15	.9298239	.0030208
46	9.0712421	9.9969642	9.0742779	10.9257221	14	.9287579	.0030358
47	9.0723055	9.9969492	9.0753563	10.9246437	13	.9276945	.0030598
48	9.0733663	9.9969342	9.0764321	10.9235679	12	.9266337	.0030658
49	9.0744244	9.9969191	9.0775053	10.9224947	11	.9255756	.0030809
50	9.0754799	9.9969040	9.0785760	10.9214240	10	.9245201	.0030960
51	9.0765329	9.9968888	9.0796441	10.9203559	9	.9234671	.0031112
52	9.0775832	9.9968736	9.0807096	10.9192904	8	.9224168	.0031264
53	9.0786310	9.9968584	9.0817726	10.9182274	7	.9213690	.0031416
54	9.0796762	9.9968431	9.0828331	10.9171669	6	.9203238	.0031569
55	9.0807189	9.9968278	9.0838911	10.9161089	5	.9192811	.0031722
56	9.0817590	9.9968125	9.0849466	10.9150534	4	.9182410	.0031875
57	9.0827966	9.9967971	9.0859996	10.9140004	3	.9172034	.0032029
58	9.0838317	9.9967817	9.0870501	10.9129499	2	.9161683	.0032183
59	9.0848643	9.9967662	9.0880981	10.9119019	1	.9151357	.0032338
60	9.0858945	9.9967507	9.0891438	10.9108562	0	.9141055	.0032493
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	83		

7	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sinee.	Com. Arith of Sine Com.
0	9.0858945	9.9967507	9.0891438	10.9108562	60	.9141055	.0032493
1	9.0869221	9.9967352	9.0901869	10.9098131	59	.9130779	.0032648
2	9.0879473	9.9967196	9.0912277	10.9087723	58	.9120527	.0032804
3	9.0889700	9.9967040	9.0922660	10.9077340	57	.9110300	.0032960
4	9.0899903	9.9966884	9.0933020	10.9066980	56	.9100097	.0033116
5	9.0910082	9.9966727	9.0943355	10.9056645	55	.9089918	.0033273
6	9.0920237	9.9966570	9.0953667	10.9046333	54	.9079763	.0033430
7	9.0930367	9.9966412	9.0963955	10.9036045	53	.9069633	.0033588
8	9.0940474	9.9966254	9.0974219	10.9025781	52	.9059526	.0033746
9	9.0950556	9.9966096	9.0984460	10.9015540	51	.9049444	.0033904
10	9.0960615	9.9965937	9.0994678	10.9005322	50	.9039385	.0034063
11	9.0970651	9.9965778	9.1004872	10.8995128	49	.9029349	.0034222
12	9.0980662	9.9965619	9.1015044	10.8984956	48	.9019338	.0034381
13	9.0990651	9.9965459	9.1025192	10.8974808	47	.9009349	.0034541
14	9.1000616	9.9965299	9.1035317	10.8964683	46	.8999384	.0034701
15	9.1010558	9.9965138	9.1045420	10.8954580	45	.8989442	.0034862
16	9.1020477	9.9964977	9.1055500	10.8944500	44	.8979523	.0035023
17	9.1030373	9.9964816	9.1065557	10.8934443	43	.8969627	.0035184
18	9.1040246	9.9964655	9.1075591	10.8924409	42	.8959754	.0035345
19	9.1050296	9.9964493	9.1085604	10.8914396	41	.8949904	.0035507
20	9.1059924	9.9964330	9.1095594	10.8904406	40	.8940076	.0035670
21	9.1069729	9.9964167	9.1105562	10.8894438	39	.8930271	.0035833
22	9.1079512	9.9964084	9.1115508	10.8884492	38	.8920488	.0035996
23	9.1089272	9.9963841	9.1125431	10.8874569	37	.8910728	.0036159
24	9.1099010	9.9963677	9.1135333	10.8864667	36	.8900990	.0036323
25	9.1108726	9.9963513	9.1145212	10.8854787	35	.8891274	.0036487
26	9.1118420	9.9963348	9.1155072	10.8844928	34	.8881580	.0036652
27	9.1128092	9.9963183	9.1164909	10.8835091	33	.8871908	.0036817
28	9.1137742	9.9963018	9.1174724	10.8825276	32	.8862258	.0036982
29	9.1147370	9.9962852	9.1184518	10.8815482	31	.8852630	.0037148
30	9.1156977	9.9962686	9.1194291	10.8805709	30	.8843023	.0037314
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	82		

7	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Aritn. of Sine Com.
30	9.1156977	9.9062686	9.1194291	10.8805709	30	.8843023	.0037314
31	9.1166562	9.9962519	9.1204043	10.8795957	29	.8833438	.0037481
32	9.1176125	9.9962352	9.1213773	10.8786227	28	.8823875	.0037648
33	9.1185667	9.9962185	9.1223482	10.8776518	27	.8814333	.0037815
34	9.1195188	9.9962017	9.1233171	10.8766829	26	.8804812	.0037983
35	9.1204688	9.9961849	9.1242839	10.8757161	25	.8795312	.0038151
36	9.1214167	9.9961681	9.1252486	10.8747514	24	.8785833	.0038319
37	9.1223624	9.9961512	9.1262112	10.8737888	23	.8776376	.0038488
38	9.1233061	9.9961343	9.1271718	10.8728282	22	.8766939	.0038657
39	9.1242477	9.9961174	9.1281303	10.8718697	21	.8757523	.0038826
40	9.1251872	9.9961004	9.1290868	10.8709132	20	.8748128	.0038996
41	9.1261246	9.9960834	9.1300413	10.8699587	19	.8738754	.0039166
42	9.1270600	9.9960663	9.1309937	10.8690062	18	.8729400	.0039337
43	9.1279934	9.9960492	9.1319442	10.8680558	17	.8720066	.0039508
44	9.1289247	9.9960321	9.1328926	10.8671074	16	.8710753	.0039679
45	9.1298539	9.9960149	9.1338390	10.8661609	15	.8701461	.0039851
46	9.1307812	9.9959977	9.1347835	10.8652165	14	.8692188	.0040023
47	9.1317064	9.9959804	9.1357260	10.8642740	13	.8682936	.0040196
48	9.1326297	9.9959631	9.1366665	10.8633335	12	.8673703	.0040369
49	9.1335509	9.9959458	9.1376051	10.8623949	11	.8664492	.0040542
50	9.1344702	9.9959284	9.1385417	10.8614583	10	.8655298	.0040716
51	9.1353875	9.9959111	9.1394764	10.8605236	9	.8646125	.0040889
52	9.1363028	9.9958936	9.1404092	10.8595908	8	.8636972	.0041064
53	9.1372161	9.9958761	9.1413400	10.8586600	7	.8627839	.0041239
54	9.1381275	9.9958586	9.1422689	10.8577311	6	.8618725	.0041414
55	9.1390370	9.9958411	9.1431959	10.8568041	5	.8609630	.0041589
56	9.1399445	9.9958235	9.1441210	10.8558790	4	.8600555	.0041765
57	9.1408501	9.9958059	9.1450442	10.8549558	3	.8591499	.0041941
58	9.1417537	9.9957882	9.1459655	10.8540345	2	.8582462	.0042118
59	9.1426555	9.9957705	9.1468850	10.8531150	1	.8573445	.0042295
60	9.1435553	9.9957528	9.1478025	10.8521975	0	.8564447	.0042472
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	82		

8	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith of Sine Com.
0	9.1435553	9.9957528	9.1478025	10.8521975	60	8.564447	.0042473
1	9.1444532	9.9957350	9.1487182	10.8512818	59	8555468	.0042650
2	9.1453493	9.9957172	9.1496321	10.8503679	58	.8546507	.0042828
3	9.1462435	9.9956993	9.1505441	10.8494559	57	.8537565	.0043007
4	9.1471358	9.9956815	9.1514543	10:8485457	56	8528642	.0043185
5	9.1480262	9.9956635	9.1523627	10.8476373	55	8519738	.0043365
6	9.1489148	9.9956456	9.1532692	10.8467308	54	8510852	.0043544
7	9.1498015	9.9956276	9.1541739	10.8458261	53	8501985	.0043724
8	9.1506864	9.9956095	9.1550769	10.8449231	52	.8493136	.0043905
9	9.1515694	9.9955915	9.1559780	10.8440220	51	.8484306	.0044085
10	9.1524507	9.9955734	9.1568773	10.8431227	50	.8475493	.0044266
11	9.1533301	9.9955552	9.1577748	10.8422253	49	.8466699	.0044448
12	9.1542076	9.9955370	9.1586706	10.8413294	48	.8457924	.0044630
13	9.1550834	9.9955188	9.1595646	10.8404354	47	.8449166	.0044812
14	9.1559574	9.9955005	9.1604569	10.8395431	46	.8440426	.0044995
15	9.1568296	9.9954822	9.1613473	10.8386527	45	.8431704	.0045178
16	9.1577000	9.9954639	9.1622361	10.8377639	44	.8423000	.0045361
17	9.1585686	9.9954455	9.1631231	10.8368769	43	.8414314	.0045545
18	9.1594354	9.9954271	9.1640083	10.8359917	42	.8405646	.0045729
19	9.1603005	9.9954087	9.1648919	10.8351081	41	.8396995	.0045913
20	9.1611639	9.9953902	9.1657737	10.8342263	40	.8388361	.0046098
21	9.1620254	9.9953717	9.1666538	10.8333462	39	.8379746	.0046283
22	9.1628853	9.9953531	9.1675322	10.8324678	38	.8371147	.0046469
23	9.1637434	9.9953345	9.1684989	10.8315911	37	.8362566	.0046655
24	9.1645998	9.9953159	9.1692839	10.8307161	36	.8354002	.0046841
25	9.1654544	9.9952972	9.1701572	10.8298428	35	.8345456	.0047028
26	9.1663074	9.9952785	9.1710289	10.8289711	34	.8336926	.0047215
27	9.1671586	9.9952597	9.1718989	10.8281011	33	.8328414	0047403
28	9.1680082	9.9952409	9.1727672	10.8272328	32	.8319919	.0047591
29	9.1688559	9.9952221	9.1736338	10.8263662	31	.8311441	.0047779
30	9.1697021	9.9952033	9.1744988	10.8255012	30	.8302979	.0047967
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	81		

8	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.1697021	9.9952033	9.1744988	10.8255012	30	8302979	.0047967
31	9.1705465	9.9951844	9.1753622	10.8246378	29	.8294534	.0048156
32	9.1713893	9.9951654	9.1762239	10.8237761	28	.8286107	.0048346
33	9.1722305	9.9951464	9.1770840	10.8229160	27	.8277695	.0048536
34	9.1730699	9.9951274	9.1779425	10.8220575	26	.8269301	.0048726
35	9.1739077	9.9951084	9.1787993	10.8212007	25	.8260923	.0048916
36	9.1747439	9.9950893	9.1796546	10.8203454	24	.8252561	.0049107
37	9.1755784	9.9950702	9.1805082	10.8194918	23	.8244216	.0049298
38	9.1764112	9.9950510	9.1813602	10.8186398	22	.8235888	.0049490
39	9.1772425	9.9950318	9.1822106	10.8177894	21	.8227575	.0049682
40	9.1780721	9.9950126	9.1830595	10.8169405	20	.8219279	.0049874
41	9.1789001	9.9949933	9.1839068	10.8160932	19	.8210999	.0050067
42	9.1797265	9.9949740	9.1847525	10.8152475	18	.8202735	.0050262
43	9.1805512	9.9949546	9.1855968	10.8144034	17	.8194488	.0050454
44	9.1813744	9.9949352	9.1864392	10.8135608	16	.8186256	.0050648
45	9.1821960	9.9949158	9.1872802	10.8127198	15	.8178040	.0050842
46	9.1830160	9.9948964	9.1881196	10.8118804	14	.8169840	.0051036
47	9.1838344	9.9948769	9.1889575	10.8110425	13	.8161656	.0051231
48	9.1846512	9.9948573	9.1897939	10.8102061	12	.8153488	.0051427
49	9.1854665	9.9948377	9.1906287	10.8093713	11	.8145336	.0051623
50	9.1862802	9.9948181	9.1914621	10.8085379	10	.8137199	.0051819
51	9.1870923	9.9947985	9.1922939	10.8077061	9	.8129077	.0052015
52	9.1879029	9.9947788	9.1931241	10.8068759	8	.8120971	.0052212
53	9.1887120	9.9947591	9.1939529	10.8060471	7	.8112880	.0052409
54	9.1895195	9.9947393	9.1947802	10.8052198	6	.8104805	.0052607
55	9.1903254	9.9947195	9.1956059	10.8043941	5	.8096746	.0052805
56	9.1911299	9.9946997	9.1964302	10.8035698	4	.8088701	.0053003
57	9.1919328	9.9946798	9.1972530	10.8027470	3	.8080672	.0053202
58	9.1927342	9.9946599	9.1980743	10.8019257	2	.8072658	.0053401
59	9.1935341	9.9946399	9.1988942	10.8011059	1	.8064659	.0053601
60	9.1943324	9.9946199	9.1997125	10.8002875	0	.8056676	.0053801
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	81		

9	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.104332-	9.9946199	9.1997125	10.8002875	60	.8056676	.0053801
1	9.1951293	9.9945999	9.2005294	10.7994706	59	.8048707	.0054001
2	9.1959245	9.9945798	9.2013449	10.7986551	58	.8040753	.0054202
3	9.1967186	9.9945597	9.2021588	10.7978411	57	.8032814	.0054403
4	9.1975110	9.9945396	9.2029714	10.7970286	56	.8024890	.0054604
5	9.1983019	9.9945194	9.2037825	10.7962175	55	.8016981	.0054806
6	9.1990913	9.9944992	9.2045922	10.7954078	54	.8009087	.0055008
7	9.1998793	9.9944789	9.2054004	10.7945996	53	.8001207	.0055211
8	9.2006658	9.9944587	9.2062072	10.7937928	52	.7993342	.0055413
9	9.2014509	9.9944383	9.2070126	10.7929874	51	.7985491	.0055617
10	9.2022345	9.9944180	9.2078165	10.7921835	50	.7977655	.0055820
11	9.2030167	9.9943975	9.2086191	10.7913809	49	.7969833	.0056025
12	9.2037974	9.9943771	9.2094203	10.7905797	48	.7962026	.0056229
13	9.2045767	9.9943566	9.2102200	10.7897808	47	.7954234	.0056434
14	9.2053545	9.9943361	9.2110184	10.7889816	46	.7946455	.0056639
15	9.2061309	9.9943156	9.2118153	10.7881847	45	.7938691	.0056844
16	9.2069059	9.9942950	9.2126109	10.7873891	44	.7930941	.0057050
17	9.2076795	9.9942773	9.2134051	10.7865949	43	.7923205	.0057227
18	9.2084516	9.9942537	9.2141980	10.7858020	42	.7915484	.0057465
19	9.2092224	9.9942330	9.2149894	10.7850106	41	.7907776	.0057670
20	9.2099917	9.9942122	9.2157795	10.7842205	40	.7900083	.0057878
21	9.2107597	9.9941914	9.2165683	10.7834317	39	.7892403	.0058086
22	9.2115263	9.9941706	9.2173556	10.7826444	38	.7884737	.0058294
23	9.2122914	9.9941498	9.2181417	10.7818583	37	.7877086	.0058502
24	9.2130552	9.9941289	9.2189264	10.7810736	36	.7869448	.0058711
25	9.2138176	9.9941079	9.2197097	10.7802902	35	.7861824	.0058921
26	9.2145787	9.9940870	9.2204917	10.7795083	34	.7854213	.0059130
27	9.2153384	9.9940659	9.2212724	10.7787276	33	.7846616	.0059341
28	9.2160967	9.9940449	9.2220518	10.7779482	32	.7839033	.0059551
29	9.2168536	9.9940238	9.2228298	10.7771702	31	.7831464	.0059762
30	9.2176092	9.9940027	9.2236065	10.7763935	30	.7823908	.0059973
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	80		

9	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
30	9.2176092	9.9940027	9.2236065	10.7763935	30	.7823908	.0059973
31	9.2183635	9.9939815	9.2243819	10.7756181	29	.7816366	.0060185
32	9.2191164	9.9939603	9.2251561	10.7748439	28	.7808836	.0060397
33	9.2198680	9.9939391	9.2259289	10.7740711	27	.7801320	.0060609
34	9.2206182	9.9939178	9.2267004	10.7732996	26	.7793818	.0060822
35	9.2213671	9.9938969	9.2274706	10.7725294	25	.7786329	.0061035
36	9.2221147	9.9938752	9.2282395	10.7717605	24	.7778853	.0061248
37	9.2228609	9.9938538	9.2290071	10.7709929	23	.7771391	.0061462
38	9.2236059	9.9938324	9.2297735	10.7702265	22	.7763941	.0061676
39	9.2243495	9.9938109	9.2305386	10.7694614	21	.7756505	.0061891
40	9.2250918	9.9937894	9.2313024	10.7686976	20	.7749082	.0062106
41	9.2258328	9.9937679	9.2320650	10.7679350	19	.7741672	.0062321
42	9.2265725	9.9937463	9.2328262	10.7671738	18	.7734275	.0062537
43	9.2273110	9.9937247	9.2335863	10.7664137	17	.7726890	.0062753
44	9.2280481	9.9977030	9.2343451	10.7656549	16	.7719519	.0062970
45	9.2287839	9.9936813	9.2351026	10.7648974	15	.7712161	.0063187
46	9.2295185	9.9936596	9.2358589	10.7641411	14	.7704815	.0063404
47	9.2302518	9.9936378	9.2366139	10.7633861	13	.7697482	.0063622
48	9.2309838	9.9936160	9.2373678	10.7626322	12	.7690162	.0063840
49	9.2317145	9.9935942	9.2381203	10.7618797	11	.7682855	.0064058
50	9.2324440	9.9935723	9.2388717	10.7611283	10	.7675560	.0064277
51	9.2331722	9.9935504	9.2396218	10.7603782	9	.7668278	.0064496
52	9.2338992	9.9935285	9.2403708	10.7596292	8	.7661008	.0064715
53	9.2346249	9.9935065	9.2411185	10.7588815	7	.7652751	.0064935
54	9.2353494	9.9934844	9.2418650	10.7581350	6	.7646506	.0065156
55	9.2360726	9.9934624	9.2426103	10.7573897	5	.7639274	.0065376
56	9.2367946	9.9934403	9.2433543	10.7566437	4	.7632054	.0065597
57	9.2375153	9.9934181	9.2440972	10.7559028	3	.7624847	.0065819
58	9.2382349	9.9933959	9.2448389	10.7551611	2	.7617651	.0066041
59	9.2389532	9.9933737	9.2455794	10.7544206	1	.7610468	.0066263
60	9.2396702	9.9933515	9.2463188	10.7536812	0	.7603298	.0066485
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	80		

10	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmer. of Sine.	Com. Arith. of Sine Com.
0	9.2396702	9.9933515	9.2462188	10.7536812	60	.7603298	.0066485
1	9.2403861	9.9933292	9.2470569	10.7529430	59	.7596139	.0066708
2	9.2411007	9.9933068	9.2477939	10.7522061	58	.7588993	.0066932
3	9.2418141	9.9932845	9.2485297	10.7514703	57	.7581859	.0067155
4	9.2425264	9.9932621	9.2492643	10.7507357	56	.7574736	.0067379
5	9.2432374	9.9932396	9.2499978	10.7500022	55	.7567626	.0067604
6	9.2439472	9.9932171	9.2507301	10.7492699	54	.7560528	.0067829
7	9.2446558	9.9931946	9.2514612	10.7485388	53	.7553442	.0068054
8	9.2453632	9.9931720	9.2521912	10.7478088	52	.7546368	.0068280
9	9.2460695	9.9931494	9.2529200	10.7470800	51	.7539305	.0068506
10	9.2467746	9.9931268	9.2536477	10.7463522	50	.7532254	.0068732
11	9.2474784	9.9931041	9.2543742	10.7456257	49	.7525216	.0068959
12	9.2481811	9.9930814	9.2550997	10.7449003	48	.7518189	.0069186
13	9.2488827	9.9930587	9.2558240	10.7441760	47	.7511173	.0069413
14	9.2495830	9.9930359	9.2565471	10.7434528	46	.7504170	.0069641
15	9.2502822	9.9930131	9.2572691	10.7427308	45	.7497178	.0069869
16	9.2509803	9.9929902	9.2579901	10.7420099	44	.7490197	.0070098
17	9.2516772	9.9929673	9.2587099	10.7412901	43	.7483228	.0070327
18	9.2523729	9.9929444	9.2594285	10.7405715	42	.7476271	.0070556
19	9.2530675	9.9929214	9.2601461	10.7398539	41	.7469325	.0070786
20	9.2537609	9.9928984	9.2608625	10.7391375	40	.7462391	.0071016
21	9.2544532	9.9928753	9.2615779	10.7384221	39	.7455468	.0071247
22	9.2551444	9.9928522	9.2622921	10.7377079	38	.7448556	.0071478
23	9.2558344	9.9928291	9.2630053	10.7369947	37	.7441656	.0071709
24	9.2565233	9.9928059	9.2637173	10.7362827	36	.7434767	.0071941
25	9.2572110	9.9927827	9.2644283	10.7355717	35	.7427890	.0072173
26	9.2578977	9.9927595	9.2651382	10.7348618	34	.7421022	.0072405
27	9.2585832	9.9927362	9.2658470	10.7341530	33	.7414168	.0072638
28	9.2592676	9.9927129	9.2665547	10.7334453	32	.7407324	.0072871
29	9.2599509	9.9926895	9.2672613	10.7327387	31	.7400491	.0073105
30	9.2606330	9.9926661	9.2679669	10.7320331	30	.7393670	.0073339
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	79		

10	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.2606330	9.9926661	9.2679669	10.7320331	30	.7393670	.0073339
31	9.2613141	9.9926427	9.2686714	10.7313286	29	.7386859	.0073573
32	9.2619941	9.9926192	9.2693749	10.7306251	28	.7380059	.0073808
33	9.2626729	9.9925957	9.2700772	10.7299228	27	.7373271	.0074043
34	9.2633507	9.9925722	9.2707786	10.7292214	26	.7366493	.0074278
35	9.2640274	9.9925486	9.2714788	10.7285212	25	.7359726	.0074514
36	9.2647030	9.9925250	9.2721780	10.7278220	24	.7352970	.0074750
37	9.2653775	9.9925013	9.2728763	10.7271238	23	.7346225	.0074987
38	9.2660509	9.9924776	9.2735733	10.7264267	22	.7339491	.0075224
39	9.2667232	9.9924539	9.2742694	10.7257306	21	.7332768	.0075461
40	9.2673945	9.9924301	9.2749644	10.7250356	20	.7326055	.0075699
41	9.2680647	9.9924063	9.2756584	10.7243416	19	.7319353	.0075937
42	9.2687338	9.9923824	9.2763514	10.7236486	18	.7312662	.0076176
43	9.2694019	9.9923585	9.2770434	10.7229566	17	.7305981	.0076415
44	9.2700689	9.9923346	9.2777343	10.7222657	16	.7299311	.0076654
45	9.2707348	9.9923106	9.2784242	10.7215758	15	.7292652	.0076894
46	9.2713997	9.9922866	9.2791130	10.7208869	14	.7286003	.0077134
47	9.2720631	9.9922626	9.2798009	10.7201991	13	.7279365	.0077374
48	9.2727263	9.9922385	9.2804878	10.7195122	12	.7272737	.0077615
49	9.2733880	9.9922144	9.2811736	10.7188264	11	.7266120	.0077856
50	9.2740487	9.9921902	9.2818585	10.7181415	10	.7259513	.0078098
51	9.2747083	9.9921660	9.2825423	10.7174577	9	.7252917	.0078340
52	9.2753669	9.9921418	9.2832251	10.7167749	8	.7246331	.0078582
53	9.2760245	9.9921175	9.2839070	10.7160930	7	.7239755	.0078825
54	9.2766811	9.9920932	9.2845878	10.7154122	6	.7233189	.0079068
55	9.2773366	9.9920689	9.2852677	10.7147323	5	.7226634	.0079311
56	9.2779911	9.9920445	9.2859466	10.7140534	4	.7220089	.0079555
57	9.2786445	9.9920201	9.2866245	10.7133755	3	.7213555	.0079799
58	9.2792970	9.9919956	9.2873014	10.7126986	2	.7207030	.0080044
59	9.2799484	9.9919711	9.2879773	10.7120227	1	.7200516	.0080289
60	9.2805988	9.9919466	9.2886523	10.7113477	0	.7194013	.0080534
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	79		

11	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith of Sine Com.
0	9.2805988	9.9919466	9.2886523	10.7113477	60	.7194012	.0080534
1	9.2812483	9.9919220	9.2893263	10.7106737	59	.7187517	.0080780
2	9.2818967	9.9918974	9.2899993	10.7100007	58	.7181033	.0081026
3	9.2825441	9.9918727	9.2906713	10.7093287	57	.7174559	.0081273
4	9.2831905	9.9918480	9.2913424	10.7086576	56	.7168095	.0081520
5	9.2838359	9.9918233	9.2920126	10.7079874	55	.7161641	.0081767
6	9.2844803	9.9917986	9.2926817	10.7073183	54	.7155197	.0082014
7	9.2851237	9.9917737	9.2933500	10.7066500	53	.7148763	.0082263
8	9.2857661	9.9917489	9.2940172	10.7059828	52	.7142339	.0082511
9	9.2864076	9.9917240	9.2946836	10.7053164	51	.7135924	.0082760
10	9.2870480	9.9916991	9.2953489	10.7046511	50	.7129520	.0083009
11	9.2876875	9.9916741	9.2960134	10.7039866	49	.7123125	.0083259
12	9.2883260	9.9916492	9.2966769	10.7033231	48	.7116730	.0083508
13	9.2889636	9.9916241	9.2973395	10.7026605	47	.7110364	.0083759
14	9.2896001	9.9915990	9.2980011	10.7019989	46	.7103999	.0084019
15	9.2902357	9.9915739	9.2986618	10.7013382	45	.7097643	.0084261
16	9.2908704	9.9915488	9.2993216	10.7006784	44	.7091296	.0084512
17	9.2915040	9.9915236	9.2999804	10.7000196	43	.7084950	.0084764
18	9.2921367	9.9914984	9.3006383	10.6993617	42	.7078633	.0085016
19	9.2927685	9.9914731	9.3012954	10.6987046	41	.7072315	.0085269
20	9.2933993	9.9914478	9.3019514	10.6980486	40	.7066007	.0085522
21	9.2940291	9.9914225	9.3026066	10.6973934	39	.7059706	.0085775
22	9.2946580	9.9913971	9.3032609	10.6967391	38	.7053420	.0086029
23	9.2952859	9.9913717	9.3039143	10.6960857	37	.7047141	.0086283
24	9.2959129	9.9913462	9.3045667	10.6954333	36	.7040871	.0086538
25	9.2965390	9.9913207	9.3052183	10.6947817	35	.7034610	.0086793
26	9.2971641	9.9912952	9.3058689	10.6941311	34	.7028359	.0087048
27	9.2977883	9.9912696	9.3065187	10.6934813	33	.7022117	.0087304
28	9.2984116	9.9912440	9.3071675	10.6928325	32	.7015884	.0087560
29	9.2990339	9.9912184	9.3078155	10.6921845	31	.7009661	.0087816
30	9.2996553	9.9911927	9.3084626	10.6915374	30	.7003447	.0088073
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	78		

