The description and use of an universal and perpetual mathematical instrument ... shewing the most expeditious and exact method of solving all practical questions in arithmetick, trigonometry, navigation, dyalling, astronomy, &c.; ... / by Benjamin Scott.

Contributors

Scott, Benjamin, -1755.
Orrery, John Boyle, Earl of, 1707-1762

Publication/Creation

London : Printed for H. Whitridge ... , J. Wilcox ... , and for the author ..., 1733.

Persistent URL

https://wellcomecollection.org/works/fta4q2xa

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Sun Dials

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THE

DESCRIPTION and USE

Of an Universal and Perpetual

Mathematical Instrument.

SHEWING

The most Expeditious and Exact Method of solving all practical Questions in

ARITHMETICK, TRIGONOMETRY, NAVIGATION, DYALLING, ASTRONOMY, &c.

VIZ.

Sun's Place,
— Right Ascension,
— Declination,
— Amplitude,
— Rising and Setting, and Equation of Time.

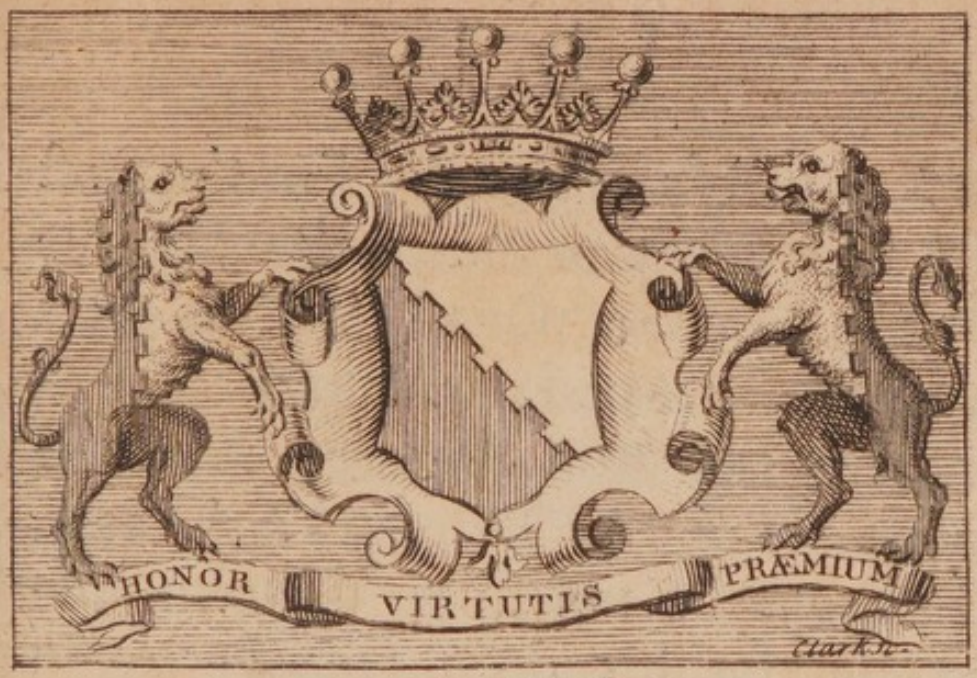
Likewise

The Dominical Letter,
Cycle of the Sun,
Golden Number,
Epact,
Fix'd and Moveable Feasts in both Accounts,
Terms and their Returns,
New and Full Moons,
Moon's Southing,
Time of High Water for Thirty-four Havens,
With the Eclipses of the Sun and Moon,
Conjunction of the Superior and Transits of the two Inferior Planets over the Disk or Face of the Sun.

By BENJAMIN SCOTT.

LONDON:

Printed for H. WHITRIDGE, near the *Royal Exchange*; J. WILCOX, in *Little-Britain*; and for the AUTHOR, at the *Mariner and Globe*, against *Exeter-Change*, in the *Strand*. M.DCC.XXXIII.



TO

The RIGHT HONOURABLE,

JOHN BOYLE,

EARL of

ORRERY.

My LORD,

MATHEMATICKS is univerſally eſteem'd the brighteſt Accompliſhment of Men of Learning; in which none have more remarkably diſtinguiſh'd themſelves than your

your Lordſhip's *Anceſtors*: For the moſt uſeful Inſtrument of this Noble Science took the Name of ORRERY from your Lordſhip's Learned and Illuſtrious Father, the Inventor thereof: And the Honourable *ROBERT BOYLE*, Eſq; will always be remember'd, with Admiration, for his deep Diſcoveries in Natural and Experimental Philoſophy, particularly for his Invention of the AIR PUMP; not to mention his extenſive Charity towards Mankind, of which the annual Lectures eſtabliſh'd for the Confirmation of Chriſtianity, and his large Donations to encourage the Tranſlations of Books into ſuch Languages as would beſt promote ſo pious a Work, will remain everlaſting Monuments.

As your Lordſhip inherits all the Ornaments of two ſuch GREAT MEN, what additional Luſtre may we not expect from you? The Encouragement you have thought fit to give to my preſent Deſign, is an Inſtance of that elegant

gant Taſte with which your Lordſhip reliſhes theſe uſeful Studies. I wiſh the Performance may anſwer your Expectation, and entertain your Hours when it will not interfere with your Lordſhip's intentive Zeal for the Service of your Country.

This Inſtrument is univerſal, not only anſwering all practical Queſtions of the Mathematicks at one View, without the tedious Operations of Numbers; but alſo repreſenting all the Seaſons and Changes of the Year, *&c.* 'Tis needleſs to trouble your Lordſhip with an Enumeration of its Uſes, or of this Book which fully explains them, ſince they both ſpeak clearly for themſelves.

But as your Lordſhip was pleaſed to encourage the Publication, I humbly offer it as a grateful Acknowledgment of the Honour done me: And that you may long live to perpetuate the Glory of your Noble Family, as a Patron of

all useful Learning and Science, and as a Shining Ornament to your Country, is the humble and sincere Wish of,

My LORD,

Your LORDSHIP'S

Most Obedient, and

Most Humble Servant,

Benjamin Scott.

THE PREFACE.

THIS *Preface is chiefly to inform the Reader of the many Advantages he may receive from a careful Perusal of the ensuing Work.* *As Mathematical Learning is justly esteemed, by all the Polite World, the Accomplishment of a fine Gentleman, it is hoped this* New *and* Practical Instrument, *intended for the Improvement of that Noble Science, will receive its deserved Encouragement. The Antients were curious for many Inventions:* Architas *made a Wooden* Dove; Archimedes *made a Sphere of Glass representing*

senting the Motions and Appearances of the Heavenly Bodies; and invented Engines with which he defended the City of Syracuse *for three Years against* Marcellus, *the* Roman *General, by throwing Stones of* 1200 *lb. Weight into his Ships:* Regiomontanus *form'd a* Wooden Eagle *and an* Iron Fly: Scalias, *a Blacksmith made a Lock, Key, and Chain of Forty-three Links of Gold, which weigh'd but one Grain and a Half, and could easily be drawn by a* Flea. *These and many more Curiosities, which might be mentioned, were the Product of Mathematical Reasoning; but none of their most accurate Inventions served the Ends and Purposes of this Instrument.*

THE Baron of Merchiston *in* Scotland, *was the first Inventer of* Logarithms; *and our Countryman, Mr.* Gunter, *was the first who apply'd them to Lines graduated upon Wood: Afterwards Mr.* Everard, *in order to shorten the* Operation, *apply'd them to a Sliding-Rule; but both these Inventions fall infinitely short of the Line of Numbers in this Instrument, because of its great Length. Besides the Conveniences and Advantages which accrue from the Length of this Line, here is also a perpetual* Almanack *for* Old *and* New Style, *and at one View may be seen all the*

Festivals,

Feſtivals, Terms, Tides, Eclipſes, Conjunctions, Tranſits, &c. *together with a Solution of all Queſtions in* Practical Mathematicks *(almoſt) by Inſpection. And as this Inſtrument is univerſally uſeful, ſo is it ornamental for any Gentleman's Study; and after a little Practice will become very eaſy, by a careful Peruſal of the following Book, which renders every Thing intelligible and plain to the meaneſt Capacity; the Terms of Art, made Uſe of in this Inſtrument, being explained; the Deſcription of every Circle, with its Uſes, being inſerted; and Tables calculated with the utmoſt Care and Labour to compleat the Whole. Certainly nothing can excite the Mind more to the Study of the Mathematicks than to have correct Inſtruments, by which the moſt intricate Problems may be ſolved to as great Exactneſs as they can poſſibly be anſwered by tedious Operations.*

BUT it may, perhaps, be objected, that ſuch Inſtruments are not eaſily procured, and if they are too ſmall, the Truth of a Problem cannot be found out. In anſwer to this we may remark, That this Inſtrument is ſo contrived, that any Queſtion being propoſed and put, a full and clear Anſwer may immediately be given, as the Practitioner will find on comparing the Examples wrought in

this

this Book by the Assistance of this Instrument, with Calculations annexed to this Treatise. And as it is useful to Gentlemen who study the Mathematicks, *so is it likewise to the* Surveyor *in taking his Distances; to the* Navigator *in working his Traverses; to the* Astronomer *in solving all Questions relating to the Sphere; to the* Dialist *in calculating of Hour Lines upon all such Planes as have Centers; and to* Schools *and* Academies *where Mathematical Lectures are read: For by this Instrument alone the Master may give the Pupil a clearer View of the Branches herein handled, than by any other Way or Method that can be proposed.*

THIS it is hoped will encourage others to the Search of Instruments whereby an Altitude may be taken at Sea to a Second; or to observe an Immersion *or* Emersion *of* Jupiter's Satellites *to as great Exactness as if taken on Shore; which would be of great Use to the Publick, and what would solve the Grand Problem,* viz. *The Longitude at Sea.*

TO conclude, neither Time, Care, nor Cost have been spared to make this Instrument answer the Ends and Purposes for which it was designed; and I cannot sufficiently ex-

press

preſs my Gratitude to that Noble Lord, who condeſcended to accept the Dedication of this Tract and Inſtrument; and alſo to the never to be forgotten Memory of the Illuſtrious and Honourable Mr. Robert Boyle, *to whoſe great Sagacity, Learning, and Penetration, the Learned Part of the World are now, and for Ages to come, may continue to be indebted; which have added ſuch Beauty to this Inſtrument as to make it univerſally Ornamental, as well as uſeful for all Studies: My Wiſhes therefore to the Readers and Encouragers of this Work are, that they may find as much Profit in uſing, as I have had Pleaſure in compiling it.*

THE

BENJAMIN SCOTT,

At the MARINER *and* GLOBE, *againſt* Exeter-Change, *in the Strand*,

MAKES and Sells all Sorts of Mathematical Inſtruments in Silver, Braſs, Ivory, and Wood, *&c.* performed according to the lateſt Improvements of Philoſophers and Practicers of the ſeveral Mathematical Arts, whereby they are render'd moſt Neat, Portable, and Accurate for Expedition.

I. In GEOMETRY, Sectors, Scales, Compaſſes, Drawing-Pens, Land-Quadrants, fine Caſes of Inſtruments for the Pocket, *&c.*

II. In SURVEYING, Theodolites, Semicircles, Circumferenters, Plain-Tables, Drawing-Tables, Water-Levels, Meaſuring-Wheels, *&c.*

III. In NAVIGATIGN, Quadrants, Foreſtaffs, *Gunter*'s Sea Compaſſes both Meridian and Azimuth, Charts, Maps, with Books of their Uſes.

IV. In DYALLING, All Sorts of Braſs Horizontal and Univerſal Dyals for Gardens or Gentlemens Pockets, Globes, Spheres, Weather-Glaſſes, Loadſtones cut or ſet in Silver or Braſs; all Sorts of Sliding-Rules, Parallel-Rules, beſt Black-Lead Pencils, *&c.*

At the Hand *and* Pen, *in* Cock-Lane, Shoreditch, *are taught*,

ASTRONOMY, NAVIGATION, and the Uſe of the GLOBES,

By CHARLES LEADBETTER.

AN EXPLANATION OF The TERMS used in the following TREATISE.

ALtitude, is the Height that the Sun, Moon, or Stars are above the Horizon at any Time of the Day or Night, reckoned in Degrees and Minutes.

Amplitude, is an Arch of the Horizon comprehended between the east and west Points thereof, and the Place on the Horizon where the Sun, Moon, or any Star rises or sets.

Angle, is the meeting of two Lines in a Point, which is best explain'd by the two Legs of the Sector moving upon the Center of the Instrument; for if the Legs be opened to any Distance, then the two Horse-hairs meeting in a Point, do make an

Angle equal to that Diſtance unto which the Legs were opened, which may be meaſured by any concentrick Circle equally divided; as for Inſtance, count the Degrees in the fifth Circle, or Circle of Signs, comprehended between the two Hairs, and that is the Quantity of the Angle ſought.

Aquarius, a Water-bearer, repreſented in the Inſtrument by an old Man pouring out a Pitcher of Water; in all aſtronomical Calculations it is the tenth Sign, unto which the Sun comes the 9th Day of *January*, and it is thus characterized ♒.

Aries, the Ram, (alias Tup) in the Inſtrument is engraved in the great Space between the third and fourth Circles; is one of the twelve cœleſtial Signs, and the firſt in order in the Zodiack; but in all aſtronomical Calculations it is number'd with o, unto which the Sun comes the 9th Day of *March*, making then our Days and Nights equal; it is called the vernal Equinox, and is thus characterized ♈.

Artificial Numbers, Sines, Tangents, and Secants, are Numbers adapted purely to ſhorten the Work in Proportion, Trigonometry, *&c.* which in the Inſtrument are repreſented by the firſt, ſecond, and third Circles.

Aſcenſional Difference, is the Difference between the right and oblique Aſcenſion of the Sun, Moon, or Star, in Degrees upon the Equator, which reduced into Time, allowing 15°

to an Hour, &c. will always be equal to the Time between the Sun's riſing and ſetting, and ſix o' Clock.

Aſtronomy, the Law of the Stars, is a Science that teaches us the Motions, Diſtances, and Magnitudes of the heavenly Bodies, with the Eclipſes, &c.

Auſtral Signs, are the ſix laſt Signs of the Zodiack, *viz.* ♎, ♏, ♐, ♑, ♒, ♓.

Azimuths, are great Circles of the Sphere meeting in the Zenith and Nadir of your Habitation, and cutting the Horizon at right Angles, which are infinite.

Biſſextile, Leap-Year, becauſe every fourth Year the ſix Calends of *March* are twice repeated; for every fourth Year the odd ſix Hours make one entire Day, which is placed in the *Julian* Calendar, next after the 24th Day of *February*, cauſing that Month to contain twenty-nine Days every fourth Year.

Boreal, or northern Signs, are theſe ſix, *viz.* ♈, ♉, ♊, ♋, ♌, ♍.

Callyopick Period, ſeventy-ſix Years.

Cancer, the Crab, the fourth Sign of the Zodiack, but third compleat in aſtronomical Calculation; it is a tropical Sign, unto which the Sun comes the 10th of *June*, having then the greateſt Declination, Meridian Altitude, and Amplitude.

Capricorn, the Goat mark'd thus, ♑, the 10th Sign in the Zodiack, a Cardinal, and the ſouth tropical Sign, unto which when the Sun comes, which is on the 10th of *December*, he makes the longeſt Nights, and ſhorteſt Days to all on the north Side the Equator; the Sun has then the greateſt ſouth Declination and Amplitude, but the leaſt meridian Altitude to all northern Inhabitants, but to the ſouthern juſt the contrary.

Co-Sine, *Co-Tangent*, and *Co-Secant*, are ſo many Degrees as any, wants of 90°.

Cycle of the Sun, is a Revolution of twenty-eight Years, in which Time the dominical Letters are the ſame they were twenty-eight Years before.

Cycle of the Moon, is a Revolution of nineteen Years, in which Time the Conjunctions and Aſpects of the Sun and Moon are near the ſame they were nineteen Years before: It is alſo called the Prime, or Golden Number; and four of theſe Revolutions make up the callippick Period, equal to ſeventy-ſix Years; in which Time the Aſpects of the Luminaries come to a more perfect Degree of Exactneſs.

Declination of the Sun, Moon, or Stars, is their Diſtance from the Equinoctial towards either Pole in Degrees and Minutes: The Sun's greateſt Declination is 23° ½, equal to the Obliquity of the Ecliptick.

Depreſ-

Depreſſion of the Pole, is ſo many Degrees as you travel or ſail towards the Equator from either Pole; you are ſaid to depreſs the Pole ſo much, becauſe it ſeems lower to you or nearer to your Horizon.

Degree, is the 360th Part of any Circle, or the 30th Part of a Sign, mark'd °.

Digit, is the twelfth Part of the Sun or Moon's Diameter.

Dominical Letter, or Lord's Day Letter, is one of the firſt ſeven of the Alphabet, whereof every common Year has one, and every Leap-Year two, by which the Sundays are marked throughout the Year in Almanacks; and Tab. I. in the Inſtrument ſhows the dominical Letter for any Year by Inſpection.

Ecliptick, is one of the ſix great Circles of the Sphere, interſecting the Equinoctial in the two oppoſite Points *Aries* and *Libra*, making an Angle therewith of 23° ½, called the Obliquity of the Ecliptick, equal to the Sun's greateſt Declination: In this Circle, according to Appearance, the Sun is always found; it is divided into twelve equal Parts, called Signs, and every Sign into 30°, every Degree into 60′ and each Minute into 60″, *&c.* Always in or near this Line (Circle) are the Eclipſes of the Luminaries made, from whence it takes its Name: this Circle alſo interſects the two Tropicks of *Cancer* and *Capricorn*.

. *Elevation of the Pole*, is an Arch of the Meridian comprehended between the Pole and the Horizon, which is always equal to the Arch of the Meridian contained between the Zenith and Equinoctial, theſe being equal, or the ſame with the Latitude of the Place.