11	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.2996553	9.9911927	9.3084626	10.6915374	30	.7003447	0088073
31	9.3002758	9.9911670	9.3091088	10.6908912	29	6997242	.0088330
32	9.3008953	9.9911412	9.3097541	10.6902459	28	.6991047	0088588
33	9.3015140	9.9911154	9.3103985	10.6896015	27	.6984860	.0088846
34	9.3021317	9.9910896	9.3110421	10.6889579	26	.6978683	.0089104
35	9.3027485	9.9910637	9.3116848	10.6883152	25	.6972515	.0089363
36	9.3033644	9.9910378	9.3123266	10.6876734	24	.6966356	.0089622
37	9.3039794	9.9910119	9.3129675	10.6870325	23	.6960206	.0089881
38	9.3045934	9.9909859	9.3136076	10.6863924	22	6954066	0090141
39	9.3052066	9.9909598	9.3142468	10.6857532	21	.6947934	.0090402
40	9.3058189	9.9909338	9.3148851	10.6851149	20	.6941811	0090662
41	9.3064303	9.9909077	9.3155226	10.6844774	19	.6935697	0090923
42	9.3070407	9.9908815	9.3161592	10.6838408	18	.6929593	.0091185
43	9.3076503	9.9908553	9.3167950	10.6832050	17	.6923497	0091447
44	9.3082590	9.9908291	9.3174299	10.6825701	16	.6917410	.0091709
45	9.3088668	9.9908029	9.3180640	10.6819360	15	.6911332	.0091971
46	9.3094737	9.9907766	9.3186972	10.6813028	14	.6905265	.0092234
47	9.3100798	9.9907502	9.3193295	10.6806705	13	.6899202	.0092498
48	9.3106849	9.9907239	9.3199611	10.6800389	12	.6893151	.0092761
49	9.3112892	9.9906974	9.3205918	10.6794082	11	.6887108	.0093026
50	9.3118926	9.9906710	9.3212216	10.6787784	10	.6881074	.0093290
51	9.3124951	9.9906445	9.3218506	10.6781494	9	.6875049	.0093555
52	9.3130968	9.9906180	9.3224788	10.6775212	8	.6869032	.0093820
53	9.3136976	9.9905914	9.3231061	10.6768939	7	.6863024	.0094086
54	9.3142975	9.9905648	5.3237327	10.6762673	6	.6857025	.0094352
55	9.3148965	9.9905382	9.3243584	10.6756416	5	.6851035	.0094618
56	9.3154947	9.9905115	9.3249832	10.6750168	4	.6845053	.0094885
57	9.3160921	9.9904848	9.3256073	10.6743927	3	.6839079	.0095152
58	9.3166885	9.9904580	9.3262305	10.6737695	2	.6833115	.0095420
59	9.3172841	9.9904312	9.3268529	10.6731471	1	.6827159	.0095688
60	9.3178789	9.9904044	9.3274745	10.6725255	0	.6821211	0095956
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	78		

12	Sine.	SINE Complement.	Tang.	TANGENT Complement		Com. Arithmet. of Sine.	Com. Arith-of Sine Com.
0	9.3178789	9.9904044	9.3274745	10.6725255	60	.6821211	.0095956
1	9.3184728	9.9903775	9.3280953	10.6719047	59	.6815272	.0096225
2	9.3190659	9.9903506	9.3287153	10.6712847	58	6809341	.0096494
3	9.3196581	9.9903237	9.3293345	10.6706655	57	6803419	.0096763
4	9.3202495	9.9902967	9.3299528	10.6700472	56	.6797505	.0097033
5	9.3208400	9.9902697	9.3305704	10.6699426	55	.6791600	.0097303
6	9.3214297	9.9902426	9.3311872	10.6688128	54	.6785703	.0097574
7	9.3220186	9.9902155	9.3318031	10.6681969	53	.6779814	.0097845
8	9.3226066	9.9901883	9.3324183	10.6675817	52	.6773934	.0098117
9	9.3231938	9.9901612	9.3330327	10 6669673	51	.6768062	.0098388
10	9.3237802	9.9901339	9.3336463	10.6663537	50	.6762198	.0098661
11	9.3243657	9.9901067	9.3342591	10.6657409	49	6756343	.0098933
12	9.3249505	9.9900794	9.3348711	10.6651289	48	6750495	.0099206
13	9.3255344	9.9900521	9.3354823	10.6645177	47	6744656	.0099479
14	9.3261174	9 9900247	9.3360927	10.6639073	46	.6738826	.0099753
15	9.3266997	9.9899973	9.3367024	10 6632976	45	.6733003	.0100027
16	9 3272811	9.9899698	9.3373113	10.6626887	44	.6727189	.0100302
17	9.3278617	9.9899423	9.3379194	10.6620806	43	.6721383	.0100577
18	9.3284416	9.9899148	9.3385267	10.6614743	42	.6715584	.0100852
19	9.3290206	9.9898873	9.3391333	10.6608667	41	6709794	.0101127
20	9.3295988	9.9898597	9.3397391	10.6602609	40	.6704012	.0101403
21	9.3301761	9.9898320	9.3403441	10.6596559	39	6698239	.0101680
22	9.3307527	9.9898043	9.3409484	10.6590516	38	.6692473	.0101957
23	9.3313285	9.9897766	9.3415519	10.6584481	37	.6686715	.0102234
24	9.3319035	9.9897489	9.3421546	10.6578454	36	.6680965	.0102511
25	9.3324777	9.9897211	9.3427566	10.6572434	35	.6675223	0102789
26	9.3330511	9.9896932	9.3433578	10.6566422	34	.6669489	.0103068
27	9.3336237	9.9896654	9.3439583	10.6560417	33	6663763	.0103346
28	9.3341955	9.9896374	9.3445580	10.6554420	32	.6658045	.0103626
29	9.3347665	9.9896095	9.3451570	10.6548430	31	.6652335	.0103905
30	9.3353368	9.9895815	9.3457552	10.6542448	30	.6646632	.0104185
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	77		

12	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.3353368	9.9895815	9.3457552	10.6542448	30	.6646632	.0104185
31	9.3359062	9.9895535	9.3463527	10.6536473	29	.6640938	.0104465
32	9.3364749	9.9895254	9.3469494	10.6530506	28	.6635251	.0104746
33	9.3370428	9.9894973	9.3475454	10.6524546	27	.6629572	.0105027
34	9.3376099	9.9894692	9.3481407	10.6518593	26	.6623901	.0105308
35	9.3381762	9.9894410	9.34 7352	10.6512648	25	.6618274	.0105590
36	9.3387418	9.9894128	9.3493295	10.6506710	24	.6612582	.0105872
37	9.3393065	9.9893845	9.3499220	10.6500780	23	.6606935	.0106155
38	9.3398706	9.9893562	9.3505143	10.6494857	22	6601294	.0106438
39	9.3404338	9.9893279	9.3511059	10.6488941	21	.6595662	.0106721
40	9.3409963	9.9892995	9.3516968	10.6483032	20	.6590037	.0107005
41	9.3415580	9.9892711	9.3522869	10.6477131	19	.6584420	.0107289
42	9.3421190	9.9892427	9.3528763	10.6471237	18	.6578810	.0107573
43	9.3426792	9.9892142	9.3534650	10.6465350	17	.6573208	.0107858
44	9.3432386	9.9891856	9.3540530	10.6459470	16	.6567614	.0108144
45	9.3437973	9.9891571	9.3546402	10.6453598	15	.6562027	.0108429
46	9.3443552	9.9891285	9.3552267	10.6447733	14	.6556448	.0108716
47	9.3449124	9.9890998	9.3558126	10.6441874	13	.6550876	.0109002
48	9.3454688	9.9890711	9.3563977	10.6436023	12	.6545312	.0109289
49	9.3460245	9.9890424	9.3569821	10.6430179	11	.6539755	.0109576
50	9.3465794	9.9890137	9.3575658	10.6424342	10	.6534206	.0109863
51	9.3471336	9.9889849	9.3581487	10.6418513	9	.6528664	.0110151
52	9.3476870	9.9889560	9.3587310	10.6412690	8	.6523130	.0110440
53	9.3482397	9.9889271	9.3593126	10.6406874	7	.6517603	.0110729
54	9.3487917	9.988898[illegible]	9.3598935	10.6401065	6	.6512083	.0111018
55	9.3493429	9.9888693	9.3604736	10.6395264	5	.6506571	.0111307
56	9.3498934	9.9888403	9.3610531	10.6389469	4	.6501066	.0111597
57	9.3504432	9.9888113	9.3616319	10.6383681	3	.6495568	.0111887
58	9.3509922	9.9887822	9.3622100	10.6377900	2	.6490078	.0112178
59	9.3515405	9.9887531	9.3627874	10.6372126	1	.6484595	.0112469
60	9.3520880	9.9887239	9.3633641	10.6366359	0	.6479120	.0112761
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	77		

13	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.3520880	9.9887239	9.3633641	10.6366359	60	.6479120	.0112761
1	9.3526340	9.9886947	9.3539401	10.6360599	59	.6473651	.0113053
2	9.3531810	9.9886655	9.3645155	10.6354845	58	.6468190	.0113345
3	9.3537264	9.9886363	9.3650901	10.6349099	57	.6462736	.0113637
4	9.3542710	9.9886070	9.3656641	10.6343359	56	.6457290	.0113930
5	9.3548150	9.9885776	9.3662374	10.6337626	55	.6451850	.0114224
6	9.3553582	9.9885482	9.3668100	10.6331900	54	.6446418	.0114518
7	9.3559008	9.9885188	9.3673819	10.6326181	53	.6440993	.0114812
8	9.3564426	9.9884894	9.3679532	10.6320468	52	.6435574	.0115106
9	9.3569836	9.9884599	9.3685238	10.6314762	51	.6430164	.0115401
10	9.3575240	9.9884303	9.3690937	10.6309063	50	.6424760	.0115697
11	9.3580637	9.9884008	9.3696629	10.6303371	49	.6419363	.0115992
12	9.3586027	9.9883712	9.3702315	10.6297685	48	.6413973	.0116288
13	9.3591409	9.9883415	9.3707994	10.6292006	47	.6408591	.0116585
14	9.3596785	9.9883118	9.3713667	10.6286333	46	.6403215	.0116882
15	9.3602154	9.9882821	9.3719333	10.6280667	45	.6397846	.0117179
16	9.3607515	9.9882523	9.3724992	10.6275008	44	.6392485	.0117477
17	9.3612870	9.9882225	9.3730645	10.6269355	43	.6387130	.0117775
18	9.3618217	9.9881927	9.3736291	10.6263709	42	.6381783	.0118073
19	9.3623558	9.9881628	9.3741930	10.6258070	41	.6376442	.0118372
20	9.3628892	9.9881329	9.3747563	10.6252437	40	.6371108	.0118671
21	9.3634219	9.9881029	9.3753190	10.6246810	39	.6365781	.0118971
22	9.3639539	9.9880729	9.3758810	10.6241190	38	.6360461	.0119271
23	9.3644852	9.9880429	9.3764423	10.6235577	37	.6355148	.0119571
24	9.3650158	9.9880128	9.3770030	10.6229970	36	.6349842	.0119872
25	9.3655458	9.9879827	9.3775631	10.6224369	35	.6344542	.0120173
26	9.3660750	9.9879525	9.3781225	10.6218775	34	.6339250	.0120475
27	9.3666036	9.9879223	9.3786813	10.6213187	33	.6333964	.0120777
28	9.3671315	9.9878921	9.3792394	10.6207606	32	.6328685	.0121079
29	9.3676587	9.9878618	9.3797969	10.6202031	31	.6323413	.0121382
30	9.3681853	9.9878315	9.3803537	10.6196463	30	.6318147	.0121685
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	76		

13	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithnetic. of Sine.	Com. Arith of Sine Com.
30	9.3681853	9.9878315	9.3803537	10.6196463	30	.6318147	.0121685
31	9.3687111	9.9878012	9.3809100	10.6190900	29	.6312889	.0121988
32	9.3692363	9.9877708	9.3814655	10.6185345	28	.6307637	.0122292
33	9.3697608	9.9877404	9.3820205	10.6179795	27	.6302392	.0122596
34	9.3702847	9.9877099	9.3825748	10.6174252	26	.6297153	.0122901
35	9.3708079	9.9876794	9.3831285	10.6168715	25	.6291921	.0123206
36	9.3713304	9.9876488	9.3836816	10.6163184	24	.6286696	.0123512
37	9.3718523	9.9876183	9.3842340	10.6157660	23	.6281477	.0123817
38	9.3723735	9.9875876	9.3847858	10.6152142	22	.6276265	0124124
39	9 3728940	9.9875570	9.3853370	10.6146630	21	.6271060	.0124430
40	9.3734139	9.9875263	9.3858876	10.6141124	20	.6265861	.0124737
41	9.3739331	9.9874955	9.3864376	10.6135624	19	6260669	.0125045
42	9.3744517	9.9874648	9.3869869	10.6130131	18	.6255483	.0125352
43	9.3749696	9.9874339	9.3875356	10.6124644	17	6250304	.0125661
44	9.3754868	9.9874031	9.3880837	10.6119163	16	.6245132	.0125969
45	9.3760034	9.9873722	9.3886312	10.6113688	15	6239966	.0126278
46	9.3765194	9.9873413	9.3891781	10.6108219	14	.6234806	.0126587
47	9.3770347	9.9873103	9.3897244	10.6102756	13	.6229653	.0126897
48	9.3775493	9.9872793	9.3902700	10.6097300	12	.6224507	.0127207
49	9.3780633	9.9872482	9 3908151	10.6091849	11	.6219367	.0127518
50	9.3785767	9.9872171	9.3913595	10.6086405	10	.6214233	.0127829
51	9.3790894	9.9871860	9.3919034	10.6080966	9	.6209106	.0128140
52	9.3796015	9.9871549	9.3924466	10.6075534	8	.6203985	.0128451
53	9.3801129	9.9871236	9.3929893	10.6070107	7	.6198871	.0128764
54	9.3806237	9 9870924	9.3935513	10.6064487	6	.6193763	.0129076
55	9.3811339	9.9870611	9.3940727	10.6059273	5	.6188661	.0129389
56	9.3816434	9.9870298	9.3946136	10.6053864	4	.6183566	.0129702
57	9.3821523	9.9869984	9.3951536	10.6048462	3	.6178477	.0130016
58	9.3826605	9.9869670	9.3956935	10.6043065	2	.6173395	.0130330
59	9.3831682	9.9869356	9.3962326	10.6037674	1	.6168318	.0130644
60	9.3836752	9.9869041	9.3967711	10.6032289	0	.6163248	.0130959
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	76		

14	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.3836752	9.9869041	9.3967711	10.6032289	60	.6163248	.0130959
1	9.3841815	9.9868726	9.3973089	10.6026911	59	.6158185	.0131274
2	9.3846873	9.9868410	9.3978463	10.6021537	58	.6153127	.0131590
3	9.3851924	9.9868094	9.3983830	10.6016170	57	.6148076	.0131906
4	9.3856969	9.9867778	9.3989191	10.6010809	56	.6143031	.0132222
5	9.3862008	9.9867461	9.3994547	10.6005453	55	.6137992	.0132539
6	9.3867040	9.9867144	9.3999896	10.6000104	54	.6132960	.0132856
7	9.3872067	9.9866827	9.4005240	10.5994760	53	.6127933	.0133173
8	9.3877087	9.9866509	9.4010578	10.5989422	52	.6122913	.0133491
9	9.3882101	9.9866191	9.4015910	10.5984090	51	.6117899	.0133809
10	9.3887109	9.9865872	9.4021237	10.5978763	50	.6112891	.0134128
11	9.3892111	9.9865553	9.4026558	10.5973442	49	.6107889	.0134447
12	9.3897106	9.9865233	9.4031873	10.5968127	48	.6102894	.0134767
13	9.3902096	9.9864913	9.4037182	10.5962818	47	.6097904	.0135087
14	9.3907079	9.9864593	9.4042486	10.5957514	46	.6092921	.0135407
15	9.3912057	9.9864273	9.4047784	10.5952216	45	.6087943	.0135727
16	9.3917028	9.9863952	9.4053076	10.5946924	44	.6082972	.0136048
17	9.3921993	9.9863630	9.4058363	10.5941637	43	.6078007	.0136370
18	9.3926952	9.9863308	9.4063644	10.5936356	42	.6073048	.0136692
19	9.3931905	9.9862986	9.4068919	10.5931081	41	.6068095	.0137014
20	9.3936852	9.9862663	9.4074189	10.5925811	40	.6063148	.0137337
21	9.3941794	9.9862340	9.4079453	10.5920547	39	.6058206	.0137660
22	9.3946729	9.9862017	9.4084712	10.5915288	38	.6053271	.0137983
23	9.3951658	9.9861693	9.4089965	10.5910035	37	.6048342	.0138307
24	9.3956581	9.9861369	9.4095212	10.5904788	36	.6043419	.0138631
25	9.3961499	9.9861045	9.4100454	10.5899546	35	.6038501	.0138955
26	9.3966410	9.9860720	9.4105690	10.5894310	34	.6033590	.0139280
27	9.3970315	9.9860394	9.4110921	10.5889079	33	.6028685	.0139606
28	9.3976215	9.9860069	9.4116146	10.5883854	32	.6023785	.0139931
29	9.3981109	9.9859742	9.4121366	10.5878634	31	.6018891	.0140258
30	9.3985996	9.9859416	9.4126581	10.5873419	30	.6014004	.0140584
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	75		

14	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.3985996	9.9859416	9.4126581	10.5873419	30	.6014004	0140584
31	9.3990878	9.9859089	9.4131789	10.5868211	29	.6009122	.0140911
32	9.3995754	9.9858762	9.4136993	10.5863007	28	.6004246	.0141238
33	9.4000625	9.9858434	9.4142191	10.5857809	27	.5999375	.0141566
34	9.4005489	9.9858106	9.4147383	10.5852617	26	.5994511	.0141894
35	9.4010248	9.9857777	9.4152570	10.5847430	25	.5989652	.0142223
36	9.4015201	9.9857449	9.4157752	10.5842248	24	.5984799	.0142551
37	9.4020048	9.9857119	9.4162928	10.5837072	23	.5979952	.0142881
38	9.4024889	9.9856790	9.4168099	10.5831901	22	5975111	.0143210
39	9.4029734	9.9856460	9.4173265	10.5826735	21	.5970276	.0143540
40	9.4034554	9.9856129	9.4178425	10.5821575	20	.5965446	0143871
41	9.4039378	9.9855798	9.4183580	10.5816420	19	.5960622	.0144202
42	9.4044196	9.9855467	9.4188729	10.5811271	18	.5955804	.0144533
43	9.4049009	9.9855135	9.4193874	10.5806126	17	.5950991	0144865
44	9.4053816	9.9854803	9.4199013	10.5800987	16	.5946184	.0145197
45	9.4058617	9.9854471	9.4204146	10.5795854	15	.5941383	.0145529
46	9.4063413	9.9854138	9.4209275	10.5790725	14	.5936587	.0145862
47	9.4068203	9.9853805	9.4214398	10.5785602	13	.5931797	.0146195
48	9.4072987	9.9853471	9.4219515	10.5780485	12	.5927013	.0146529
49	9.4077766	9.9853138	9.4224628	10.5775372	11	.5922234	.0146862
50	9.4082539	9.9852803	9.4229735	10.5770265	10	.5917461	.0147197
51	9.4087306	9.9852468	9.4234838	10.5765162	9	.5912694	.0147532
52	9.4092068	9.9852133	9.4239935	10.5760065	8	.5907932	0147867
53	9.4096824	9.9851798	9.4245026	10.5754974	7	.5903176	.0148202
54	9.4101575	9.9851462	5.4250113	10.5749887	6	.5898425	.0148538
55	9.4106320	9.9851125	9.4255194	10.5744806	5	.5893680	.0148875
56	9.4111059	9.9850789	9.4260271	10.5739729	4	.5888941	0149211
57	9.4115793	9.9850452	9.4265342	10.5734658	3	.5884207	.0149548
58	9.4120522	9.9850114	9.4270408	10.5729592	2	.5879478	.0149886
59	9.4125245	9.9849776	9.4275469	10.5724532	1	.5874755	.0150224
60	9.4129962	9.9849438	9.4280525	10.5719475	0	.5870038	0150562
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	75		

15	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
0	9.4129962	9.9849438	9.4280525	10.5719475	60	.5870038	.0150562
1	9.4134674	9.9849099	9.4285575	10.5714425	59	.5865326	.0150901
2	9.4139381	9.9848760	9.4290621	10.5709379	58	5860619	.0151240
3	9.4144082	9.9848420	9.4295661	10.5704339	57	.5855918	.0151580
4	9.4148778	9.9848081	9.4300697	10.5699303	56	.5851222	.0151919
5	9.4153468	9.9847740	9.4305727	10.5694273	55	.5846532	.0152260
6	9.4158152	9.9847400	9.4310753	10.5689247	54	.5841848	.0152600
7	9.4162832	9.9847059	9.4315773	10.5684227	53	.5837168	.0152941
8	9.4167506	9.9846717	9.4320789	10.5679211	52	.5832494	.0153283
9	9.4172174	9.9846375	9.4325799	10.5674201	51	.5827826	.0153625
10	9.4176837	9.9846033	9.4330804	10.5669196	50	.5823163	.0153967
11	9.4181495	9.9845690	9.4335805	10.5664195	49	5818505	0154310
12	9.4186148	9.9845347	9.4340800	10.5659200	48	5813852	.0154653
13	9.4190795	9.9845004	9.4345791	10.5654209	47	.5809205	.0154996
14	9.4195436	9.9844660	9.4350776	10.5649224	46	.5804564	.0155340
15	9.4200073	9.9844316	9.4355757	10 5644243	45	.5799927	.0155684
16	9.4204704	9.9843971	9.4360733	10.5639267	44	.5795296	.0156029
17	9.4209330	9.9843626	9.4365704	10.5634296	43	.5790670	.0156374
18	9.4213950	9.9843281	9.4370670	10.5629330	42	.5786050	.0156719
19	9.4218566	9.9842935	9.4375631	10.5624369	41	.5781434	.0157065
20	9.4223176	9.9842589	9.4380587	10.5619413	40	.5776824	.0157411
21	9.4227780	9.9842242	9.4385538	10.5614462	39	.5772220	.0157758
22	9 4232380	9.9841895	9.4390485	10.5609515	38	.5767620	.0158104
23	9.4236974	9.9841548	9.4395426	10.5604574	37	.5763026	.0158452
24	9.4241563	9.9841200	9.4400363	10.5599637	36	.5758437	.0158800
25	9.4246147	9.9840852	9.4405295	10.5594705	35	.5753853	.0159148
26	9.4250726	9.9840503	9.4410222	10.5589778	34	.5749274	.0159497
27	9.4255299	9.9840154	9.4415145	10.5584855	33	.5744701	.0159846
28	9.4259867	9.9839805	9.4420062	10.5579938	32	.5740133	.0160195
29	9.4264430	9.9839455	9.4424975	10.5575025	31	.5735570	.0160545
30	9.4268988	9.9839105	9.4429883	10.5570117	30	.5731012	.0160895
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	74		

15	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-met. of Sine.	Com. Arith. of Sine Com.
30	0.4268988	9.9839105	9.4429883	10.5570117	30	.5731012	.0160895
31	9.4273541	9.9838755	9.4434786	10.5565214	29	.5726459	.0161245
32	9.4278089	9.9838404	9.4439685	10.5560315	28	.5721911	.0161596
33	9.4282631	9.9838052	9.4444579	10.5555421	27	.5717369	.0161948
34	9.4287169	9.9837701	9.4449468	10.5550532	26	.5712831	.0162299
35	9.4291701	9.9837348	9.4454352	10.5545648	25	.5708299	.0162652
36	9.4296228	9.9836996	9.4459232	10.5540768	24	.5703772	.0163004
37	9.4300750	9.9836643	9 4464107	10.5535893	23	.5699250	.0163357
38	9.4305267	9.9836290	9.4468978	10.5531022	22	.5694733	.0163710
39	9.4309779	9.9 35936	9.4473843	10.5526157	21	.5690221	0164064
40	9.4314286	9.9835582	9.4478704	10.5521296	20	.5685714	.0164418
41	9.4318788	9.9835227	9.4483561	10.5516439	19	.5681212	.0164773
42	9.4323285	9.9834872	9.4488413	10.5511587	18	.5676715	.0165128
43	9.4327777	9.9834517	9.4493260	10.5506740	17	.5672223	.0165483
44	9.4332264	9.9834161	9.4498102	10.5501898	16	.5667736	.0165839
45	9.4336746	9.9833805	9.4502940	10.5497060	15	.5663254	.0166195
46	9.4341223	9 9833449	9.4507774	10.5492226	14	.5658777	.0166551
47	9.4345694	9.9833092	9.4512602	10.5487398	13	.5654306	.0106908
48	9.4350161	9.9832735	9.4517427	10.5482573	12	.5649839	.0167265
49	9.4354623	9.9832377	9.4522246	10.5477754	11	.5645377	.0167623
50	9.4359080	9.9832019	9.4527061	10.5472939	10	.5640920	.0167981
51	9.4363532	9.9831661	9.4531872	10.5468128	9	.5636468	.0168339
52	9.4367980	9.9831302	9.4536678	10.5463322	8	.5632020	.0168698
53	9.4372422	9.9830942	9.4541479	10.5458521	7	.5627578	.0169058
54	9.4376859	9.9830583	9.4546276	10.5453724	6	.5623141	.0169417
55	9.4381292	9.9830223	9.4551069	10.5448931	5	.5618708	.0169777
56	9.4385719	9.9829862	9.4555857	10.5444143	4	.5614281	.0170138
57	9.4390142	9.9829501	9.4560641	10.5439359	3	.5609858	.0170499
58	9.4394560	9.9829140	9.4565420	10.5434580	2	.5605440	.0170860
59	9.4398973	9.9828778	9.4570194	10.5429806	1	.5601027	.0171222
60	9.4403381	9.9828416	9.4574964	10.5425036	0	.5596619	.0171586
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	74		

16	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.4403381	9.9828416	9.4574964	10.5425036	60	.5596619	.0171584
1	9.4407784	9.9828054	9.4579730	10.5420270	59	.5592216	.0171946
2	9.4412182	9.9827691	9.4584491	10.5415509	58	.5587818	.0172309
3	9.4416576	9.9827328	9.4589248	10.5410752	57	.5583424	.0172672
4	9.4420965	9.9826964	9.4594001	10.5405999	56	.5579035	.0173036
5	9.4425349	9.9826600	9.4598749	10.5401251	55	.5574651	.0173400
6	9.4429728	9.9826236	9.4603492	10.5396508	54	.5570272	.0173764
7	9.4434103	9.9825871	9.4608232	10.5391768	53	.5565897	.0174129
8	9.4438472	9.9825506	9.4612967	10.5387033	52	.5561528	.0174494
9	9.4442837	9.9825140	9.4617697	10.5382303	51	.5557163	.0174860
10	9.4447197	9.9824774	9.4622423	10.5377577	50	.5552803	0175226
11	9.4451553	9.9824408	9.4627145	10.5372855	49	.5548447	.0175592
12	9.4455904	9.9824041	9.4631863	10.5368137	48	.5544096	.0175959
13	9.4460250	9.9823674	9.4636576	10.5363424	47	.5539750	.0176326
14	9.4464591	9.9823306	9.4641285	10.5358715	46	.5535409	.0176694
15	9.4468927	9.9822938	9.4645990	10.5354010	45	.5531073	.0177062
16	9.4473259	9.9822569	9.4650690	10.5349310	44	.5526741	.0177431
17	9.4477586	9.9822201	9.4655386	10.5344614	43	.5522414	.0177799
18	9.4481909	9.9821831	9.4660078	10.5339922	42	.5518091	.0178169
19	9.4486227	9.9821462	9.4664765	10.5335235	41	.5513773	.0178538
20	9.4490540	9.9821092	9.4669448	10.5330552	40	.5509460	.0178908
21	9.4494849	9.9820721	9.4674127	10.5325873	39	.5505151	.0179279
22	9.4499153	9.9820351	9.4678802	10.5321198	38	.5500847	.0179649
23	9.4503452	9.9819979	9.4683473	10.5316527	37	.5496548	.0180021
24	9.4507747	9.9819608	9.4688139	10.5311861	36	.5492252	.0180391
25	9.4512037	9.9819236	9.4692801	10.5307199	35	.5487966	.0180764
26	9.4516322	9.9818863	9.4697459	10.5302541	34	.5483678	.0181137
27	9.4520603	9.9818490	9.4702112	10.5297888	33	.5479397	.0181510
28	9.4524879	9.9818117	9.4706762	10.5293238	32	.5475121	.0181883
29	9.4529151	9.9817744	9.4711407	10.5288593	31	.5470849	.0182256
30	9.4533418	9.9817370	9.4716048	10.5283952	30	.5466582	.0182630
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	73		