Epact, is the Difference between the common ſolar and lunar Year; for the firſt contains 365, and the latter 354; their Difference is 11, and is called the Epact, for ſo much doth the Moon gain of the Sun every Year, which in nineteen Years Time finiſhes one Revolution; that is, the Full and Change of the Moon, *&c.* are made on the ſame Day that they were nineteen Years before.

Equation of Time, or natural Days, was never rightly underſtood, till this our Age: It was firſt demonſtrated by the famous *Street*, and next by the Reverend and Learned Mr. *Flamſteed*. It conſiſts of two Parts; the firſt is nothing but the Difference the Sun's apparent Longitude and right Aſcenſion; which Difference is occaſioned by the Obliquity of the Ecliptick, and being turned into Time will give the firſt Part of the Equation, which in the firſt and third Quadrants is to be added to the equal Time, becauſe there the Sun's right Aſcenſion is leſs than the Longitude or Place in the Ecliptick; but in the ſecond and fourth Quadrants the ſame Equation is to be ſubſtracted from the equal Time, to make it apparent, becauſe there the right Aſcenſion exceeds the long.

The

The ſecond Part of the Equation depends on the Earth's Eccentricity and mean Anomaly ; for all the Time the Sun apparently is moving from his Apogæon to the Perigæon, which is from the 18th of *June* to the 18th of *December*, the mean Place goeth before the true ; therefore the Equation of the Eccentrick being reduced into Time muſt be added to the equal Time to make it apparent, becauſe of the Earth's Rotation upon its own Axis : But while the Earth (or apparently the Sun) is moving from the Perigæon to the Apogæon, that is, the laſt ſix Signs of mean Anomaly, from the 18th Day of *December* to the 18th Day of *June*, here, I ſay, the true Place goes before the mean ; ſo that the Equation of the Eccentrick being reduced into Time, and ſubſtracted from the equal Time, will give the apparent, *& contra*, becauſe of the Earth's diurnal Motion from Weſt to Eaſt. Now the abſolute Equation of natural Days is compounded of the two Parts above-mentioned ; for if they both add, or both ſubſtract, then their Sum, otherwiſe their Difference is the abſolute Equation of Time, which is placed in the tenth Circle in the Inſtrument over-againſt every Day of the Month.

Equinoctial, in the Heaven, or Equator on the Earth, is that great Circle of the Sphere, whoſe Poles are the Artick and Antartick Poles of the World ; it divides the Globe into two equal Hemiſpheres, *viz.* North and South, and paſſes through the Eaſt and Weſt Points of the Horizon ; and at the Meridian it is always raiſed as much above the Horizon as is the Comple-

ment of the Latitude of the Place of Habitation, or equal to the Arch of the Meridian, which is contained between the Zenith and the elevated Pole; every 15° of this Circle is equal to one Hour in Time, to which Circles when the Sun, Moon, or Star comes, they have then neither Declination nor Amplitude, which is on the 9th of *March*, and the 12th of *September*; the Sun then entring *Aries* and *Libra* makes the vernal and autumnal Equinoxes, the Days and Nights being then equal all the World over.

Flux and Reflux of the Sea, or the ebbing and flowing thereof; theſe you have in the Inſtrument in the nineteenth Circle, which is the ſame with the Tides, or Time of high Water.

Finitor, is the ſame with Horizon, which ſee.

Focus, the Orbs of the Planets are Ellipſes, and every Ellipſis has two Focii or Navel-Points, which are the Centers by which the Ellipſis is drawn: In the copernican Syſtem the Sun is fixed upon the lower Focus, on which the apparent Motion is made, and the equal Motion is made upon the upper Focus.

Gemini, the Twins, the third Sign in the Zodiack, but in Number the ſecond in all aſtronomical Calculations, to which the Sun comes the 10th Day of *May*, making then no Night but Twilight at *London*; it is thus characterized ♊.

Golden

Golden Number, is the ſame with the Cycle of the Moon, which ſee.

Gregorian Year, is the Reformation of the Calendar by Pope *Gregory* XIII. in the Year 1582, and is now in this Age, eleven Days before the old Stile uſed by us in *England*, and will continue ſo till the Year 1800, and then will be twelve Days before us, and ſo on every hundred Years they will gain one Day.

Horizon, is one of the ſix great Circles of the Sphere, it divides the Heavens and the Earth into two equal Parts, or Hemiſpheres, and is the Boundary of Day and Night, unto which, when the Sun, Moon, and Stars apparently come, they ſeem to riſe and ſet : Every particular Perſon upon Earth has a particular Horizon, the Poles of which are the Zenith and Nadir.

Index, the two flat Pieces of Braſs that move upon the Center of the Inſtrument marked with the Letters A and B, for Diſtinction ſake ; and the Figures upon each of them are the Number of the concentrick Circles in the Inſtrument, which is a ready Guide for you to any Circle at Pleaſure.

Julian Year, or Account, is the old Account of the Year inſtituted by *Julius Cæſar*, which to this Day is uſed in *England*, and in all Proteſtant Countries ; it is called the old Stile in Contradiction to the new Account, framed by Pope *Gregory* XIII. This *Julian* Year contains 365 Days ſix Hours, which ſaid ſix Hours in four

Years

Years make one Day, and is placed in the Calendar next after the 24th of *February*, making that Month to consiſt of 29 Days every fourth Year, which is called Leap-Year, becauſe from that Day to the End of the Year, the Days of the Month go forward from *Saturday* to *Monday*, *&c.*

Julian Period, is a Cycle of 7980 Years, produced by the continual Multiplication of the three Cycles, *viz.* the Solar, the Lunar, and the Indiction, one into another. *Julius Scaliger* fixed the Beginning of this Period 764 Years before the Creation of the World. It is of good Uſe for Aſtronomers and Chronologers.

Jupiter, is the higheſt Planet, except *Saturn*, in the planetary Syſtem; he performs one Revolution in 11 Years 314 Days 12 Hours and 20′, his mean diurnal Motion is 4′ 59″, his Orbit makes an Angle with the Ecliptick of 1′ 20″: this Planet has four Satellites moving round him; he is 577 Times greater than our Earth: Every 19 Years and 312 Days this Planet with Saturn make their mean Conjunction, being advanced further in the Zodiack by 8 H. 2° 48′, their true Conjunctions you have in the Inſtrument till the Year 1821 incluſive.

Latitude of a Star, is the Diſtance of the Star from the Ecliptick either North or South: In Geography it is the Diſtance of your Habitation from the Equator North or South, which is the ſame with the Height of the Pole above the Horizon.

Longitude

Longitude of a Star, is its Place in the Zodiack, reckoning from the Beginning of *Aries*. In Geography it is the Diſtance of your Habitation, either Eaſt or Weſt, from any other Meridian, reckoned in Degrees upon the Equator.

Leap-Year, the ſame with Biſſextile, which ſee.

Leo, the Lyon, the fifth Sign in the Zodiack, thus characterized ♌, into which the Sun comes the 12th Day of July, whence in the Latitude of *London* then begins to be perfect Night.

Libra, the Balance, the ſeventh Sign in the Zodiack, characterized thus ♎, unto which the Sun comes the 12th Day of *September*, making the autumnal Equinox.

Mars, the Name of one of the Planets, which moves round the Sun in an Orb between that of the Earth and *Jupiter*; he performs his Revolution in 1 Year 321 Days 23 Hours and 27 Minutes; his mean diurnal Motion is 31′ 27″; his Orbit makes an Angle with the Ecliptick of 1° 52′, and he is 15 Times leſs than our Earth.

Mercury, the Name of one of the Planets, whoſe Orb is next unto the Sun, for that Reaſon he is ſeldom ſeen; he is never more than 29° from the Sun; he performs his Revolution in 87 Days 23 Hours 16 Seconds: The Inclination of his Orbit with the Ecliptick is 6° 54′,

and

and he is twenty-ſeven Times leſs than our Earth. In the Inſtrument you have the Times of his tranſiting the Sun's Diſk for this Century, which always happens when he is Retrogade, and at the Conjunction with the Sun, when his Latitude is leſs than the Sun's apparent Semidiameter.

Meridian, is one of the ſix great Circles of the Sphere, exactly in the Middle between Eaſt and Weſt, unto which when the Sun comes it has then the greateſt Altitude that he can have that Day.

Metonick Year, the ſame with the Cycle of the Moon, which ſee.

Minute, is the 60th Part of a Degree, and is marked thus ′.

Moon, is one of the ſeven Planets, the loweſt and neareſt of all to our Earth; her periodical Revolution is 27 Days 7 Hours 43 Minutes and 7 Seconds; her Orb interſects the Ecliptick in two oppoſite Points, making an Angle therewith of 5° 18′; the Time and Quantity of her Eclipſes you have by the Inſtrument, until the Year 1750.

Nadir, is the Point in the Heavens ſeemingly under your Feet.

Nape-Tide, are thoſe that happen at the Quarters of the Moon, which are the leaſt of all; becauſe then the Luminaries are fartheſt removed

ved aſunder in reſpect of Attraction, cauſes the Sea then to ſwell the leaſt.

Nocturnal Arch, is the Time any heavenly Body is under the Horizon, which in the Sun is always equal to the double of his Riſing.

Nodes, in Aſtronomy, are the Interſections of the Orbs of the Planets with the Earth's Orb or Ecliptick.

Northern Signs, are thoſe ſix in which the Sun when he comes has both North Declination and Amplitude; and they are *Aries*, *Taurus*, *Gemini*, *Cancer*, *Leo*, *Virgo*; in which the Sun continues from the 9th of *March* to the 12th of *September*.

Number of Direction; this Number was invented on Purpoſe to find the moveable Feaſts by; it can never exceed 35, becauſe ſo many Days there are juſt from *March* 21 to *April* 25 incluſive, which are the Bounds or Limits of *Eaſter*, becauſe that Feaſt can never fall lower than the firſt, nor higher than the laſt. We have a Rule to find this Number arithmetically; but in the Inſtrument, Table III. you may find it by Inſpection for ever.

Oblique Aſcenſion, is that Degree and Minute of the Equinoctial, which riſes with the Center of the Sun or Star, or with any Part of the Heavens in an oblique Sphere.

Oblique

Oblique Deſcenſion, is that Part of the Equinoctial that ſets with the Sun, Moon, or Star, or with any Part of the Heaven in an oblique Sphere.

Piſces, is the twelfth and laſt Sign of the Zodiack, characterized thus ♓ ; in the Inſtrument repreſented by two Fiſhes tied together by their Tails : The Sun enters this Sign the 8th Day of *February*.

Planets, are the erratick or wandring Stars ; they are not like the fixed Stars, for theſe two Reaſons, 1*ſt*, Becauſe they are not in the ſame Poſition to one another ; and 2*dly*, Becauſe they never twinkle as the fixed Stars do : of theſe there are ſeven, which are placed in the Inſtrument, *viz.* the Sun, and Moon's Eclipſes ; *Saturn*, *Jupiter*, and *Mars*'s Conjunctions ; *Venus* and *Mercury*'s Tranſits over the Sun's Diſk.

Quarters of the Moon, are the middle Points of her Orb, between the Conjunction and Oppoſition, or when the Luminaries are 90° aſunder, called the firſt and laſt Quarter.

Return, in Law, hath two ſeveral Applications ; the one is the Return of Writs by Sheriffs and Bailiffs, which is only a Certificate made to the Court of that which he hath done, touching the Execution of their Writ directed to him ; and this among the Civilians is termed *Certificatorium* : Of Returns in this Signification ſpeaks the Statute of *Weſtminſter*, 2. *Chap.* 39. So is the

the Return of a Commiſſion, a Certificate or Anſwer to the Court of that which is done by the Commiſſioners, Sheriffs, or other to whom ſuch Writs, Commiſſions, Precepts, or Mandates are directed. Alſo certain Days in every Term are called Returns, or Days of Bank; and ſo *Hillary* Term hath four Returns, *viz.*

Octabis Hillarii, 8 Days, *Jan.* 20.
Quindena Hillarii, 15 Days, *Jan.* 27.
Craſtino Purificationis, *February* 3.
Octabis Purificationis, *February* 9, that is eight Days after the Purification.

Eaſter Term hath five Returns, *viz.*

Quindena Paſchæ, is 15 Days after *Eaſter.*
Tres Paſchæ, is three Weeks after *Eaſter.*
Menſe Paſchæ, is a Month after *Eaſter.*
Quinque Paſchæ, is five Weeks after *Eaſter.*
Craſtino Aſcenſionis Domini, is the Morrow next after *Aſcenſion Day.*

Trinity Term hath four Returns, *viz.*

Craſtino Trinitatis, being the Morrow after *Trinity Sunday.*
Octabis Trinitatis, being eight Days after *Trinity Sunday.*
Quindena Trinitatis, is 15 Days after *Trinity Sunday.*
Tres Trinitatis, is three Weeks after *Trinity Sunday.*

Laſtly,

Laſtly, *Michaelmas* Term has ſix Returns, *viz.*

Tres Michaelis, is three Weeks after *Michaelmas*, *October* 20.
Menſe Michaelis, is a Month after *Michaelmas*, *October* 27.
Craſtino Animarum, is five Weeks after *Michaelmas*, *November* 3; or the Day after *All-Souls*.
Craſtino Martini, is the Morrow next after St. *Martin*, *November* 12.
Octabis Martini, is eight Days after St. *Martin*, *November* 18.
Quindena Martini, is 15 Days after St. *Martin*, *November* 25.

The other Application of this Word is in caſe of a Replevin; for if a Man diſtrain Cattle for Rent, *&c.* and afterward avow or juſtify his Act, ſo as it be found lawful, the Cattle before delivered unto him that was diſtrained, upon Security given to follow the Action, ſhall now be returned to him that diſtrained them.

Right Aſcenſion of the Sun, Moon, or Star, is that Degree of the Equinoctial counted from the Beginning of *Aries* which riſes with it in a right Sphere: Or it is that Degree and Minute of the Equinoctial which comes to the Meridian with the Sun Moon, or Star in an oblique Sphere; every 15° is equal to 1 Hour, and 360° to 24. See the Table in Page .

Riſing

Riſing of the Sun, Moon, or Star, is their appearing above the eaſtern Horizon. The Time of the Sun's riſing in all Places, is always equal to half the Length of the Night.

Sagittarius, the Archer, or Bowman, thus characterized ♐ : It is the ninth Sign in the Zodiack, the Sun enters it about the 12th day of *November*.

Saturn, the higheſt Planet in the *Syſtem*; he performs his Revolution in 29 Years, 167 days 22 hours, 57″ : He is 298 Times greater than our Earth. In the Inſtrument you have his Conjunction with *Jupiter*, and is thus characterized ♄.

Scorpio, the Scorpion, is the 8th Sign in the Zodiack, thus characterized ♏, into which the Sun enters the 13th Day of *October*.

Setting of the heavenly Bodies, are their going down in the weſtern Horizon. Hence the Time of Sun-ſetting in any Latitude is always equal to half the Length of the Day.

Signs, are the 12 Signs of the Zodiack, *viz.* *Aries* ♈, *Taurus* ♉, *Gemini* ♊, *Cancer* ♋, *Leo* ♌, *Virgo* ♍, *Libra* ♎, *Scorpio* ♏, *Sagitary* ♐, *Capricorn* ♑, *Aquarius* ♒, *Piſces* ♓.

Southern Signs, are *Libra*, *Scorpio*, *Sagitary*, *Capricorn*, *Aquarius*, *Piſces*; becauſe while the Sun continues in them, which is from *September* the 12th, to *March* the 9th following,

ing,

ing, he has both South Declination and Ampli-tude.

Spring-Tides, are made near the New and Full Moons; the Tides are higher than when the Moon is in the Quarters, and the Equinoctiall Spring Tides are the greateſt of all.

Sun, according to Appearance, is one of the ſeven Planets, and gives Light to the other ſix; his mean diurnal Motion is 59′ 8″; he always moves in the Ecliptick, in which he performs one Revolution in 365 Days 5 Hours 49′ 23′, and is 258309 Times greater than our Earth: All his Eclipſes that will be viſible at *London*, you have in the Inſtrument till the Year 1750.

Taurus, the Bull, the ſecond Sign in the Zodiack, marked thus ♉, into this Sign the Sun enters about the 9th Day of *April*.

Terms, at *Weſtminſter*, there be four every Year, during which Time Matters of Juſtice are diſpatched: Two of which are fixed, *viz. Hilary*, and *Michaelmas*, that is, begin and end on certain Days of the Month, which, in the Inſtrument, you will find placed againſt their proper Days in *January*, *February*, *October*, and *November*; the other two, which are called *Eaſter Term* and *Trinity-Term*, are moveable; according as *Eaſter* falls, ſo they fall high or low, ever keeping at a certain Diſtance from *Eaſter*, &c. Theſe two in the Inſtrument are placed in the Segments of Circles amongſt the moveable Feaſts.

Tides

Tides. See Nape and Spring-Tides.

Time begins at Noon.

Venus, one of the ſeven Planets, thus characterized ♀ ; ſhe moves in an Orb, between that of the Earth and *Mercury*, and performs her Revolution in 224 Days 16 Hours and 49′; ſhe is a true Attendant of the Sun, for ſhe is never more than 48° from him. When this Planet will be ſeen in the Sun, the Inſtrument will inform you till the Year 1769. The Orbit of this Planet makes an Angle with the Ecliptick of 3° 24′ only; but for all that, ſhe has ſometimes near 9° of Latitude; ſhe is three times leſſer than our Earth.

Virgo, is one of the 12 Signs of the Zodiack, being the ſixth in order, marked thus ♍, and in the Inſtrument engraved as a beautiful Maid, unto which the Sun comes the 12th or 13th Day of *Auguſt*.