16	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.4533418	9.9817370	9.4716048	10.5283952	30	.5466582	.0182630
31	9.4537681	9.9816995	9.4720685	10.5279315	29	.5462319	.0183005
32	9.4541939	9.9816620	9.4725318	10.5274683	28	.5458061	.0183380
33	9.4546192	9.9816245	9.4729947	10.5270053	27	.5453808	.0183755
34	9.4550441	9.9815870	9.4734571	10.5265428	26	.5449559	.0184130
35	9.4554686	9.9815494	9.4739192	10.5260808	25	.5445314	.0184506
36	9.4558926	9.9815117	9.4743808	10.5256192	24	.5441074	.0184883
37	9.4563161	9.9814740	9.4748421	10.5251579	23	.5436839	.0185260
38	9.4567392	9.9814363	9.4753029	10.5246971	22	.5432608	.0185637
39	9.4571618	9.9813986	9.4757633	10.5242367	21	.5428382	.0186014
40	9.4575840	9.9813608	9.4762233	10.5237767	20	.5424160	.0186392
41	9.4580058	9.9813229	9.4766829	10.5233171	19	5419942	.0186771
42	9.4584271	9.9812850	9.4771421	10.5228579	18	.5415729	.0187150
43	9.4588480	9.9812471	9.4776009	10.5223991	17	.5411520	.0187526
44	9.4592684	9.9812091	9.4780592	10.5219408	16	.5407316	.0187909
45	9.4596884	9.9811711	9.4785172	10.5214828	15	.5403116	.0188289
46	9.4601079	9.9811331	9.4789748	10.5210251	14	.5398921	.0188669
47	9.4605270	9.9810950	9.4794319	10.5205681	13	.5394730	.0189050
48	9.4609456	9.9810569	9.4798887	10.5201113	12	.5390544	.0189431
49	9.4613638	9.9810187	9.4803451	10.5196549	11	.5386362	.0189813
50	9.4617816	9.9809805	9.4808011	10.5191989	10	.5382184	.0190195
51	9.4621989	9.9809423	9.4812566	10.5187434	9	.5378011	.0190577
52	9.4626158	9.9809040	9.4817118	10.5182882	8	.5373842	.0190960
53	9.4630323	9.9808657	9.4821666	10.5178334	7	.5369677	.0191343
54	9.4634483	9.9808273	9.4826210	10.5173790	6	.5365517	.0191727
55	9.4638639	9.9807889	9.4830750	10.5169250	5	.5361361	.0192111
56	9.4642790	9.9807505	9.4835286	10.5164714	4	.5357210	.0192495
57	9.4646938	9.9807120	9.4839818	10.5160182	3	.5353062	.0192880
58	9.4651081	9.9806735	9.4844346	10.5155654	2	.5348919	.0193265
59	9.4655219	9.9806349	9.4848870	10.5151130	1	.5344781	.0193651
60	9.4659353	9.9805963	9.4853390	10.5146610	0	.5340647	.0194037
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	73		

17	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
0	9.4659353	9.9805963	9.4853390	10.5146610	60	5340647	.0194037
1	9.4663483	9.9805577	9.4857907	10.5142093	59	5336517	.0194423
2	9.4667609	9.9805190	9.4862415	10.5137581	58	.5332391	.0194810
3	9.4671730	9.9804803	9.4866928	10.5133072	57	.5328270	.0195197
4	9.4675848	9.9804415	9.4871433	10:5128567	56	.5324152	.0195585
5	9.4679960	9.9804027	9.4875933	10.5124067	55	.5320040	.0195973
6	9.4684069	9.9803639	9 4880430	10.5119570	54	.5315931	.0196361
7	9.4688173	9.9803250	9.4884924	10.5115076	53	.5311827	.0196750
8	9 4692273	9.9802860	9.4889413	10.5110587	52	.5307727	.0197140
9	9.4696369	9.9802471	9.4893898	10.5106102	51	.5303631	.0197529
10	9.4700461	9.9802081	9.4898380	10.5101620	50	.5299539	.0197919
11	9.4704548	9.9801690	9.4902858	10.5097142	49	.5295452	.0198310
12	9.4708631	9.9801299	9.4907332	10.5092668	48	.5291369	.0198701
13	9.4712710	9.9800908	9.4911802	10.5088198	47	.5287290	.0199092
14	9.4716785	9.9800516	9.4916269	10.5083731	46	.5283215	.0199484
15	9.4720856	9.9800124	9.4920731	10.5079269	45	.5279144	.0199876
16	9.4724922	9.9799732	9.4925190	10.5074810	44	.5275078	.0200268
17	9.4728985	9.9799339	9.4929646	10.5070354	43	.5271015	.0200661
18	9.4733043	9.9798946	9.4934097	10.5065903	42	.5266957	.0201054
19	9.4737097	9.9798552	9.4938545	10.5061455	41	.5262903	.0201448
20	9.4741146	9.9798158	9.4942988	10.5057012	40	.5258844	.0201842
21	9.4745192	9.9797764	9.4947429	10.5052571	39	.5254808	.0202236
22	9.4749234	9.9797369	9.4951865	10.5048135	38	.5250766	.0202631
23	9.4753271	9 9796973	9.4956298	10.5043702	37	.5246729	.0203027
24	9.4757304	9.9796578	9.4960727	10.5039273	36	.5242696	.0203422
25	9.4761334	9.9796182	9.4965152	10.5034848	35	.5238666	.0203818
26	9.4765359	9.9795785	9.4969574	10.5030426	34	.5234641	.0204215
27	9.4769380	9.9795388	9.4973991	10.5026009	33	.5230620	.0204612
28	9.4773396	9.9794991	9.4978406	10.5021594	32	.5226604	.0205009
29	9.4777409	9.9794593	9.4982816	10.5017184	31	.5222591	.0205407
30	9.4781418	9.9794195	9.4987223	10.5012777	30	.5218582	.0205805
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	72		

17	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
30	9.4781418	9.9794195	9.4987223	10.5012777	30	.5218582	.0205805
31	9.4785423	9.9793796	9.4991626	10.5008374	29	.5214577	.0206204
32	9.4789423	9.9793398	9.4996026	10.5003974	28	.5210577	.0206602
33	9.4793420	9.9792998	9.5000422	10.4999578	27	.5206580	.0207002
34	9.4797412	9.9792599	9.5004814	10.4995186	26	.5202588	.0207402
35	9.4801401	9.9792198	9.5009203	10.4990797	25	.5198599	.0207802
36	9.4805385	9.9791798	9.5013588	10.4986410	24	.5194615	.0208201
37	9.4809366	9.9791397	9.5017969	10.4982031	23	.5190634	.0208603
38	9.4813342	9.9790996	9.5022347	10.4977653	22	.5186658	.0209004
39	9.4817315	9.9790594	9.5026721	10.4973279	21	.5182685	.0209406
40	9.4821283	9.9790192	9.5031092	10.4968908	20	.5178717	.0209808
41	9.4825248	9.9789789	9.5035459	10.4964541	19	.5174752	.0210211
42	9.4829208	9.9789386	9.5039822	10.4960178	18	.5170792	.0210614
43	9.4833165	9.9788983	9.5044182	10.4955818	17	.5166835	.0211017
44	9.4837117	9.9788579	9.5048538	10.4951462	16	.5162882	.0211421
45	9.4841066	9.9788175	9.5052891	10.4947109	15	.5158934	.0211825
46	9.4845010	9.9787770	9.5057240	10.4942760	14	.5154990	.0212230
47	9.4848951	9.9787365	9.5061586	10.4938414	13	.5151049	.0212635
48	9.4852888	9.9786960	9.5065928	10.4934072	12	.5147112	.0213040
49	9.4856820	9.9786554	9.5070267	10.4929733	11	.5143180	.0213446
50	9.4860749	9.9786148	9.5074602	10.4925398	10	.5139251	.0213852
51	9.4864674	9.9785741	9.5078933	10.4921067	9	.5135326	.0214259
52	9.4868595	9.9785334	9.5083261	10.4916739	8	.5131405	.0214666
53	9.4872512	9.9784927	9.5087586	10.4912414	7	.5127488	.0215073
54	9.4876426	9.9784519	9.5091907	10.4908093	6	.5123574	.0215481
55	9.4880335	9.9784111	9.5096224	10.4903776	5	.5119665	.0215889
56	9.4884240	9.9783702	9.5100539	10.4899461	4	.5115760	.0216298
57	9.4888142	9.9783293	9.5104849	10.4895151	3	.5111858	.0216707
58	9.4892040	9.9782883	9.5109156	10.4890844	2	.5107960	.0217117
59	9.4895934	9.9782474	9.5113460	10.4886540	1	.5104066	.0217526
60	9.4899824	9.9782063	9.5117760	10.4882240	0	.5100176	.0217937
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	72		

18	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.4899824	9.9782063	9.5117760	10.4882240	60	.5100176	.0217937
1	9.4903710	9.9781653	9.5122057	10.4877943	59	.5096290	.0218347
2	9.4907592	9.9781241	9.5126351	10.4873649	58	.5092408	.0218759
3	9.4911471	9.9780830	9.5130641	10.4869359	57	.5088529	.0219170
4	9.4915345	9.9780418	9.5134927	10.4865073	56	.5084655	.0219582
5	9.4919216	9.9780006	9.5139210	10.4860790	55	.5080784	.0219994
6	9.4923083	9.9779593	9.5143490	10.4856510	54	.5076917	.0220407
7	9.4926946	9.9779180	9.5147766	10.4852234	53	.5073054	.0220820
8	9.4930806	9.9778767	9.5152039	10.4847961	52	.5069194	.0221233
9	9.4934661	9.9778353	9.5156309	10.4843691	51	.5065339	.0221647
10	9.4938513	9.9777938	9.5160575	10.4849425	50	.5061487	.0222062
11	9.4942361	9.9777523	9.5164838	10.4835162	49	.5057639	.0222477
12	9.4946205	9.9777108	9.5169097	10.4830903	48	.5053795	.0222892
13	9.4950046	9.9776693	9.5173353	10.4826647	47	.5049954	.0223307
14	9.4953883	9.9776277	9.5177606	10.4822394	46	.5046117	.0223723
15	9.4957716	9.9775860	9.5181855	10.4818145	45	.5042284	.0224140
16	9.4961545	9.9775444	9.5186101	10.4813899	44	.5038455	.0224556
17	9.4965370	9.9775026	9.5190344	10.4809656	43	.5034630	.0224974
18	9.4969192	9.9774609	9.5194583	10.4805417	42	.5030808	.0225391
19	9.4973010	9.9774191	9.5198819	10.4801181	41	.5026990	.0225809
20	9.4976824	9.9773772	9.5203052	10.4796948	40	.5023176	.0226228
21	9.4980635	9.9773354	9.5207282	10.4792718	39	.5019365	.0226646
22	9.4984442	9.9772934	9.5211508	10.4788492	38	.5015558	.0227066
23	9.4988245	9.9772515	9.5215730	10.4784270	37	.5011755	.0227485
24	9.4992045	9.9772095	9.5219950	10.4780050	36	.5007955	.0227905
25	9.4995840	9.9771674	9.5224166	10.4775834	35	.5004160	.0228326
26	9.4999633	9.9771253	9.5228379	10.4771621	34	.5000367	.0228747
27	9.5003421	9.9770832	9.5232589	10.4767411	33	.5996579	.0229168
28	9.5007206	9.9770410	9.5236795	10.4763205	32	.5992794	.0229590
29	9.5010987	9.9769988	9.5240999	10.4759001	31	.5989013	.0230012
30	9.5014764	9.9769566	9.5245199	10.4754801	30	.5985236	.0230434
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	71		

18	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith of Sine Com
30	9.5014764	9.9769566	9.5245199	10.4754801	30	4985236	.0230434
31	9.5018538	9.9769143	9.5249395	10.4750605	29	.4981462	.0230857
32	9.5022308	9.9768720	9.5253589	10.4746411	28	.4977692	.0231280
33	9.5026075	9.9768296	9.5257779	10.4742221	27	.4973925	.0231704
34	9.5029838	9.9767872	9.5261966	10.4738034	26	.4970162	.0232128
35	9.5033597	9.9767447	9.5266150	10.4733850	25	.4966403	.0232553
36	9.5037353	9.9767022	9.5270331	10.4729669	24	.4962647	.0232978
37	9.5041105	9.9766597	9.5274508	10.4725492	23	.4958895	.0233403
38	9.5044853	9.9766171	9.5278682	10.4721318	22	4955147	.0233829
39	9.5048598	9.9765745	9.5282853	10.4717147	21	.4951402	.0234255
40	9.5052339	9.9765318	9.5287021	10.4712979	20	.4947661	0234682
41	9.5056077	9.9764891	9.5291186	10.4708814	19	.4943923	.0235109
42	9.5059811	9.9764464	9.5295347	10.4704653	18	.4940189	.0235536
43	9.5063542	9.9764036	9.5299505	10.4700495	17	.4936458	0235964
44	9.5067269	9.9763608	9.5303661	10.4696339	16	.4932731	.0236392
45	9.5070992	9.9763179	9.5307813	10.4692187	15	.4929008	.0236821
46	9.5074712	9.9762750	9.5311961	10.4688039	14	.4925288	.0237250
47	9.5078428	9.9762321	9.5316107	10.4683893	13	.4921572	.0237679
48	9.5082141	9.9761891	9.5320250	10.4679750	12	.4917859	.0238109
49	9.5085850	9.9761461	9.5324389	10.4675611	11	.4914150	.0238539
50	9.5089556	9.9761030	9.5328526	10.4671474	10	.4910444	.0238970
51	9.5093258	9.9760599	9.5332659	10.4667341	9	.4906742	.0239401
52	9.5096956	9.9760167	9.5336789	10.4663211	8	.4903044	.0239833
53	9.5100651	9.9759736	9.5340916	10.4659084	7	.4899349	.0240264
54	9.5104343	9.9759303	5.5345040	10.4654960	6	.4895657	.0240697
55	9.5108031	9.9758870	9.5349161	10.4650839	5	.4891969	.0241130
56	9.5111716	9.9758437	9.5353278	10.4646722	4	.4888284	.0241563
57	9.5115397	9.9758004	9.5357393	10.4642607	3	.4884603	.0241996
58	9.5119074	9.9757570	9.5361505	10.4638495	2	.4880926	.0242430
59	9.5122749	9.9757135	9.5365613	10.4634387	1	.4877251	.0242865
60	9.5126419	9.9756701	9.5369719	10.4630281	0	.4873581	.0243299
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	71		

19	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
0	9.5126419	9.9756701	9.5369719	10.4630281	60	.4873581	.0243299
1	9.5130086	9.9756265	9.5373821	10.4626179	59	.4869914	.0243735
2	9.5133750	9.9755830	9.5377920	10.4622080	58	.4866250	.0244170
3	9.5137410	9.9755394	9.5382017	10.4617983	57	.4862590	.0244606
4	9.5141067	9.9754957	9.5386110	10.4613890	56	.4858933	.0245043
5	9.5144721	9.9754521	9.5390200	10.4609800	55	.4855279	.0245479
6	9.5148371	9.9754083	9.5394287	10.4605713	54	.4851629	.0245917
7	9.5152017	9.9753646	9.5398371	10.4601629	53	.4847983	.0246354
8	9.5155660	9.9753208	9.5402453	10.4597547	52	.4844340	.0246792
9	9.5159300	9.9752769	9.5406531	10.4593469	51	.4840700	.0247231
10	9.5162936	9.9752330	9.5410605	10.4589394	50	.4837064	.0247670
11	9.5166569	9.9751891	9.5414678	10.4585322	49	.4833431	.0248109
12	9.5170198	9.9751451	9.5418747	10.4581253	48	.4829802	.0248549
13	9.5173824	9.9751011	9.5422813	10.4577187	47	.4826176	.0248989
14	9.5177447	9.9750570	9.5426877	10.4573123	46	.4822553	.0249430
15	9.5181066	9.9750128	9.5430937	10 4569063	45	.4818934	.0249871
16	9.5184682	9 9749688	9.5434994	10.4565005	44	.4815318	.0250312
17	9.5188295	9.9749246	9.5439048	10.4560952	43	.4811705	.0250754
18	9.5191904	9.9748804	9.5443100	10.4556900	42	.4808096	.0251196
19	9.5195510	9.9748361	9.5447148	10.4552852	41	.4804490	.0251639
20	9.5199112	9.9747918	9.5451193	10.4548807	40	.4800888	.0252082
21	9.5202711	9.9747475	9.5455236	10.4544764	39	.4797289	.0252525
22	9 5206307	9.9747031	9.5459276	10.4540724	38	.4793693	.0252969
23	9.5209899	9.9746587	9.5463312	10.4536688	37	.4790101	.0253413
24	9.5213488	9.9746142	9.5467346	10.4532654	36	.4786512	.0253853
25	9.5217074	9.9745697	9.5471377	10.4528623	35	.4782926	.0254303
26	9.5220656	9.9745252	9.5475405	10 4524595	34	.4779344	.0254748
27	9.5224235	9.9744806	9.5479430	10.4520570	33	.4775765	.0255194
28	9.5227811	9.9744359	9.5483452	10.4516548	32	.4772189	.0255641
29	9.5231383	9.9743913	9.5487471	10.4512529	31	.4768617	.0256087
30	9.5234953	9.9743466	9.5491487	10.4508513	30	.4765047	.0256534
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	70		

19	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.5234953	9.9743466	9.5491487	10.4508513	30	.4765047	.0256534
31	9.5238518	9.9743018	9.5495500	10.4504500	29	.4761482	.0256982
32	9.5242081	9.9742570	9.5499511	10.4500489	28	.4757919	.0257430
33	9.5245640	9.9742122	9.5503519	10.4496481	27	.4754360	.0257878
34	9.5249196	9.9741673	9.5507523	10.4492477	26	.4750804	.0258327
35	9.5252749	9.9741224	9.5511525	10.4488475	25	.4747251	.0258776
36	9.5256298	9.9740774	9.5515524	10.4484476	24	.4743702	.0259226
37	9.5259844	9.9740324	9.5519521	10.4480479	23	.4740156	.0259676
38	9.5263387	9.9739873	9.5523514	10.4476486	22	.4736613	0260127
39	9.5266927	9.9739422	9.5527504	10.4472496	21	.4733073	.0260578
40	9.5270463	9.9738971	9.5531492	10.4468508	20	.4729537	.0261029
41	9.5273997	9.9738519	9.5535477	10.4464523	19	4726003	.0261481
42	9.5277526	9.9738067	9.5539459	10.4460541	18	.4722474	.0261933
43	9.5281053	9.9737615	9.5543438	10.4456562	17	.4718947	.0262385
44	9.5284577	9.9737162	9.5547415	10.4452585	16	.4715423	.0262838
45	9.5288097	9.9736709	9.5551388	10.4448612	15	.4711903	.0263291
46	9.5291614	9.9736255	9.5555359	10.4444641	14	.4708386	.0263745
47	9.5295128	9.9735801	9.5559327	10.4440673	13	.4704872	.0264199
48	9.5298638	9.9735346	9.5563292	10.4436708	12	.4701362	.0264654
49	9.5302146	9.9734891	9.5567255	10.4432745	11	.4697854	.0265109
50	9.5305650	9.9734435	9.5571214	10.4428786	10	.4694350	.0265565
51	9.5309151	9.9733980	9.5575171	10.4424829	9	.4690849	.0266020
52	9.5312649	9.9733523	9.5579125	10.4420875	8	.4687351	.0266477
53	9.5316143	9.9733067	9.5583077	10.4416923	7	.4683857	.0266933
54	9.5319635	9.9732610	9.5587025	10.4412975	6	.4680365	.0267390
55	9.5323123	9.9732152	9.5590971	10.4409029	5	.4676877	.0267848
56	9.5326608	9.9731694	9.5594914	10.4405086	4	4673392	.0268306
57	9.5330090	9.9731236	9.5598854	10.4401146	3	.4669910	.0268764
58	9.5333569	9.9730777	9.5602792	10.4397208	2	.4666431	.0269223
59	9.5337044	9.9730318	9.5606727	10.4393273	1	.4662956	.0269682
60	9.5340517	9.9729858	9.5610659	10.4389341	0	.4659483	.0270142
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	70		

20	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.5340517	9.9729858	9.5610659	10.4389341	60	.4659483	.0270142
1	9.5343986	9.9729398	9.5614588	10.4385412	59	.4656014	.0270602
2	9.5347452	9.9728938	9.5618515	10.4381485	58	.4652548	.0271062
3	9.5350915	9.9728477	9.5622439	10.4377561	57	.4649085	.0271523
4	9.5354375	9.9728016	9.5626360	10.4373640	56	.4645625	.0271984
5	9.5357832	9.9727554	9.5630278	10.4369722	55	.4642168	.0272446
6	9.5361286	9.9727092	9.5634194	10.4365806	54	.4638714	.0272908
7	9.5364737	9.9726629	9.5638107	10.4361893	53	.4635263	.0273371
8	9.5368184	9.9726166	9.5642018	10.4357982	52	.4631816	.0273834
9	9.5371628	9.9725703	9.5645925	10.4354075	51	.4628372	.0274297
10	9.5375069	9.9725239	9.5649831	10.4350169	50	.4624930	.0274761
11	9.5378508	9.9724775	9.5653733	10.4346267	49	.4621492	.0275225
12	9.5381943	9.9724310	9.5657633	10.4342367	48	.4618057	.0275690
13	9.5385375	9.9723845	9.5661530	10.4338470	47	.4614625	.0276155
14	9.5388804	9.9723380	9.5665424	10.4334576	46	.4611196	.0276620
15	9.5392230	9.9722914	9.5669316	10.4330684	45	.4607770	.0277086
16	9.5395653	9.9722448	9.5673205	10.4326795	44	.4604347	.0277552
17	9.5399073	9.9721981	9.5677091	10.4322909	43	.4600927	.0278019
18	9.5402489	9.9721514	9.5680975	10.4319025	42	.4597511	.0278486
19	9.5405903	9.9721047	9.5684856	10.4315144	41	.4594097	.0278953
20	9.5409314	9.9720579	9.5688735	10.4311265	40	.4590686	.0279421
21	9.5412721	9.9720110	9.5692611	10.4307389	39	.4587279	.0279890
22	9.5416126	9.9719642	9.5696484	10.4303516	38	.4583874	.0280358
23	9.5419527	9.9719172	9.5700355	10.4299645	37	.4580473	.0280828
24	9.5422926	9.9718703	9.5704223	10.4295777	36	.4577074	.0281297
25	9.5426321	9.9718233	9.5708088	10.4291912	35	.4573679	.0281767
26	9.5429713	9.9717762	9.5711951	10.4288049	34	.4570287	.0282238
27	9.5433103	9.9717291	9.5715811	10.4284189	33	.4566897	.0282709
28	9.5436489	9.9716820	9.5719669	10.4280331	32	4563511	.0283180
29	9.5439873	9.9716348	9.5723524	10.4276476	31	.4560127	.0283652
30	9.5433253	9.9715876	9.5727377	10.4272623	30	.4556747	.0284124
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	69		

20	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithnetic. of Sine.	Com. Arith. of Sine Com.
30	9.5443253	9.9715876	9.5727377	10.4272623	30	.4556747	.0284124
31	9.5446630	9.9715404	9.5731227	10.4268773	29	.4553370	.0284596
32	9.5450005	9.9714931	9.5735074	10.4264926	28	.4549995	.0285069
33	9.5453376	9.9714457	9.5738919	10.4261081	27	.4546624	.0285543
34	9.5456745	9.9713984	9.5742761	10.4257239	26	.4543255	0286016
35	9.5460110	9.9713509	9.5746601	10.4253399	25	.4539890	.0286491
36	9.5463472	9.9713035	9.5750438	10.4249562	24	.4536528	.0286965
37	9.5466832	9.9712560	9.5754292	10 4245728	23	.4533168	.0287440
38	9.5470189	9.9712084	9.5758104	10 4241896	22	.4529811	0287916
39	9.5473542	9.9711608	9.5761934	10.4238066	21	.4526458	.0288392
40	9.5476893	9.9711132	9.5765761	10.4234239	20	.4523107	.0288868
41	9.5480240	9.9710655	9.5769585	10.4230415	19	.4519760	.0289345
42	9.5483585	9.9710178	9.5773407	10.4226593	18	.4516415	.0289822
43	9.5486927	9.9709701	9.5777226	10.4222774	17	.4513073	.0290299
44	9.5490266	9.9709223	9.5781043	10.4218957	16	.4509734	.0290777
45	9.5493602	9.9708744	9.5784858	10.4215142	15	.4506398	.0291256
46	9.5496935	9.9708265	9.5788669	10.4211331	14	.4503065	.0291735
47	9.5500265	9.9707786	9.5792479	10.4207521	13	.4499735	.0292214
48	9.5503592	9.9707306	9.5796286	10.4203714	12	.4496408	.0292694
49	9.5506916	9.9706826	9.5800090	10.4199910	11	.4493084	.0293174
50	9.5510237	9.9706346	9.5803892	10.4196108	10	.4489763	.0293654
51	9.5513556	9.9705865	9.5807691	10.4192309	9	.4486444	.0294135
52	9.5516871	9.9705383	9.5811488	10.4188512	8	.4483129	.0294617
53	9.5520184	9.9704902	9.5815282	10.4184718	7	.4479816	.0295098
54	9.5523494	9.9704419	9.5819074	10.4180926	6	.4476506	.0295581
55	9.5526801	9.9703937	9.5822864	10.4177136	5	.4473199	.0296063
56	9.5530105	9.9703454	9.5826651	10.4173349	4	.4469893	.0296546
57	9.5533406	9.9702970	9.5830435	10.4169565	3	.4466594	.0297030
58	9.5536704	9.9702486	9.5834217	10.4165783	2	.4463296	.0297514
59	9.5539999	9.9702002	9.5837997	10.4162003	1	.4460001	.0297998
60	9.5543292	9.9701517	9.5841774	10.4158226	0	.4456708	.0298483
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	69		

21	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-met. of Sine.	Com. Arith of Sine Com.
0	9.5543292	9.9701517	9.5841774	10.4158226	60	.4456708	.0298483
1	9.5546581	9.9701032	9.5845549	10.4154451	59	.4453419	.0298968
2	9.5549868	9.9700547	9.5849321	10.4150679	58	.4450132	0299453
3	9.5553152	9.9700061	9.5853091	10.4146909	57	.4446848	.0299939
4	9.5556433	9.9699574	9.5856859	10.4143141	56	.4443567	.0300426
5	9.5559711	9.9699087	9.5860624	10.4139376	55	.4440289	0300913
6	9.5562987	9.9698600	9.5864386	10.4135614	54	.4437013	.0301400
7	9.5566259	9.9698112	9.5868147	10.4131853	53	.4433741	.0301888
8	9.5569529	9.9697624	9.5871904	10.4128096	52	.4430471	.0302376
9	9.5572796	9.9697136	9.5875660	10.4124340	51	.4427204	.0302864
10	9.5576060	9.9696647	9.5879413	10.4120587	50	.4423940	.0303353
11	9.5579321	9.9696158	9.5883163	10.4116837	49	.4420679	.0303842
12	9.5582579	9.9695668	9.5886912	10.4113088	48	.4417421	0304332
13	9.5585835	9.9695177	9.5890657	10.4109343	47	.4414165	0304823
14	9.5589088	9.9694687	9.5894401	10.4105599	46	4410912	.0305313
15	9.5592338	9.9694196	9.5898142	10.4101858	45	.4407662	.0105804
16	9.5595585	9.9693704	9.5901881	10.4098119	44	.4404415	.0306296
17	9.5598829	9.9693212	9.5905617	10.4094383	43	.4401171	.0306788
18	9.5602071	9.9692720	9.5909351	10.4090649	42	.4397929	.0307280
19	9.5605310	9.9692227	9.5913082	10.4086918	41	.4394690	.0307773
20	9.5608546	9.9691734	9.5916812	10.4083188	40	.4391454	.0308266
21	9.5611779	9.9691240	9.5920539	10.4079461	39	.4388221	.0308759
22	9.5615010	9.9690746	9.5924263	10.4075737	38	.4384990	.0309254
23	9.5618237	9.9690252	9.5927985	10.4072015	37	.4381763	.0309748
24	9.5621462	9.9689757	9.5931705	10.4068295	36	.4378538	.0310243
25	9.5624685	9.9689262	9.5935423	10.4064577	35	.4375315	.0310738
26	9.5627904	9.9688766	9.5939138	10.4060862	34	.4372096	.0311234
27	9.5631121	9.9688270	9.5942851	10.4057149	33	.4368879	0311730
28	9.5634335	9.9687773	9.5946561	10.4053439	32	.4365665	.0312227
29	9.5637546	9.9687276	9.5950269	10.4049731	31	.4362454	.0312724
30	9.5640754	9.9686779	9.5953975	10.4046025	30	4359246	.0313221
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	68		

21	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-met. of Sine.	Com. Arit: of Sine Com
30	9.5640754	9.9686779	9.5953975	10.4046025	30	.4359246	.0313221
31	9.5643960	9.9686281	9.5957679	10.4042321	29	.4356040	.0313719
32	9.5647163	9.9685783	9.5961380	10.4038620	28	.4352837	.0314217
33	9.5650363	9.9685284	9.5965079	10.4034921	27	.4349637	.0314716
34	9.5653561	9.9684785	9.5968776	10.4031224	26	.4346439	.0315215
35	9.5656756	9.9684286	9.5972470	10.4027530	25	.4343244	.0315714
36	9.5659948	9.9683786	9.5976162	10.4023838	24	.4340052	.0316214
37	9.5663137	9.9683285	9.5979852	10.4020148	23	.4336863	.0316715
38	9.5666324	9.9682784	9.5983540	10.4016460	22	.4333676	.0317216
39	9.5669508	9.9682283	9 5987225	10.4012775	21	4330492	.0317717
40	9.5672689	9.9681781	9.5990908	10.4009092	20	.4327311	.0318219
41	9.5675868	9.9681279	9.5994588	10.4005411	19	.4324132	.0318721
42	9.5679044	9.9680777	9.5998267	10.4001733	18	.4320956	.0319223
43	9.5682217	9.9680274	9.6001943	10.3998057	17	.4317783	.0319726
44	9.5685387	9.9679771	9.6005617	10.3994383	16	.4314613	.0320229
45	9.5688555	9.9679267	9.6009289	10.3990711	15	4321445	.0320733
46	9.5691721	9.9678763	9.6012958	10.3987042	14	.4308279	.0321237
47	9.5694883	9.9678258	9.6016625	10.3983375	13	.4305117	.0321742
48	9.5698043	9.9677753	9.6020290	10.3979710	12	.4301957	.0322247
49	9.5701200	9.9677247	9.6023953	10.3976047	11	.4298800	.0322753
50	9.5704355	9.9676741	9.6027613	10.397238-	10	.4295645	.0323259
51	9.5707506	9.9676235	9.6031271	10.3968729	9	.4292494	.0323765
52	9.5710656	9.9675728	9.6034927	10.3965073	8	.4289344	.0324272
53	9.5713802	9.9675221	9.6038581	10.3961419	7	.4286198	.9324779
54	9.5716946	9.9674713	9.6042233	10.3957766	6	.4283054	.0325287
55	9.5720087	9.9674205	9.6045882	10.3954118	5	.4279913	.0325795
56	9.5723226	9.9673697	9.6049529	10.3950471	4	.4276774	.9326303
57	9.5726362	9 9673188	9.6053174	10.3946826	3	.4273638	.0326812
58	9.5729495	9.9672679	9.6056817	10.3943183	2	.4270505	.0327321
59	9.5732626	9.9672169	9.6060457	10.3939543	1	.4267374	.0327831
60	9.5735754	9.9671659	9.6064096	10.3935904	0	.4264246	.0328341
	SINE. Complement.	Sine.	TANGENT Complement.	Tang.	68		

22	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.5735754	9.9671659	9.6064096	10.3935904	60	.4264246	.0328341
1	9.5738880	9.9671148	9.6067732	10.3932268	59	.4261120	.0328852
2	9.5742003	9.9670637	9.6071366	10.3928634	58	.4257997	.0329363
3	9.5745123	9.9670125	9.6074997	10.3925003	57	.4254877	.0329875
4	9.5748240	9.9669614	9.6078627	10.3921373	56	.4251760	.0330386
5	9.5751356	9.9669101	9.6082254	10.3917746	55	.4248644	.0330899
6	9.5754468	9.9668588	9.6085880	10.3914120	54	.4245532	.0331412
7	9.5757578	9.9668075	9.6089503	10.3910497	53	.4242422	.0331925
8	9.5760685	9.9667562	9.6093124	10.3906876	52	.4239315	.0332438
9	9.5763790	9.9667048	9.6096742	10.3903258	51	.4236210	.0332952
10	9.5766892	9.9666533	9.6100359	10.3899641	50	.4233108	.0333467
11	9.5769991	9.9666018	9.6103973	10.3896027	49	.4230009	.0333982
12	9.5773088	9.9665503	9.6107586	10.3892414	48	.4226912	.0334497
13	9.5776183	9.9664987	9.6111196	10.3888804	47	.4223817	.0335013
14	9.5779275	9.9664471	9.6114804	10.3885196	46	.4220725	.0335529
15	9.5782364	9.9663954	9.6118409	10.3881591	45	.4217636	.0336046
16	9.5785450	9.9663437	9.6122013	10.3877987	44	.4214550	.0336563
17	9.5788535	9.9662920	9.6125615	10.3874385	43	.4211465	.0337080
18	9.5791616	9.9662402	9.6129214	10.3870786	42	.4208384	.0337598
19	9.5794695	9.9661884	9.6132812	10.3867188	41	.4205305	.0338116
20	9.5797772	9.9661365	9.6136407	10.3863593	40	.4202228	.0338635
21	9.5800845	9.9660846	9.6140000	10.3860000	39	.4199155	.0339154
22	9.5803917	9.9660326	9.6143591	10.3856409	38	.4196083	.0339674
23	9.5806986	9.9659806	9.6147186	10.3852820	37	.4193014	.0340194
24	9.5810052	9.9659285	9.6150766	10.3849234	36	.4189948	.0340715
25	9.5813116	9.9658764	9.6154351	10.3845649	35	.4186884	.0341236
26	9.5816177	9.9658243	9.6157934	10.3842066	34	.4183823	.0341757
27	9.5819236	9.9657721	9.6161514	10.3838486	33	.4180764	.0342279
28	9.5822292	9.9657199	9.6165093	10.3834907	32	.4177708	.0342801
29	9.5825345	9.9656677	9.6168669	10.3831331	31	.4174655	.0343323
30	9.5828397	9.9656153	9.6172243	10.3827757	30	.4171603	.0343847
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	67		

22	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Co'n. Aritmetic. of Sine.	Co'n. Aritm. of Sine Com.
30	9.5828397	9.9656153	9.6172243	10.3827757	30	.4171603	.0343847
31	9.5831445	9.9655630	9.6175815	10.3824185	29	.4168555	.0344370
32	9.5834491	9.9655106	9.6179385	10.3820615	28	.4165509	.0344894
33	9.5837535	9.9654582	9.6182953	10.3817047	27	.4162465	.0345418
34	9.5840570	.9654057	9.6186519	10.3813481	26	.4159424	.0345943
35	9.584361[illegible]	.9653532	9.6190083	10.3809917	25	.4156385	.0346468
36	9.5846651	.9653006	9.6193645	10.3806355	24	.4153349	.0346994
37	9.5849685	9.9652480	9.6197205	10.3802795	23	.4150315	.0347520
38	9.5842716	9.9651953	9.6200762	10.3799238	22	.4147284	.0348047
39	9.5855745	9.9651426	9.6204318	10.3795682	21	.4144255	.0348574
40	9.5858771	9.9650899	9.6208872	10.3792128	20	.4141229	.0349101
41	9.5861795	9.9650371	9.6211423	10.3788577	19	.4138205	.0349629
42	9.5864816	9.9649843	9.6214974	10.3785026	18	.4135184	.0350157
43	9.5867835	9.9649314	9.6218520	10.3781480	17	.4132165	.0350686
44	9.5870851	9.9648785	9.6222066	10.3777934	16	.4129149	.0351215
45	9.5873865	9.9648256	9.6225609	10.3774391	15	.4126135	.0351744
46	9.5876876	9.9647726	9.6229150	10.3770850	14	.4123124	.0352274
47	9.5879885	9.9647195	9.6232690	10.3767310	13	.4120115	.0352805
48	9.5882892	9.9646665	9.6236227	10.3763773	12	.4117108	.0353335
49	9.5885896	9.9646133	9.6239763	10.3760237	11	.4114104	.0353867
50	9.5888897	9.9645602	9.6243296	10.3756704	10	.4111103	.0354398
51	9.5891897	9.9645069	9.6246827	10.3753173	9	.4108103	.0354931
52	9.5894893	9.9644537	9.6250356	10.3749644	8	.4105107	.0355463
53	9.5897888	9.9644004	9.6253884	10.3746116	7	.4102112	.0355996
54	9.5900880	9.9643470	5.6257409	10.3742591	6	.4099120	.0356530
55	9.5903869	9.9642937	9.6260932	10.3739068	5	.4096130	.0357062
56	9.5906856	9.9642402	9.6264454	10.3735546	4	.4093144	.0357598
57	9.5909841	9.9641868	9.6267973	10.3732027	3	.4090159	.0358132
58	9.5912823	9.9641332	9.6271491	10.3728509	2	.4087177	.0358668
59	9.5915803	9.9640797	9.6275006	10.3724994	1	.4084197	.0359203
60	9.5918780	9.9640261	9.6278519	10.3721481	0	.4081220	.0359739
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	67		

23	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet of Sine.	Com. Arith. of Sine Com.
0	9.5918780	9.9640261	9.6278519	10.3721481	60	.4081220	.0359739
1	9.5921755	9.9639724	9.6282030	10.3717969	59	.4078245	.0360276
2	9.5924728	9.9639187	9.6285540	10.3714460	58	4075272	.0360813
3	9.5927698	9.9638650	9.6289048	10.3710952	57	4072302	.0361350
4	9.5930666	9.9638112	9.6292553	10.3707447	56	.4669334	.0361888
5	9.5933631	9.9637574	9.6296057	10.3703943	55	.4066369	.0362426
6	9.5936594	9.9637036	9.6299558	10.3700442	54	4063406	.0362964
7	9.5939555	9.9636496	9.6303058	10.3696942	53	4060445	.0363504
8	9.5942513	9.9635957	9.6306556	10.3693444	52	4057487	.0364043
9	9.5945469	9.9635417	9.6310052	10.3689948	51	4054531	.0364583
10	9.5948422	9.9634877	9.6313545	10.3686455	50	.4051578	0365123
11	9.5951373	9.9634336	9.6317037	10.3682963	49	4048627	0365664
12	9.5954322	9.9633795	9.6320527	10.3679473	48	4045678	.0366205
13	9.5957268	9.9633253	9.6324015	10.3675985	47	4042732	.0366747
14	9.5960212	9.9632711	9.6327501	10.3672499	46	.4039788	.0367289
15	9.5963154	9.9632168	9.6330985	10.3669015	45	.4036846	.0367832
16	9.5966093	9.9631625	9.6334468	10.3665532	44	.4033907	.0368375
17	9.5969030	9.9631082	9.6337948	10.3662052	43	.4030970	.0368918
18	9.5971965	9.9630538	9.6341426	10.3658574	42	.4028035	.0369462
19	9.5974897	9.9629994	9.6344903	10.3655097	41	.4025103	.0370006
20	9.5977827	9.9629449	9.6348378	10.3651622	40	.4022175	.0370551
21	9.5980754	9.9628904	9.6351850	10.3648150	39	.4019246	.0371096
22	9.5983680	9.9628358	9.6355321	10.3644679	38	.4016321	.0371642
23	9.5986602	9.9627812	9.6358790	10.3641210	37	.4013398	.0372188
24	9.5989523	9.9627266	9.6362257	10.3637743	36	.4010477	.0372734
25	9.5992441	9.9626719	9.6365722	10.3634278	35	.4007559	.0373281
26	9.5995357	9.9626172	9.6369185	10.3630815	34	.4004643	.0373828
27	9.5998270	9.9625624	9.6372646	10.3627354	33	.4001730	0374376
28	9.6001181	9.9625076	9.6376106	10.3623894	32	.3998819	0374924
29	9.6004090	9.9624527	9.6379563	10.3620437	31	.3995910	0375473
30	9.6006997	9.9623978	9.6383019	10.3616981	30	.3993003	.0376022
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	66		

23	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Co. Arith-metic. of Sine.	Com. Arith. of Sine Com.
30	9.6006997	9.9623978	9.6383019	10.3616981	30	.3993003	.0376022
31	9.6009901	9.9623428	9.6386473	10.3613527	29	.3990099	.0376572
32	9.6012803	9.9622878	9.6389925	10.3610075	28	3987197	.0377112
33	9.6015703	9.9622328	9.6393375	10.3606625	27	3984297	.0377672
34	9.6018600	9.9621777	9.6396823	10.3603177	26	.3981400	0378223
35	9 6021495	9.9621226	9.6400269	10.3699731	25	.3978505	.0378774
36	9.6024388	9.9620674	9.6403714	10.3596286	24	.3975612	.0379326
37	9.6017278	9.9620122	9.6407156	10 3592844	23	.3972722	.0379878
38	9.6030166	9.9619569	9.6410597	10.3589403	22	.3969834	0380431
39	9.6033052	9.9619016	9.6414036	10.3585964	21	.3966948	.0380984
40	9.6035936	9.9618463	9 6417473	10.3582527	20	.3964064	.0381537
41	9.6038817	9.9617909	9.6420908	10.3579092	19	3961183	.0382091
42	9.6041696	9.9617355	9.6424342	10.3575658	18	.3958304	.0382645
43	9.6044573	9.9616800	9.6427773	10.3572227	17	.3955427	.0383200
44	9.6047448	9.9616245	9.6431203	10.3568797	16	.3952552	.0383755
45	9.6050320	9.9615689	9.6434631	10.3565370	15	.3949680	.0384311
46	9.6053190	9.9615133	9.6438057	10.3561943	14	.3946810	.0384867
47	9.6056057	9.9614576	9.6441481	10.3558519	13	.3943943	.0385424
48	9.6058923	9.9614020	9.6444903	10.3555097	12	.3941077	.0385980
49	9.6061786	9.9613463	9 6448324	10.3551676	11	.3938214	.0386538
50	9.6064647	9.9612904	9.6451743	10.3548257	10	.3935353	.0387096
51	9.6067506	9.9612346	9.6455160	10,3544840	9	.3932494	.0387654
52	9.6070362	9.9611787	9.6458575	10.3541425	8	.3929638	.0388213
53	9.6073216	9.9611228	9.6461988	10.3538012	7	.3926784	.0388772
54	9.6076068	9.9610668	9.6465400	10.3534600	6	.3923932	.0389332
55	9.6078918	9.9610108	9.6468810	10.3531190	5	.3921082	.0389892
56	9.6081765	9.9609548	9.6472217	10.3527783	4	.3918235	.0390452
57	9.6084611	9.9608987	9.6475624	10.3524376	3	.3915389	.0391013
58	9.6087454	9.9608426	9.6479028	10.3520972	2	.3912546	.0391574
59	9.6090294	9.9607864	9.6482431	10.3517569	1	.3909706	.0392136
60	9.6093133	9.9607302	9.6485831	10.3514169	0	.3906867	.0392698
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	66		

24	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-metic. of Sine.	Com. Arith. of Sine Com.
0	9.6093133	9.9607302	9.6485831	10.3514169	60	.3906867	.0392698
1	9.6095969	9.9606739	9.6489230	10.3510770	59	.3904031	.0393261
2	9.6098803	9.9606176	9.6492628	10.3507372	58	.3901197	.0393824
3	9.6101635	9.9605612	9.6496023	10.3503977	57	.3898365	.0394388
4	9.6104465	9.9605048	9.6499417	10.3500583	56	.3895535	.0394952
5	9.6107293	9.9604484	9.6502809	10.3497191	55	.3892707	.0395516
6	9.6110118	9.9603919	9.6506199	10.3493801	54	.388988[illegible]	.0396081
7	9.6112941	9.9603354	9.6509587	10.3490413	53	.3887059	.0396646
8	9.6115762	9.9602788	9.6512974	10.3487026	52	.3884238	.0397212
9	9.6118580	9.9602222	9.6516359	10.3483641	51	.3881420	.0397778
10	9.6121397	9.9601655	9.6519742	10.3480258	50	.3878603	.0398345
11	9.6124211	9.9601088	9.6523123	10.3476877	49	.3875789	.0398912
12	9.6127023	9.9600520	9.6526502	10.3473497	48	.3872977	.0399480
13	9.6129833	9.9599952	9.6529881	10.3470119	47	.3870167	.0400048
14	9.6132641	9.9599384	9.6533257	10.3466743	46	.3867359	.0400616
15	9.6135446	9.9598815	9.6536631	10.3463369	45	.3864554	.0401185
16	9.6138250	9.9598246	9.6540004	10.3459996	44	.3861750	.0401754
17	9.6141051	9.9597676	9.6543375	10.3456625	43	.3858949	.0402324
18	9.6143850	9.9597106	9.6546744	10.3453256	42	.3856150	.0402894
19	9.6146647	9.9596535	9.6550112	10.3449888	41	.3853353	.0403465
20	9.6149441	9.9595964	9.6553477	10.3446523	40	.3850559	.0404036
21	9.6152234	9.9595393	9.6556841	10.3443159	39	.3847766	.0404607
22	9.6155024	9.9594821	9.6560204	10.3439796	38	.3844976	.0405179
23	9.6157812	9.9594248	9.6563564	10.3436436	37	.3842188	.0405752
24	9.6160598	9.9593675	9.6566923	10.3433077	36	.3839401	.0406325
25	9.6163382	9.9593102	9.6570280	10.3429720	35	.3836618	.0406898
26	9.6166164	9.9592528	9.9573636	10.3426364	34	.3833836	.0407472
27	9.6168944	9.9591954	9.9576989	10.3423011	33	.3831056	.0408046
28	9.6171721	9.9591380	9.9580341	10.3419659	32	.3828279	.0408620
29	9.6174496	9.9590805	9.9583692	10.3416308	31	.3825504	.0409195
30	9.6177270	9.9590229	9.9587041	10.3412960	30	.3822730	.0409771
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	65		

24	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-netic. of Sine.	Com. Arith. of Sine Com.
30	9.0177270	9.9590299	9.6587041	10.3412960	30	.3822730	.0409771
31	9.6180041	9.9589653	9.6590387	10.3409613	29	.3819959	.0410347
32	9.6182809	9.9589077	9.6593733	10.3406267	28	.3817191	.0410923
33	9.6185576	9.9588500	9.6597076	10.3402924	27	.3814424	.0411500
34	9.6188341	9.9587923	9.6600418	10.3399582	26	.3811659	.0412077
35	9.6191103	9.9587345	9.6603758	10.3396242	25	.3808897	.0412655
36	9.6193864	9.9586767	9.6607097	10.3392903	24	.3806136	.0413233
37	9.6196622	9.9586188	9.6610434	10.3389566	23	.3803378	.0413812
38	9.6199378	9.9585609	9.6613769	10.3386231	22	.3800622	.0414391
39	9.6202132	9.9585030	9.6617103	10.3382897	21	.3797868	.0414970
40	9.6204884	9.9584450	9.6620434	10.3379566	20	.3795116	.0415550
41	9.6207634	9.9583869	9.6623765	10.3376235	19	.3792366	.0416131
42	9.6210382	9.9583288	9.6627093	10.3372907	18	.3789618	.0416712
43	9.6213127	9.9582707	9.6630420	10.3369580	17	.3786873	.0417293
44	9.6215871	9.9582125	9.6633745	10.3366255	16	.3784129	.0417875
45	9.6218612	9.9581543	9.6637069	10.3362931	15	.3781388	.0418457
46	9.6221351	9.9580961	9.6640391	10.3359609	14	.3778649	.0419039
47	9.6224088	9.9580378	9.6643711	10.3356289	13	.3775912	.0419622
48	9.6226824	9.9579794	9.6647030	10.3352970	12	.3773176	.0420206
49	9.6229557	9.9579210	9.6650346	10.3349654	11	.3770443	.0420790
50	9.6232287	9.9578626	9.6653662	10.3346338	10	.3767713	.0421374
51	9.6235016	9.9578041	9.6656975	10.3543025	9	.3764984	.0421959
52	9.6237743	9.9577456	9.6660288	10.3339712	8	.3762257	.0422544
53	9.6240468	9.9576870	9.6663598	10.3336402	7	.3759532	.0423130
54	9.6243190	9.9576284	9.6666907	10.3333093	6	.3756810	.0423716
55	9.6245911	9.9575697	9.6670214	10.3329786	5	.3754089	.0424303
56	9.6248629	9.9575110	9.6673519	10.3326481	4	.3751371	.0424890
57	9.6251346	9.9574522	9.6676823	10.3323177	3	.3748654	.0425478
58	9.6254060	9.9573934	9.6680126	10.3319874	2	.3745940	.0426066
59	9.6256772	9.9573346	9.6683426	10.3316574	1	.3743228	.0426654
60	9.6259483	9.9572757	9.6686725	10.3313275	0	.3740517	.0427243
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	65		

25	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-mer. of Sine.	Com. Arith. of Sine Com.
0	9.6259483	9.9572757	9.6686725	10.3313275	60	3740517	.0427243
1	9.6262191	9.9572168	9.6690023	10.3309977	59	3737809	.0427832
2	9.6264897	9.9571578	9.6693319	10.3306681	58	.3735103	.0428422
3	9.6267601	9.9570988	9.6696613	10.3303387	57	3732399	.0429012
4	9.6270303	9.9570397	9 6699906	10.3300094	56	.3729697	.0429603
5	9.6273003	9.9569806	9.6703197	10.3296803	55	.3726997	.0430194
6	9.6275701	9.9569215	9.6706486	10.3293514	54	.3724299	.0430785
7	9.6278397	9.9568623	9.6709774	10.3290226	53	.3721603	.0431377
8	9 6281090	9.9568030	9.6713060	10.3286940	52	.3718910	.0431970
9	9.6283782	9.9567437	9.6716345	10.3283655	51	.3716218	.0432563
10	9.6286472	9.9566844	9.6719628	10.3280372	50	.3713528	.0433156
11	9.6289160	9.9566250	9.6722910	10.3277090	49	.3710840	.0433750
12	9.6291845	9.9565656	9.6726190	10.3273810	48	.3708155	.0434344
13	9.6294529	9.9565061	9.6729468	10.3270532	47	.3705471	.0434939
14	9.6297211	9.9564466	9.6732745	10.3267255	46	.3702789	.0435534
15	9 6299890	9.9563870	9.6736020	10.3263980	45	.3700110	.0436130
16	9.6302568	9.9563274	9.6739294	10.3260706	44	.3697432	.0436726
17	9.6305243	9.9562678	9.6742566	10.3257454	43	.3694757	.0437322
18	9.6307917	9.9562081	9.6745836	10.3254164	42	.3692083	.0437919
19	9.6310589	9.9561483	9.6749105	10.3250895	41	.3689411	.0438517
20	9.6313258	9.9560886	9.6752372	10.3247628	40	.3686742	.0439114
21	9.6315926	9.9560287	9.6755638	10.3244362	39	.3684074	.0439713
22	9.6318591	9.9559689	9.6758903	10.3241097	38	.3681409	.0440311
23	9.6321255	9 9559089	9.6762165	10.3237835	37	.3678745	.0440911
24	9.6323916	9.9558490	9.6765426	10.3234574	36	.3676084	.0441510
25	9.6326576	9.9557890	9.6768686	10.3231314	35	.3673424	.0442110
26	9.6329233	9.9557289	9.6771944	10.3228056	34	.3670767	.0442711
27	9.6331889	9.9556688	9.6775201	10.3224799	33	.3668111	0443312
28	9.6334542	9.9556087	9.6778456	10.3221544	32	.3665458	.0443913
29	9.6337194	9.9555485	9.6781709	10.3218291	31	.3662806	.0444515
30	9.6339844	9.9554882	9.6784961	10.3215039	30	.3660156	.0445118
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	64		

25	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Co.n.Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.6339844	9.9554882	9.6784961	10.3215039	30	.3660156	.0445118
31	9.6342491	9.9554280	9.6788211	10.3211788	29	.3657509	.0445720
32	9.6345137	9.9553676	9.6791460	10.3208540	28	.3654863	.0446324
33	9.6347780	9.9553073	9.6794708	10.3205292	27	.3652220	.0446927
34	9.6350422	9.9552469	9.6797953	10.3202047	26	.3649578	.0447531
35	9.6353062	9.9551864	9.6801198	10.3198802	25	.3646938	.0448136
36	9.6355699	9.9551259	9.6804440	10.3195560	24	.3644301	.0448741
37	9.6358335	9.9550653	9.6807682	10.3192318	23	.3641665	.0449347
38	9.6360969	9.9550047	9.6810921	10.3189079	22	.3639031	.0449953
39	9.6363601	9.9549441	9.6814160	10.3185840	21	.3636399	.0450559
40	9.6366231	9.9548834	9.6817396	10.3182604	20	.3633769	.0451166
41	9.6368859	9.9548227	9.6820632	10.3179368	19	.3631141	.0451773
42	9.6371484	9.9547619	9.6823865	10.3176135	18	.3628516	.0452381
43	9.6374108	9.9547011	9.6827098	10.3172902	17	.3625892	.0452989
44	9.6376731	9.9546402	9.6830328	10.3169672	16	.3623269	.0453598
45	9.6379351	9.9545793	9.6833557	10.3166443	15	.3620649	.0454207
46	9.6381969	9.9545184	9.6836785	10.3163215	14	.3618031	.0454816
47	9.6384585	9.9544574	9.6840011	10.3159989	13	.3615415	.0455426
48	9.6387199	9.9543963	9.6843236	10.3156764	12	.3612801	.0456037
49	9.6389812	9.9543352	9.6846459	10.3153541	11	.3610188	.0456648
50	9.6392422	9.9542741	9.6849681	10.3150319	10	.3607578	.0457259
51	9.6395030	9.9542129	9.6852901	10.3147099	9	.3604970	.0457871
52	9.6397637	9.9541517	9.6856120	10.3143880	8	.3602363	.0458483
53	9.6400241	9.9540904	9.6859338	10.3140662	7	.3599759	.0459096
54	9.6402844	9.9540291	5.6862553	10.3137447	6	.3597156	.0459709
55	9.6405445	9.9539677	9.6865768	10.3134232	5	.3594555	.0460323
56	9.6408044	9.9539063	9.6868981	10.3131019	4	.3591956	.0460937
57	9.6410640	9.9538448	9.6872192	10.3127808	3	.3589360	.0461552
58	9.6413235	9.9537833	9.6875402	10.3124598	2	.3586765	.0462167
59	9.6415828	9.9537218	9.6878611	10.3121389	1	.3584172	.0462782
60	9.6418420	9.9536602	9.6881818	10.3118182	0	.3581580	.0463398
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	64		

26	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-met. of Sine.	Com. Arith of Sine Com.
0	9.6418420	9.9536602	9.6881818	10.3118182	60	3581580	.0463398
1	9.6421009	9.9535985	9.6835023	10.3114977	59	3578991	0464015
2	9.6423596	9.9535369	9.6888227	10.3111773	58	.3576404	0464639
3	9.6426182	9.9534751	9.6891430	10.3108570	57	.3573818	.0465241
4	9.6428765	9.9534134	9.6894631	10:3105369	56	.3571235	.0465866
5	9.6431347	9.9533515	9.6897831	10.3102169	55	.3568653	.0466485
6	9.6433926	9.9532897	9.6901030	10.3098970	54	.3566074	.0467103
7	9.6436504	9.9532278	9.6904226	10.3095774	53	.3563496	.0467722
8	9 6439080	9.9531658	9.6907422	10.3092578	52	.3560920	.0468342
9	9.6441654	9.9531038	9.6910616	10.3089384	51	.3558346	.0468962
10	9.6444226	9.9530418	9.6913809	10.3086191	50	.3555774	.0469582
11	9.6446796	9.9529797	9.6917000	10.3083000	49	.3553204	.0470203
12	9.6449365	9.9529175	9.6920189	10.3079811	48	.3550635	.0470825
13	9.6451931	9.9528553	9.6923378	10.3076622	47	.3548069	.045 1447
14	9.6454496	9.9527931	9.6926565	10.3073435	46	.3545504	.0472069
15	9.6457058	9.9527308	9.6929750	10.3070250	45	.3542942	.0472692
16	9.6459619	9.9526685	9.6932934	10.3067066	44	.3540381	.0473315
17	9.6462178	9.9526061	9.6936117	10.3063883	43	.3537822	.0473939
18	9.6464735	9:9525437	9.6939298	10.3060702	42	.3535265	.0474563
19	9.6467290	9.9524813	9.6942478	10.3057522	41	.3532710	.0475187
20	9.6469844	9.9524188	9.6945656	10.3054344	40	.3530156	.0475812
21	9.6472395	9.9523562	9.6948833	10.3051167	39	.3527605	.0476438
22	9.6474945	9.9522936	9.6952009	10.3047991	38	.3525055	.0477064
23	9.6477492	9 9522310	9.6955183	10.3044817	37	.3522508	.0477690
24	9.6480038	9.9521683	9.6958355	10.3041645	36	.3519962	.0478317
25	9.6482582	9.9521055	9.6961527	10.3038473	35	.3517418	.0478945
26	9.6485124	9.9520428	9.6964697	10.3035303	34	.3514876	.0479572
27	9.6487665	9.9519799	9.6967865	10.3032135	33	.3512335	.0480201
28	9.6490203	9.9519171	9.6971032	10,3028968	32	.3509797	.0480829
29	9.6492740	9.9518541	9.6974198	10.3025802	31	.3507260	.0481459
30	9.6495274	9.9517912	9.6977363	10.3022637	30	.3504726	.0482088
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	63		