Year. See Julian Year.

Zenith, or *Vertex*, is that Place in the Heavens right over one's Head, being diametrically oppoſite unto the *Nadir*, and is always 90° diſtant every Way from the Horizon; and here note, that the Arch of the Meridian, between the Zenith and Equinoctial, is always equal to the Arch of the Meridian between the Horizon and the elevated Pole, which are the ſame with the Latitude of the Place.

Zodiack, is a Zone or Girdle, ſurrounding the Heavens; it is in Breadth 18°, the Middle of which is the Ecliptick, or apparent Way of the Sun, in which are drawn the twelve Signs as above deſcribed.

A DE

A DESCRIPTION OF THE *INSTRUMENT.*

IT conſiſts of 20 Circles, 12 Segments of Circles, and three Tables.

1. In the firſt Circle is graduated the Line of Numbers, which is the ſame with that Line commonly known by the Name of *Gunter's-Line*: but this has the Advantage of all others, becauſe of its Length, which in Circumference is 58, 43 Inches; for its Diameter is 18 6 Inches, which is almoſt 5 Foot in length, if ſtretched out: By this Line is performed Multiplication, Diviſion, the Rule of Proportion, and Extraction of Roots. But firſt you are to obſerve the Numeration upon this Circle, which is thus: The Figure 1 at the Beginning of the Circle (where you ſee the Word Numbers) may either be 01, or 10 or 100, or 1000, *&c.* then will the other 1 at the oppoſite Part of the Circle (for it is a double Radius) be 1, 10, 100, 1000, 10000, encreaſing all

round in a ten-fold Proportion; and the like may be ſaid of the intermediate Diviſions; for,

If the Figure at End be	The large Diviſions will be	And the next Diviſion will be
.1	.01	.001
1.0	.1	.01
10.	1.	.1
100.	10.	1.
1000.	100.	10.
10000.	1000.	100.
100000.	10000.	1000.

Theſe Diviſions from 1 to 3 in each Radius, are each divided into 10, but from 3 to the End of the Radius, the Primes are divided into 5, and thoſe tenths each into 5, ſo each one of thoſe ſmaller Diviſions are .02, *&c.*

To multiply by theſe Numbers.

Rule. Set the Leg A (of the Sector) to Unity, on the Circle of Numbers, there ſtay it, and move the Leg B to either Sector; as the Sector now ſtands, move the Leg A to the other Sector, and the Hair of the Leg B will cut the Product.

Example.

Multiply	by	Products
7.3	20.2	147.5
5.7	13.5	77.0
9.4	7.6	71.4
4.2	16.9	71.0
6.8	13.1	89.1
14.3	15.7	224.5
1.5	33.8	50.7
18.6	6.2	115.3
3.3	25.4	83.8
2.9	12.9	37.4
8.8	8.8	77.4

3. *Division by the Circle of Numbers.*

Rule. Set the Hair of the Leg A to Unity, and the Hair of the Leg B to the Divisor; here screw the Sector fast, and move the Hair of the Leg B to the Dividend; the Hair of the Leg A will cut the Quotient. *Example.*

Divide	by	Quotient
147.5	7.3	20.2
77.0	5.7	13.5
71.4	9.4	7.6
71,0	4.2	16.9
89.1	6.8	13.1
224.5	14.3	15.7
50.7	1.5	33.8
115.3	18.6	6.2
83.8	3.3	25.4
37.4	2.9	12.9
77.4	8.8	8.8

4. *The single Rule of Three direct, or continual Proportion upon this Circle of Numbers. Rule.*

Set the Hair of the Leg A to the first Term, here hold it fast, and move the Hair of the Leg B to the second Term; here screw the Leg fast, and move the Leg A to the third Term, then will the Hair of the Leg B cut the fourth proportional Term sought. *Example.*

If 2 Yards of Cloth cost 4 *s.* what will 6 Yards cost at that Rate?

If you work according to the Rule above, you will find the Answer to be 12 Yards: For, as 2 : 4 : : 6 : 12.

Secondly, If 15 Yards of any thing coſt 10 *s.* what will 5 ½ coſt?

Anſw. 3° 66, which Fraction 66 of a Shilling is = to 8 *d.*

Note, You muſt always be ſure to have ſpecial Regard to the Numeration upon the Circle, as directed above, otherwiſe you may miſtake an Integer for a Fraction, or 1 for 10, &c. which will cauſe great Errors.

V. *To extract the Square Root upon the Circle of Numbers.*

Rule. Set the Hair A to Unity, and open the other Leg till that opening be juſt half the Diſtance between Unity, and the given Square to be extracted; then will the Hair B cut the Root of that Square: Then for Proof of your Work, move this Opening of the Legs until the Hair A cut the Root above found, for then will the Hair B alſo cut the given Square. *Example.*

What's the ſquare Root of 9?

I ſet the Hair A to Unity, (or 1) and move the Leg B till it is juſt half the Diſtance between that and the given Square 9, and then I find it falls upon 3, the Root ſought, and by the ſame Method I find the Square.

Root of	16	to be	4
	25		5
	36		6
	49		7
	64		8
	81		9
	144		12

VI. *To Extract the Cube Root by the Circle of Numbers.*

Rule. Having found the given Cube upon the Circle, ſet the Hair A to Unity, there ſtay it, and move the Leg B until it is exact $\frac{1}{3}$ of the Diſtance between 1 where the Hair A reſteth, and the given Cube. Now, I ſay, the Hair B cuts the Root ſought. *Example.*

What's the Cube Root of 1728?

I ſet the Hair A to Unity at the Top, (but now I call that 1, 1000, from which I number my Cube) and divides the Space from Unity to 1728 into three equal Parts, and the Hair B doth then fall upon 12, the Root ſought; And after the ſame Manner do I find the Cube.

Root of	8000	to be	20
	15625		25
	27000		30
	45499293		357
	9869198625		2145

Deſcription and Uſe of the Circle of Sines and Secants.

The Line (or rather Circle) of Sines is taken from the Tables of Artificial Sines, which you have in moſt Books of the Mathematicks: It begins with 1, and is numbred round to the right Hand with 2, 3, 4, *&c.* to 90°, which are Degrees; every Degree of which from 1 to 5 inclu-

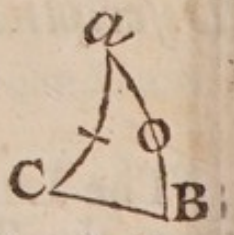
ſive

five are divided into 60 unequal Parts, called Minutes: But the Degrees from 5 to 10 inclusive are divided into every two Minutes, from 10 to 30; every Degree is divided into 5 Minutes, that is, every Division thereof is 5 Minutes; from 30 to 40°, every Division there is 10 Minutes; from 40° to 60 Degrees, every Division is 15 Minutes; from 60 to 70 Degrees, every Division is 30 Minutes; from 70 to 80 Degrees, every Division is one Degree: from 80 to 90 Degrees, every Division is 2 Degrees.

The double Figures which are placed with each Degree of the Sines, are Co-Sines, which serve here for Secants, because that the Co-Sine, or Sine Complement, taken from the double Radius, there remains the Secant of the same Arch. Whole Divisions are the same as in the Sines above-mentioned.

The Use of this Circle of Sines in Spherick Trigonometry, the Doctrine of the Spheres, Geography, Dialling, &c.

First, In the Spherick Triangle, right angled at B, there are given *a* C 40°, and the Angle at C 25° 30′, to find *a* B.



Operation.

Set the Hair B to Radius or Sine of 90°, there hold it, and bring the Hair A to the Sine 40° screw this Opening fast, and move the Sector until the Hair B cut the given Angle C 25°, 30′ then

then doth the Hair A cut 16° 4′, the fourth proportional Sine ſought.

Secondly, *Its Uſe in Geography, two Places, viz.* London *and* Nipcho, *both in the Latitude of* 51° 32′ N. *and differing in Longitude* 116°, *I demand their Diſtance in Engliſh Miles.*

ANALOGY.

As the Radius, or whole Sine of 90°
Is to the Sine Complement of the given Latitude, or Diſtance between the Zenith and Pole,
So is the Sine of half the Difference of Longitude,
To the Sine of half their Diſtance in the Arch of a great Circle.

OPERATION.

Set the Hair B to the Sine of 90, and the Hair A to the Sine Complement of the given Latitude 38′, 28; move this Opening until the Hair B cut the Half of the given Difference of Longitude 38°, 15′, and then doth the Hair A cut the Sine of 31° 56′, which doubled is 63° 52′, which multiplied by 69′½ the Miles in one Degree, gives 4430 ½ Engliſh Miles, the Diſtance ſought.

Thirdly,

Thirdly, *The Use of the Line of Sines in the Doctrine of the Sphere.*

Let it be required to find the Sun's Declination the 9th Day of *April*, or the 12th of *August*, the 12th of *October*, or the 7th of *February*; all which Days the Sun entreth ♉, ♌, ♏, and ♓ being 30 distant from the Equinoctial Points ♈ and ♎, which with the Obliquity of the Ecliptick 23° 30′ are given, to find the Declination that the Sun has then.

Analogy.

As the Radius, or whole Sine of 90
Is to the Sine of the Sun's Distance from the next Equinoctial Point ♈ or ♎,
So is the Sine of the Obliquity of the Ecliptick, or greatest Declination,
To the Sine of the Declination sought.

Operation.

Set the Hair of the Leg B to the Sine 90, and the Hair A to the Sine of 30°, move this Opening of the Sector, until the Hair B cut the Sine of $23°\frac{1}{2}$, the Sun's greatest Declination, and then the Hair A will cut $11°\frac{1}{2}$ in the same Circle of Sines, which is the Sun's Declination then, and is North on the two first Days mentioned, and South on the two last: After the same Manner may the Declination be found in any other Point of the Ecliptick.

Secondly,

Secondly, *For the Sun's Amplitude.*

Example, What is the greateſt Amplitude the Sun can have at *London*; this is when he toucheth the Tropicks of *Cancer* and *Capricorn*?

Analogy.

As the Sine Complement of the Latitude
38° 28′
Is to the Radius, or Sine of 90,
So is the Sine of the Declination
To the Sine of the Amplitude.

Operation.

Set the Leg A to the Sine of 38° 28′, and the Hair B to the Sine of 90; then move this Opening of the Sector, till the Hair A cut the Sine of 23° ½, then will the Hair B cut the Sine of 39° 52′, which is the Sun's Amplitude when he is in either Tropick.

Thirdly, *To find the Sun's Altitude when he is due Eaſt or Weſt at* London.

Example, What Altitude will the Sun have the 22d Day of *April*, at 51′ paſt 6 in the Morning, or at 9′ paſt 5 in the Afternoon, at which Times the Sun is due Eaſt and Weſt?

Ana-

ANALOGY.

As the Sine of the Latitude,
Is to Radius, or Sine of 90,
So is the Sine of the Declination
To the Sine of the Altitude.

Note, This is only of Uſe from the 9th of *March* to the 12th of *September*, that is, while the Sun is in Northern Signs: But by the ſame Method you may find the Sun's Depreſſion under the Horizon, when he comes to the Eaſt and Weſt Azimuths, or is under the Eaſt and Weſt Points of the Compaſs.

OPERATION.

Set the Hair of the Leg A to the Sine of the given Latitude 51° 32′, and the Hair B to the Sine of 9°; then move this Opening that the Hair A may cut the Declination which the Sun has on the 22d Day of *April* 15° 32′, and then doth the Hair B cut the Sine of 20°, which is the Altitude that the Sun hath at the given Time.

Fourthly, *To find the Sun's Altitude at 6 o'Clock in the Morning or Evening, when the Sun is in Northern Signs, or his Depreſſion at that time when he is in the ſix Southern Signs.*

Example. What Altitude has the Sun on *April* the 22d, when his Declination is 15° 32′ North at *London*.

ANA-

Analogy.

As the Radius, or Sine of 90
Is to the Sine of the Latitude 51° 32′
So is the Sine of the Declination 15° 32′
To the Sine of the Sun's Altitude ſought,

Operation.

Bring the Hair B to the Sine of 90, and the Hair A to the Sine of 51° 32′, move this Opening of the Sector till the Hair B cut the Sine of the Declination 15° 32′, then doth the Hair A cut the Sun's Altitude, at that time which is 12° 6′, and ſo high is the Sun at 6 o'Clock, at the given Time and Place. And ſo likewiſe on *October* 24th, or *January* 26th, when the Sun has 15° 32′ South Declination, at 6 o'Clock he will be 12° 6′ below the Horizon. But at *Rome*, whoſe Latitude is 41° 50 N. on thoſe Days, the Sun's Altitude and Depreſſion at 6 o'Clock will be 10° 17′, and ſo for any other Place in the known World, you may expeditiouſly find the ſame.

Laſtly, *To find the Altitude of the Sun any Hour of the Day, when he is in the Equinoctial.*

Example. Let it be required to find the Sun's Altitude on *March* the 9th, or *September* the 12th, when he is in the Equinoctial, and has then no Declination in the Latitude of *London*, at 9 o'Clock in the Morning, or 3 in the Afternoon.

Ana-

ANALOGY.

As the Radius, or Sine of 90
Is to the Sine of the Complement of the Latitude 38, 28,
So is the Sine of the Sun's Diſtance from the Hour of 6,
To the Sine of the Altitude ſought.

OPERATION.

Set the Hair B to the Sine of 90, and the Hair A to the Sine of the Complement of the Latitude of *London* 38° 28′; move this Opening that the Hair B cut 45° the Sine of the given Time 3 Hours from 6 o'Clock, and then doth the Hair A cut the Sine of 26° 6′, and ſuch is the Sun's Altitude at 9 in the Morning, or 3 in the Afternoon at the given Time and Place above-mentioned.

Note, That every Hour in Time is equal to 15° in the Equator. See the Table in pag. and the Word *Equinoctial*.

Deſcription and Uſe of the third Circle, entitled Tangents.

This Circle is taken from the Table of Artificial Tangents, which you will find in moſt Mathematical Books, and begins with 1, and ſo is number'd all round towards the right Hand with 2, 3, 4, 5, *&c.* to 45°, and back again with 46, 47, 48, *&c.* to 89; which ſtands with 1 Degree in a ſmall Character. The Numeration upon this Circle of Tangents is thus, *viz.*

From

From { 1° to 5° / 5 to 10 / 10 to 45 } every Diviſion is { 1 Minute / 2 Min. / 5 Min.

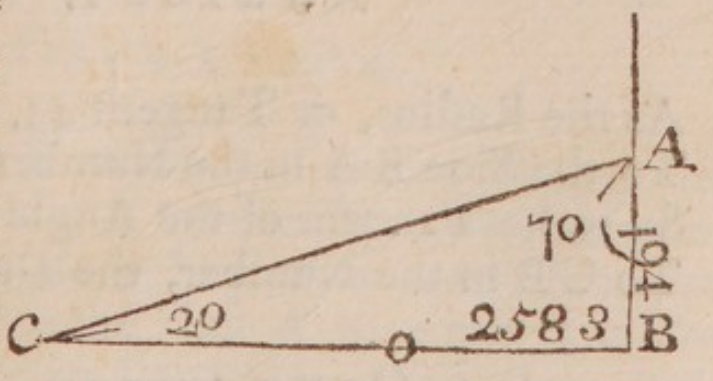
And then back again,

From { 45° to 80° / 80 to 85 / 85 to 89 } every Diviſion is { 5 / 2 / 1

Now having deſcribed the Number, Sines, Secants and Tangents, I ſhall next ſhew their joint Uſe, which are univerſal in all Parts of the Mathematicks; the Numbers and Sines may be uſed alone, as I have ſhewed above, but the Secants and Tangents muſt be uſed jointly with the other, *viz.* with the Numbers and Sines as I ſhall now ſhew,

And firſt, in plain Trigonometry, where I ſhall apply it in taking of Heights and Diſtances, *&c.*

Admit I am on the Top of St. *Paul's*, *London*, whoſe Height is 94 Yards, and there with a Quadrant I obſerve a Place towards *Hamſtead*, and takes the Angle BAC, and finds it to be 70°, I demand how far the Place ſeen is from the Baſe of my ſtanding at B, *viz.* the Side C B is required.



Firſt, By the Sines and Numbers.

Analogy.

As the Sine of the Angle C,
To the Height B A on the Circle of Numbers,
So is the Sine of the Angle A,
To the Diſtance C B.

Operation.

Set the Hair A to the Sine 20°, and the Hair B to 94 in the Circle of Numbers; move this Opening of the Sector forward, towards the right Hand, until the Hair A cut the Sine 70°, then will the Hair B cut 258.3 in the Numbers towards the right Hand, which are Yards, the Diſtance required.

Note, The firſt Figure 2 in the Numbers towards the right Hand, in this Caſe, is 200, and every grand Diviſion next is 10, and every Subdiviſion is one Unite.

Secondly, By the Tangents and Numbers.

Analogy.

As the Radius, or Tangent 45,
To the Side B A in the Numbers,
So is the Tangent of the Angle A,
To C B in the Number, the Diſtance ſought.

Operation.

Set the Hair B to the Tangent 45°, and the Hair A to the Tangent 70; move this Opening for-

forward, till the Hair A cut 94 in the Numbers, then doth the Hair B cut 258.3 in the Numbers, the Diſtance ſought.

2. *The Uſe of the Numbers, Sines, Tangents, and Secants in Plain-Sailing.*

Example, Admit you ſail away N.E. by N. from 48° 12′ N. Latitude, till your Departure be 52 Miles, I demand the Diſtance run, and Difference of Latitude.

Firſt, For the Difference of Latitude, *a b*.

Analogy.

As the Radius, or Sine of 90°
To the Departure *b c* on the Numbers,
So is the Tangent Complement of the Courſe, Angle *c*,
To the different Latitude *a b* upon the Numbers.

Operation.