26	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Co. Arith-met. of Sine.	Com. Arith. of Sine Com.
30	9.6495274	9.9517912	9.6977363	10.3022637	30	.3504726	.0482088
31	9.6497807	9.9517282	9.6980526	10.3019474	29	.3502193	.0482718
32	9.6500338	9.9516651	9.6983687	10.3016313	28	.3499662	.0483349
33	9.6502868	9.9516020	9.6986847	10.3013153	27	.3497132	.0483980
34	9.6505395	9.9515389	9.6990006	10.3009994	26	.3494605	.0484611
35	9.6507920	9.9514757	9.6993164	10.3006836	25	.3492080	0485243
36	9.6510444	9.9514124	9.6996320	10.3003680	24	.3489556	.0485876
37	9.6512966	9.9513492	9 6999474	10.3000526	23	.3487034	.0486508
38	9.6515486	9.9512858	9.7002628	10.2997372	22	.3484514	0487142
39	9.6518004	9.9512224	9.7005780	10.2994220	21	.348199[illegible]	.0487776
40	9.6520521	9.9511590	9.7008930	10.2991070	20	.3479479	.0488410
41	9.6523035	9.9510956	9.7012080	10.2987920	19	.3476965	.0489044
42	9.6525548	9.9510320	9.7015227	10.2984773	18	.3474452	.0489680
43	9.6528059	9.9509685	9.7018374	10.2981626	17	.3471941	.0490315
44	9.6530568	9.9509049	9.7021519	10.2978481	16	.3469432	.0490951
45	9.6533075	9.950841[illegible]	9.7024663	10.2975337	15	.3466925	.0491588
46	9.6535581	9.9507775	9.7027805	10.2972195	14	.3464419	.0492225
47	9.6538084	9.9507138	9.7030946	10.2969054	13	.3461916	.0492862
48	9.6540586	9.9506500	9.7034086	10.2965914	12	.3459414	.0493500
49	9.6543086	9.9505861	9.7037225	10.2962775	11	.3456914	.0494139
50	9.6545584	9.9505223	9.7040362	10.2959638	10	.3454416	.0494777
51	9.6548081	9.9504583	9.7043497	10.2956503	9	3451919	.0495417
52	9.6550575	9.9503944	9.7046632	10.2953368	8	.3449425	.0496056
53	9.6553068	9.9503303	9.7049765	10.2950235	7	.3446932	.9496697
54	9.6555559	9.9502663	9.7052897	10.2947103	6	.3444441	.0497337
55	9.6558048	9.9502022	9.7056027	10.2943973	5	.3441952	.0497978
56	9.6560536	9.9501380	9.7059156	10.2940844	4	.3439464	.9498620
57	9.6563021	9.9500738	9.7062284	10.2937716	3	.3436979	.0499262
58	9.6565505	9.9500095	9.7065410	10.2934590	2	.3434495	.0499905
59	9.6567987	9.9499452	9.7068535	10.2931465	1	.3432013	0500548
60	9.6570468	9.9498809	9.7071659	10.2928341	0	.3429532	.0501191
	SINE. Complement.	Sine.	TANGENT Complement.	Tang.	63		

27	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.6570468	9.9498809	9.7071659	10 2928341	60	.3429532	.0501191
1	9.6572946	9.9498165	9.7074781	10.2925219	59	.3427054	.0501835
2	9.6575423	9.9497521	9.7077902	10.2922098	58	.3424577	.0502479
3	9.6577898	9 9496876	9.7081022	10.2918978	57	.3422102	.0503124
4	9.6580371	9.9496230	9.7084141	10.2915859	56	.3419629	.0503770
5	9.6582842	9.9495585	9.7087258	10.2912742	55	.3417158	.0504412
6	9.6585312	9.9494938	9.7090374	10.2909626	54	.3414688	.0505062
7	9.6587780	9.9494293	9.7093488	10.2906512	53	.3412220	.0505708
8	9.6590246	9.9493645	9.7096601	10.2903399	52	.3409754	.0506355
9	9.6592710	9.9492997	9.7099713	10.2900287	51	.3407290	.0507003
10	9.6595173	9.9492349	9.7102824	10.2897176	50	.3404827	.0507651
11	9.6597634	9.9491700	9.7105933	10.2894067	49	.3402367	.0508300
12	9.6600093	9.9491051	9.7109041	10.2890959	48	.3399907	.0508949
13	9.6602550	9.9490402	9.7112148	10.2887852	47	.3397450	.0509598
14	9.6605005	9.9489752	9.7115254	10.2884746	46	.3394995	.0510248
15	9.6607459	9.9489101	9.7118358	10.2881642	45	.3392541	.0510899
16	9.6609911	9.9488450	9.7121461	10.2878539	44	.3390089	.0511550
17	9.6612361	9.9487799	9.7124562	10.2875438	43	.3387639	.0512201
18	9.6614810	9.9487147	9.7127662	10.2872338	42	.3385190	.0512853
19	9.6617257	9.9486495	9.7130761	10.2869239	41	.3382743	.0513505
20	9.6619701	9 9485842	9.7133859	10.2866141	40	.3380298	.0514158
21	9.6622145	9.9485189	9.7136956	10.2863044	39	.3377855	.0514811
22	9.6624586	9.9484535	9.7140051	10.2859949	38	.3375414	.0515465
23	9.6627026	9.9483881	9.7143145	10.2856855	37	.3372974	.0516119
24	9.6629464	9.9483227	9.7146237	10.2853763	36	.3370536	.0516773
25	9.6631900	9.9482572	9.7149329	10.2850671	35	.3368100	0517428
26	9.6634335	9.9481916	9.7152419	10.2847581	34	.3365665	0518084
27	9.6636768	9.9481260	9.7155508	10.2844492	33	.3363232	.0518740
28	9.6639199	9.9480604	9.7158595	10.2841405	32	.3360801	.0519390
29	9.6641628	9.9479947	9.7161682	10.2838318	31	.3358372	.0520053
30	9.6644056	9.9479289	9.7164767	10.2835233	30	.3355944	.0520711
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	62		

27	Sine.	Sine Complement.	Tang.	Tangent Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.6644056	9.9479289	9.7164767	10.2835233	30	.3355944	.0520711
31	9.6646482	9.9478631	9.7167851	10.2832149	29	.3353518	.0521369
32	9.6648906	9.9477973	9.7170933	10.2829067	28	.3351094	.0522027
33	9.6651329	9.9477314	9.7174014	10.2825986	27	.3348671	.0522680
34	9.6653749	9.9476655	9.7177094	10.2822906	26	.3346251	.0523345
35	9.6256168	9.9475995	9.7180173	10.2819827	25	.3343832	.0524005
36	9.6658586	9.9475335	9.7183251	10.2816749	24	.3341414	.0524665
37	9.6661001	9.9474674	9.7186327	10 2813673	23	.3338999	.0525326
38	9.6663415	9.9474013	9.7189402	10.2810598	22	.3336585	.0525987
39	9.6665828	9.9473352	9.7192476	10.2807524	21	.3334172	.0526648
40	9.6668238	9.9472689	9.7195549	10.2804451	20	.3331762	.0527311
41	9.6670647	9.9472027	9.7198620	10.2801380	19	3329353	.0527973
42	9.6673054	9.9471364	9.7201690	10.2798309	18	.3326946	.0528636
43	9.6675459	9.9470700	9.7204759	10.2795241	17	.3324541	.0529300
44	9.6677863	9.9470036	9.7207827	10.2792173	16	.3322137	.0529964
45	9.6680265	9.9469372	9.7210893	10.2789107	15	.3319735	.0530628
46	9.6682665	9.9468707	9.7213958	10.2786042	14	.3317335	.0531293
47	9.6685064	9.9468042	9.7217022	10.2782978	13	.3314936	.0531958
48	9.6687461	9.9467376	9.7220085	10.2779915	12	.3312539	.0532624
49	9.6689856	9.9466710	9 7223147	10.2776853	11	.3310144	.0533290
50	9.6692250	9.9466043	9.7226207	10.2773793	10	.3307750	.0533957
51	9.6694642	9.9465376	9.7239266	10.2770734	9	.3305358	.0534624
52	9.6697032	9.9464708	9.7232324	10.2767676	8	.3302968	.0535292
53	9.6699420	9.9464040	9.7235381	10.2764619	7	.3300580	.0535960
54	9.6701807	9.9463371	9.7238436	10.2761564	6	.3298193	0536629
55	9.6704192	9.9462702	9.7241490	10.2758510	5	.3295808	.0537298
56	9.6706576	9.9462032	9.7244543	10.2755457	4	3293424	0537968
57	9.6708958	9.9461362	9.7247595	10.2752405	3	.3291042	.0538638
58	9.6711338	9.9460692	9.7250646	10.2749354	2	.3288662	.0539308
59	9.6713716	9.9460021	9.7253695	10.2746305	1	.3286284	.0539979
60	9.6716093	9.9459349	9.7256744	10.2743256	0	.3283907	.0540651
	Sine Complement.	Sine.	Tangent Complement.	Tang.	62		

28	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith met. of Sine.	Com. Arith. of Sine Com.
0	9.6716093	9.9459349	9.7256744	10.2743256	60	.3283907	.0540651
1	9.6718468	9.9458677	9.7259791	10.2740209	59	.3281537	.0541323
2	9.6720841	9.9458005	9.7262837	10.2737163	58	.3279159	.0541995
3	9.6723213	9.9457332	9 7265881	10.2734119	57	.3276787	.0542668
4	9.6725583	9.9456659	9.7268925	10.2731075	56	3274417	.0543341
5	9.6727952	9.9455985	9.7271967	10.2728033	55	.3272048	.0544015
6	9.6730319	9.9455310	9.7275008	10.2724992	54	.3269681	.0544690
7	9.6732684	9.9454636	9.7278048	10.2721952	53	.3267316	.0545364
8	9.6735047	9.9453960	9.7281087	10.2718913	52	.3264953	.0546040
9	9.6737409	9.9453285	9.7284124	10.2715876	51	.3262591	.0546715
10	9.6739769	9.9452609	9.7287161	10.2712839	50	.3260231	.0547391
11	9.6742128	9.9451932	9.7290196	10.2709804	49	.3257872	.0548068
12	9.6744485	9.9451255	9.7293230	10.2706770	48	3255515	.0548745
13	9.6746840	9.9450577	9.7296263	10.2703737	47	.3253160	.0549423
14	9.6749194	9.9449899	9.7299295	10.2700705	46	.3250806	.0550101
15	9.6751546	9.9449220	9.7302325	10.2697675	45	.3248454	.0550780
16	9.6753896	9 9448541	9.7305354	10.2694646	44	.3246104	.0551459
17	9.6756245	9.9447862	9.7308383	10.2691617	43	.3243756	.0552138
18	9.6758592	9.9447182	9.7311410	10.2688590	42	.3241408	.0552818
19	9.6760937	9.9446501	9.7314436	10.2685564	41	.3239063	.0553499
20	9.6763281	9.9445821	9.7317460	10.2682540	40	.3236719	.0554179
21	9.6765623	9.9445139	9.7320484	10.2679516	39	.3234377	.0554861
22	9 6767963	9.9444457	9.7323506	10.2676494	38	.3232037	.0555543
23	9 6770302	9.9443775	9.7326527	10.2673473	37	.3229698	.0556225
24	9.6772640	9.9443092	9.7329547	10.2670453	36	.3227360	.0556908
25	9.6774975	9.9442409	9.7332566	10.2667434	35	.3225025	0557591
26	9.6777309	9.9441725	9.7335584	10.2664416	34	.3222691	.0558275
27	9.6779642	9.9441041	9.7338601	10.2661399	33	.3220358	.0558959
28	9.6781972	9.9440356	9.7341616	10.2658384	32	.3218028	.0559644
29	9.6784301	9.9439671	9.7344631	10.2655369	31	.3215699	.0560329
30	9.6786629	9.9438985	9.7347644	10.2652356	30	.3213371	.0561015
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	61		

28	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith of Sine Com.
30	9.6786629	9.9438985	9.7347644	10.2652356	30	.3213371	.0561015
31	9.6788955	9.9438299	9.7350656	10.2649344	29	.3211045	.0561701
32	9.6791279	9.9437612	9.7353667	10.2646333	28	.3208721	.0562388
33	9.6793602	9.9436925	9.7356677	10.2643323	27	.3206398	.0563075
34	9.6795923	9.9436238	9.7359685	10.2640315	26	.3204076	.0563762
35	9.6798243	9.9435549	9.7362693	10.2637307	25	.3201750	.0564451
36	9.6800560	9.9434861	9.7365699	10.2634301	24	.3199440	.0565139
37	9.6802877	9.9434172	9.7368705	10 2631295	23	.3197123	.0565828
38	9.6805191	9.9433482	9.7371709	10.2628291	22	.3194809	.0566518
39	9.6807504	9.9432792	9.7374712	10.2625288	21	.3192496	.0567208
40	9.6809816	9.9432102	9.7377714	10.2622286	20	.3190184	.0567898
41	9.6812126	9.9431411	9.7380715	10.2619285	19	3187874	.0568589
42	9.6814434	9.9430720	9.7383714	10.2616286	18	.3185566	.0569280
43	9.6816741	9.9430028	9.7386713	10.2613287	17	.3183259	.0569972
44	9.6819046	9.9429335	9.7389710	10.2610290	16	.3180954	.0570665
45	9.6821349	9.9428643	9.7392707	10.2607293	15	.3178651	.0571357
46	9.6823651	9.9427949	9.7395702	10.2604298	14	.3176349	.0572051
47	9.6825952	9.9427255	9.7398696	10.2601304	13	.3174048	.0572745
48	9.6828250	9.9426561	9.7401689	10.2598311	12	.3171750	.0573439
49	9.6830548	9.9425866	9.7404681	10.2595319	11	.3169452	.0574134
50	9.6832843	9.9425171	9.7407672	10.2592328	10	.3167157	.0574829
51	9.6835137	9.9424476	9.7410662	10.2589338	9	.3164863	.0575524
52	9.6837430	9.9423779	9.7413650	10.2586350	8	.3162570	.0576221
53	9.6839720	9.9423083	9.7416638	10.2583362	7	.3160280	.0576917
54	9.6842010	9.9422386	9.7419624	10.2580376	6	.3157990	.0577614
55	9.6844297	9.9421688	9.7422609	10.2577391	5	.3155703	.0578312
56	9.6846583	9.9420990	9.7425594	10.2574406	4	.3153417	.0579010
57	9.6848868	9.9420291	9.7428577	10.2571423	3	.3151132	.0579709
58	9.6851151	9.9419592	9.7431559	10.2568441	2	.3148849	.0580408
59	9.6853432	9.9418893	9.7434540	10.2565460	1	.3146568	.0581107
60	9.6855712	9.9418193	9.7437520	10.2562480	0	.3144288	.0581807
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	61		

29	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.6855712	9.9418193	9.7437520	10.2562480	60	.3144288	.0581807
1	9.6857991	9.9417492	9.7440499	10.2559501	59	.3142009	.0582508
2	9.6860267	9.9416791	9.7443476	10.2556524	58	.3139733	.0583209
3	9.6862542	9.9416090	9.7446453	10.2553547	57	.3137458	.0583910
4	9.6864816	9.9415388	9.7449428	10.2550572	56	.3135184	.0584612
5	9.6867088	9.9414685	9.7452403	10.2547597	55	.3132912	.0585315
6	9.6869359	9.9413982	9.7455376	10.2544624	54	.3130641	.0586018
7	9.6871628	9.9413279	9.7458349	10.2541651	53	.3128372	.0586721
8	9.6873895	9.9412575	9.7461320	10.2538680	52	.3126105	.0587425
9	9.6876161	9.9411871	9.7464290	10.2535710	51	.3123839	.0588129
10	9.6878425	9.9411166	9.7467259	10.2532741	50	.3121575	.0588834
11	9.6880688	9.9410461	9.7470227	10.2529773	49	.3119312	.0589539
12	9.6882949	9.9409755	9.7473194	10.2526806	48	.3117051	.0590245
13	9.6885209	9.9409048	9.7476160	10.2523840	47	.3114791	.0590952
14	9.6887467	9.9408342	9.7479125	10.2520875	46	.3112533	.0591658
15	9.6889723	9.9407634	9.7482089	10.2517911	45	.3110277	.0592366
16	9.6891978	9.9406927	9.7485052	10.2514948	44	.3108022	.0593073
17	9.6894232	9.9406219	9.7488013	10.2511987	43	.3105768	.0593781
18	9.6896484	9.9405510	9.7490974	10.2509026	42	.3103516	.0594490
19	9.6898734	9.9404801	9.7493934	10.2506066	41	.3101266	.0595199
20	9.6900983	9.9404091	9.7496892	10.2503108	40	.3099017	.0595909
21	9.6903231	9.9403381	9.7499850	10.2500150	39	.3096769	.0596619
22	9.6905476	9.9402670	9.7502806	10.2497194	38	.3094524	.0597330
23	9.6907721	9.9401959	9.7505762	10.2494238	37	.3092279	.0598041
24	9.6909964	9.9401248	9.7508716	10.2491284	36	.3090036	.0598752
25	9.6912205	9.9400535	9.7511669	10.2488331	35	.3087795	.0599465
26	9.6914445	9.9399823	9.7514622	10.2485378	34	.3085555	.0600177
27	9.6916683	9.9399110	9.7517573	10.2482427	33	.3083317	.0600890
28	9.6918919	9.9398396	9.7520523	10.2479477	32	.3081081	.0601604
29	9.6921155	9.9397682	9.7523472	10.2476528	31	.3078845	.0602318
30	9.6923388	9.9396968	9.7526420	10.2473580	30	.3076612	.0603032
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	60		

29	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.6923388	9.9396968	9.7526420	10.2473580	30	.3076612	.0603032
31	9.6925620	9.9396253	9.7529368	10.2470632	29	.3074380	.0603747
32	9.6927851	9.9395537	9.7532314	10.2467686	28	.3072149	.0604463
33	9.6930080	9.9394821	9.7535259	10.2464741	27	.3069920	.0605179
34	9.6932308	9.9394105	9.7538203	10.2461797	26	.3067692	.0605895
35	9.6934534	9.9393388	9.7541146	10.2458854	25	.3065466	.0606612
36	9.6936758	9.9392671	9.7544088	10.2455912	24	.3063242	.0607329
37	9.6938981	9.9391953	9.7547029	10.2452971	23	.3061019	.0608047
38	9.6941203	9.9391234	9.7549969	10.2450031	22	.3058797	.0608766
39	9.6943423	9.9390515	9.7552908	10.2447092	21	.3056577	.0609485
40	9.6945642	9.9389796	9.7555846	10.2444154	20	.3054358	.0610204
41	9.6947859	9.9389076	9.7558783	10.2441217	19	3052141	.0610924
42	9.6950074	9.9388356	9.7561718	10.2438282	18	.3049926	.0611644
43	9.6952288	9.9387635	9.7564653	10.2435347	17	.3047712	.0612365
44	9.6954501	9.9386914	9.7567587	10.2432413	16	.3045499	.0613086
45	9.6956712	9.9386192	9.7570520	10.2429480	15	.3043288	.0613808
46	9.6958922	9.9385470	9.7573452	10.2426548	14	.3041078	.0614530
47	9.6961130	9.9384747	9.7576383	10.2423617	13	.3038870	.0615253
48	9.6963336	9.9384024	9.7579313	10.2420687	12	.3036664	.0615976
49	9.6965541	9.9383300	9.7582242	10.2417758	11	.3034456	.0616700
50	9.6967745	9.9382576	9.7585170	10.2414830	10	.3032255	.0617424
51	9.6969947	9.9381851	9.7588096	10.2411904	9	.3030053	.0618149
52	9.6972148	9.9381126	9.7591022	10.2408978	8	.3027852	.0618874
53	9.6974347	9.9380400	9.7593947	10.2406053	7	.3025653	.0619600
54	9.6976545	9.9379674	9.7596871	10.2403129	6	.3023455	.0620326
55	9.6978741	9.9378947	9.7599794	10.2400206	5	.3021259	.0621[illegible]
56	9.6980936	9.9378220	9.7602716	10.2397284	4	3019064	.0621780
57	9.6983129	9.9377492	9.7605637	10.2394363	3	.3016871	.0622508
58	9.6985321	9.9376764	9.7608557	10.2391443	2	.3014679	.0623236
59	9.6987511	9.9376035	9.7611476	10.2388524	1	.3012489	.0623965
60	9.6989700	9.9375306	9.7614394	10.2385606	0	.3010300	.062469[illegible]
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	60		

30	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith met. of Sine.	Com. Arith. of Sine Com.
0	9.6989700	9.9375306	9.7614394	10.2385606	60	.3010300	.0624694
1	9.6991887	9 9374577	9.7617311	10.2382689	59	.3008113	.0625423
2	9.6994073	9.9373847	9.7620227	10.2379773	58	.3005927	0626153
3	9.6996258	9.9373116	9 7623142	10.2376858	57	3003742	0626884
4	9.6998441	9.9372385	9.7626056	10.2373944	56	3001560	.0627615
5	9.7000622	9.9371653	9.7628969	10.2371031	55	.2999378	.0628347
6	9.7002802	9.9370921	9.7631881	10.2368119	54	.2997198	.0629079
7	9.7004981	9.9370189	9.7634792	10.2365208	53	.2995019	.0629811
8	9.7007158	9.9369456	9.7637702	10.2362298	52	.2992844	.0630544
9	9.7009334	9.9368722	9.7640612	10.2359388	51	.2990666	.0631278
10	9.7011508	9.9367988	9.7643520	10.2356480	50	.2988492	.0632012
11	9.7013681	9.9367254	9.7646427	10.2353573	49	2986319	.0632746
12	9.7015852	9.9366519	9.7649334	10.2350666	48	.2984148	.0633481
13	9.7018022	9.9365783	9.7652239	10.2347761	47	.2981978	.0634217
14	9.7020190	9.9365047	9.7655143	10.2344857	46	.2979810	.0634953
15	9.7022357	9.9364311	9.7658047	10.2341953	45	.2977643	.0635689
16	9.7024523	9 9363574	9.7660949	10.2339051	44	.2975477	.0636426
17	9.7026687	9.9362836	9.7663851	10.2336149	43	.2973313	.0637164
18	9.7028849	9.9362098	9.7666751	10.2333249	42	.2971151	.0637902
19	9.7031010	9.9361360	9.7669651	10.2330349	41	.2968989	.0638640
20	9.7033170	9.9360621	9.7672550	10.2327450	40	.2966830	.0639379
21	9.7035329	9.9359881	9.7675448	10.2324553	39	.2964671	.0640119
22	9 7037486	9.9359141	9.7678344	10.2321656	38	.2962514	.0640859
23	9.7039641	9.9358401	9.7681240	10.2318760	37	.2960359	.0641599
24	9.7041795	9.9357660	9.7684135	10.2315865	36	.2958205	0642340
25	9.7043947	9.9356918	9.7687029	10.2312971	35	.2956052	0643082
26	9.7046099	9.9356177	9.7689922	10.2310078	34	.2953901	.0643823
27	9.7048248	9.9355434	9.7692814	10.2307186	33	.2951752	.0644566
28	9.7050397	9.9354691	9.7695705	10.2304295	32	.2949603	.0645309
29	9.7052543	9.9353948	9.7698596	10.2301404	31	.2947457	.0646052
30	9.7054689	9.9353204	9.7701485	10.2298515	30	.2945311	.0646796
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	59		

30	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com.Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.7054689	9.9353204	9.7701485	10.2298515	30	.2945311	.0646796
31	9.7056833	9.9352459	9.7704373	10.2295627	29	.2943167	.0647541
32	9.7058975	9.9351715	9.7707261	10.2292739	28	.2941025	.0648285
33	9.7061116	9.9350969	9.7710147	10.2289853	27	.2938884	.0649031
34	9.7063256	9.9350223	9.7713033	10.2286967	26	.2936744	.0649777
35	9.7065394	9.9349477	9.7715917	10.2284082	25	.2934606	.0650523
36	9.7067531	9.9348730	9.7718801	10.2281199	24	.2932469	.0651270
37	9.7069667	9.9347983	9.7721684	10.2278316	23	.2930333	.0652017
38	9.7071801	9.9347235	9.7724566	10.2275434	22	.2928199	.0652765
39	9.7073933	9.9346486	9.7727447	10.2272553	21	.2926067	.0653514
40	9.7076064	9.9345738	9.7730327	10.2269673	20	.2923936	.0254262
41	9.7078194	9.9344988	9.7733206	10.2266794	19	.2921806	.0655012
42	9.7080323	9.9344238	9.7736084	10.2263916	18	.2919677	.0655762
43	9.7082450	9.9343488	9.7738961	10.2261039	17	.2917550	.0656512
44	9.7084575	9.9342737	9.7741838	10.2258162	16	.2915425	.0657263
45	9.7086699	9.9341986	9.7744713	10.2255287	15	.2913301	.0658014
46	9.7088822	9.9341234	9.7747588	10.2252412	14	.2911178	.0658766
47	9.7090943	9.9340482	9.7750462	10.2249538	13	.2909057	.0659518
48	9.7093063	9.9339729	9.7753334	10.2246666	12	.2906937	.0660271
49	9.7095182	9.9338976	9.7756206	10.2243794	11	.2904818	.0661024
50	9.7097299	9.9338222	9.7759077	10.2240923	10	.2902701	.0661778
51	9.7099415	9.9337467	9.7761947	10.2238053	9	.2900585	.0662533
52	9.7101529	9.9336713	9.7764816	10.2235184	8	.2898471	.0663287
53	9.7103642	9.9335957	9.7767685	10.2232315	7	.2896358	.0664043
54	9.7105753	9.9335201	5.7770552	10.2229448	6	.2894247	.0664799
55	9.7107863	9.9334445	9.7773418	10.2226582	5	.2892137	.0665555
56	9.7109972	9.9333688	9.7776284	10.2223716	4	.2890028	.0666312
57	9.7112080	9.9332931	9.7779149	10.2220851	3	.2887920	.0667069
58	9.7114186	9.9332173	9.7782012	10.2217988	2	.2885814	.0667827
59	9.7116290	9.9331415	9.7784875	10.2215125	1	.2883710	.0668585
60	9.7118393	9.9330656	9.7787737	10.2212263	0	.2881607	.0669344
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	59		

31	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.7118393	9.9330656	9.7787737	10.2212262	60	.2881607	.0669344
1	9.7120495	9.9329897	9.7790599	10.2209401	59	.2879505	.0670103
2	9.7122596	9.9329137	9.7793459	10.2206541	58	.2877404	.0670863
3	9.7124695	9.9328376	9.7796318	10.2203683	57	.2875305	.0671624
4	9.7126792	9.9327616	9.7799177	10.2200823	56	.2873208	.0672384
5	9.7128889	9.9326854	9.7802034	10.2197966	55	.2871111	.0673146
6	9.7130983	9.9326092	9.7804891	10.2195109	54	.2869017	.0673908
7	9.7133077	9.9325330	9.7807747	10.2192253	53	.2866923	.0674670
8	9.7135169	9.9324567	9.7810602	10.2189398	52	.2864831	.0675433
9	9.7137260	9.9323804	9.7813456	10.2186544	51	.2862740	.0676196
10	9.7139349	9.9323040	9.7816309	10.2183691	50	.2860651	.0676960
11	9.7141437	9.9322276	9.7819162	10.2180838	49	.2858563	.0677724
12	9.7143524	9.9321511	9.7822013	10.2177987	48	.2856476	.0678489
13	9.7145609	9.9320746	9.7824864	10.2175136	47	.2854391	.0679254
14	9.7147693	9.9319980	9.7827713	10.2172287	46	.2852307	.0680020
15	9.7149776	9.9319213	9.7830562	10.2169438	45	.2850224	.0680787
16	9.7151857	9.9318447	9.7833410	10.2166590	44	.2848143	.0681553
17	9.7153937	9.9317679	9.7836258	10.2163742	43	.2846063	.0682321
18	9.7156015	9.9316911	9.7839104	10.2160896	42	.2843985	.0683089
19	9.7158092	9.9316143	9.7841949	10.2158051	41	.2841908	.0683857
20	9.7160168	9.9315374	9.7844794	10.2155206	40	.2839832	.0684626
21	9.7162243	9.9314605	9.7847638	10.2152362	39	.2837757	.0685395
22	9.7164316	9.9313835	9.7850481	10.2149519	38	.2835684	.0686165
23	9.7166387	9.9313065	9.7853323	10.2146677	37	.2833613	.0686935
24	9.7168458	9.9312294	9.7456164	10.2143836	36	.2831542	.0687706
25	9.7170526	9.9311522	9.7859004	10.2140996	35	.2829474	.0688478
26	9.7172594	9.9310750	9.7861844	10.2138156	34	.2827406	0689250
27	9.7174660	9.9309978	9.7864682	10.2135318	33	.2825340	0690022
28	9.7176725	9.9309205	9.7867520	10.2132480	32	2823275	0690795
29	9.7178789	9.9308432	9.7870357	10.2129643	31	.2821211	.0691568
30	9.7180851	9.9307658	9.7873193	10.2126807	30	.2819149	0692342
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	58		

31	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com
30	9.7180851	9.9307658	9.7873193	10.2126807	30	.2819149	.0692341
31	9.7182912	9.9306883	9.7876028	10.2123972	29	.2817088	.0693117
32	9.7184971	9.9306109	9.7878863	10.2121137	28	.2815029	.0693891
33	9.7187030	9.9305333	9.7881696	10.2118304	27	.2812970	.0694667
34	9.7189086	9.9304557	9.7884529	10.2115471	26	.2810914	.0695443
35	9.7191142	9.9303781	9.7887361	10.2112639	25	.2808858	.0696219
36	9.7193196	9.9303004	9.7890192	10.2109808	24	.2806804	.0696996
37	9.7195249	9.9302226	9.7893023	10.2106977	23	.2804751	.0697774
38	9.7197300	9.9301448	9.7895852	10.2104148	22	.2802700	.0698552
39	9.7199350	9.9300670	9.7898681	10.2101319	21	.2800650	.0699330
40	9.7201399	9.9299891	9.7901508	10.2098492	20	.2798601	.0700109
41	9.7203447	9.9299112	9.7904335	10.2095665	19	.2796553	.0700888
42	9.7205493	9.9298332	9.7907161	10.2092839	18	.2794507	.0701668
43	9.7207538	9.9297551	9.7909987	10.2090013	17	.2792462	.0702449
44	9.7209581	9.9296770	9.7912811	10.2087189	16	.2790419	.0703230
45	9.7211623	9.9295989	9.7915635	10.2084365	15	.2788377	.0704011
46	9.7213664	9.9295207	9.7918458	10.2081542	14	.2786336	.0704793
47	9.7215704	9.9294424	9.7921280	10.2078720	13	.2784296	.0705576
48	9.7217742	9.9293641	9.7924101	10.2075899	12	.2782258	.0706359
49	9.7219779	9.9292857	9.7926921	10.2073079	11	.2780221	.0707143
50	9.7221814	9.9292073	9.7929741	10.2070259	10	.2778186	.0707927
51	9.7223848	9.9291289	9.7932560	10.2067440	9	.2776152	.0708711
52	9.7225881	9.9290504	9.7935378	10.2064622	8	.2774119	.0709496
53	9.7227913	9.9289718	9.7938195	10.2061805	7	.2772087	.0710283
54	9.7229943	9.9288932	9.7941011	10.2058989	6	.2770057	.0711068
55	9.7231972	9.9288145	9.7943827	10.2056173	5	.2768028	.0711855
56	9.7234000	9.9287358	9.7946641	10.2053359	4	.2766030	.0712643
57	9.7236026	9.9286571	9.7949455	10.2050545	3	.2763974	.0713429
58	9.7238051	9.9285783	9.7952268	10.2047732	2	.2761949	.0714217
59	9.7240075	9.9284994	9.7955081	10.2044919	1	.2759925	.0715006
60	9.7242097	9.9284205	9.7957892	10.2042108	0	.2757903	.0715795
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	58		

32	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
0	9.7242097	9.9284205	9.7957892	10.2042108	60	.2757903	.0715796
1	9.7244118	9.9283415	9.7960703	10.2039297	59	.2755882	.0716585
2	9.7246138	9.9282625	9.7963513	10.2036487	58	.2753862	0717375
3	9.7248156	9.9281834	9.7966322	10 2033678	57	.2751844	.0718166
4	9.7250174	9.9281043	9.796913c	10:2030870	56	.2749826	.0718957
5	9.7252189	9.9280251	9.7971938	10.2028062	55	.2747811	.0719749
6	9.7254204	9.9279459	9.7974745	10.2025255	54	.2745796	.0720541
7	9.7256217	9.9278666	9.7977552	10.2022449	53	.2743783	.0721334
8	9.7258229	9.9277873	9.7980356	10.2019644	52	.2741771	.0722127
9	9.7260240	9.9277079	9.7983160	10.2016840	51	.2739760	.0722921
10	9.7262249	9.9276285	9.7985964	10.2014036	50	.2737751	.0723715
11	9.7264257	9.9275490	9.7988767	10.2011233	49	.2735743	.0724510
12	9.7266264	9.9274695	9.7991569	10.2008431	48	.3733736	.0725305
13	9.7268269	9.9273899	9.7994370	10.2005630	47	.2731731	.0726101
14	9.7270273	9.9273103	9.7997170	10.2002830	46	.2729727	.0726897
15	9.7272276	9.9272306	9.7999970	10.2000030	45	.2727724	.0727694
16	9.7274278	9.9271509	9.8002769	10.1997231	44	.2725722	.0728491
17	9.7276278	9.9270711	9.8005567	10.1994433	43	.2723722	.0729289
18	9.7278277	9.9269913	9.8008365	10.1991635	42	.2721723	.0730087
19	9.7280275	9.9269114	9.8011161	10.1988839	41	.2719725	.0730886
20	9.7282271	9.9268314	9.8013957	10.1986043	40	.2717729	.0731686
21	9.7284267	9.9267514	9,8016752	10.1983248	39	.2715733	.0732486
22	9.728626c	9.9266714	9.8019546	10.1980454	38	.2713740	.0733286
23	9.7288253	9.9265913	9.8022340	10.1977660	37	.2711747	.0734087
24	9.7290244	9.9265112	9.8025133	10.1974867	36	.2709756	.0734888
25	9.7292234	9.9264310	9.8027925	10.1972075	35	.2707766	.0735690
26	9.7294223	9.9263507	9.8030716	10.1969284	34	.2705777	.0736493
27	9.7296211	9.9262704	9.803350c	10.1966494	33	.2703790	0737296
28	9.7298197	9.9261901	9.8036296	10.1963704	32	.2701803	.0738099
29	9.7300182	9.9261096	9.8039085	10.1960915	31	.2699818	.0738904
30	9.7302165	9.9260292	9.8041873	10.1958127	30	.2697835	.0739708
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	57		

32	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.7302165	9.9260292	9.8041873	10.1958127	30	.2697835	.0739708
31	9.7304148	9.9259487	9.8044661	10.1955339	29	.2695852	.0740512
32	9.7306129	9.9258681	9.8047447	10.1952553	28	.2693871	.0741319
33	9.7308109	9.9257875	9.8050233	10.1949767	27	.2691891	.0742125
34	9.7310087	9.9257069	9.8053019	10.1946981	26	.2689913	.0742931
35	9.7312064	9.9256261	9.8055803	10.1944197	25	.2687936	.0743739
36	9.7314040	9.9255454	9.8058587	10.1941413	24	.2685960	.0744546
37	9.7316015	9.9254646	9.8061370	10.1938630	23	.2683985	.0745354
38	9.7317989	9.9253837	9.8064152	10.1935848	22	.2682011	.0746163
39	9.7319961	9.9253028	9.8066933	10.1933067	21	.2680039	.0746972
40	9.7321932	9.9252218	9.8069714	10.1930286	20	.2678068	.0747782
41	9.7323902	9.9251408	9.8072494	10.1927506	19	2676098	.0748592
42	9.7325870	9.9250597	9.8075273	10.1924727	18	.2674130	.0749403
43	9.7327837	9.9249786	9.8078052	10.1921948	17	.2672163	.0750214
44	9.7329803	9.9248974	9.8080829	10.1919171	16	.2670197	.0751026
45	9.7331768	9.9248161	9.8083606	10.1916394	15	.2668232	.0751839
46	9.7333731	9.9247349	9.8086383	10.1913617	14	.2666269	.0752651
47	9.7335693	9.9246535	9.8089158	10.1910842	13	.2664307	.0753465
48	9.7337654	9.9245721	9.8091933	10.1908067	12	.2662346	.0754279
49	9.7339614	9.9244907	9.8094707	10.1905292	11	.2660386	.0755093
50	9.7341572	9.9244092	9.8097480	10.1902520	10	.2658428	.0755908
51	9.7343529	9.9243277	9.8100253	10.1899747	9	.2656471	.0756723
52	9.7345485	9.9242461	9.8103025	10.1896975	8	.2654515	.0757539
53	9.7347440	9.9241644	9.8105796	10.1894204	7	.2652560	.0758356
54	9.7349393	9.9240827	9.8108566	10.1891434	6	.2650607	.0759173
55	9.7351345	9.9240010	9.8111336	10.1888664	5	.2648655	.0759990
56	9.7353296	9.9239191	9.8114105	10.1885895	4	.2646704	.0760809
57	9.7355246	9.9238373	9.8116873	10.1883127	3	.2644754	.0761627
58	9.7357195	9.9237554	9.8119641	10.1880359	2	.2642805	.0762446
59	9.7359141	9.9236734	9.8122408	10.1877592	1	.2640858	.0763266
60	9.7361088	9.9235914	9.8125174	10.1874826	0	.2638912	.0764086
	SINE. Complement.	Sine.	TANGENT Complement.	Tang.	57		

33	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.7361088	9.9235914	9.8125174	10.1874826	60	.2638912	.0764086
1	9.7363032	9.9235093	9.8127939	10.1872061	59	.2636968	.0764907
2	9.7364976	9.9234272	9.8130704	10.1869296	58	.2635024	.0765728
3	9.7366918	9.9233450	9.8133468	10.1866532	57	.2633082	.0766550
4	9.7368859	9.9232628	9.8136231	10.1863769	56	.2631141	.0767372
5	9.7370799	9.9231865	9.8138993	10.1861007	55	.2629201	.0768195
6	9.7372737	9.9230982	9.8141755	10.1858243	54	.2627263	.0769018
7	9.7374675	9.9230158	9.8144516	10.1855484	53	.2625325	.0769842
8	9.7376611	9.9229334	9.8147277	10.1852723	52	.2623389	.0770666
9	9.7378546	9.9228509	9.8150036	10.1849964	51	.2621454	.0771491
10	9.7380479	9.9227684	9.8152795	10.1847205	50	.2619521	.0772316
11	9.7382412	9.9226858	9.8155554	10.1844446	49	.2617588	.0773142
12	9.7384343	9.9226032	9.8158311	10.1841689	48	.2615657	.0773969
13	9.7386273	9.9225205	9.8161068	10.1838932	47	.2613727	.0774795
14	9.7388201	9.9224377	9.8163824	10.1836176	46	.2611799	.0775623
15	9.7390129	9.9223549	9.8166580	10.1833420	45	.2609871	.0776451
16	9.7392055	9.9222721	9.8169335	10.1830665	44	.2607945	.0777279
17	9.7393980	9.9221891	9.8172089	10.1827911	43	.2606020	.0778109
18	9.7395904	9.9221061	9.8174842	10.1825158	42	.2604096	.0778938
19	9.7397827	9.9220232	9.8177595	10.1822405	41	.2602173	.0779768
20	9.7399748	9.9219401	9.8180347	10.1819653	40	.2600252	.0780599
21	9.7401668	9.9218570	9.8183098	10.1816902	39	.2598332	.0781430
22	9.7403587	9.9217738	9.8185849	10.1814151	38	.2596413	.0782261
23	9.7405505	9.9216906	9.8188599	10.1811401	37	.2594495	.0783094
24	9.7407421	9.9216073	9.8191348	10.1808652	36	.2592579	.0783927
25	9.7409337	9.9215240	9.8194096	10.1805904	35	.2590663	.0784760
26	9.7411251	9.9214406	9.8196844	10.1803156	34	.2588749	.0785594
27	9.7413164	9.9213572	9.8199592	10.1800408	33	.2586836	.0786428
28	9.7415075	9.9212737	9.8202338	10.1797662	32	.2584925	.0787263
29	9.7416986	9.9211902	9.8205084	10.1794916	31	.2583014	.0788098
30	9.7418895	9.9211066	9.8207829	10.1792171	30	.2581105	.0788934
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	56		

33	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.7418895	9.9211066	9.8207829	10.1792171	30	.2581105	.0788934
31	9.7420803	9.9210229	9.8210574	10.1789426	29	.2579197	.0789771
32	9.7422710	9.9209393	9.8213317	10.1786683	28	.2577290	.0790607
33	9.7424616	9.9208555	9.8216060	10.1783940	27	.2575384	.0791445
34	9.7426520	9.9207717	9.8218803	10.1781197	26	.2573480	0792283
35	9.7428423	9.9206878	9.8221545	10.1778455	25	.2571577	.0793122
36	9.7430325	9.9206039	9.8224286	10.1775714	24	.2569675	.0793961
37	9.7432226	9.9205200	9.8227026	10.1772974	23	.2567774	.0794800
38	9.7434126	9.9204360	9.8229766	10.1770234	22	.2565874	0795640
39	9.7436024	9.9203519	9.8232505	10.1767495	21	.2563976	.0796481
40	9.7437921	9.9202678	9.8235244	10.1764756	20	.2562079	.0797322
41	9.7439817	9.9201836	9.8237981	10.1762019	19	.2560183	.0798164
42	9.7441712	9.9200994	9.8240719	10.1759281	18	.2558288	.0799006
43	9.7443606	9.9200151	9.8243455	10.1756545	17	.2556394	.0799849
44	9.7445498	9.9199308	9.8246191	10.1753809	16	.2554502	.0800692
45	9.7447390	9.9198464	9.8248926	10.1751074	15	.2552610	.0801536
46	9.7449280	9.9197619	9.8251660	10.1748340	14	.2550723	.0802381
47	9.7451169	9.9196775	9.8254394	10.1745606	13	.2548831	.0803225
48	9.7453056	9.9195929	9.8257127	10.1742873	12	.2546944	.0804071
49	9.7454943	9.9195083	9.8259860	10.1740140	11	.2545057	.0804917
50	9.7456828	9.9194237	9.8262592	10.1737408	10	.2543172	.0805763
51	9.7458712	9.9193390	9.8265323	10.1734677	9	.2541288	.0806610
52	9.7460595	9.9192542	9.8268053	10.1731947	8	.2539405	.0807458
53	9.7462477	9.9191694	9.8270783	10.1729217	7	.2537523	.0808306
54	9.7464358	9.9190845	9.8273513	10.1726487	6	.2535642	.0809155
55	9.7466237	9.9189996	9.8276241	10.1723759	5	.2533763	.0810004
56	9.7468115	9.9189146	9.8278969	10.1721031	4	.2531885	.0810854
57	9.7469992	9.9188296	9.8281696	10.171830	3	.2530008	.0811704
58	9.7471868	9.9187445	9.8284423	10.171557	2	.2528132	.0812555
59	9.7473742	9.9186594	9.8287149	10.171285	1	.2526257	.0813406
60	9.7475617	9.9185742	9.8289874	10.1710126	0	.2524383	.0814258
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	56		

34	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Con.
0	9.7475617	9.9185742	9.8289874	10.1710126	60	.2524383	.0814258
1	9.7477489	9.9184890	9.8292599	10.1707401	59	.2522511	.0815110
2	9.7479360	9.9184037	9.8295323	10.1704677	58	.2520640	.0815963
3	9.7481230	9.9183183	9.8298047	10.1701953	57	.2518770	.0816817
4	9.7483099	9.9182329	9.8300769	10:1699231	56	.2516901	.0817671
5	9.7484967	9.9181475	9.8303492	10.1696508	55	.2515033	.0818525
6	9.7486833	9.9180620	9.8306213	10.1693787	54	.2513167	.0819380
7	9.7488699	9.9179764	9.8308934	10.1691066	53	.2511302	.0820236
8	9.7490562	9.9178908	9.8311654	10.1688346	52	.2509438	.0821092
9	9.7492425	9.9178051	9.8314374	10.1685626	51	.2507575	.0821948
10	9.7494287	9.9177194	9.8317093	10.1682907	50	.2505713	.0822806
11	9.7496148	9.9176336	9.8319811	10.1680189	49	.2503852	.0823664
12	9.7498007	9.9175478	9.8322529	10.1677471	48	.3501993	.0824522
13	9.7499866	9.9174619	9.8325246	10.1674754	47	.2500134	.0825381
14	9.7501723	9.9173760	9.8327963	10.1672037	46	.2498277	.0826240
15	9.7503579	9.9172900	9.8330679	10.1669321	45	.2496421	.0827100
16	9.7505434	9.9172040	9.8333394	10.1666606	44	.2494566	.0827960
17	9.7507287	9.9171179	9.8336109	10.1663891	43	.2492713	.0828821
18	9.7509140	9.9170317	9.8338823	10.1661177	42	.2490860	.0829683
19	9.7510991	9.9169455	9.8341536	10.1658464	41	.2489009	.0830545
20	9.7512842	9.9168593	9.8344249	10.1655751	40	.2487158	.0831407
21	9.7514691	9.9167730	9.8346961	10.1653039	39	.2485309	.0832270
22	9.7516538	9.9166866	9.8349673	10.1650327	38	.2483462	.0833134
23	9.7518385	9 9166002	9.8352384	10.1647616	37	.2481615	.0833998
24	9.7520231	9.9165137	9.8355094	10.1644906	36	.2479769	.0834863
25	9.7522075	9.9164272	9.8357804	10.1642196	35	.2477925	.0835728
26	9.7523919	9.9163406	9.8360513	10.1639487	34	.2476081	.0836594
27	9.7525761	9.9162539	9.8363221	10.1636779	33	.2474239	.0837461
28	9.7527603	9.9161673	9.8365929	10.1634071	32	.2472398	.0838327
29	9.7529442	9.9160805	9.8368636	10 1631364	31	.2470558	.0839195
30	9.7531280	9.9159937	9.8371342	10.1628657	30	.2468720	.0840063
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	55		

34	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.7531280	9.9159937	9.8371343	10.1628657	30	.2468720	.0840063
31	9.7533118	9.9159069	9.8374049	10.1625951	29	.2466882	.0840931
32	9.7534954	9.9158200	9.8376755	10.1623245	28	.2465046	.0841800
33	9.7536790	9.9157330	9.8379460	10.1620540	27	.2463210	.0842670
34	9.7538624	9.9156460	9.8382164	10.1617836	26	.2461376	.0843540
35	9.7540457	9.9155589	9.8384867	10.1615133	25	.2459543	.0844412
36	9.7542288	9.9154718	9.8387571	10.1612429	24	.2457712	.0845282
37	9.7544119	9.9153846	9.8390273	10.1609727	23	.2455881	.0846154
38	9.7545949	9.9152974	9.8392975	10.1607025	22	.2454051	.0847026
39	9.7547777	9.9152101	9.8395676	10.1604324	21	.2452223	.0847899
40	9.7549604	9.9151228	9.8398377	10.1601623	20	.2450396	.0848772
41	9.7551431	9.9150354	9.8401077	10.1598923	19	.2448569	.0849646
42	9.7553256	9.9149479	9.8403776	10.1596224	18	.2446744	.0850521
43	9.7555080	9.9148604	9.8406475	10.1593525	17	.2444920	.0851396
44	9.7556902	9.9147729	9.8409174	10.1590826	16	.2443098	.0852271
45	9.7558724	9.9146852	9.8411871	10.1588129	15	.2441276	.0853148
46	9.7560544	9.9145976	9.8414569	10.1585431	14	.2439455	.0854024
47	9.7562364	9.9145099	9.8417265	10.1582735	13	.2437636	.0854901
48	9.7564182	9.9144221	9.8419961	10.1580039	12	.2435818	.0855779
49	9.7565999	9.9143342	9.8422657	10.1577343	11	.2434001	.0856658
50	9.7567815	9.9142464	9.8425351	10.1574649	10	.2432185	.0857536
51	9.7569630	9.9141584	9.8428046	10.1571954	9	.2430370	.0858416
52	9.7571444	9.9140704	9.8430739	10.1569261	8	.2428556	.0859296
53	9.7573256	9.9139824	9.8433432	10.1566568	7	.2426744	.0860176
54	9.7575068	9.9138943	9.8436125	10.1563875	6	.2424932	.0861057
55	9.7576878	9.9138061	9.8438817	10.1561183	5	.2423122	.0861939
56	9.7578687	9.9137179	9.8441508	10.1558492	4	.2421313	.0862821
57	9.7580495	9.9136296	9.8444199	10.1555801	3	.2419505	.0863704
58	9.7582302	9.9135413	9.8446889	10.1553111	2	.2417697	.0864587
59	9.7584108	9.9134530	9.8449579	10.1550421	1	.2415892	.0865471
60	9.7585913	9.9133645	9.8452268	10.1547732	0	.2414087	.0866355
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	55		

35	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.7585913	9.9133645	9.8452268	10.1547732	60	.2414087	.0866355
1	9.7587717	9.9132760	9.8454956	10.1545044	59	.241228	.0867240
2	9.7589519	9.9131875	9.8457644	10.1542356	58	.241048	.0868125
3	9.7591321	9.9130989	9.8460332	10.1539668	57	.2408679	.0869011
4	9.7593121	9.9130102	9.8463018	10.1536982	56	.2406879	.0869898
5	9.7594920	9.9129215	9.8465705	10.1534295	55	.2405080	.0870785
6	9.7596718	9.9128328	9.8468390	10.1531610	54	.2403282	.0871672
7	9.7598515	9.9127440	9.8471075	10.1528925	53	.2401485	.0872560
8	9.7600311	9.9126551	9.8473760	10.1526240	52	.2399689	.0873449
9	9.7602106	9.9125662	9.8476444	10.1523556	51	.2397894	.0874338
10	9.7603899	9.9124772	9.8479127	10.152087[illegible]	50	.2396101	.0875228
11	9.7605692	9.9123882	9.8481810	10.1518190	49	.2394308	.0876118
12	9.7607483	9.9122991	9.8484492	10.1515508	48	.2392517	.0877009
13	9.7609274	9.9122099	9.8487174	10.1512826	47	.2390726	.0877901
14	9.7611063	9.9121207	9.8489855	10.1510145	46	.2388937	.0878793
15	9.7612851	9.9120315	9.8492536	10.1507464	45	.2387149	.0879685
16	9.7614638	9.9119422	9.8495216	10.1504784	44	.2385362	.0880578
17	9.7616424	9.9118528	9.8497896	10.1502104	43	.2383576	.0881472
18	9.7618208	9.9117634	9.8500575	10.1499425	42	.2381792	.0882366
19	9.7619992	9.9116739	9.8503253	10.1496747	41	.2380008	.0883261
20	9.7621775	9.9115844	9.8505931	10.1494069	40	.2378225	.0884156
21	9.7623556	9.9114948	9.8508608	10.1491392	39	.2376444	.0885052
22	9.7625337	9.9114051	9.8511285	10.1488715	38	.2374663	.0885949
23	9.7627116	9.9113155	9.8513961	10.1486039	37	.2372884	.0886845
24	9.7628894	9.9112257	9.8516637	10.1483363	36	.2371106	.0887743
25	9.7630671	9.9111359	9.8519312	10.1480688	35	.2369329	.0888641
26	9.7632447	9.9110460	9.8521987	10.1478013	34	.2367553	.0889540
27	9.7634222	9.9109561	9.8524661	10.1475339	33	.2365778	.0890439
28	9.7635996	9.9108661	9.8527335	10.1472665	32	.2364004	.0891339
29	9.7637769	9.9107761	9.8530008	10.1469992	31	.2362231	.0892239
30	9.7639540	9.9106860	9.8532680	10.1467320	30	.2360460	.0893140
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	54		

35	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith of Sine Com.
30	9.7639540	9.9106860	9.8532680	10.1467320	30	.2360460	.0893140
31	9.7641311	9.9105959	9.8535352	10.1464648	29	2358689	.0894041
32	9.7643080	9.9105057	9.8538023	10.1461977	28	.2356920	.0894943
33	9.7644849	9.9104155	9.8540694	10.1459306	27	.2355151	.0895846
34	9.7646616	9.9103251	9.8543365	10.1456635	26	.2353384	.0896749
35	9.7648382	9.9102348	9.8546034	10.1453966	25	.2351618	.0897652
36	9.7650147	9.9101444	9.8548704	10.1451296	24	.2349853	.0898556
37	9.7651911	9.9100538	9.8551372	10.1448628	23	.2348089	.0899461
38	9.7653674	9.9099633	9.8554041	10.1445959	22	.2346326	.0900366
39	9.7655436	9.9098728	9.8556708	10.1443292	21	.2344564	.0901272
40	9.7657197	9.9097821	9.8559376	10.1440624	20	.2342803	.0902179
41	9.7658957	9.9096915	9.8562042	10.1437958	19	.2341043	.0903085
42	9.7660715	9.9096007	9.8564708	10.1435292	18	.2339285	.0903993
43	9.7662473	9.9095099	9.8567374	10.1432626	17	.2337527	.0904901
44	9.7664229	9.9094190	9.8570039	10.1429961	16	.2335771	.0905810
45	9.7665985	9.9093281	9.8572704	10.1427296	15	.2334015	.0906719
46	9.7667739	9.9092371	9.8575368	10.1424632	14	.2332261	.0907629
47	9.7669492	9.9091461	9.8578030	10.1421969	13	.2330508	.0908539
48	9.7671244	9.9090550	9.8580694	10.1419306	12	.2328756	.0909450
49	9.7672996	9.9089639	9.8583357	10.1416643	11	.2327004	.0910361
50	9.7674746	9.9088727	9.8586019	10.1413981	10	.2325254	.0911273
51	9.7676494	9.9087814	9.8588680	10.1411320	9	.2323506	.0912186
52	9.7678242	9.9086901	9.8591341	10.1408659	8	.2321758	.0913099
53	9.7679989	9.9085988	9.8594002	10.1405998	7	.2320011	.0914012
54	9.7681735	9.9085073	5.8596661	10.1403339	6	.2318265	.0914927
55	9.7683480	9.9084159	9.8599321	10.1400679	5	.2316520	.0915841
56	9.7685223	9.9083243	9.8601980	10.1398020	4	.2314777	.0916757
57	9.7686966	9.9082327	9.8604638	10.1395362	3	.2313034	.0917673
58	9.7688707	9.9081411	9.8607296	10.1392704	2	.2311292	.0918589
59	9.7690448	9.9080494	9.8609954	10.1390046	1	.2309553	.0919506
60	9.7692187	9.9079576	9.8612610	10.1387390	0	.2307813	.0920424
	SINE. Complement.	Sine.	TANGENT Complement.	Tang.	54		