Set the Hair B to the Radius, or Tangent of 45, and the Hair A to the Tangent Complement of the Courſe 56° 15′, then carefully move this Opening, that the Hair A may cut 52 in the Numbers, the given Departure; and then doth the Hair B cut ſomething more than 78 in the Numbers for the Diſtance run, *a c*.

ANALOGY.

As the Radius, Sine of 90,
To the Departure *bc*, 52 Miles,
So is the ſecant Complement of the Courſe Angle *c* 56° 15′;
To the Diſtance run *a c* in the Numbers.

OPERATION.

Set the Hair B to the Sine of 90, and the Hair A to the Secant of 56° $\frac{1}{4}$ (which is no other than the Sine Complement) move this Opening; that the Hair A may cut the Departure 52 in the Number, and then the Hair B will fall near 94 in the Numbers, the Diſtance ſought; and after this Manner any Queſtion in Plain Traverſe, or Mercator Sailing may be wrought with Truth and Expedition.

3. *The Uſe of the Numbers, Sines and Tangents in the Doctrine of the Sphere, or Practical Aſtronomy.*

Example, June 25, I would know the Sun's right Aſcenſion, having his Place and greateſt Declination given.

ANALOGY.

As the Radius, Sine of 90
To the Sine Complement of the Sun's greateſt Declination, or Obliquity of the Ecliptick,

SS

So is the Tangent of the Sun's Diſtance from the next Equinoctial Point ♈ or ♎ in the Ecliptick,

To the Tangent of the Sun's Diſtance from the ſame Point in the Equinoctial.

On the Day above given, the Sun's Place is ♋ 14° 10′ at Noon, that is 75° 50′ from the next Equinoctial Point ♎.

Operation.

Set the Hair B to the Sine of 90, and the Hair A to the Sine of the Complement of the Sun's greateſt Delination 66°½, ſcrew this Opening faſt and carry the Hair A to cut 75° 50′, the Sun's Diſtance from the next Equinocial Point ♎ in the Tangents, then doth the Hair B cut the Tangent of 74° 37′ the Sun's Diſtance from ♎ reckoned in the Equinoctial, which ſubſtracted from 180° reſts 105° 23′, the Sun's right Aſcenſion reckoned from the beginning of ♈, which I turn into Time (by the Table in pag.) thus,

		H.	′	″
Deg.	105 is	7	0	0
Min.	15 is	0	1	0
Min.	8 is	0	0	32
Sum		7	1	32

Sum 7 1 32 is the Sun's right Aſcenſion in Time.

2. *To find the Sun's right Aſcenſion by having the Sun's preſent and greateſt Declination given.*

ANALOGY.

As the Radius, Sine of 90
To the Tangent Complement of the greateſt Declination $23^{\circ}\frac{1}{2}$,
So is the Tangent of the preſent Declination,
To Sine of the Right Aſcenſion.

Example, Let the Sun's Declination be 22°, 45 N.

OPERATION.

Set the Hair B to the Sine of 90, and the Hair A to the Tangent of $66\frac{1}{2}$; move this Opening of the Sector till the Hair A cut the Tangent of the Sun's Declination 22° 45′, and then doth the Hair B cut the Sine of 74° 37′ the Sun's Diſtance in the Equinoctial from *Libra* as before.

3. *To find the Aſcenſional Difference, alſo the Sun's Riſing and Setting, and the Length of the Day and Night in any Latitude.*

ANALOGY.

As the Radius, Sine of 90
To the Tangent of the Latitude,

So

So is the Tangent of the Sun's Declination on the Day propoſed,

To the Sine of the Aſcenſional Difference in Degrees and Minutes, which muſt be reduced into Time by the Table, p. and if the Declination be North, add the Aſcenſional Difference in Time to 6 Hours gives the Sun's ſetting at that Time and Place, which doubled is the Length of the Day, whoſe Complement to 24 Hours is the Length of the Night, and the Sun's ſetting ſubſtracted from 12 Hours leaves his riſing: But if the Sun's Declination be South, then the Aſcenſional Difference in Time ſubſtracted from 6 Hours leaves the ſetting, whoſe Complement to 12 Hours is the riſing, and then the Length of the Day and Night is ſhewed as above.

Example, *Auguſt* 29th 1725, I would know the Aſcenſional Difference, the Time of the Sun's riſing and ſetting, the Length of the Day and Night for *London* and *Rome*.

Operation for *London*.

Note, The Sun's Place and Declination taken at Noon, will be near enough for a Work of this Nature.

Set the Hair B to the Sine 90, and the Hair A to the Tangent of the Latitude 51° 32′; move this Opening till the Hair A cut the Sun's Declination that day at Noon 5° 16′, and then doth the Hair B cut the Sine of 6° 40, and ſuch is the Aſcenſional Difference ſought, which reduced into Time is 26′ 40″. Now becauſe the Sun has

North Declination, I add this to 6 Hours, ſo thee

	H.	′	″
Sun ſets that Night at	6	26	40
And riſeth at	5	33	20

6	26	40	doubled is	12	53	20	Day.
5	33	20		11	6	40	Night.

Operation for *Rome*.

Set the Hair B to the Sine 90, and the Hair A to the Tangent of the Latitude of *Rome* 41° 50′; move this Opening till the Hair B cut the Tangent of the Sun's Declination 5° 16′, and then doth the Hair A cut the Sine of 4° 44′ the Aſcenſional Difference ſought.

Caution.

In all Analogies wrought by this Inſtrument, you muſt carefully mind whether your ſecond Tangent be more or leſs than 45°; if it be more, as in the Caſe above, where the Latitude of *London* is 51°½, then doth that Hair that lay at Radius, give you the fourth Term or Anſwer: But if the ſecond Term, *viz.* Tangent, be leſs than 45°, as in the Caſe above for *Rome*, where it was 41° 50′, then the ſame Hair that lay at Radius, muſt lie at the third Term, and the Hair that cut the ſecond Term will give the fourth Term. The Reaſon of this is, becauſe the Tangent of 45° is equal to the Sine of 90°, and that then the Tangents above 45 encreaſe exceedingly.

Now

Now this 4° 44′ turn'd into Time is 18′ 56″, which added to 6H. makes 6 H. 18′ 56″, the Time of the Sun's ſetting at *Rome* on the given Day above.

				H.	′	″
6	18	56	Sun ſets, doubled is	12	37	52
5	41	4	Riſes, doubled is	11	22	8

for the Length of the Day and Night at *Rome*.

4. *The Latitude of the Place of Habitation, with the Sun's Azimuth given, to find his Altitude upon that Azimuth.*

ANALOGY.

As the Radius, Sine of 90
To the Tangent of the Latitude,
So the Sine of the Sun's Azimuth from the Eaſt or Weſt,
To the Tangent of his Altitude.

Example, Let the Latitude of the Place be *London*, and the Sun's Azimuth from the Eaſt or Weſt 9° 40′, What's the Altitude?

OPERATION.

Set the Hair B to the Sine of 90, and the Hair A to the Tangent 51° 32′, then move this Opening until the Hair A cut the Sine of 9° 49′, (mind the Caution in pag. 40) and then doth the Hair B cut 12° 6′ in the Tangents, and ſo high is the Sun at that Time and Place.

5. *Given*

5. *Given the Elevation of the Pole, the Sun's Declination and Hour, or Sun's Diſtance from the Meridian, to find the Sun's Altitude.*

ANALOGY.

As the Radius, Sine of 90
To the Tangent Complement of the Latitude.
So Sine Complement of the Sun's Diſtance from Noon,
To the Tangent of a fourth Arch.

Now Note,

If the Time given be between 6 in the Morning, and 6 at Night, then this fourth Arch muſt be ſubſtracted from the Sun's Diſtance from the North Pole.

But if the Time be before 6 in the Morning, or after 6 at Night, then add this fourth Arch to the Sun's Diſtance from the North Pole, the Sum or Difference is the fifth Arch.

Now ſay,

As the Sine Complement of the fourth Arch,
To the Sine of the Latitude of your Habitation.
So is the Sine Complement of the fifth Arch.
To the Sine of the Sun's Altitude.

Example. What's the Sun's Altitude the 22d Day of *April* at *London* at 9 in the Morning, or 3 in the Afternoon?

OPE-

Operation.

Set the Hair B to the Sine of 90°, and the Hair A to the Tangent Complement of the Latitude of *London*, 38° 28′; move this Opening, that the Hair B may lie on the Sine of the Sun's Distance, from 6 o'Clock, which in this Example is 45°, and then doth the Hair A cut the Tangent of 29° 20′, which is the fourth Arch.

From a Quadrant	90°	0′
Take the Sun's Declination	15	32
Reſt the Sun's Diſtance from the North Pole.	74	28
The fourth Arch ſubſtracted	29	20
Remains the fifth Arch	45	8

Then ſet the Hair B to the Sine Complement of the fourth Arch, *viz.* 60° 40′, and the Hair A to the Sine of the Latitude of *London* 51° 32′; move this Opening until the Hair cut the Sine Complement of the fifth Arch 44° 52′, and then doth the Hair A cut the Sine 39° 19′, the Altitude ſought: And thus may the Sun's Altitude at any Time and Place be exactly and ſpeedily found.

6. *Given the Latitude of the Place, the Sun's Declination and Altitude, to find the Hour of the Day.*

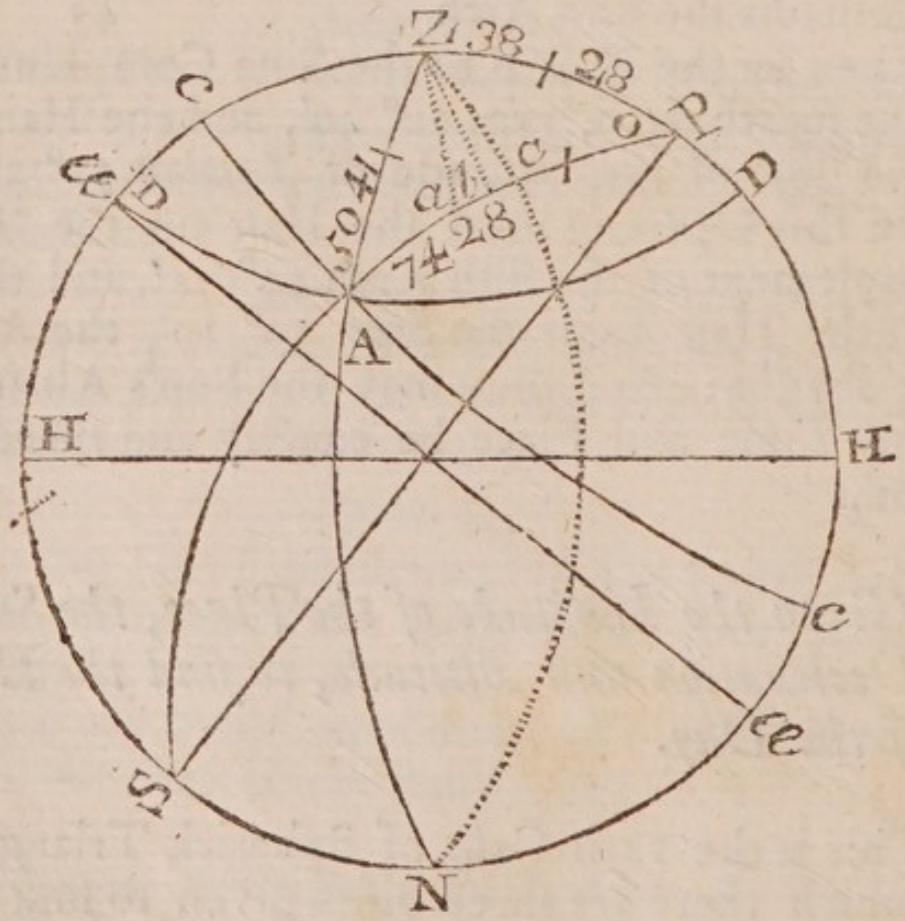
This is the 11th Caſe of Spherick Triangles, in which there are three Sides given to find the Angle at the Pole.

Example.

Example. *April* 22d, at *London* the Sun's Declination 15° 32′, Altitude 39° 19′, what's the Hour?

This will be performed with more Difficulty than the foregoing Problems were to thoſe unskill'd in Spherick *Trigonometry*, for whoſe ſakes is inſerted the annexed Scheme for Demonſtration Sake.

The primitive Circle repreſents the Meridian of the Place, P the North Pole, S the South, *ææ* the Equinoctial, HH the Horizon, HD the Sun's Altitude 39 19, HP the Latitude 51 32, *æc* the Declination 15 32, in the oblique Spheric Triangle, AZP.



ZP

ZP, AP, AZ } is the Complement of the { Lat. 38° 28′, Decl. 74 28, Alt. 50 41 } Given,

o find the Angle APZ, or Time from Noon.

Rule, Take half the longeſt Side, *viz.* AP 4° 28′, half is 37° 14′.

2. Take half the Sum of the other two Sides, *viz.* AZ 50° 41 added to ZP 38 28, their Sum is 89° 9′, half is 44° 34′.

3. Take half the Difference of the two ſhorteſt Sides, *viz.* AZ and ZP, their Difference is 12° 13′, half is 6° 6½. Now ſay,

As the Tangent of half the longeſt Side
To the Tangent of half the Sum of the other two Sides,
So is the Tangent of the Difference of the two ſhorteſt Sides,
To the Tangent of half the Difference of the Segment of the Baſe, which in this Caſe before us ſubſtracted from half the Baſe *b*P leaves *c*P.

Then in the right Angle ſpherical Triangle *zc*P, right angled at *c*, I ſay,

As the Radius Sine 90,
To Tangent *c*P, above found,
So Tangent Complement ZP,
To the Sine Complement of the Angle *c*PZ.

Operation.

Set the Hair A to the Tangent 37° 14′, and the Hair B to the Tangent 44 34; move this Opening until the Hair A cut the Tangent 6° 6½, then will the Hair B cut the Tangent

7°

7° 54′; ſubſtract this 7° 54′ from *b*P 37 14, and the Remainder is 29° 20′ *c*P.

Now, ſet the Hair B to the Sine of 90, and the Hair A to the Tangent Complement of the Side ZP, *viz.* to the Tangent of 51 32; then carefully move this Opening of the Sector, until the Hair A cut the Tangent of 29° 20′ (equal to the Side *c*P) and then doth the Hair B cut the Sine Complement of 45° nearly, and ſo much is the Angle at the Pole required, which reduc'd into Time, is three Hours; ſo the Time of the Day is either nine in the Morning, or three in the Afternoon. And by what goes before, it is evident, that any Problem in the Sphere may ſpeedily and exactly be wrought by the Inſtrument, ſo I think it needleſs to give any more Examples of that kind; only to make good my Promiſe, I ſhall ſhew their Uſe in Dialling.

7. *The Uſe of the Sines and Tangents in Dialling.*

Firſt, For an horizontal Dial.

Analogy.

As Radius Sine 90,
Is to the Sine of the Latitude of your Habitation,
So are the Tangents of 15°, 30°, 45°, 60°, and 75°, ſeverally in the Equator,
To the Tangents of the Diſtances of the Hour Lines of 1, 11; 2, 10; 3, 9; 4, 8; 5

and

and 7 from the Subſtile or Meridian upon the Plane.

Example, I would have the Hours Diſtances of an horizontal Dial for the Latitude of *London*.

Operation.

Set the Hair B to the Sine of 90, and the Hair A to the Sine of the Latitude of *London* 51° 32'; ſcrew this Opening of the Legs faſt, and move the Hair B to cut the Tangent of 15, then doth the Hair A cut the Tangent of 11° 51'; and ſuch is the Diſtance of the hour Lines of 1 and 11 from the Subſtile, and after the ſame manner you will find the other hour Lines, quarters and half hour Lines, as exhibited in the adjacent Table. But when the Tangent in the Equator, which in the Proportion is your third Term, exceeds 45, then doth the Hair B that lay at Radius give the fourth Term; mind the Caution in Page 40.

The firſt Column is the Hours, half hours and quarters; in the Second is contain'd

H.		° '	° '
12		0 0	0 0
	¼	3 45	2 56
	½	7 30	5 52
	¾	11 15	8 51
11	1	15 0	11 51
	¼	18 45	14 52
	½	22 30	17 57
	¾	26 15	21 6
10	2	30 0	24 20
	¼	33 45	27 36
	½	37 30	31 0
	¾	41 15	34 28
9	3	45 0	38 3
	¼	48 45	41 45
	½	52 30	45 34
	¾	56 15	49 30
8	4	60 0	53 35
	¼	63 45	57 47
	½	67 30	62 6
	¾	71 15	66 33
7	5	75 0	71 6
	¼	78 45	75 45
	½	82 30	80 25
	¾	86 15	85 13
6	6	90 0	90 0

tain'd the Degrees and Minutes in the Equinoctial anſwering to thoſe Hours, being the ſame with the Angle at the Pole; the third and laſt to the right Hand contains the Degrees and Minutes of each Hour Diſtance upon the Plane.

Laſtly, *For the Hour Diſtances upon a vertical North and South Plane.*

ANALOGY.

As Radius, Sine 90
To the Sine Complement of the Latitude of your Habitation,
So are the Tangents of 15, 30, 45, 60 and 75°, being the Angle at the Pole of each ſeveral Hour Line,
To the Tangents of the Diſtances of the Hour Lines of 1, 11; 2, 10; 3, 9; 4, 8; 5, 7; as this Table ſheweth.

Operation.

Set the Hair B, to the Sine of 90, and the Hair A to the Sine of 38° 28′ (it being the Complement of the given Latitude 51° 32′) ; to this opening ſcrew the two Legs of the Sector faſt, and move the Hair B to cut 15° in the Tangents, and then doth the Hair A cut the Tangent of 9° 28′, which is the Diſtance of the hour Lines of 1 and 11 from the Subſtile or twelve o'Clock ; and thus by the Inſtrument you may examine this Table, or make another for any given Place. I ſuppoſe my Reader to be acquainted with Dialling, ſo I ſhall forbear to ſhew how to delineate the hour Lines when calculated, or the making of any other Dial, becauſe that is not my preſent Deſign, but to ſhew only the Uſe of the Inſtrument.

Hours	Ang. at the Pole	Hour Diſtan.
12	0 0	0 0
1	3 45	2 20
2	7 30	4 41
3	11 15	7 3
1 ·	15 0	9 28
1	18 45	11 56
2	22 30	14 27
3	26 15	17 4
2 ·	30 0	19 45
1	33 45	22 35
2	37 30	25 32
3	41 15	28 38
3 ·	45 0	31 54
1	48 45	35 22
2	52 30	19 3
3	56 15	42 58
4 ·	60 0	47 9
1	63 45	51 36
2	67 30	56 20
3	71 15	61 23
5 ·	75 0	66 42
1	78 45	72 17
2	82 30	78 3
3	86 15	84 0
6 ·	90 0	90 0

4. *The Deſcription and Uſe of the Space between the third and fourth Circles.*

This great Space is divided into 12 equal Parts, in which are engraved the Figures of the Zodiacal Conſtellations, as the Ram, the Bull, the two naked Boys, the Crab-fiſh, the Lyon, the Virgin, the Ballance or Pair of Scales, the Scorpion, the Archer or ſhooting Horſeman, the Goat, the Water-bearer, and the two Fiſhes.

In this ſame Place, you have alſo all the Eclipſes of the Sun and Moon, that will be viſible at *London*, until the Year 1750, as for Example, looking upon the Inſtrument, I ſee 1724 ☉ 6^h 36′ D $11\frac{3}{4}$, upon which lay one of the Hairs of the Sector, and it will cut the 11th Day of *May*, which is to inform you that the Sun is then eclips'd, and the greateſt Darkneſs thereof will be at 36 Minutes paſt ſix at Night, when $11\frac{3}{4}$ Digits will be eclipſed on the under ſide, as the D for Digits ſignifies; *Note*, That with Rays about it, thus ☉, is the Sun, and that without Rays, thus ●, is the Moon; and when the Luminary is but Part eclipſed, there it is alſo ſhewed thus ◠; when the lower Side is eclipſed, or thus ◡, when the upper Side is obſcured; whenever you find the Figures, which repreſent the apparent Time of the middle Eclipſe to be more than 12, that the Exceſs above 12 is the Time the next Morning, as 17 Hours is at 5 the next, *&c.* for all aſtronomical Times begin at Noon on one Day, and ends at Noon the next

next; see the Word *Time*. *Example* 2, On *Sept.* 8d 15h 2′, *Anno* 1736, you will find ● 15 2 D 20½, which tells you that the Moon is totally eclipsed at 2′ past three in the Morning on the ninth of *September* 1736.

Also here you have the Conjunction of Saturn, Jupiter and Mars, ☌ ♄ ♃ ♂, in 24° ♐, to which lay the Hair of the Sector, and it cuts *December* 29 1722, the Time when that Conjunction happened.

In the same Space you will also find when the two inferior Planets, Venus and Mercury, may be seen in the Sun. As for Instance, In one of the Twins, you will find 1761 ♀ in ☉ at 10 M, which is to inform you that at ten o'Clock in the Morning, or Forenoon, the Planet Venus may be seen in the Sun, to which lay your Hair, and it cuts *May* 26.

And *Anno* 1769 ☿ in ☉ at 9 N. to which lay the Hair, and it cuts *October* 29. And *Anno* 1776 ☿ in ☉ at N. to which lay the Hair, and it gives you *October* 22, the Day when that happens: *Note*, Whenever you find a Figure with an N annexed, tells you that is at Night, at so many Hours as the Figure expresses; but when you meet with an N, and no Figure annexed, as in the Years 1736, and 1743, then that Time is at Noon. Farther note, That when two several Eclipses, conjunction Transits, &c. happened upon one and the same Day, that then you will find them plac'd in the Space between Circle 12th and 13th, amongst the Saints Days; as for Instance, in the Years 1736 and 1743, on *October* 31, and *October* 25, you will find two Transits of ☿ over the Sun's Disk, placed here

for the Reaſon above given: And likewiſe an Eclipſe of the Moon on the 14th Day of *February*, *Anno* 1747. Theſe Eclipſes and Tranſits are not only pleaſant for Gentlemen to contemplate, but alſo uſeful to Mankind in general, as being helpful in determining the Difference of Meridians between any two Places upon this terraqueous Ball.

5. *Deſcription and Uſe of the Fifth Circle.*

Note, The 4th Circle is nothing but an Abounddary of the 5th.

The 5th Circle, as mark'd on the Legs of the Sector, contains the Signs of the Zodiack, which are 12 in Number, noted by their proper Characters, each Sign being divided into 30 equal Parts call'd Degrees, and Numbers with 10, 20, 30, each; in this you have the Sun's Place anſwering to each Day in the Year, as I ſhall ſhew when I come to ſpeak of the Days, *&c.*

6. *Deſcription and Uſe of the Sixth Circle.*

In this Circle you have the Sun's right Aſcenſion in Time, beginning with one Hour, and numbred round with 2, 3, 4, *&c.* to 24 Hours; this Circle is unequally divided, to anſwer the Sun's Place each Day in the Year, every Diviſion of which is one Minute in Time; its Uſe is to find the Time of Southing of the Planets and fixed Stars; for if from the right Aſcenſion of the Moon or Star, you take the Sun's right Aſcenſion

ſion in Time, there will remain the Hour and Minute of their Southing: By laying the Hair of the Sector to the Day of the Month in the 12th Circle, or to the Sun's Place in the 5th Circle, it will give you the Sun's right Aſcenſion at that Time: And ſo for the Moon or any Star that are in or near the Ecliptick, by laying the Hair to their Longitude, it gives you their right Aſcenſion in Time: But if the Moon or Star have Latitude (as frequently they have) it increaſes, or diminiſhes the right Aſcenſion according to the Star's Place at that Time, for if it have North Latitude and be

In ♈ ♒ ♓ ♈ ♉ ♊ Decreaſes
♋ ♌ ♍ ♎ ♏ ♐ Increaſes } right Aſcenſion.

But if the Star have South Latitude

In ♑ ♒ ♓ ♈ ♉ ♊ Increaſes
♋ ♌ ♍ ♎ ♏ ♐ Decreaſes } right Aſcenſion.

I ſhall here ſubjoin a new Table, ſhewing in each Sign, to 9° of North and South Latitude, how much you ſhall add or ſubſtract to or from the right Aſcenſion in the Ecliptick found by the Inſtrument, that ſo you may gain the true right Aſcenſion of the Star anſwering unto its Latitude and Longitude.

Add.

N. / Latitude. / S.	1	2	3	4	5	6	7	8	9
♋ ♑	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
♌ ♒	0 52	1 48	2 44	3 40	4 40	5 40	6 40	7 40	8 40
♍ ♓	1 24	2 52	4 20	5 48	7 16	8 48	10 20	11 52	13 24
♎ ♈	1 32	3 8	4 44	6 20	7 56	9 32	11 8	12 48	14 28
♏ ♉	1 28	2 52	4 16	5 40	7 40	8 21	9 52	11 16	12 40
♐ ♊	0 56	1 48	2 44	3 36	4 28	5 16	6 8	6 56	7 44

Subſtract.

N. / Latitude / S.	1	2	3	4	5	6	7	8	9
♋ ♑	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
♌ ♒	0 56	1 48	2 44	3 36	4 28	5 15	6 8	6 56	7 48
♍ ♓	1 28	2 52	4 16	5 40	7 4	8 28	9 48	11 16	12 40
♎ ♈	1 32	3 8	4 44	6 40	7 56	9 32	11 8	12 48	14 24
♏ ♉	1 24	2 52	4 20	5 28	7 16	8 48	10 20	11 52	13 28
♐ ♊	0 52	1 48	2 44	3 40	4 40	5 40	6 40	7 40	8 40

The Use of this TABLE.

With the Longitude of the Planet or Star, enter the 5th Circle of the Inſtrument, to which lay the Hair of the Sector, and then it will cut the 6th Circle, and give you its right Aſcenſion: Suppoſing it to be the Ecliptick; thus done, enter this Table with the Star's Latitude on the Head, and Longitude in the firſt or ſecond Column, and in the Angle, or Place of Meeting, you have the Minutes and Seconds in Time to be added to, or ſubſtracted from, the right Aſcenſion, as the Table directs above found, and the Sum or Remainder will be the true right Aſcenſion of that Star. *Example*, *Anno* 1725, *December* 3, I would know at what Time the Moon will be upon the Meridian in the South: The Moon is 10 Days old, and conſequently the eſtimate Time of Southing is at eight at Night, at which Time I find her Place in Longitude to be ♈ 16° 58′, in Latitude 0° 56′ South; now, I turn to the Inſtrument and move one of the Hairs of the Sector to the Longitude of the Moon, ♈ 16° 58′, and it cuts the right Aſcenſion in one Hour two Minutes; this done, with the Moon's Latitude 56′ South, I turn to the annexed Table, and enter ♈ South Latitude, with one Degree (and by making Proportion for the 16 Degrees of Longitude) I find 1′ 30″ with the Title Add, therefore to the right Aſcenſion above found, as in the Ecliptick 1^h 3′ 30″, the Moon's true right Aſcenſion; then to the Time propos'd, the Sun's Place is ♐ 22° 54′, to which bring one of the Hairs in the Inſtrument, and it cuts 17^h 28′ $\frac{1}{3}$ for the Sun's right Aſcenſion, which

ſubſtracted from the Moon's right Aſcenſion) by firſt adding 24 Hours, which you muſt always do when need requires) there remains 7^h 35′ 10″, the true Time of Night that the Moon will be upon the ſouth Part of the Meridian.

7. *The Deſcription and Uſe of the Seventh Circle.*

This Circle gives the Sun's Declination every Day in the Year, and is divided and laid down according to the Sun's Place, or Days of the Month, into four grand unequal Diviſions, beginning ♈ and ♎ and numbred each Way to ♋ and ♑ with 10°, 20°, 23° 30′, being the Sun's greateſt Declination when he enters the tropical Signs ♋ and ♑. Every Diviſion of this Circle, from 0° to 23° is 15′, but from 23° to 23° 30′ (here the Declination alters but ſlowly) each Diviſion is 5′ till you come to 23°, 25′, and then you have four Dots, every one of which is a Minute, which brings you to 23° 30′ the greateſt Declination.

The Sun's Declination increaſes from the 9th of *March* to the 10th of *June*, and from the 12th of *September* to the 10th of *December*; in the former Caſe it is North, and in the latter, South.

It decreaſes from the 10th of *June* to the 12th of *September*, and from the 10th of *December* to the 9th of *March*; in the firſt Caſe it is North, and South in the latter; ſo that from *March* 9, to *September* 12, the Sun has North Declination; that is, while he is running

thro

thro' theſe ſix Signs ♈, ♉, ♊, ♋, ♌, ♍: And from *September* 12, to *March* 9, he has ſouth Declination; that is, while he is running thro' theſe ſix Signs ♎, ♏, ♐, ♑, ♒, ♓, as the Inſtrument plainly ſheweth.

Example, What's the Sun's Declination the third of *July*?

OPERATION.

Lay the Hair to the Day of the Month in the 12th Circle, or to the Sun's Place ♋ 21 48 in the 5th Circle, and it will cut the Circle of Declination in 21° 44′, and is North as the Title directs. I might here ſubjoin Tables (as I have done for the right Aſcenſion) to make the Inſtrument ſerviceable in the Planets and Stars Declinations, but that would cauſe the Book to ſwell too much; beſides I ſhould then exceed the Bounds of my intended Deſign.

8. *The Deſcription and Uſe of the Eighth Circle, as mark'd on the Sector.*

This Circle gives you the Sun's Amplitude, ſerving only for the Latitude of 51° 32′; beginning at ♈ and ♎, and numbred each Way with 10, 20, 30, 39° 52, ending at ♋ and ♑, being the greateſt Amplitude that can happen in the Latitude abovemention'd, *See Page* : Every Diviſion of which is 30′ till you come to 39°, and then each Diviſion is 10′, which bring you to 39° 52′, the greateſt Amplitude; it increaſes and decreaſes as the Declination doth, which ſee,

and

and is always North, when the Sun is in northern Signs; and South, when he is in ſouthern.

Example, What's the Sun's Amplitude, *July* 3?

Operation.

Lay the Hair of the Sector to either the Day of the Month in the 12th Circle, or to the Sun's Place in the 5th Circle, and it will cut the eighth Circle in $36° \frac{2}{3}$, the Amplitude of riſing and ſetting from the Eaſt and Weſt to the Northward. It is of great Uſe to Mariners to find the Variation of the Compaſs.

9. *The Deſcription and Uſe of the Ninth Circle, as mark'd on the Sector.*

This Circle ſhews the Sun's riſing and ſetting every Day in the Year, for the Latitude of 51′ 32″; in which the Roman Letters ſtand for his riſing, and the common Figure the ſetting; every Diviſion of which Circle is a Minute in Time, in which you may obſerve the Sun riſes on the 10th of *June* (being the longeſt Day) at 3^h 47′ 16″, and ſets that Night at 8^h 12′ 44″ which are the Complement of each other to 12 Hours; the Double of the Sun's ſetting, always gives the Length of the Day; ſo the longeſt Day in Latitude of *London* is 16^h 25′ 28″, which taken from 24 Hours leaves the Length of the Night, 7^h 34′ 32″, *See Page* 17, the Words *Riſing* and *Setting*. When you would find the Sun's riſing and ſetting for any Day propoſed, lay

lay one of the Hairs of the Sector to the Day of the Month, and it cuts this 9th Circle in the Hour and Minute of the Sun's rising that Day.

Example, *July* 4, I would know the Time of the Sun's rising and setting, the Length of the Day and Night, and how much the Days have decreas'd.

Operation.

Lay the Hair of the Sector to the given Day, *July* 4, and it cuts this 9th Circle at 40″ past 4, the Sun's rising; and 40″ before 8, his setting; which doubled, is 15^h 58′ 40″, the Length of the Day; this substracted from the longest Day at *London* 16^h 25′ 28″, rests 26′ 48″, and so much are the Days shortned.

10. *The Description and Use of the Tenth Circle, as mark'd on the Sector.*

This Circle gives you the Equation of natural Days, commonly called the Equation of Time, the Reason of which you have under that Word, to which I refer you; it is numbred round with Figures, which signifies Minutes, and the Divisions are Seconds, every one of which is 15″. There are four Days in the Year that the Sun and pendulum Clock go together, which are these,

April 4
June 6
August 20
December 12

with these Words, fast, slow, which tells you whether the Watch is faster or slower than the Sun.

There

There are alſo four Days in the Year on which the greateſt Equations happen, *viz.*

			′	″	Watch too
January	30	Equations	4	59	faſt.
May	4		4	13	ſlow.
July	15		5	46	faſt.
October	23		16	9	ſlow.

When you would find the Equation of any Day, you have no more to do than to lay the Hair of the Sector to the Day of the Month, and there is the Equation given.

Example, *July* 5, I would know the Equation, and whether the Sun, which ſhews the apparent Time, or the Watch, which ſhews the equall Time, is then the faſteſt.

Operation.

Lay the Hair of the Sector to the given Day, *July* 5, and it cuts this 10th Circle in 5′ 14″, Watches too faſt.

Note, On each Side of the four Days of the greateſt Equation, you will meet with half Diviſions, which are 5″ each, as againſt *July* 9 and 11, ſhort of the Day of the greateſt Equation, and on *July* 19 and 21; on the other Side the greateſt Equation you will meet with four ſuch half Diviſions.

11. *The Description and Use of the Eleventh Circle, as marked on the Sector.*

This Circle contains the Letters proper for each Day in the Year, being the first Seven of the Alphabet, and serveth to find the Day of the Week, having first found the Sunday Letter, which is always one of those Seven, in a common Year; but the Leap-Year hath two, the first serving from the first of *January* to the 24th of *February*, and the other Letter from thence to the Year's End.

The Letter that begins each Month in the Year is known by the first Letter of the following Words, *viz.*

At, Dover, Dwells, George, Brown, Esquire,
Jan. Feb. March, April, May, June,
Great, Charles, Finch, And, David, Frier,
July, August, Sept. Octob. Nov. Dec.

By which you may observe, that *January* and *October* begins with an A; *February*, *March*, and *November* with D; *April* and *July* with G; *May* with B; *June* with E; *August* with C; and *September* and *December* with the Letter F. By these several Letters are the Days of the Week known, for having first found your Sunday Letter for the given Year, the next Letter in Order is Monday, the next Tuesday, *&c.*

Example, I would know what Day of the Week the 6th of *July*, in the Year 1725.

The

The Dominical or Sunday Letter is C, which I look for in the given Month *July*, and I find it placed with the 4, 11, 18 and the 25 Days, which are all Sundays in *April* and *July*, therefore if the 4th be Sunday, then the 5th is Monday, and the 6th is Tuesday, *&c.*

Example 2, What Day of the Week doth *Christmas-day* fall on, in this Year 1725? Having found the Sunday Letter C, for the given Year 1725; I find it plac'd against the 5, 12, 19 and 26 Days in *September* and *December* (according to the Verse in Page 61) which Days are all Sundays. then the 25th is Saturday.