36	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith of Sine Com.
0	9.7692187	9.9079576	9.8612610	10.1387390	60	.2307813	.0920424
1	9.7693925	9.9078658	9.8615267	10.1384733	59	.2306075	.0921340
2	9.7695662	9.9077740	9.8617923	10.1382077	58	.2304338	.0922260
3	9.7697398	9.9076820	9.8620578	10.1379422	57	.2302602	.0923180
4	9.7699134	9.9075901	9.8623233	10.1376767	56	.2300866	.0924099
5	9.7700868	9.9074980	9.8625887	10.1374113	55	.2299132	.0925020
6	9.7702601	9.9074059	9.8628541	10.1371459	54	.2297399	.0925941
7	9.7704332	9.9073138	9.8631195	10.1368805	53	.2295668	.0926862
8	9.7706063	9.9072216	9.8633848	10.1366152	52	.2293937	.0927784
9	9.7707793	9.9071293	9.8636500	10.1363500	51	.2292207	.0928707
10	9.7709522	9.9070370	9.8639152	10.1360848	50	.2290478	.0929630
11	9.7711249	9.9069446	9.8641803	10.1358197	49	.2288751	.0930554
12	9.7712976	9.9068522	9.8644454	10.1355546	48	.2287024	.0931478
13	9.7714702	9.9067597	9.8647105	10.1352895	47	.2285298	.0932403
14	9.7716426	9.9066671	9.8649755	10.1350245	46	.2283574	.0933329
15	9.7718150	9.9065745	9.8652404	10.1347596	45	.2281850	.0934255
16	9.7719872	9 9064819	9 8655053	10.1344948	44	.2280128	.0935181
17	9.7721593	9.9063892	9.8657702	10.1342298	43	.2278407	.0936108
18	9.7723314	9.9062964	9.8660350	10.1339650	42	.2276686	.0937036
19	9.7725033	9.9062036	9.8662997	10.1337003	41	.2274967	.0937964
20	9.7726751	9.9061107	9.8665644	10.1334356	40	.2273249	.0938893
21	9.7728468	9.9060177	9.8668291	10.1331709	39	.2271532	.0939823
22	9 7730185	9.9059247	9.8670937	10.1329063	38	.2269815	.0940753
23	9.7731900	9.9058317	9.8673583	10.1326417	37	.2268100	.0941683
24	9.7733614	9.9057386	9.8676228	10.1323772	36	.2266386	0942614
25	9.7735327	9.9056454	9.8678873	10.1321127	35	.2264673	.0943546
26	9.7737039	9.9055522	9.8681517	10.1318483	34	.2262961	.0944478
27	9.7738749	9.9054589	9.8684160	10.1315840	33	.2261251	.0945411
28	9.7740459	9.9053656	9.8686804	10.1313196	32	.2259541	.0946344
29	9.7742168	9.9052722	9.8689446	10.1310554	31	.2257832	.0947278
30	9.7743876	9.9051787	9.8692089	10.1307911	30	.2256124	.0948213
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	53		

36	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.7743876	9.9051787	9.8692089	10.1307911	30	.2256124	.0948213
31	9.7745583	9.9050852	9.8894731	10.1305269	29	2254417	.0949148
32	9.7747288	9.9049916	9.8697372	10.1302628	28	.2252712	.0950084
33	9.7748993	9.9048980	9.8700013	10.1299987	27	.2251007	.0951020
34	9.7750697	9.9048043	9.8702653	10.1297347	26	.2249303	.0951957
35	9.7752399	9.9047106	9.8705293	10.1294707	25	.2247601	.0952894
36	9.7754101	9.9046168	9.8707933	10.1292067	24	.2245899	.0953832
37	9.7755801	9.9045230	9.8710572	10.1289428	23	.2244199	.0954770
38	9.7757501	9.9044291	9.8713210	10.1286790	22	2242499	.0955709
39	9.7759199	9.9043351	9.8715848	10.1284152	21	.2240801	.0956649
40	9.7760897	9.9042411	9.8718486	10.1281514	20	.2239103	.0957589
41	9.7762593	9.9041470	9.8721123	10.1278877	19	.2237407	.0958530
42	9.7764289	9.9040529	9.8723760	10.1276240	18	.2235711	.0959471
43	9.7765983	9.9039587	9.8726396	10.1273604	17	.2234017	.0960413
44	9.7767676	9.9038644	9.8729032	10.1270968	16	.2232324	.0961356
45	9.7769369	9.9037701	9.8731668	10.1268332	15	.2230631	.0962299
46	9.7771060	9.9036758	9.8734302	10.1265698	14	.2228940	.0963243
47	9.7772750	9.9035813	9.8736937	10.1263063	13	.2227250	.0964187
48	9.7774439	9.9034868	9.8739571	10.1260429	12	.2225561	.0965132
49	9.7776128	9.9033923	9.8742204	10.1257796	11	.2223872	.0966077
50	9.7777815	9.9032977	9.8744838	10.1255162	10	.2222185	.0967023
51	9.7779501	9.9032031	9.8747470	10.1252530	9	.2220499	.0967969
52	9.7781186	9.9031084	9.8750102	10.1249898	8	.2218814	.0968916
53	9.7782870	9.9030136	9.8752734	10.1247266	7	.2217130	.0969864
54	9.7784553	9.9029188	5.8755365	10.1244635	6	.2215447	.0970812
55	9.7786235	9.9028239	9.8757996	10.1242004	5	.2213765	.0971761
56	9.7787916	9.9027289	9.8760627	10.1239373	4	.2212084	.0972711
57	9.7789596	9.9026339	9.8763257	10.1236743	3	.2210404	.0973661
58	9.7791275	9.9025389	9.8765886	10.1234114	2	.2208725	0974611
59	9.7792953	9.9024438	9.8768515	10.1231485	1	.2207047	.0975562
60	9.7794630	9.9023486	9.8771144	10.1228856	0	.2205370	0976514
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	53		

37	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.7794630	9.9023486	9.8771144	10.1228856	60	.2205370	.0976514
1	9.7796306	9.9022534	9.8773772	10.1226228	59	.2203694	.0977466
2	9.7797981	9.9021581	9.8776400	10.1223600	58	.2202019	.0978419
3	9.7799655	9.9020628	9.8779027	10.1220973	57	.2200346	.0979372
4	9.7801328	9.9019674	9.8781654	10.1218345	56	.2198672	.0980326
5	9.7803000	9.9018719	9.8784281	10.1215719	55	.2197000	.0981281
6	9.7804671	9.9017764	9.8786907	10.1213093	54	.2195329	.0982236
7	9.7806341	9.9016808	9.8789533	10.1210467	53	.2193659	.0983192
8	9.7808010	9.9015852	9.8792158	10.1207842	52	.2191990	.0984148
9	9.7809677	9.9014895	9.8794782	10.1205218	51	.2190323	.0985105
10	9.7811344	9.9013938	9.8797407	10.1202592	50	.2198856	.0986062
11	9.7813010	9.9012980	9.8800031	10.1199969	49	.2186990	.0987020
12	9.7814675	9.9012021	9.8802654	10.1197346	48	.2185325	.0987979
13	9.7816339	9.9011662	9.8805277	10.1194723	47	.2183661	.0988938
14	9.7818002	9.9010102	9.8807900	10.1192100	46	.2181998	.0989898
15	9.7819664	9.9009142	9.8810522	10.1189478	45	.2180336	.0990858
16	9.7821324	9.9008181	9.8813144	10.1186856	44	.2178676	.0991819
17	9.7822984	9.9007219	9.8815765	10.1184235	43	.2177016	.0992781
18	9.7824643	9.9006257	9.8818386	10.1181614	42	.2175358	.0993743
19	9.7826301	9.9005294	9.8821007	10.1178993	41	.2173659	.0994706
20	9.7827958	9.9004331	9.8823627	10.1176374	40	.2172042	.0995669
21	9.7829614	9.9003367	9.8826246	10.1173754	39	.2170386	.0996633
22	9.7831268	9.9002403	9.8828866	10.1171134	38	.2168732	.0997597
23	9.7832922	9.9001438	9.8831484	10.1168516	37	.2167078	.0998562
24	9.7834575	9.9000472	9.8834103	10.1165897	36	.2165425	.0999528
25	9.7836227	9.8999506	9.8836721	10.1163279	35	.2163773	.1000494
26	9.7837878	9.8998539	9.8839338	10.1160662	34	.2162122	.1001461
27	9.7839528	9.8997572	9.8841956	10.1158044	33	.2160472	.1002428
28	9.7841177	9.8996604	9.8844572	10.1155428	32	.2158823	.1003396
29	9.7842824	9.8995636	9.8847189	10.1152811	31	.2157176	.1004364
30	9.7844471	9.8994667	9.8849805	10.1150195	30	.2155529	.1005333
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	52		

37	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith of Sine Com.
30	9.7844471	9.8094667	9.8849805	10.1150195	30	2155529	.1005333
31	9.7846117	9.8993697	9.8852420	10.1147580	29	.2153883	.1006303
32	9.7847762	9.8992727	9.8855035	10.1144965	28	.2152238	.1007273
33	9.7849406	9.8991756	9.8857650	10.1142350	27	.2150594	.1008244
34	.7851049	9.8990784	9.8860264	10.1139736	26	.2148951	.1009216
35	9.7852691	9.8989812	9.8862878	10.1137122	25	.2147309	.1010188
36	9.7854332	9.8988840	9.8865492	10.1134508	24	.2145668	.1011160
37	9.7855972	9.8987867	9.8868105	10.1131895	23	.2144028	.1012133
38	9.7857611	9.8986893	9.8870718	10.1129282	22	.2142389	.1013107
39	9.7859249	9.8985919	9.8873330	10.1126670	21	.2140751	.1014081
40	9.7860886	9.8984944	9.8875942	10.1124058	20	.2139114	.1015056
41	9.7862522	9.8983968	9.8878554	10.1121446	19	.2137478	.1016032
42	9.7864157	9.8982992	9.8881165	10.1118835	18	.2135843	.1017008
43	9.7865791	9.8982015	9.8883775	10.1116225	17	.2134209	1017985
44	9.7867424	9.8981038	9.8886386	10.1113614	16	.2132576	.1018962
45	9.7869056	9.8980060	9.8888996	10.1111004	15	.2130944	.1019940
46	9.7870687	9.8979082	9.8891605	10.1108395	14	.2129313	.1020918
47	9.7872317	9.8978103	9.8894214	10.1105786	13	.2127683	.1021897
48	9.7873946	9.8977123	9.8896823	10.1103177	12	.2126054	.1022877
49	9.7875574	9.8976143	9.8899432	10.1100568	11	.2124426	.1023857
50	9.7877202	9.8975162	9.8902040	10.1097960	10	.2122798	.1024838
51	9.7878828	9.8974181	9.8904647	10.1095353	9	.2121172	.1025819
52	9.7880453	9.8973199	9.8907254	10.1092746	8	.2119547	.1026801
53	9.7882077	9.8972216	9.8909861	10.1090139	7	.2117923	.1027784
54	9.7883701	9.8971233	5.8912468	10.1087532	6	.2116299	.1028767
55	9.7885323	9.8970249	9.8915074	10.1084926	5	.2114677	.1029751
56	9.7886944	9.8969265	9.8917679	10.1082321	4	.2113056	.1030735
57	9.7888565	9.8968280	9.8920285	10.1079715	3	.2111435	.1031720
58	9.7890184	9.8967294	9.8922890	10.1077110	2	.2109816	.1032706
59	9.7891802	9.8966308	9.8925494	10.1074506	1	.2108198	.1033692
60	9.7893420	9.8965321	9.8928098	10.1071902	0	.2106580	.1034679
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	52		

38	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
0	9.7893420	9.8965321	9.8928098	10.1071902	60	.2106580	.1034679
1	9.7895036	9.8964334	9.8930702	10.1069298	59	.2104964	.1035666
2	9.7896652	9.8963346	9.8933306	10.1066694	58	.2103348	.1036654
3	9.7898266	9.8962358	9.8935909	10.1064091	57	.2101734	.1037642
4	9.7899880	9.8961369	9.8938511	10.1061489	56	.2100120	.1038631
5	9.7901493	9.8960379	9.8941114	10.1058886	55	.2098508	.1039621
6	9.7903104	9.8959389	9.8943715	10.1056285	54	.2096896	.1040611
7	9.7904715	9.8958398	9.8946317	10.1053683	53	.2095285	.1041602
8	9.7906325	9.8957406	9.8948918	10.1051082	52	.2093675	.1042594
9	9.7907933	9.8956414	9.8951519	10.1048481	51	.2092067	.1043586
10	9.7909541	9.8955422	9.8954119	10.1045881	50	2090459	.1044578
11	9.7911148	9.8954429	9.8956719	10.1043281	49	2088852	.1045572
12	9.7912754	9.8953435	9.8959319	10.1040681	48	2087246	.1046565
13	9.7914359	9.8952440	9.8961918	10.1038083	47	.2085641	.1047560
14	9.7915963	9.8951445	9.8964517	10.1035483	46	.2084037	.1048555
15	9.7917566	9.8950450	9.8967116	10.1032884	45	.2082434	.1049550
16	9.7919168	9.8949453	9.8969714	10.1030286	44	.2080832	.1050547
17	9.7920769	9.8948457	9.8972312	10.1027688	43	.2079231	.1051543
18	9.7922369	9.8947459	9.8974910	10.1025090	42	.2077631	.1052541
19	9.7923968	9.8946461	9.8977507	10.1022493	41	.2076032	.1053539
20	9.7925566	9.8945463	9.8980104	10.1019896	40	2074434	1054537
21	9.7927163	9.8944463	9.8982700	10.1017300	39	.2072837	.1055537
22	9.7928760	9.8943464	9.8985296	10.1014704	38	.2071240	.1056536
23	9.7930355	9.8942463	9.8987892	10.1012108	37	.2069645	.1057537
24	9.7931949	9.8941462	9.8990487	10.1009513	36	.2068051	.1058538
25	9.7933543	9.8940461	9.8993082	10.1006918	35	.2066457	.1059539
26	9.7935135	9.8939458	9.8995677	10.1004323	34	.2064865	.1060542
27	9.7936727	9.8938456	9.8998271	10.1001729	33	.2063273	.1061544
28	9.7938317	9.8937452	9.9000865	10.0999135	32	.2061683	.1062548
29	9.7939907	9.8936448	9.9003459	10.0996541	31	.2060093	.1063552
30	9.7941496	9.8935444	9.9006052	10.0993948	30	.2058504	.1064556
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	51		

38	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith of Sine Com.
30	9.7941496	9.8935444	9.9006052	10.0993948	30	.2058504	.1064556
31	9.7943083	9.8934439	9.9008645	10.0991355	29	.2056917	.1065561
32	9.7944670	9.8933433	9.9011237	10.0988763	28	.2055330	.1066567
33	9.7946256	9.8932426	9.9013830	10.0986170	27	.2053744	.1067574
34	9.7947841	9.8931419	9.9016422	10.0983578	26	.2052159	.1068581
35	9.7949425	9.8930412	9.9019013	10.0980987	25	.2050575	.1069588
36	9.7951008	9.8929404	9.9021604	10.0978396	24	.2048992	.1070596
37	9.7952590	9.8928395	9.9024195	10.0975805	23	.2047410	.1071605
38	9.7954171	9.8927385	9.9026786	10.0973214	22	.2045829	.1072615
39	9.7955751	9.8926375	9.9029376	10.0970624	21	.2044249	.1073625
40	9.7957330	9.8925365	9.9031966	10.0968034	20	.2042670	.1074635
41	9.7958909	9.8924354	9.9034555	10.0965445	19	.2041091	.1075646
42	9.7960486	9.8923342	9.9037144	10.0962856	18	.2039514	.1076658
43	9.7962062	9.8922329	9.9039733	10.0960267	17	.2037938	.1077671
44	9.7963638	9.8921316	9.9042321	10.0957679	16	.2036362	.1078684
45	9.7965212	9.8920303	9.9044910	10.0955090	15	.2034788	.1079697
46	9.7966786	9.8919289	9.9047497	10.0952503	14	.2033214	.1080711
47	9.7968359	9.8918274	9.9050085	10.0949915	13	.2031641	.1081726
48	9.7969930	9.8917258	9.9052672	10.0947328	12	.2030070	.1082742
49	9.7971501	9.8916242	9.9055259	10.0944741	11	.2028499	.1083758
50	9.7973071	9.8915226	9.9057845	10.0942155	10	.2026929	.1084774
51	9.7974640	9.8914208	9.9060431	10.0939569	9	.2025360	.1085792
52	9.7976208	9.8913191	9.9063017	10.0936983	8	.2023792	.1086809
53	9.7977775	9.8912172	9.9065603	10.0934397	7	.2022225	.1087828
54	9.7979341	9.8911153	9.9068188	10.0931812	6	.2020659	.1088847
55	9.7980906	9.8910133	9.9070773	10.0929227	5	.2019094	.1089867
56	9.7982470	9.8909113	9.9073357	10.0926643	4	.2017530	.1090887
57	9.7984034	9.8908092	9.9075942	10.0924059	3	.2015966	.1091909
58	9.7985596	9.8907071	9.9078525	10.0921475	2	.2014404	.1092929
59	9.7987158	9.8906049	9.9081109	10.0918891	1	.2012842	.1093951
60	9.7988718	9.8905026	9.9083692	10.0916308	0	.2011282	.1094974
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	51		

39	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arim. of Sine Com.
0	9.7988718	9.8905026	9.9083692	10.0916308	60	.2011282	.109497-
1	9.7990278	9.8904003	9.9086275	10.0913725	59	.2009722	.1095997
2	9.7991836	9.8902979	9.9088858	10.0911141	58	.2008164	.1097021
3	9.7993394	9.8901954	9.9091440	10.0908560	57	.2006606	.1098046
4	9.7994951	9.8900929	9.9094022	10.0905978	56	.2005049	.1099071
5	9.7996507	9.8899903	9.9096605	10.0903397	55	.2003493	.1100097
6	9.7998062	9.8898877	9.9099185	10.0900815	54	.2001938	.1101123
7	9.7999616	9.8897850	9.9101766	10.0898234	53	.2000384	.1102150
8	9.8001169	9.8896822	9.9104347	10.0895653	52	.1998831	.1103178
9	9.8002721	9.8895794	9.9106927	10.0893073	51	.1997279	.1104206
10	9.8004272	9.8894765	9.9109507	10.089049[illegible]	50	.1995728	.1105235
11	9.8005823	9.8893736	9.9112087	10.0887913	49	.1994177	.1106264
12	9.8007372	9.8892706	9.9114666	10.0885334	48	.0992628	.1107294
13	9.8008921	9.8891675	9.9117245	10.0882755	47	.1991079	.1108325
14	9.8010468	9.8890644	9.9119824	10.0880176	46	.1989532	.1109356
15	9.8012015	9.8889612	9.9122403	10.0877597	45	.1987985	.1110388
16	9.8013561	9.8888580	9.9124981	10.0875019	44	.1986439	.1111420
17	9.8015106	9.8887547	9.9127559	10.0872441	43	.1984894	.1112453
18	9.8016649	9.8886513	9.9130137	10,0869863	42	.1983351	.1113487
19	9.8018190	9.8885479	9.9132714	10.0867286	41	.1981808	.1114521
20	9.8019735	9.8884444	9.9135291	10.0864709	40	.1980265	.1115556
21	9.8021276	9.8883408	9.9137868	10.0862132	39	.1978724	.1116592
22	9.8022816	9.8882372	9.9140444	10.0856556	38	.1977184	.1117627
23	9.8024355	9.8881335	9.9143020	10.0856980	37	.1975645	.1118665
24	9.8025894	9.8880298	9.9145596	10.0854404	36	.1974106	.1119702
25	9.8027431	9.8879260	9.9148171	10.0851829	35	.1972569	.1120740
26	9.8028968	9.8878221	9.9150747	10.0849253	34	.1971032	.1121779
27	9.8030504	9.8877182	9.9153322	10.0846678	33	.1969496	.1122818
28	9.8032038	9.8876142	9.9155896	10.0844104	32	.1967962	.1123858
29	9.8033572	9.8875102	9.9158471	10.0841529	31	.1966428	.1124898
30	9.8035105	9.8874061	9.9161045	10.0838955	30	.1964895	.1125939
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	50		

39	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arith-metic. of Sine.	Com. Arith. of Sine Com.
30	9.8035105	9.8874061	9.9161045	10.0838955	30	.1964895	.1125939
31	9.8036637	9.8873019	9.9163618	10.0836382	29	.1963363	.1126981
32	9.8038168	9.8871977	9.9166192	10.0833808	28	.1961832	.1128023
33	9.8039699	9.8870934	9.9168765	10.0831235	27	.1960301	.1129066
34	9.8041228	9.8869890	9.9171338	10.0828662	26	.1958772	.1130110
35	9.8042757	9.8868846	9.9173911	10.0826089	25	.1957243	.1131154
36	9.8044284	9.8867801	9.9176483	10.0823517	24	.1955716	.1132199
37	9.8045811	9.8866756	9.9179055	10.0820945	23	.1954189	.1133244
38	9.8047336	9.8865710	9.9181627	10.0818373	22	.1952664	.1134290
39	9.8048861	9.8864663	9.9184198	10.0815802	21	.1951139	.1135337
40	9.8050385	9.8863616	9.9186765	10.0813231	20	.1949615	.1136384
41	9.8051908	9.8862568	9.9183340	10.0810660	19	.1948092	.1137432
42	9.8053430	9.8861519	9.9191911	10.0808089	18	.1946570	.1138481
43	9.8054951	9.8860470	9.9194481	10.0805519	17	.1945049	.1139530
44	9.8056472	9.8859420	9.9197051	10.0802949	16	.1943528	.1140580
45	9.8057991	9.8858370	9.9199621	10.0800379	15	.1942008	.1141630
46	9.8059510	9.8857319	9.9202191	10.0797809	14	.1940490	.1142681
47	9.8061027	9.8856267	9.9204760	10.0795240	13	.1938973	.1143733
48	9.8062544	9.8855215	9.9207329	10.0792671	12	.1937456	.1144785
49	9.8064060	9.8854162	9.9209898	10.0790102	11	.1935940	.1145838
50	9.8065575	9.8853109	9.9212466	10.0787534	10	.1934425	.1146891
51	9.8067089	9.8852055	9.9215034	10.0784966	9	.1932911	.1147945
52	9.8068601	9.8851000	9.9217602	10.0782398	8	.1931398	.1149000
53	9.8070114	9.8849945	9.9220170	10.0779830	7	.1929886	.1150055
54	9.8071626	9.8848889	9.9222737	10.0777263	6	.1928374	.1151111
55	9.8073136	9.8847832	9.9225304	10.0774696	5	.1926864	.1152168
56	9.8074646	9.8846775	9.9227871	10.0772129	4	.1925354	.1153225
57	9.8076154	9.8845717	9.9230437	10.0769563	3	.1923846	.1154283
58	9.8077662	9.8844659	9.9233004	10.0766996	2	.1922338	.1155341
59	9.8079169	9.8843599	9.9235570	10.0764430	1	.1920831	.1156401
60	9.8080675	9.8842540	9.9238135	10.0761865	0	.1919325	.1157460
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	50		

40	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith of Sine Com
0	9.8080675	9.8842540	9.9238135	10.0761865	60	·1919325	.1157460
1	9.8082180	9.8841479	9.9240701	10.0759299	59	.1917820	.1158521
2	9.8083684	9.8840418	9.9243266	10.0756734	58	.1916316	1159582
3	9.8085188	9.8839357	2.9245831	10 0754169	57	.1914812	.1160643
4	9.8086690	9.8838294	9.9248396	10:0751604	56	.1913310	.1161706
5	9.8088192	9.8837232	9.9250960	10.0749040	55	.1911808	.1162768
6	9.8089692	9.8836168	9.9253524	10.0746476	54	.1910308	.1163832
7	9.8091192	9.8835104	9.9256088	10.0743912	53	.1908808	.1164896
8	9.8092691	9.8834039	9.9258652	10.0741348	52	.1907309	.1165961
9	9.8094189	9.8832974	9.9261215	10.0738785	51	.1905811	.1167026
10	9.8095686	9.8831908	9.9263778	10.0736222	50	.1904314	.1168092
11	9.8097182	9.8830841	9.9266341	10.0733659	49	.1902818	.1169159
12	9.8098678	9.8829774	9.9268904	10.0731096	48	.1901322	.1170226
13	9.8100172	9.8828706	9.9271466	10.0728534	47	.1899828	.1171294
14	9.8101666	9.8827638	9.9274028	10.0725972	46	.1898334	.1172362
15	9.8103159	9.8826568	9.9276590	10.0723410	45	.1896841	.1173432
16	9.8104650	9.8825499	9.9279152	10.0720848	44	·1895350	.1174501
17	9.8106141	9.8824428	9.9281713	10.0718287	43	·1893859	·1175572
18	9.8107631	9.8823357	9.9284274	10.0715726	42	.1892369	.1176643
19	9.8109121	9.8822285	9.9286835	10.0713165	41	·1890879	·1177715
20	9.8110609	9.8821213	9.9289396	10.0710604	40	.1889391	·1178787
21	9.8112096	9.8820140	9.9291956	10.0708044	39	.1887904	.1179860
22	9.8113583	9.8819067	9.9294516	10.0705484	38	.1886417	1180973
23	9.8115069	9.8817992	9.9297076	10.0702924	37	.1884931	.1182008
24	9.8116554	9.8816918	9.9299636	10.0700364	36	.1883446	.1183082
25	9.8118038	9.8815842	9.9302195	10.0697805	35	.1881962	.1184158
26	9.8119521	9.8814766	9.9304755	10.0695245	34	.1880479	.1185234
27	9.8121003	9.8813689	9.9307314	10.0692686	33	.1878997	.1186311
28	9.8122484	9.8812612	9.9309872	10.0690128	32	.1877516	.1187388
29	9.8123965	9.8811534	9.9312431	10.0687569	31	.1876035	·1188466
30	9.8125444	9.8810455	9.9314989	10.0685011	30	.1874556	1189545
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	49		

40	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
30	9.8125444	9.8810455	9.9314989	10.0685011	30	.1874556	.1189545
31	9.8126923	9.8809376	9.9317547	10.0682453	29	.1873077	.1190624
32	9.8128401	9.8808296	9.9320105	10.0679895	28	.1871599	.1191704
33	9.8129878	9.8807215	9.9322662	10.0677338	27	.1870122	.1192785
34	9.8131354	9.8806134	9.9325220	10.0674780	26	.1868646	.1193866
35	9.8132829	9.8805052	9.9327777	10.0672223	25	.1867171	.1194948
36	9.8134303	9.8803970	9.9330334	10.0669666	24	.1865697	.1196030
37	9.8135777	9.8802887	9.9332890	10.0667110	23	.1864223	.1197113
38	9.8137250	9.8801803	9.9335446	10.0664554	22	.1862750	.1198197
39	9.8138721	9.8800719	9.9338003	10.0661997	21	.1861279	.1199281
40	9.8140192	9.8799634	9.9340559	10.0659441	20	.1859808	.1200366
41	9.8141662	9.8798548	9.9343114	10.0656886	19	.1858338	.1201452
42	9.8143131	9.8797462	9.9345670	10.0654330	18	.1856869	.1202538
43	9.8144600	9.8796375	9.9348225	10.0651775	17	.1855400	.1203625
44	9.8146067	9.8795287	9.9350780	10.0949220	16	.1853933	.1204713
45	9.8147534	9.8794199	9.9353335	10.0646665	15	.1852466	.1205801
46	9.8148999	9.8793110	9.9355889	10.0644111	14	.1851001	.1206890
47	9.8150464	9.8792021	9.9358444	10.0641556	13	.1849536	.1207979
48	9.8151928	9.8790930	9.9360998	10.0639002	12	.1848072	.1209070
49	9.8153391	9.8789840	9.9363552	10.0636448	11	.1846609	.1210160
50	9.8154854	9.8788748	9.9366105	10.0633895	10	.1845146	.1211252
51	9.8156315	9.8787656	9.9368659	10.0631341	9	.1843685	.1212344
52	9.8157776	9.8786563	9.9371212	10.0628788	8	.1842224	.1213437
53	9.8159235	9.8785470	9.9373765	10.0626235	7	.1840765	.1214530
54	9.8160694	9.8784376	5.9376318	10.0623682	6	.1839306	.1215624
55	9.8162152	9.8783281	9.9378871	10.0621129	5	.1837848	.1216719
56	9.8163609	9.8782186	9.9381423	10.0618577	4	.1836391	.1217814
57	9.8165066	9.8781090	9.9383975	10.0616025	3	.1834934	.1218910
58	9.8166521	9.8779994	9.9386527	10.0613473	2	.1833479	.1220006
59	9.8167975	9.8778896	9.9389079	10.0610921	1	.1832025	.1221104
60	9.8169425	9.8777799	9.9391631	10.0608369	0	.1830571	.1222201
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	49		

41	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.8169429	9.8777799	9.9391640	10.0608369	60	.1830570	.1222201
1	9.8170882	9.8776700	9.9394182	10.0605818	59	.1829118	.1223300
2	9.8172334	9.8775601	9.9396733	10.0603267	58	.1827666	.1224399
3	9.8173785	9.8774501	9.9399284	10.0600716	57	.1826215	.1225499
4	9.8175235	9.8773401	9.9401835	10.0598165	56	.1824765	.1226599
5	9.8176685	9.8772300	9.9404385	10.0595615	55	.1823315	.1227700
6	9.8178133	9.8771198	9.9406936	10.0593064	54	.1821867	.1228802
7	9.8179581	9.8770096	9.9409486	10.0590514	53	.1820419	.1229904
8	9.8181028	9.8768993	9.9412036	10.0587964	52	.1818972	.1231007
9	9.8182474	9.8767889	9.9414585	10.0585415	51	.1817526	.1232111
10	9.8183919	9.8766785	9.9417135	10.0582865	50	.1816081	.1233215
11	9.8185364	9.8765680	9.9419684	10.0580316	49	.1814936	.1234320
12	9.8186807	9.8764574	9.9422233	10.0577767	48	.1813193	.1235426
13	9.8188250	9.8763468	9.9424782	10.0575218	47	.1811750	.1236531
14	9.8189692	9.8762361	9.9427331	10.0572669	46	.1810308	.1237639
15	9.8191133	9.8761253	9.9429879	10.0570121	45	.1808867	.1238747
16	9.8192573	9.8760145	9.9432428	10.0567572	44	.1807427	.1239855
17	9.8194012	9.8759036	9.9434976	10.0565024	43	.1805988	.1240964
18	9.8195450	9.8757927	9.9437524	10.0562476	42	.1804550	.1242073
19	9.8196887	9.8756816	9.9440072	10.0559928	41	.1803112	.1243184
20	9.8198325	9.8755706	9.9442619	10.0557381	40	.1801675	.1244294
21	9.8199761	9.8754594	9.9445166	10.0554834	39	.1800239	.1245406
22	9.8201196	9.8753482	9.9447714	10.0552286	38	.1798804	.1246518
23	9.8202630	9.8752369	9.9450261	10.0549739	37	.1797370	.1247631
24	9.8204063	9.8751256	9.9452807	10.0547193	36	.1795937	.1248744
25	9.8205496	9.8750142	9.9455354	10.0544646	35	.1794504	.1249858
26	9.8206927	9.8749027	9.9457900	10.0542100	34	.1793073	.1250972
27	9.8208358	9.8747912	9.9460447	10.0539553	33	.1791642	.1252088
28	9.8209788	9.8746795	9.9462993	10.0537007	32	.1790212	.1253205
29	9.8211217	9.8745679	9.9465539	10.0534461	31	.1788783	.1254321
30	9.8212646	9.8744561	9.9468084	10.0531916	30	.1787354	.1255430
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	48		

41	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Co n. Arith. of Sine Com.
30	9.8212646	9.8744561	9.9468084	10.0531916	30	.1787354	.1255439
31	9.8214073	9.8743443	9.9470630	10.0529370	29	.1785927	.1256557
32	9.8215500	9.8742325	9.9473175	10.0526825	28	.1784500	.1257675
33	9.8216926	9.8741205	9.9475720	10.0524280	27	.1783074	.1258796
34	9.8218351	9.8740085	9.9478265	10.0521735	26	.1781649	.1259915
35	9.8219775	9.8738965	9.9480810	10.0519190	25	.1780225	.126103
36	9.8221198	9.8737844	9.9483355	10.0516645	24	.1778802	.1262156
37	9.8222621	9.8736722	9.9485899	10.0514101	23	.1777379	.1263278
38	9.8224042	9.8735599	9.9488443	10.0511557	22	.1775958	.1264401
39	9.8225463	9.8734476	9.9490987	10.0509013	21	.1774537	.126552
40	9.8226883	9.8733352	9.9493531	10.0506469	20	.1773117	.126664
41	9.8228302	9.8732227	9.9496075	10.0503925	19	.1771698	.126777
42	9.8229721	9.8731102	9.9498619	10.0501381	18	.1770279	.126889
43	9.8231138	9.8729976	9.9501162	10.0498838	17	.1768862	.127002
44	9.8232555	9.8728849	9.9503705	10.0496295	16	.1767445	.1271151
45	9.8233971	9.8727722	9.9506248	10.0493752	15	.1766029	.127227
46	9.8235386	9.8726594	9.9508791	10.0491209	14	.1764614	.127340
47	9.8236800	9.8725466	9.9511334	10.0488666	13	.1763200	.127453
48	9.8238213	9.8724337	9.9513876	10.0486124	12	.1761787	.1275663
49	9.8239626	9.8723207	9.9516419	10.0483581	11	.1760374	.1276793
50	9.8241037	9.8722076	9.9518961	10.0481039	10	.1758963	.127792
51	9.8242448	9.8720945	9.9521503	10.0478497	9	.1757552	.127905
52	9.8243858	9.8719813	9.9524045	10.0475955	8	.1756142	.1280187
53	9.8245267	9.8718681	9.9526587	10.0473413	7	.1754733	.1281319
54	9.8246676	9.8717548	9.9529128	10.0470872	6	.1753324	.1282451
55	9.8248083	9.8716414	9.9531670	10.0468330	5	.1751917	.1483586
56	9.8249490	9.8715279	9.9534211	10.0465789	4	.1750510	.1284721
57	9.8250896	9.8714144	9.9536752	10.0463248	3	.1749104	.1285856
58	9.8252301	9.8713008	9.9539293	10.0460707	2	.1747699	.1286992
59	9.8253705	9.8711872	9.9541834	10.0458166	1	.1746295	.1288128
60	9.8255109	9.8710735	9.9544374	10.0455626	0	.1744891	.1289265
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	48		

42	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
0	9.8255109	9.8710735	9.9544374	10.0455626	60	.1744891	.1289265
1	9.8256512	9.8709597	9.9546915	10.0453085	59	.1743488	.1290403
2	9.8257913	9.8708458	9.9549455	10.0450545	58	.1742087	1291542
3	9.8259314	9.8707319	9.9551995	10.0448005	57	.1740686	.1292681
4	9.8260715	9.8706179	9.9554535	10:0445465	56	.1739285	.1293821
5	9.8262114	9.8705039	9.9557075	10.0442925	55	.1737886	.1294961
6	9.8263512	9.8703898	9.9559615	10.0440385	54	.1736488	.1296102
7	9.8264910	9.8702756	9.9562154	10.0437846	53	.1735090	.1297244
8	9.8266307	9.8701613	9.9564694	10.0435307	52	.1733693	.1298387
9	9.8267703	9.8700470	9.9567233	10.0432767	51	.1732297	.1299530
10	9.8269098	9.8699326	9.9569772	10.0430228	50	.1730902	.1300674
11	9.8270493	9.8698182	9.9572311	10.0427689	49	.1729507	.1301818
12	9.8271887	9.8697037	9.9574850	10.0425150	48	.1728113	.1302963
13	9.8273279	9.8695891	9.9577389	10.0422611	47	.1726721	.1304109
14	9.8274671	9.8694744	9.9579927	10.0420073	46	.1725329	.1305256
15	9.8276063	9.8693597	9.9582465	10.0417535	45	.1723937	.1306403
16	9.8277453	9.8692449	9.9586004	10.0414996	44	.1722547	.1307551
17	9.8278843	9.8691301	9.9587542	10.0412458	43	.1721157	.1308699
18	9.8280231	9.8690152	9.9590080	10.0409920	42	.1719769	.1309848
19	9.8281619	9.8689002	9.9592618	10.0407382	41	.1718381	.1310998
20	9.8283006	9.8687851	9.9595155	10.0404845	40	.1716994	.1312149
21	9.8284393	9.8686700	9.9597693	10.0402307	39	.1715607	.1313300
22	9.8285778	9.8685548	9.9600230	10.0399770	38	.1714222	.1314452
23	9.8287163	9 8684396	9.9602767	10.0397233	37	.1712837	.1315604
24	9.8288547	9.8683242	9.9605305	10.0394695	36	.1711453	.1316758
25	9.8289930	9.8682088	9.9607842	10:0392158	35	.1710070	.1317912
26	9.8291312	9.8680934	9.9610378	10.0389622	34	.1708688	.1319066
27	9.8292694	9.8679779	9.9612915	10.0387085	33	.1707306	.1320221
28	9.8294075	9.8678623	9.9615452	10.0384548	32	.1705925	.1321377
29	9.8295454	9.8677466	9.9617988	10 0382012	31	.1704546	.1322534
30	9.8296833	9.8676309	9.9620525	10.0379475	30	.1703167	.1323961
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	47		

42	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Co.n. Arithmetic. of Sine.	Co.n. Arit. of Sine Com.
30	9.8296833	9.8676309	9.9620525	10.0379475	30	.1703167	.1323691
31	9.8298212	9.8675151	9.9623061	10.0376939	29	.1701788	.1324849
32	9.8299589	9.8673992	9.9625597	10.0374403	28	.1700411	.1326008
33	9.8300966	9.8672833	9.9628133	10.0371867	27	.1699034	.1327167
34	9.8302342	9.8671673	9.9630669	10.0369331	26	.1697658	.1328327
35	9.8303717	9.8670512	9.9633204	10.0366796	25	.1696283	.1329488
36	9.8305091	9.8669351	9.9635740	10.0364260	24	.1694909	.1330649
37	9.8306464	9.8668189	9.9638275	10.0361725	23	.1693536	.1331811
38	9.8307837	9.8667026	9.9640811	10.0359189	22	.1692163	.1332974
39	9.8309209	9.8665863	9.9643346	10.0356654	21	.1690791	.1334137
40	9.8310580	9.8664699	9.9645881	10.0354119	20	.1689420	.1335301
41	9.8311950	9.8663534	9.9648416	10.0351584	19	.1688050	.1336466
42	9.8313320	9.8662369	9.9650951	10.0349049	18	.1686680	.1337631
43	9.8314688	9.8661202	9.9653486	10.0346514	17	.1685312	.1338797
44	9.8316056	9.8660036	9.9656020	10.0343980	16	.1683944	.1339964
45	9.8317422	9.8658868	9.9658555	10.0341445	15	.1682577	.1341132
46	9.8318789	9.8657700	9.9661089	10.0338911	14	.1681211	.1342300
47	9.8320155	9.8656531	9.9663623	10.0336377	13	.1679845	.1343469
48	9.8321519	9.8655362	9.9666157	10.0333843	12	.1678481	.1344638
49	9.8322883	9.8654192	9.9668692	10.0331308	11	.1677117	.1345808
50	9.8324246	9.8653021	9.9671225	10.0328775	10	.1675754	.1346979
51	9.8325609	9.8651849	9.9673759	10.0326241	9	.1674391	.1348151
52	9.8326970	9.8650677	9.9676293	10.0323707	8	.1673030	.1349323
53	9.8328331	9.8649504	9.9678827	10.0321173	7	.1671669	.1350496
54	9.8329691	9.8648331	5.9681360	10.0318640	6	.1670309	.1351669
55	9.8331050	9.8647156	9.9683893	10.0316107	5	.1668950	.1352844
56	9.8332408	9.8645981	9.9686427	10.0313573	4	.1667592	.1354019
57	9.8333766	9.8644806	9.9688960	10.0311040	3	.1666234	.1355194
58	9.8335122	9.8643629	9.9691493	10.0308507	2	.1664878	.1356371
59	9.8336478	9.8642452	9.9694025	10.0305974	1	.1663522	.1357548
60	9.8337833	9.8641275	9.9696559	10.0303441	0	.1662167	.1358725
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	47		

43	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine.	Com. Arith. of Sine Com.
0	9.8337833	9.8641275	9.9696559	10.0303441	60	.1662167	.1358725
1	9.8339188	9.8640096	9.9699091	10.0300909	59	.1660[illegible]12	.1359904
2	9.8340541	9.8638917	9.9701624	10.0298376	58	.1659459	.1361083
3	9.8341894	9.8637737	9.9704157	10.0295843	57	.1658106	.1362263
4	9.8343246	9.8636557	9.9706689	10.0293311	56	.1656754	.1363443
5	9.8344597	9.8635376	9.9709221	10.0290779	55	.1655403	.1364624
6	9.8345948	9.8634194	9.9711754	10.0288246	54	.1654052	.1365806
7	9.8347297	9.8633011	9.9714286	10.0285713	53	.1652703	.1366989
8	9.8348646	9.8631828	9.9716818	10.0283182	52	.1651354	.1368172
9	9.834999[illegible]	9.8630644	9.9719350	10.0280659	51	.1650005	.1369356
10	9.8351341	9.8629460	9.9721882	10.0278118	50	.1648659	.1370540
11	9.8352688	9.8628274	9.9724413	10.0275587	49	.1647312	.1371726
12	9.8354033	9.8627088	9.9726945	10.0273055	48	.1645967	.1372912
13	9.8355378	9.8625902	9.9729477	10.0270523	47	.1644622	.1374098
14	9.8356722	9.8624714	9.9732008	10.0267992	46	.1643278	.1375286
15	9.8358066	9.8623520	9.9734539	10.0265461	45	.1641934	.1376474
16	9.8359408	9.8622338	9.9737071	10.0262929	44	.1640592	.1377662
17	9.8360750	9.8621148	9.9739602	10.0260398	43	.1639250	.1378852
18	9.8362091	9.8619958	9.9742133	10.0257867	42	.1637909	.1380042
19	9.8363431	9.8618767	9.9744664	10.0255336	41	.1636569	.1381233
20	9.8364771	9.8617576	9.9747195	10.0252805	40	.1635229	.1382424
21	9.8366109	9.8616383	9.9749726	10.0250274	39	.1633891	.1383617
22	9.8367447	9.8615190	9.9752257	10.0247743	38	.1632553	.1384810
23	9.8368784	9.8613997	9.9754787	10.0245213	37	.1631216	.1386003
24	9.8370121	9.8612803	9.9757318	10.0242682	36	.1629879	.1387197
25	9.8371456	9.8611608	9.9759849	10.0240151	35	.1628544	.1388392
26	9.8372791	9.8610412	9.9762379	10.0237621	34	.1627209	.1389588
27	9.8374125	9.8609215	9.9764909	10.0235091	33	.1625875	.1390785
28	9.8375458	9.8608018	9.9767440	10.0232560	32	.1624542	.1391982
29	9.8376790	9.8606821	9.9769970	10.0230030	31	.1623210	.1393179
30	9.8378122	9.8605622	9.9772500	10.0227500	30	.1621878	.1394378
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	46		

43	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Co. Arithmetic. of Sine.	Co. Arith. of Sine Com.
30	9.8[illegible]7812[illegible]	9.8605622	9.9772500	10.0227500	30	.1621878	.1394378
31	9.8379455	9.8604423	9.9775030	10.0224970	29	.1620547	.1395577
32	9.8380783	9.8603225	9.9777560	10.0222440	28	.1619217	.1396777
33	9.8382112	9.8602022	9.9780090	10.0219910	27	.1617888	.1397978
34	9.8383441	9.8600821	9.9782620	10.0217380	26	.1616559	.1399179
35	9.8384769	9.8599619	9.9785149	10.0214851	25	.1615231	.1400381
36	9.8386096	9.8598416	9.9787679	10.0212321	24	.1613904	.1401584
37	9.8387422	9.8597213	9.9790209	10.0209791	23	.1612578	.1402787
38	9.8388747	9.8596009	9.9792738	10.0207262	22	.1611253	1403991
39	9.8390072	9.8594804	9.9795268	10.0204732	21	.1609928	1405196
40	9.8391396	9.8593599	9.9797797	10.0202203	20	.1608604	1406401
41	9.8392719	9.8592393	9.9800326	10.0199674	19	.1607281	.1407607
42	9.8394041	9.8591186	9.9802856	10.0197144	18	.1605959	.1408814
43	9.8395363	9.8589978	9.9805385	10.0194615	17	.1604637	1410022
44	9.8396684	9.8588770	9.9807914	10.0192086	16	.1603316	.1411230
45	9.8398004	9.8587561	9.9810443	10.0189557	15	.1601996	.1412439
46	9.8399323	9.8586351	9.9812972	10.0187028	14	.1600677	.1413649
47	9.8400642	9.8585141	9.9815501	10.0184499	13	.1599358	.1414859
48	9.8401959	9.8583929	9.9818030	10.0181970	12	.1598041	.1416071
49	9.8403276	9.8582718	9.9820559	10.0179441	11	.1596724	.1417282
50	9.8404593	9.8581505	9.9823087	10.0176913	10	.1595407	.1418495
51	9.8405908	9.8580292	9.9825616	10.0174384	9	.1594092	.1419708
52	9.8407223	9.8579078	9.9828145	10.0171855	8	.1592777	.142092[illegible]
53	9.8408537	9.8577863	9.9830673	10.0169327	7	.1591463	.1422137
54	9.8409850	9.8576648	5.9833202	10.0166798	6	.1590150	.1423352
55	9.8411162	9.8575432	9.9835730	10.0164270	5	.1588838	.1424568
56	9.8412474	9.8574215	9.9838259	10.0161741	4	.1587526	.1425785
57	9.8413785	9.8572998	9.9840787	10.0159213	3	.1586215	.1427002
58	9.8415095	9.8571779	9.9843315	10.0156685	2	.1584905	1428221
59	9.8416404	9.8570561	9.9845844	10.0154156	1	1583596	.1429439
60	9.8417713	9.8569341	9.9848372	10.0151628	0	.1582287	1430659
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	46		

44	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmet. of Sine.	Com. Arith. of Sine Com.
0	9.8417713	9.8569341	9.9848372	10.0151628	60	.1582287	.1430659
1	9.8419021	9.8568121	9.9850900	10.0149100	59	.1580979	.1431879
2	9.8420328	9.8566900	9.9853428	10.0146572	58	.1579671	.1433109
3	9.8421634	9.8565678	9.9855956	10.0144044	57	.1578366	.1434322
4	9.8422939	9.8564455	9.9858484	10.0141516	56	.1577061	.1435545
5	9.8424244	9.8563232	9.9861012	10.0138988	55	.1575756	.1436768
6	9.8425548	9.8562008	9.9863540	10.0136460	54	.1574452	.1437992
7	9.8426851	9.8560784	9.9866068	10.0133932	53	.1573149	.1439216
8	9.8428154	9.8559558	9.9868596	10.0131404	52	.1571846	.1440442
9	9.8429456	9.8558332	9.9871123	10.0128877	51	.1570544	.1441668
10	9.8430757	9.8557106	9.9873651	10.0126349	50	.1569243	.1442894
11	9.8432057	9.8555878	9.9876179	10.0123821	49	.1567943	.1444122
12	9.8433356	9.8554650	9.9878706	10.0121294	48	.1566644	.1445350
13	9.8434655	9.8553421	9.9881234	10.0118766	47	.1565345	.1446579
14	9.8435953	9.8552192	9.9883761	10.0116239	46	.1564047	.1447808
15	9.8437250	9.8550961	9.9886289	10.0113711	45	.1562750	.1449039
16	9.8438547	9.8549730	9.9888816	10.0111184	44	.1561453	.1450270
17	9.8439842	9.8548499	9.9891344	10.0108656	43	.1560158	.1451501
18	9.8441137	9.8547266	9.9893871	10.0106129	42	.1558863	.1452734
19	9.8442432	9.8546033	9.9896399	10.0103601	41	.1557568	.1453967
20	9.8443725	9.8544799	9.9898926	10.0101074	40	.1556275	.1455201
21	9.8445018	9.8543564	9.9901453	10.0098547	39	.1554982	.1456436
22	9.8446310	9.8542329	9.9903981	10.0096019	38	.1553690	.1457671
23	9.8447601	9.8541093	9.9906508	10.0093492	37	.1552399	.1458907
24	9.8448891	9.8539856	9.9909035	10.0090965	36	.1551109	.1460144
25	9.8450181	9.8538619	9.9911562	10.0088438	35	.1549819	.1461381
26	9.8451470	9.8537381	9.9914089	10.0085911	34	.1548530	.1462619
27	9.8452758	9.8536142	9.9916616	10.0083384	33	.1547242	.1463858
28	9.8454045	9.8534902	9.9919143	10.0080857	32	.1545955	.1465098
29	9.8455332	9.8533662	9.9921670	10.0078330	31	.1544668	.1466338
30	9.8456618	9.8532421	9.9924197	10.0075803	30	.1543382	.1467579
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	45		

44	Sine.	SINE Complement.	Tang.	TANGENT Complement.		Com. Arithmetic. of Sine	Com. Arith of Sine Com.
30	9.8456618	9.8532421	9.9924197	10.0075803	30	.1543382	.1467579
31	9.8457903	9.8531179	9.9926724	10.0073276	29	.1542097	.1468821
32	9.8459188	9.8529936	9.9929251	10.0070749	28	.1540812	.1470064
33	9.8460471	9.8528693	9.9931778	10.0068222	27	.1539529	.1471307
34	9.8461754	9.8527449	9.9934305	10.0065695	26	.1538246	.1472551
35	9.8463036	9.8526204	9.9936832	10.0063168	25	.1536964	.1473796
36	9.8464318	9.8524959	9.9939359	10.0060641	24	.1535682	.1475041
37	9.8465599	9.8523713	9.9941886	10.0058114	23	.1534401	.1476287
38	9.8466879	9.8522466	9.9944413	10.0055587	22	.1533121	.1477534
39	9.8468158	9.8521218	9.9946940	10.0053060	21	.1531842	.1478782
40	9.8469436	9.8519970	9.9949466	10.0050534	20	.1530564	.1480030
41	9.8470714	9.8518721	9.9951993	10.0048007	19	1529286	.1481279
42	9.8471991	9.8517471	9.9954520	10.0045480	18	.1528009	.1482529
43	9.8473267	9.8516220	9.9957047	10.0042953	17	.1526733	.1483780
44	9.8474543	9.8514969	9.9959573	10.0040427	16	.1525457	.1485031
45	9.8475817	9.8513717	9.9962100	10.0037900	15	.1524183	.1486283
46	9.8477091	9.8512465	9.9964627	10.0035373	14	.1522909	.1487535
47	9.8478365	9.8511211	9.9967154	10.0032846	13	.1521635	.1488789
48	9.8479637	9.8509957	9.9969680	10.0030320	12	.1520363	.1490043
49	9.8480909	9.8508702	9.9972207	10.0027793	11	.1519091	.1491298
50	9.8482180	9.8507446	9.9974734	10.0025266	10	.1517820	.1492554
51	9.8483450	9.8506190	9.9977260	10.0022740	9	.1516550	.1493810
52	9.8484720	9.8504933	9.9979787	10.0020213	8	.1515280	.1495067
53	9.8485989	9.8503675	9.9982314	10.0017686	7	.1514011	.1496325
54	9.8487257	9.8502417	9.9984840	10.0015160	6	.1512743	.1497583
55	9.8488524	9.8501157	9.9987367	10.0012633	5	.1511476	.1498843
56	9.8489791	9.8499897	9.9989893	10.0010107	4	.1510209	.1500103
57	9.8491057	9.8498637	9.9992420	10.0007580	3	.1508943	.1501363
58	9.8492322	9.8497375	9.9994947	10.0005053	2	.1507678	.1502625
59	9.8493586	9.8496113	9.9997473	10.0002527	1	.1506414	.1503887
60	9.8494850	9.8494850	10. 0000000	10.0000000	0	.1505150	.1505150
	SINE Complement.	Sine.	TANGENT Complement.	Tang.	45		

10,0080780

10,0036639

10,0000000
9,4129762
10,0999135

9,5129097

10,
9,8376790
9,8842540

9,8219330

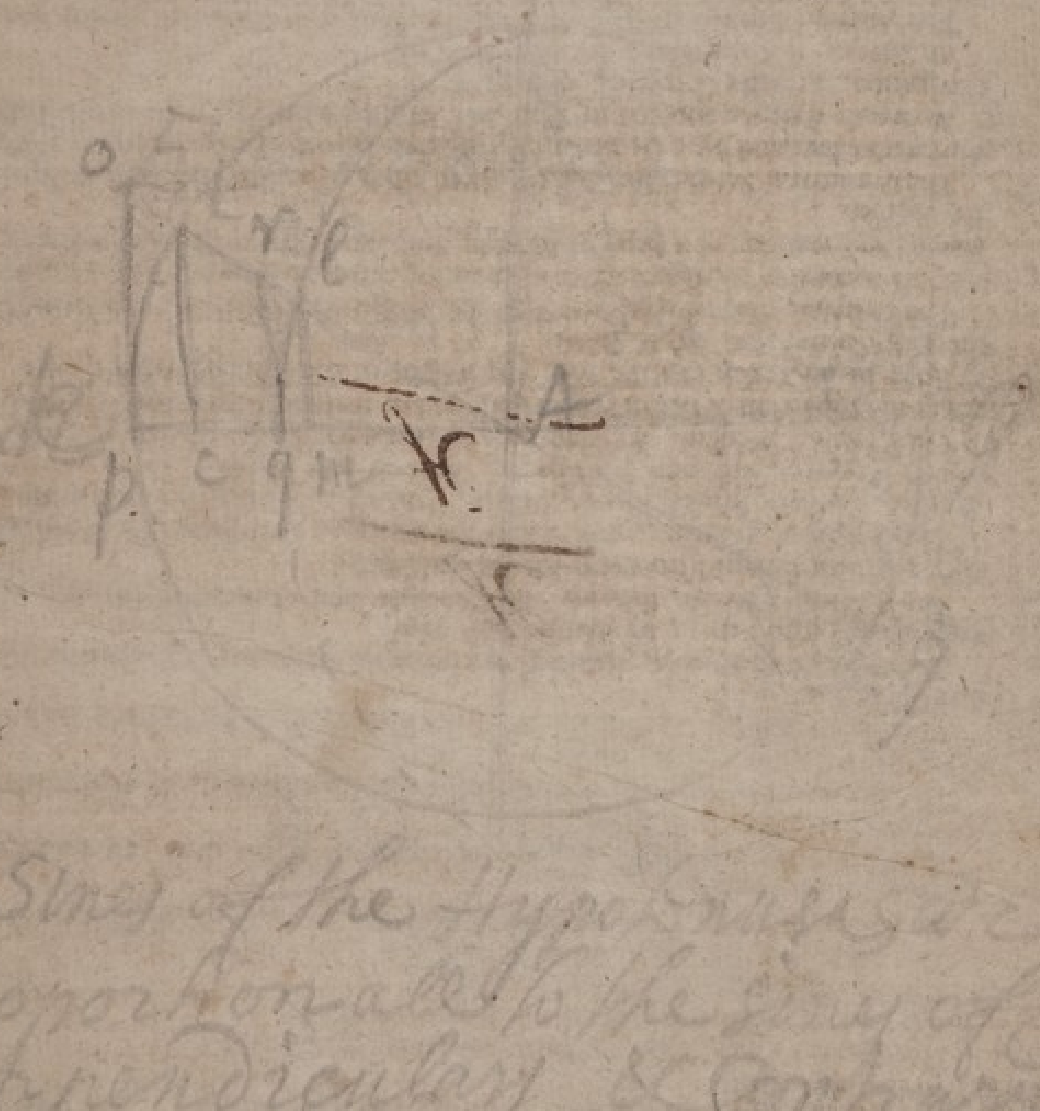
H

h

9,9031084
2,8920946
9,5849685

10,4770631

2,5739547



y Sines of the Hypotenuse are
proportionall to the Sines of y
perpendiculars & Contrary
al : at :: lm : tc

6020800
3010300
9010961

10, 7187517

0791812

sab − R = t db − t cb 7781512

9010360

10,

sab = t db = R − t a

9.8376790
9.8080845
9.6457465

9.8842840
9.9407570
10
10, 9624836

H

R − cs = cs = m

cs − R = m = cs

cs = m = R − cs

B

20.000.000.000
9.9652480
10.0347520