12. *The Description and Use of the Twelfth Circle, as mark'd on the Sector.*

This Circle contains the Months with the Days in each; the Number of Days in each Month are expreſt by the Roman Character, and each particular Day by a Graduation, and numbred with 10, 20, 30, or 31; and in *February* the Days are numbred with 10, 20, 28, which are the Number of Days that Month contains in a common Year, but in the Leap-Year, it has 29 Days; but, however, the Days in every Month anſwering the Sun's Place in general thro' a Revolution of four Years, therefore the Leap-Year and the three common Years are reduc'd to an Equality, in which the Leap-Day is diſtributed amongſt them all four. For in every of the three common Years the Sun's Place is on the ſame Day of the Month in the following Year leſs by 14′ 20″, but in the Leap-Year it is increas'd by 44′ 48″, that is the Motion of a Day, 59′ 8″, leſſen'd by

by 14′ 20″, as is evident from the following Table deduced from Calculation.

January 1,	1721	☉ ♒	22°	20′	At Noon.
	22	☉ ♒	22	5	
	23	☉ ♒	21	51	
	24	☉ ♓	21	36	
	25	☉ ♒	22	22	

June 1,	1721	☉ ♊	21	16	At Noon
	22	☉ ♊	21	2	
	23	☉ ♊	20	48	
	24	☉ ♊	21	31	
	25	☉ ♋	21	17	

December 1,	1721	☉ ♐	20	30	At Noon.
	22	☉ ♐	20	15	
	23	☉ ♐	20	0	
	24	☉ ♐	20	46	
	25	☉ ♐	20	31	

By which it appears, that in finding the Sun's Place by the Inſtrument, there will be no leſs than 30′ Difference on the ſame Day of the Month in the firſt paſt Leap-Year, and on the third paſt Leap-Year: But the Inſtrument being (*viz.* the Days of the Month and Sun's Place) adapted to the firſt after Leap-Year; therefore, if it be 2d paſt, then ſubſtract 14′ 20″ from the Place by the Inſtrument, and in the 3d paſt Leap-Year ſubſtract 28′ 40′, but in the Leap-Year add 44′ 48″, and you will by this Method

Method come at the Sun's true Place, agreeing with Calculation.

Example, what's the Sun's true Place on *September* 8, at Noon, in the following Years 1725, 26, 27, and 1728?

Operation.

Lay the Hair of the Sector to the given Day, and it cuts the 5th Circle in ♍ about 26° ½, then because the Year 1725 is first past Leap-Year, I conclude that to be the Sun's true Place for that Day and Year; then from ♍ 26° 30′ 00″

Sub. 14⅓

Rest ☉ Place 1726 the same Day 26 15 40

Sub. 14 20

Rest ☉ Place 1727 the same Day 26 00 20

Add 44 48

Sum ☉ Place 1728 the same Day ♍ 26 45 8

By this Method you will nearly come at the Sun's true Place at any Time.

13. *The Description and Use of the Thirteenth Circle, as marked on the Sector.*

In this Circle are placed the fixed Feasts, Terms and their Returns, answering to the Days of the Month in the 12th and 14th Circles; and there you have also a Transit of Mercury over the Sun, with a Lunar Eclipse, as mention'd in Page

as

as for Example, lay the Hair of the Sector even with the Bottom of any Word herein mention'd, and it will cut the Days of the Month in the 12th and 14th Circles that such Feast falls upon; as for Instance, St. *James* I find to be *July* 25, and looking in *January*, I find Term begins; the Hair laid to the Bottom of the Word (that is even with the Line that the Word is suppos'd to stand in) and it cuts the 23d Day of the Month, the Day that *Hillary* Term begins; but when that Day is Sunday then the Term begins on Monday, and likewise on Monday in *Michaelmas* Term, *&c.*; these are call'd fix'd Terms, because they keep one certain Day of the Month, as you may find them placed in the Instrument: Also in the Calendar Circle you will find the Words Fire of *London*, to the Bottom of which lay the Hair, and it will cut *September* 2, which is the Day on which that great Conflagration begun in the Year 1666. Lastly, I find wrote Octab. Pur. (see the Word *Return*) the Hair laid to it will give *Feb.* 9, for the last Return of Hillary Term, which signifies Octabis Purificationis, that is eight Days after the Purification of our blessed Virgin *Mary*; and in this Circle the Days are represented by Dots, and figured with 10, 20, 30 and 31, as the Month has 30 or 31 Days.

14. *The Description and Use of the Fourteenth Circle, as marked on the Sector.*

This Circle contains the Days of the Month, and serves for the same Purpose that the 12th and 13th Circles do.

15. *Deſcription and Uſe of the Fifteenth Circle.*

This Circle is divided into 52 equal Parts, diſtinguiſhed by large Dots, every one of which anſwers to 7 Days in the 14th Circle, and numbred round with 1, 2, 3, *&c.* to 52, which end at *December* 30: Its Uſe is to know the Number of Weeks from the Beginning of the Year, to any Day in the Year propos'd. As for Example, I would know how many Weeks it is from *January* 1, to *July* 9. Look for *July* 9 in the 11th or 14th Circle, to which lay the Hair of the Sector, and it will cut the 15th Circle at 27 Weeks and one Day; now becauſe the Year contains 52 Weeks and one Day, therefore take away one Day, and you will have juſt 27 Weeks from *January* 1 to *July* 9 incluſive, and ſo of the reſt.

16. *The Deſcription and Uſe of the Sixteenth Circle.*

This Circle contains the Days in the Year, and is number'd round with 10, 20, 30, *&c.* to 365, being the Number of Days in the Year, where that Reckoning ends at *December* 31, and anſwers to the Days in the 14th Circle: The Uſe of it, is to know how many Days it is between any two Number of Days propoſed.

As for Example, Suppoſe I would know how many Days it is from *January* 1, to *July* 8.

Operation.

Look for *July* 8 in the 12th Circle, to which lay the Hair of the Sector, and it will cut the 16th Circle at 189, which are the Days propoſed.

Example 2. How many Days is it from *April* 29 to *Auguſt* 29?

Place the Hair A to *April* the 29th, and the Hair B to *Auguſt* 29; ſcrew this Opening faſt and move the Hair A to 365 upon the 16th Circle, and then doth the Hair B cut 122 upon the ſame Circle, which are the Number of Days required, and the Weeks upon the 15th Circle, which are 17 Weeks and 3 Days, *&c.*

By the firſt Example, above, find how many Days there are from *January* 1 to *April* 29, and *Auguſt* 29, ſeverally, ſubſtract the one from the other, and the Remainder is the Anſwer; thus,

From *January* 1 to *April* 29, are Days	119
From *January* 1 to *Auguſt* 29, are Days	241
Difference, is Anſwer in Days	122

Note, In Leap-Year, add one Day more to your Account, or Anſwer: But the Inſtrument performs any Addition or Subſtraction upon this, or upon the Circle of Weeks.

17. *The Description and Use of the Seventeenth Circle.*

This Circle contains these Letters of the Alphabet, a, b, c, d, e, f, g, h, i, k, l, m, n, p, q, r, t, u, w, being 19 in Number, and answers to the 19 Primes and Epacts. These are taken from Table II. and transferred into this Circle, to shew the New and Full Moons: For when the Epact is 1, the Letter a is putt to represent it; the following Year the Epact will be 12, there the Letter b is placed, to represent that Epact; and the next Year after that the Epact will be 23, which is represented by the Letter c; and so on all round the 19 Epacts, as you may the better perceive in Table II. Then having found the Epact for any given Year, if you add that to the Number of Months from *March*, and substract the Sum from 30, the Remains is the Day of the Month that the Moon changes on; so that from Table II. the Letter that answers to the Epact is placed in this 17th Circle right against the Day of the Month on which the Moon changes that Year.

Now you are not to suppose or imagine that the Letters in Table II. have any more Right or Title to the Epacts with which they are placed than any other would have, but only when the Epact is 1 the first Letter in the Alphabet is adapted to it, *&c.* and therefore Number and Alphabet begin together.

Example

Example, I would know the Change, Full and Quarters of the Moon in *July* 1725.

Operation.

Have Recourſe to Table II, and there looking in the higheſt Line, I find the Year 1725, and under it 16, the Golden Number, and under that 26 f, the Epact and Letter for the ſaid Year. This done, go to the Circle of Months and find the Letter f (which is the Letter of Direction in this Caſe) in the 17th Circle, to which lay the Hair of the Sector, and it cuts the 28th Day of *July*, the Day on which the Moon changeth ;

Now obſerve, from - - - - - -		28	
	Subſtr.	7	
Laſt Quarter is upon the - - -		21	Day.
	Subſtr.	7	
Full Moon is upon the - - - -		14	Day.
	Subſtr.	8	
Firſt Quarter is upon the - - -		6	Day.

But when the New Moon happens in the firſt ſeven Days of the Month, then you muſt add two ſevens and two eights and that will give you the Firſt Quarter, Full Moon, and Laſt Quarter, and alſo will bring you to the next New Moon ; for theſe two ſeven and two eight Days make 30 Days, which is about half a

Day too much from one Conjunction or New Moon to another.

Now you are to obſerve, that this Method finds the New and Full Moons according to their mean or middle Motion, ſuppoſing them to move in Circles, and equally every Day alike; according to which the Sun moves in a Day 59′ 8″ and the Moon 13° 10′ 35″, their Difference 12° 11′ 27″ is the mean Motion of the Moon from the Sun in a Day; now at this Rate their mean Conjunction is made in 29 D. 12 H. 44′ 6″, which is ſooner by 11 H. 15′ 54″ than is ſhewed by the Inſtrument. But Aſtronomers well knowing that the Luminaries (according to Appearance) do not move in Circles, but in Ellipſes, therefore their Motions cannot be equally alike every Day, ſo that the mean Conjunction above-mentioned is not the true, but will be ſometimes too ſoon, and at other Times too late, but will never differ more than 14 Hours of the true Time.

Example 2. I demand the Change, Full and Quarters of the Moon in *December* 1725.

Operation.

The Letter of Direction was found in the laſt Example to be f, (which always ſerves all the Year) this I ſeek in the 17th Circle, under the Month *December*, to which I lay the Hair of the Sector, and it cuts the Circle of Months in *December* 23, which is the Day of the New Moon, in that Month and Year; to which add 8 Days, there is given the 31ſt Day of *December* for the Firſt Quarter, and ſubſtract 8 there is given

given the 15th Day for the Laſt Quarter, ſubſtract 7 from 15 leaves 8 for the Full Moon, and 7 from that gives *December* 1 for the Firſt Quarter.

To know when to add or ſubſtract 7 or 8 Days, depends purely upon the Knowledge of the Moon's Apogeon and Perigeon, Things purely Aſtronomical, therefore you may do it at your own Diſcretion.

18. *The Deſcription and Uſe of the Eighteenth Circle.*

This Circle has the Names of the Points of the Compaſs, which are in Number 34, beginning at North with N, and ſo numbering round, and putting the firſt Letter of the Word for the whole Word, as NbE ſignifies North or Nore by Eaſt, as underneath.

N - - -	North
NbE - - -	Nore by Eaſt
NNE - -	Nore Nor Eaſt
NEbN - -	Nore Eaſt by North
NE - - -	Nore Eaſt
NEbE - -	Nore Eaſt by Eaſt
ENE - -	Eaſt Nor Eaſt
EbN - -	Eaſt by North
E - - -	Eaſt
EbS - - -	Eaſt by South
ESE - - -	Eaſt South Eaſt
SEbE - -	South Eaſt by Eaſt
SE - - -	South Eaſt
SEbS - -	South Eaſt by South

SSE - - -	South South East
SbE - - -	South by East
S - - -	South
SbW - -	South by West
SSW - -	South South West
SWbS - -	South West by South
SW - - -	South West
SWbW - -	South West by West
WSW - -	West South West
WbS - - -	West by South
W - - -	West
WbN - -	West by North
WNW - -	West North West
NWbW - -	North West by West
NW - - -	North West
NWbN - -	North West by North
NNW - -	North North West
NbW - -	North by West.

Although there are but 32 Lines near the Center of the Inſtrument in which the Havens are wrote, yet there are the Names of 34 Havens inſerted, becauſe *Breſt* and *Scilly*, which are two ſeveral Places, are wrote both in one Line; as alſo are *Leith* and *Maes* both in another Line, which are alſo two different Places.

Every Point of the Compaſs is 11° 15′, and every Diviſion thereof is 3° 45′ of a great Circle; but in Time every Point is 45′, and every Diviſion or Quarter Point contains 11′ 15″.

The Uſe of this Circle is to know what Point of the Compaſs the Moon is upon, on the Full and Change Days; for that being turn'd into Time, allowing (as above) 45′ to every Point, and that Time added to the Time of the Moon's

Southing

Southing any Day, will give the Time of High Water the ſame Day at the given Port, which I ſhall further explain in the two following Circles, becauſe this Circle, and the two following depend one upon another.

19. *The Deſcription and Uſe of the Nineteenth Circle.*

This Circle is divided into 24 equal Parts, or Hours, and number'd with one, two, three, *&c.* to twelve, and then the other Semicircle begins again with one, and is number'd as before with Roman Letters; every Hour is again ſubdivided into twelve equal Parts, every one of which is 5′ in Time; this Circle of Hours anſwers to the 18th Circle of the Points of the Compaſs, where you may obſerve that North Eaſt and South Weſt is three Hours in Time; and ſo likewiſe all the Points of the Compaſs in the 18th Circle have the Time anſwering in the 19th Circle; that is, ſhews you in Time how much any Point of the Compaſs is diſtant from the Meridian, counting round according to the apparent Motion of the Sun, *viz.* from Eaſt to Weſt: Its Uſe I ſhall ſhew when I have explained the 20th Circle.

20. *The Deſcription and Uſe of the Twentieth Circle.*

This Circle is divided into 30 equal Parts, and number'd round with 1, 2, 3, 4, *&c.* to 30, being the Days of the Moon's Age, from Change to Change, according to her mean Motion,

tion, as ſet down in the Deſcription of the 17th Circle. Between this Circle and the Center of the Inſtrument you have the Names of 32 Ports or Havens, and they are ſet againſt that Point of the Compaſs in the 18th Circle, on which the Moon is, upon the Full and Change Days; as for Inſtance, you have *London* right againſt North Eaſt, which tells you that a North Eaſt and South Weſt (becauſe there is every twelve Hours a Tide) Moon makes High Water at *London* Bridge on Full and Change Days, which anſwers to three Hours in Time in the 19th Circle; alſo at *Portſmouth* and *Southampton* a North and South Moon makes full Sea on Full and Change Days; for whenever the Moon is on the Meridian, 'tis full Sea at thoſe Ports, and ſo of the reſt; which Ports you will find inſerted amongſt the Cities at the End of this Book.

21. *The Uſe of the Eighteenth, Nineteenth, and Twentieth Circles*, &c.

Firſt, In the Deſcription of the 11th Circle I have ſhewed how to find the Day of the Week. And,

Secondly, In the Deſcription of the 17th Circle I have ſhewed how to find the New and Full Moons in any Month and Year.

Thirdly, To find the Moon's Place in the Zodiack for any Day of her Age.

Firſt, Find the Day of the laſt Change (as has been ſhewed in pag. 69, 70.) in the 17th Circle; bring one Hair of the Sector to that Day,

Day, and where it cuts upon Circle 20, count in that Circle ſo many Days forward as the Moon is old; where that Reckoning ends, lay the Hair of the other Leg of the Sector, and it will cut the Circle of Signs (*viz.* the 5th Circle) in the Sign and Degree of the Moon's Place in Longitude, with reſpect to the laſt Conjunction; but, becauſe the Sun moves near a Degree in a Day the Year round, therefore to the Sign and Degree of the Zodiack above found, add ſo many Degrees as the Moon is Days old, and you will have her Place pretty near the Truth; nay near enough in a Work of this Nature: And that Place ſo found, will be to the ſame Time of the Day that the laſt Conjunction was at; *i. e.* if the laſt Conjunction of the Sun and Moon was at eight in the Morning, then the Moon's Place in Longitude found by this Inſtrument is alſo at eight o' Clock in the Morning on that Day propoſed.

Example, I would know the Moon's Place in Longitude on the 10th Day of *July* 1725.

By the Method in pag. 69, I find the laſt New Moon was upon *June* 28, to which I lay one of the Hairs of the Sector in the 12th Circle, and it cuts the 20th Circle at a little more than 24; here begin and count forward in this Circle as many Days as the Moon is old, which in this Example are 12, ſo I call 25 one, 26 two, and ſo on; ſo that the Moon's Age 12 ends at a little more than 6 in the 20th Circle, to this I bring the other Hair of the Sector, and it then cuts the 5th Circle of Signs at ♐ 11°, to this

add

add 12° (for the Reaſon above) the Sum is ♐ 23°, the Moon's Place in Longitude, which is at Midnight on the ſaid 10th Day, becauſe the laſt New Moon was at that Time, which is ſurprizingly near the Truth.

Example 2. Let the Moon's Place be ſought on *September* 18, 1725.

Firſt, I find the laſt New Moon was *Aug.* 26, and the Moon is now 23 Days old; the Hair brought to the Day of the Month given, cuts the 20th Circle in 29; at this 29 I begin and count the Moon's Age 23, which ends at 22 in this 20th Circle, to which I bring the other Hair of the Sector and it then cuts the 5th Circle of Signs in ♊ 23°, to which I add 23° (the Number of Days the Moon is old) and the Sum is ♋ 16°, the Moon's Place in Longitude on the given Day at 6 at Night, becauſe the laſt New Moon was at that Time.

4. *To find the Time of the Moon's Southing.*

In the Deſcription of the 6th Circle pag. 52, I have given the exact Method of finding the true Time of the Moon's Southing; but becauſe every one is not an Aſtronomer, that Method may ſeem too prolix, I ſhall here ſhew you how to do it ſpeedily by the Inſtrument, but withal you muſt remember, that this Method will often fail you ſome Minutes in the true Time, becauſe it ſuppoſes the Moon to move always equally alike in the Ecliptick.

Rule,

Rule. Find the Moon's Age in the 20th Circle, and againſt that in the 19th Circle is the Time of her Southing that Day.

Example. July 11, 1725, I would know what Time the Moon will be South.

Counting from the Day of the laſt Change to the Day propoſed is 13 Days her Age, which ſought in the 20th Circle, gives 10 H. 24′ in the 19th Circle, the Time of her Southing. You muſt obſerve that if her Age exceeds 15 Days, that then the Time found as above is in the Morning.

Example, July 21, 1725, I would know the Time of the Moon's Southing.

The Days of her Age 23, in the 20th Circle gives 6 H. 24′ in the Morning, becauſe her Age is more than 15 Days.

5. *To find the Time of High Water at any of the Ports mentioned in the Inſtrument.*

Rule. Bring the Hair A to 30 in the 20th Circle, and the Hair B to the Day of her Age in the ſame Circle, ſcrew this Opening faſt, and with this Opening lay the Hair A to the Port where you would find the Time of High-Water, and then will the Hair B cut the 19th Circle at the Time of High Water at that Port.

Example

Example. July 12, 1725, I would know the Time of High Water at *London* Bridge.

OPERATION.

The Hair A laid to 30 in the 20th Circle, and the Hair B to the Moon's Age, 14 Days, this Opening ſcrew'd faſt, I move the Hair A to the given Port, *viz. London*, and then the Hair B cuts 2 H. 12′, the Time of High Water.

Alſo if I move the ſaid Opening that the Hair A may cut the Port *Onkney*, then will the Hair B cut the 19th Circle at 8 H. 12′, the Time of High Water at that Port on the ſame Day, *&c.*.

Note, Every Tide comes later by 24′, becauſe there is a Tide every 12 Hours and 24′, according to the mean Motion of the Moon of 48 a Day.

6. *To find the Time of the Moon's Riſing and Setting.*

Rule, Bring the Hair A of the Sector to the Day of the Moon's laſt Change in the 11th or 14th Circles, here hold it faſt, and obſerve where it cuts the 20th Circle, here begin and count ſo many Days as the Moon is old, to which lay the Hair of the Leg B in the 20th Circle, and in Circle 9 it will cut the Hour and Minute of the Sun's ſetting (which is always equal to the Semidiurnal Arch or Half Stay above the Horizon (ſee the Deſcription of the 9th Circle) where he is in that Place of the Zodiack;

diack; now becauſe the Moon comes later to the Horizon every Day by 48′, therefore to the Sun's ſetting, found as above, always add 12′, and that Sum is the Semidiurnal Arch of the Moon, or her Half Stay above the Horizon at that Time; then bring the Hair A to 12, either at N or S in the 19th Circle, and the Hair B to the aboveſaid Hour and Minute of half the Moon's Stay above the Horizon in the ſame 19th Circle, here ſcrew the Sector faſt; with this Opening bring the Hair A to the Moon's Age in the 20th Circle, and the Hair B will ſhew her ſetting in the 19th Circle; or bring the Hair B to her Age in the 20th Circle, and the Hair A will cut her riſing in the 19th Circle.

The Reaſon of this Rule is, that Addition and Subſtraction is performed in any Lines or Circle of equal Parts; ſee the Deſcription of the 15th and 16th Circles.

Example. I would know the Time of the Moon's riſing and ſetting, *Auguſt* 5, 1725.

Operation.

Firſt. The laſt Change Day was *July* 28, therefore on the propoſed Day the Moon is 8 Days old, theſe known, I bring the Hair A to the 28th Day of *July*, in the 11th or 14th Circle, and it cuts the 20th Circle near 26 ½, where I begin and count 8 Days the Moon's Age, and that Reckoning ends at 4 ½ in the 20th Circle, and cuts the 9th Circle at 4 H. 22′, the Time of the Sun's ſetting when he hath the ſame South Declination that the Moon now hath; to this

this I add 12′ (for the Reaſon aforemention'd) and the Sum is 4 H. 34′, the Moon's Semidiurnal Arch or Half Stay above the Horizon at that Time; then I bring the Hair A to 12 in the 19th Circle, and the Hair B to 4 H. 34′ in the 19th Circle (the Moon's Semidiurnal Arch) ſcrew this Opening of the Sector faſt, and move the Hair A to the Moon's Age 8, in the 20th Circle, and then doth the Hair B cut the 19th Circle at 10 H. 55′, the Time of the Moon's ſetting that Night; and bring the Hair B to her Age 8 Days in the 20th Circle, and then doth the Hair A cut the 19th Circle at 1 H. 50′ after Noon, the ſame 5th of *Auguſt*, the Time of the Moon's riſing.

Example, 2. What Time doth the Moon riſe and ſet at *London*, the 18th Day of *October*, 1725?

OPERATION.

The laſt Change before *October* 18 was on *September* 25, and on the given Day the Moon is 23 Days old; theſe Things known, lay the Hair A to *September* 25 in the 11th or 14th Circle, and it cuts the 20th Circle at 1 ½, begin here and count 23 Days, the Moon's Age on the propoſed Day, and that Reckoning falls in the 20th Circle at 24 ½, to which bring the Hair B, and then it cuts the 9th Circle at 8, the Time of the Sun's ſetting, was he in that Place where the Moon now is; to which I add 12′ makes 8 H. 12′, half the Moon's Stay above the Horizon on the given Day; then I bring the Hair A to 12, in the 19th Circle, and the Hair B to 8 H.

8 H. 12′ in the ſame Circle, this Opening of the Sector I ſcrew faſt, and bring the Hair A to the Moon's Age 23 Days in the 20th Circle, then doth the Hair B cut 2½ in the 19th Circle, the Time of the Moon's ſetting: Alſo bring the Hair B to the Moon's Age 23 in the 20th Circle and then doth the Hair A cut 10½ the riſing at Night. When the Moon has little or no Latitude, and is in the middle Part of her Orbit, about the conjugate Diameter, then this Rule above will be tolerably true; but when the Moon has near 5° of Latitude, and is near her Perigeon, *&c.* then it will differ much from the Truth.

And now I have deſcribed and ſhewn the Uſe of every Circle from the Circumference to the Center; I ſhall next explain

The Deſcription and Uſe of Table I.

This Table ſhews the Dominical Letter and Cycle of the Sun, for one Cycle, or Revolution of the Letter, *viz.* 28 Years, but may be made perpetual by placing 1748 where 1720 now ſtands, when theſe Years in the Table are expired; but to ſave the Reader that Trouble I ſhall at the laſt Page in this Book inſert Tables for finding the Dominical Letter in both Accounts by Inſpection, beginning with the Year of our Lord 1500, and ending with the Year 2500, being 1000 Years compleat.

Deſcription and Uſe of Table II.

Of this I have already ſpoken in the Deſcription of Circle 17, and it being ſo plain that little

needs be ſaid in Explanation. The Table begins with the Year 1720, and ends with 1728, in which is explain'd one Revolution of the Golden Number, and 19 Epacts in the *Julian* Account, with the Letters of Direction before deſcribed in Page , and the Tables may be made perpetuall by placing the Year 1739 where 1720 now ſtands, *&c.* but to ſave you the Trouble, conſult the Tables at the laſt Page of this Book, where you will find, as by the Deſcription of them, the Golden Number; and not only the Golden Number, but the Epacts in the three moſt accepted Accounts, *viz.* the *Julian* or *Engliſh* Account; the true Vulgar Foreign or Old Foreign Account; the true *Gregorian* or New Foreign Account for 1000 Years compleat.

Here I muſt undeceive moſt of our common Almanack Writers, who hold for a Fundamentall Rule, That the *Gregorian* Epact is always ſo much leſs than our Epact, as is the Difference of Days in the two Accounts, which they ſay increaſe every 100 Years one Day. But you may find, upon further Enquiry, that what they aim at is only the Vulgar Foreign, not the true *Gregorian* Epact; and how far they have and will fall ſhort of the ſame by the above Rule, the Tables before-mention'd may evince. For from 1700 to 1799 the Difference of Stiles is 11 Days, take any Year within that Compaſs of Time their ſaid Rule holds good; but in 1800 to 1899 the Difference of Stiles is 12 Days, and the true Vulgar Foreign Epacts being the ſame as in 1700, *&c.* if 12 be deducted from the *Engliſh* Epact it will give one leſs than the true Vulgar Foreign, and conſequently by uſing

the ſame they will quote falſe Feaſts in that Century as they have done in former Centuries. But I forbear expecting a Reformation for the future.

Deſcription and Uſe of Table III.

This Table ſhews the Number of Direction according to the *Julian* Account (as the Tables at the laſt Page of this Book the Number of Direction in the true *Gregorian* Account) for ever, by entering the Side with the Dominical Letter, and the Bottom with the Golden Number, which you will always find by the two laſt Tables for the Year propoſed. Example, this Year 1732, the *Engliſh* Dominical Letters are BA, and the Golden Number is 4, find 4 at the Bottom of this third Table, and the Letter B on the left Hand thereof, if for any Feaſt that falls before the 25th Day of *February*; but for all the Feaſts which happen after the ſaid 25th of *February*, take the Letter A, and in the Place of meeting, if you take B, the Number is 13; but if you take A, the Number is 19; theſe are called the Number of Directions; and their Uſe is to find the Moveable Feaſts, which are ſhewed in the 12 Segments of Circles, which I come next to explain.

The Deſcription and Uſe of the twelve Segments of Circles in the Inſtrument.

In theſe 12 Segments of Circles are contained all the Moveable Feaſts, with the beginning and ending of *Eaſter* and *Trinity Terms*, with their

Returns; the Title of each Segment is a ſufficient Explanation, only obſerve, that every Circle is ſet under each Word unto which it belongs, and number'd with 10, 20, 30, &c, and dotted to 35, which Number of 35 they all contain, being the Number of Direction, each Segment being divided into 35, only including thoſe two Days of the Month, between which the Feſtival falls, and anſwers to the 12th Circle of Months and Days; as the Boundary of *Septuageſima Sunday* is *January* 18, and *February* 21, between thoſe two Days incluſive it always falls, as you may ſee if you lay the Hair of the Sector to the firſt Dot in its Segment, it will cut *January* 18; and laid to the laſt, or 35th Dot, it will cut *February* 21 in the 12th Circle; and likewiſe the Boundary of *Trinity Term* you will find to be from *May* 22 to *June* 25, between thoſe two Days that Term always begins inclusive, and ſo of all the reſt.

Note, When the Number of Direction is 1, you are not to lay the Hair of the Sector at the Line in the beginning of the Segment, which is nothing but the Boundary of that Segment, but to lay it to the firſt Dot therein, as your Reaſon will ſoon direct you.

To find any one, or all the Moveable Feaſts in the Engliſh *Account, with the Terms and their Returns.*

Rule, Having found the Number of Direction in the Table for the Year propoſed, carry the Number to any of the 12 Segments that has the

Name

Name of the Feaſt that you are ſeeking for, and count the Number of Dots equal to the Number of Direction, to which lay the Hair of the Sector, and it will cut the 12th Circle in the Day of the Month that that Feaſt falls upon.

Example, In the Year 1733, I would know what Day *Septuageſima Sunday*, *Sexageſima Sunday*, &c. falls upon.

Firſt, In Table III. I find the Number of Direction to be 4, this I carry to the Segment of the Circle noted with the Words *Septuageſima*, and to the fourth Dot therein I lay the Hair of the Sector, and it cuts *January* 21 in the 12th Circle, the Day that *Septuageſima Sunday* falls on; and by laying the Hair to 4 in the Segment, noted with *Sexageſima-Sunday*, it cuts the 12th Circle in *Jan.* 28; and by applying the Hair of the Sector ſeverally in each Segment to 4 the Number of Direction, I have all the Feaſts and Terms for the ſaid Year, as followeth, *viz.*

Septuageſima Sunday, *Jan.* 21.
Sexageſima Sunday, *Jan.* 28.
Shrove Sunday, *Feb.* 4.
Quadrageſima Sunday, *Feb.* 11.
Second Sunday in Lent, *Feb.* 18.
Third Sunday in Lent, *Feb.* 25.
Midlent Sunday, *March* 4.
Fifth Sunday in Lent, *March* 11.
Palm Sunday, *March* 18.
Good Friday, *March* 23.
Eaſter Sunday, *March* 25.
Low Sunday, *April* 1.

Quindena Paſchæ, *April* 9.
Eaſter Term begins *April* 11.
Tres Paſchæ, *April* 16.
Menſe Paſchæ, *April* 23.
Rogation Sunday, *April* 29.
Quinque Paſchæ, *April* 30.
Craſtino Aſcenſionis, *May* 4.
Eaſter Term ends, *May* 6.
Whitſunday, *May* 13.
Trinity Sunday, *May* 20.
Craſtino Trinitatis, *May* 21.
Trinity Term begins *May* 25.
Octabis Trinitatis, *May* 28.
Quindena Trinitatis, *June* 4.
Tres Trinitatis, *June* 14.
Trinity Term ends, *June* 13.

Example 2. What's the Time of *Eaſter*, according to the *Engliſh* Account, in the Year 1850?

By Table I. I find the Dominical Letter to be A, and by Table II. the Golden Number 8, with which in Table III. I find the Number of Direction to be 33, this I ſeek in the Segment of the Circle noted with *Eaſter Sunday*, to which I lay the Hair of the Sector and it cuts in Circle 12 *April* 23, which is *Eaſter Sunday* that Year.

Note, The ſame Rule holds for finding the Foreign Feaſts, with the *Gregorian* Number of Direction, as with the *Julian*, which brings me to the promiſed

Deſcrip-

Deſcription and Uſe of the Six Tables at the laſt Page of this Book,

For finding the Cycle of the Sun, Dominical Letter, Golden Number and Epact according to the *Julian* or *Engliſh* Account; as alſo the Dominical Letter, Epact, and Number of Direction in the true *Gregorian* and true Vulgar Foreign Accounts, together with the Difference of Days between the ſaid Accounts for 1000 Years compleat; and conſequently by theſe Tables, and the Univerſal Inſtrument, the Movable Feaſts in both Accounts may be found for any Year within the ſaid Term, by Inſpection, *viz.*

I. TABLE. The Firſt Table ſhews the Cycle of the Sun from 1500 to 2500 Years.

II. TABLE. The Second ſhews the Characteriſtick for finding the *Gregorian* Dominical Letter, and alſo the Days Difference in Accounts, *ditto.*

III. TABLE. The Third ſhews the Dominical Letter in both Accounts, *ditto.*

IV. TABLE. The Fourth ſhews the Golden Number, *ditto.*

V. TABLE. The Fifth ſhews the Epact, *ditto.*

VI. TABLE. And the Sixth ſhews the *Gregorian* Number of Direction for ever.

To find the Cycle of the Sun.

Rule, Seek for the Centuries in the Side of the Firſt Table, and for the odd Years in the upper Part thereof, and in the Square of theſe two Numbers you ſhall find the Cycle of the Sun.

Example, What is the Cycle of the Sun for the Year 1735?

Firſt I look for the Centuries, *viz.* 1700, in the Side of Table I. and for the odd Years, *viz.* 35, in the upper Part thereof, and in their common meeting do find the Number 8, which is the Cycle of the Sun.

To find the Characteriſtick and Days Difference in Accounts.

Rule, Look for the Centuries in the firſt Column of Table II. and oppoſite thereto in the ſecond Column is the Characteriſtick, and in the third is the Days Difference in Accounts.

Example, What is the Characteriſtick and Days Difference in Accounts for the Century 1800?

I anſwer, by the foregoing Rule, that 3 is the Characteriſtick, and 12 the Days Difference in Accounts, or Difference of Stiles.

By

By the Characteriſtick and Cycle of the Sun to find the Gregorian *Dominical Letter.*

Rule, Look for the Characteriſtick in the Side of Table III. and the Cycle of the Sun at the Top thereof, and in their common meeting you ſhall find the *Gregorian* Dominical Letter.

Example, In the Year 1735, Characteriſtick 2, Cycle of the Sun 8 given, what is the *Gregorian* Dominical Letter?

Firſt find 2 the Characteriſtick for 1700 in the Side of Table III. then look for 8 the Cycle of the Sun in the Top of the ſaid Table, and in the Square of their meeting you will ſee B, which is the *Gregorian* Dominical Letter.

To find the Julian *Dominical Letter.*

Rule, Search always in the Side of Table III. for the fifth Characteriſtick, which is marked with this ſpecial Note ☜ and the Cycle of the Sun for the Year propoſed in the Top of the ſame, and in their Interſection you ſhall find the *Julian* Dominical Letter.

Example, What is the *Julian* Dominical Letter for the Year 1735?

Find the 5th Characteriſtick in the Side of Table III. and 8 the Cycle of the Sun in the Top thereof, and where they meet is E the *Julian* Dominical Letter.

To find the Golden Number.

Rule, Look for the Centuries in the Side of Table IV. and the odd Years in the upper Part thereof, and in their common meeting you ſhall find the Golden Number.

Example, What is the Golden Number for the Year 1735?

Firſt I ſearch for the Century 1700 in the Side of Table IV. and for the odd Years, *viz.* 35, in the upper Part thereof, and in the Square of theſe two Numbers do find 7, which is the Golden Number.

By having the Golden Number to find the Julian *Epact.*

Rule, Find the Golden Number in the Top Column of Table V. and underneath in the next Column is the *Julian* Epact.

Example, What is the *Julian* Epact for the Year 1735?

Golden Number 7 given; look in the Top Column of Table V. for the Golden Number 7, and underneath in the ſecond Column is 17 the *Julian* Epact.

By

By having the Golden Number to find the Gregorian *and Vulgar Foreign Epacts.*

Rule, Find the Century for the propoſed Year in the Side of Table V. and the Golden Number in the Top thereof, and in their meeting is the *Gregorian* Epact.

Note, Always take the Number 6 from the *Gregorian* Epact, and the Remainder will be the true Vulgar Foreign Epact; but if Subſtraction cannot be made, add 30 to the *Gregorian* Epact, and then deduct as aforeſaid.

Example, What is the *Gregorian* and Vulgar Foreign Epacts for the Year 1735?

Golden Number 7 given; Firſt I look for the Century 1700 in the Side of Table V. and in the Top thereof for 7 the Golden Number, and in the Square of theſe two Numbers do find 12, which is the *Gregorian* Epact, from which I take 6 and the Remainder is 6, which is the Vulgar Foreign Epact.

By knowing the Gregorian *Dominical Letter and Epact to find the Number of Direction.*

Find the Dominical Letter in Table VI. on the left Hand, and the Epact at the Bottom, and in the common Angle or Place of meeting is the Number of Direction ſought.

Example,

Example, What is the Number of Direction for the Year 1735?

The Dominical is B, which find on the left Hand, and in the Bottom Line find the Epact 12, and in the Place of meeting is 20, the Number of Direction ſought.

By the Gregorian *Number of Direction to find all the Foreign Feaſts.*

Rule, Enter the Segment of the Circle in the Univerſal Inſtrument with the *Gregorian* Number of Direction for the Feaſt requir'd, as you have been lately taught to do with the *Julian* Number of Direction, ſo ſhall you obtain your Deſire.

Example, *Septuageſima* or the next *Sunday* but one before *Shrove Sunday* is requir'd for the Year 1735?

Number of Direction 20 given; Firſt I look for 20, the *Gregorian* Number of Direction, in the Segment of the Circle noted *Septuageſima*; and by applying one Leg of the Sector to cut the ſame Number, do find in the the 12th Circle that the Hair of the ſaid Leg is upon the 6th Day of *February*, which is *Septuageſima Sunday*; and by the ſame Method *Shrove Sunday* will be found to be the 20th Day of *February*, and conſequently *Dies Cinerum*, or *Aſh-Wedneſday*, the 23d, *ditto*; *Paſcha*, or *Eaſter*, the 10th of *April*; *Aſcenſio*, or *Aſcenſion-Day*, the 19th of *May*; *Pentecoſt*, or *Whitſunday* the 29th of *May*, &c.

A TABLE

A TABLE for converting of Hours and Minutes of Time, into Degrees and Minutes of the Equator., *& contra.*

Time Hour ′ ″	Motion ° ′ ″	Time ′ ″ ‴	Motion ° ′ ′ ″ ‴	Time ′ ″ ‴	Motion ° ′ ″ ‴	Time ′ ″ ‴	Motion ° ′ ′ ″ ‴
1	15	1	0 15	21	5 15	41	10 15
2	30	2	0 30	22	5 30	42	10 30
3	45	3	0 45	23	5 45	43	10 45
4	60	4	1 0	24	5 0	44	11 0
5	75	5	1 15	25	6 15	45	11 15
6	90	6	1 30	26	6 30	46	11 30
7	105	7	1 45	27	6 45	47	11 45
8	120	8	2 0	28	7 0	48	12 0
9	135	9	2 15	29	7 15	49	12 15
10	150	10	2 30	30	7 30	50	12 30
11	165	11	2 45	31	7 45	51	12 45
12	180	12	3 0	32	8 0	52	13 0
13	195	13	3 15	33	8 15	53	13 15
14	210	14	3 30	34	8 30	54	13 30
15	225	15	3 45	35	8 45	55	13 45
16	240	16	4 0	36	9 0	56	14 0
17	255	17	4 15	37	9 15	57	14 15
18	270	18	4 30	38	9 30	58	14 30
19	285	19	4 45	39	9 45	59	14 45
20	300	20	5 0	40	10 0	60	15 0
21	315						
22	330						
23	345						
24	360						

The Use of this Table you have in Page 37.

A Perpetual TABLE of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Amsterdam.		Barbados.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
°	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	°
1	5 54 48	6 5 12	5 58 48	6 1 12	1
2	5 49 36	6 10 24	5 58 8	6 1 52	2
3	5 44 20	6 15 40	5 57 8	6 2 52	3
4	5 39 8	6 20 52	5 56 8	6 3 52	4
5	5 33 52	6 26 8	5 55 12	6 4 48	5
6	5 28 32	6 31 38	5 54 16	6 5 44	6
7	5 23 12	6 36 48	5 53 16	6 6 44	7
8	5 17 48	6 42 12	5 52 20	6 7 40	8
9	5 12 24	6 47 36	5 51 20	6 8 40	9
10	5 6 52	6 53 8	5 50 20	6 9 40	10
11	5 1 20	6 58 40	5 49 20	6 10 40	11
12	4 55 44	7 4 16	5 48 24	6 11 36	12
13	4 50 0	7 10 0	5 47 40	6 12 20	13
14	4 44 2	7 15 58	5 46 24	6 13 36	14
15	4 38 16	7 21 44	5 45 20	6 14 40	15
16	4 32 16	7 27 44	5 44 20	6 15 40	16
17	4 26 8	7 33 52	5 43 16	6 16 44	17
18	4 19 52	7 40 8	5 42 12	6 17 48	18
19	4 13 24	7 46 36	5 41 8	6 18 42	19
20	4 6 48	7 53 12	5 40 4	6 19 56	20
21	4 0 0	8 0 0	5 39 4	6 20 56	21
22	3 53 0	8 7 0	5 37 56	6 22 4	22
23	3 45 44	8 14 16	5 36 48	6 23 12	23
23½	3 42 4	8 17 56	5 36 12	6 23 48	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual TABLE of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Boston New Eng.		Cambridge.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
°	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	°
1	5 56 20	6 3 40	5 55 20	6 5 40	1
2	5 52 24	6 7 36	5 49 24	6 10 36	2
3	5 48 56	6 11 4	5 47 36	6 12 24	3
4	5 45 12	6 14 48	5 39 16	6 20 44	4
5	5 41 28	6 18 32	5 34 0	6 26 0	5
6	5 37 48	6 22 12	5 28 48	6 31 12	6
7	5 34 0	6 26 0	5 23 28	6 36 32	7
8	5 30 16	6 29 44	5 18 8	6 41 52	8
9	5 26 28	6 33 32	5 12 44	6 47 16	9
10	5 22 36	6 37 24	5 8 20	6 52 40	10
11	5 18 44	6 41 16	5 1 40	6 58 20	11
12	5 14 48	6 45 12	4 56 12	7 3 48	12
13	5 10 52	6 49 8	4 51 32	7 9 28	13
14	5 6 56	6 53 4	4 44 48	7 15 12	14
15	5 2 2	6 57 8	4 38 56	7 21 4	15
16	4 58 44	7 1 16	4 33 0	7 27 0	16
17	4 53 36	7 6 24	4 26 52	7 33 8	17
18	4 50 20	7 9 40	4 20 36	7 39 24	18
19	4 46 0	7 14 0	4 15 16	7 45 44	19
20	4 41 40	7 18 20	4 9 12	7 50 48	20
21	4 37 8	7 22 52	4 1 0	7 59 0	21
22	4 32 36	7 27 24	3 54 0	8 6 0	22
23	4 27 56	7 32 4	3 46 52	8 13 8	23
23½	4 25 32	7 34 28	3 43 8	8 16 52	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual Table of the Sun's Rising and Setting for these Places,

The Sun's Declination North.	Constantinople.		Copenhagen.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
°	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	°
1	5 56 16	6 3 44	5 54 8	6 5 52	1
2	5 52 32	6 7 28	5 48 16	6 11 44	2
3	5 48 48	6 11 12	5 42 24	6 17 36	3
4	5 45 4	6 14 56	5 36 28	6 23 32	4
5	5 41 20	6 18 40	5 30 32	6 29 28	5
6	5 37 32	6 22 28	5 24 32	6 35 28	6
7	5 34 44	6 25 16	5 18 32	6 41 28	7
8	5 29 52	6 30 8	5 12 24	6 47 36	8
9	5 26 0	6 34 0	5 6 16	6 53 44	2
10	5 22 12	6 37 48	5 0 4	6 59 56	10
11	5 18 12	6 41 48	4 53 44	7 6 16	11
12	5 14 16	6 45 44	4 47 20	7 12 40	12
13	5 11 16	6 49 44	4 40 48	7 19 20	13
14	5 6 12	6 53 48	4 34 52	7 25 8	14
15	5 2 8	6 57 52	4 27 24	7 32 36	15
16	4 57 56	7 2 4	4 20 28	7 39 32	16
17	4 53 48	7 6 12	4 13 24	7 46 36	17
18	4 49 28	7 10 32	4 6 8	7 53 52	18
19	4 45 4	7 14 56	3 59 40	8 1 20	19
20	4 41 40	7 19 20	3 50 56	8 9 4	20
21	4 36 8	7 23 52	3 42 56	8 17 4	21
22	4 31 28	7 28 32	3 34 36	8 25 24	22
23	4 26 43	7 33 16	3 25 56	8 34 4	23
23½	4 24 20	7 35 40	3 21 28	8 38 32	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual TABLE of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Cracovia.		Dantzick.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
0	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	0
1	5 55 12	6 4 48	5 54 28	6 5 32	1
2	5 50 24	6 9 36	5 48 52	6 11 8	2
3	5 45 36	6 14 24	5 43 20	6 16 40	3
4	5 40 44	6 19 16	5 37 44	6 22 16	4
5	5 35 56	6 24 4	5 32 8	6 27 52	5
6	5 31 4	6 28 56	5 26 28	6 33 32	6
7	5 26 8	6 33 52	5 20 44	6 39 16	7
8	5 21 12	6 38 48	5 15 0	6 45 0	8
9	5 16 12	6 43 48	5 9 56	6 50 44	9
10	5 11 12	6 48 48	5 3 20	6 56 40	10
11	5 6 4	6 53 56	4 57 24	7 2 36	11
12	5 0 56	6 59 4	4 51 24	7 8 36	12
13	4 55 44	7 4 16	4 45 16	7 14 44	13
14	4 51 24	7 8 36	4 39 0	7 21 0	14
15	4 45 4	7 14 56	4 32 44	7 27 16	15
16	4 39 36	7 20 24	4 26 16	7 33 44	16
17	4 34 0	7 26 0	4 19 36	7 40 24	17
18	4 28 16	7 31 44	4 12 52	7 47 8	18
19	4 22 28	7 37 32	4 5 52	7 54 8	19
20	4 16 32	7 43 28	3 58 40	8 1 20	20
21	4 10 24	7 49 36	3 51 16	8 8 44	21
22	4 4 8	7 55 52	3 43 36	8 16 24	22
23	3 57 36	8 2 24	3 35 44	8 24 16	23
23½	3 54 20	8 5 40	3 31 36	8 28 24	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual TABLE of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Dublin.		Edenburgh.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
0	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	0
1	5 54 40	6 5 20	5 54 4	6 5 56	1
2	5 49 16	6 10 44	5 48 4	6 11 56	2
3	5 43 56	6 16 4	5 42 4	6 17 56	3
4	5 38 32	6 21 28	5 36 8	6 23 52	4
5	5 33 12	6 26 48	5 30 4	6 29 56	5
6	5 27 32	6 32 28	5 24 0	6 36 0	6
7	5 21 48	6 38 12	5 18 48	6 41 12	7
8	5 16 32	6 43 28	5 11 40	6 48 20	8
9	5 10 52	6 49 8	5 5 28	6 54 32	9
10	5 5 12	6 54 48	4 59 8	7 0 52	10
11	5 0 28	6 59 32	4 52 40	7 7 20	11
12	4 53 40	7 6 20	4 46 12	7 13 48	12
13	4 47 20	7 12 40	4 39 36	7 20 24	13
14	4 41 16	7 18 44	4 32 48	7 27 12	14
15	4 35 36	7 24 24	4 25 56	7 34 4	15
16	4 29 8	7 30 52	4 18 52	7 41 8	16
17	4 22 52	7 37 8	4 11 40	7 48 20	17
18	4 16 28	7 43 32	4 4 16	7 55 44	18
19	4 9 12	7 50 48	3 56 40	8 3 20	19
20	4 2 56	7 57 4	3 48 44	8 11 16	20
21	3 56 12	8 3 48	3 41 36	8 19 24	21
22	3 50 4	8 9 56	3 32 4	8 27 56	22
23	3 43 32	8 16 28	3 23 12	8 36 48	23
23½	3 37 4	8 22 56	3 18 36	8 41 24	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual Table of the Sun's Rising and Setting for these Places

The Sun's Declination North.	Hanover.		Jerusalem.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
0	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	0
1	5 54 48	6 5 12	5 57 28	6 2 32	1
2	5 49 32	6 10 28	5 54 52	6 5 8	2
3	5 44 20	6 15 40	5 52 20	6 7 40	3
4	5 39 4	6 20 56	5 49 48	6 10 12	4
5	5 34 24	6 25 36	5 47 12	6 12 48	5
6	5 28 24	6 31 36	5 44 40	6 15 20	6
7	5 23 4	6 36 56	5 42 0	6 18 0	7
8	5 17 40	6 42 20	5 39 38	6 20 22	8
9	5 12 16	6 47 44	5 36 52	6 23 8	9
10	5 6 44	6 53 16	5 34 12	6 25 48	10
11	5 1 8	6 58 52	5 31 36	6 28 24	11
12	4 55 28	7 4 32	5 28 52	6 31 8	12
13	4 49 44	7 10 16	5 26 0	6 34 0	13
14	4 43 56	7 16 4	5 23 24	6 36 36	14
15	4 38 0	7 22 0	5 20 40	6 39 20	15
16	4 31 56	7 28 4	5 17 56	6 42 4	16
17	4 25 48	7 34 12	5 15 4	6 44 56	17
18	4 19 28	7 40 32	5 12 12	6 47 48	18
19	4 13 0	7 47 0	5 9 20	6 50 40	19
20	4 6 24	7 53 36	5 6 24	6 53 36	20
21	3 59 32	8 0 28	5 3 28	6 58 32	21
22	3 52 28	8 7 32	5 1 20	6 59 40	22
23	3 45 12	8 14 48	4 57 12	7 2 48	23
23½	3 41 38	8 18 22	4 55 40	7 4 20	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual Table of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Lisbon.		Madrid.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
°	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	°
1	5 56 48	6 3 12	5 56 36	6 3 24	1
2	5 53 36	6 6 24	5 53 16	6 6 44	2
3	5 50 20	6 9 40	5 49 52	6 10 8	3
4	5 47 8	6 12 52	5 46 28	6 13 32	4
5	5 43 56	6 16 4	5 43 4	6 16 56	5
6	5 41 36	6 19 24	5 39 40	6 20 20	6
7	5 37 24	6 22 36	5 36 8	6 23 52	7
8	5 34 8	6 25 52	5 32 48	6 27 12	8
9	5 31 48	6 29 12	5 29 16	6 30 44	9
10	5 27 28	6 32 32	5 25 44	6 34 16	10
11	5 24 24	6 35 36	5 22 16	6 37 44	11
12	5 20 44	6 39 16	5 18 40	6 41 20	12
13	5 17 16	6 42 44	5 15 0	6 45 0	13
14	5 13 38	6 46 22	5 11 24	6 48 36	14
15	5 10 20	6 49 40	5 7 44	6 52 16	15
16	5 6 48	6 53 12	5 4 0	6 56 0	16
17	5 3 12	6 56 48	5 0 12	6 59 48	17
18	4 59 32	7 0 28	4 56 20	7 3 40	18
19	4 55 48	7 4 12	4 52 24	7 7 36	19
20	4 52 4	7 7 56	4 48 24	7 11 36	20
21	4 48 4	7 11 56	4 44 24	7 15 36	21
22	4 44 16	7 15 44	4 40 16	7 19 44	22
23	4 40 20	7 19 40	4 36 40	7 23 56	23
23½	4 38 20	7 21 40	4 33 52	7 26 8	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual Table of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Moscow.		New York.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
0	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	0
1	5 54 12	6 5 48	5 56 24	6 3 36	1
2	5 48 24	6 11 36	5 52 52	6 7 8	2
3	5 42 16	6 17 44	5 49 20	6 10 40	3
4	5 36 44	6 23 16	5 45 44	6 14 16	4
5	5 30 52	6 29 8	5 42 8	6 17 52	5
6	5 24 56	6 35 4	5 38 32	6 21 28	6
7	5 19 0	6 41 0	5 34 56	6 25 4	7
8	5 13 0	6 47 0	5 31 16	6 28 44	8
9	5 6 52	6 53 8	5 27 36	6 32 24	9
10	5 0 44	6 59 16	5 23 56	6 36 4	10
11	4 54 32	7 5 28	5 20 12	6 39 48	11
12	4 48 8	7 11 52	5 16 24	6 43 36	12
13	4 41 48	7 18 12	5 12 32	6 47 28	13
14	4 35 12	7 24 48	5 8 44	6 51 16	14
15	4 28 32	7 31 28	5 6 0	6 54 0	15
16	4 21 44	7 38 16	5 0 22	6 59 38	16
17	4 14 44	7 45 16	4 56 32	7 3 28	17
18	4 7 32	7 52 28	4 52 58	7 7 2	18
19	4 0 8	7 59 52	4 48 36	7 11 24	19
20	3 51 44	8 7 16	4 46 4	7 13 56	20
21	3 44 40	8 15 20	4 40 8	7 19 52	21
22	3 36 28	8 23 32	4 35 44	7 24 16	22
23	3 28 0	8 32 0	4 31 24	7 28 36	23
23½	3 23 36	8 36 24	4 28 56	7 31 4	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual Table of the Sun's Rising and Setting for these Places,

The Sun's Declination North.	Oxford.		Paris.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
°	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	°
1	5 54 48	6 5 12	5 55 20	6 4 40	1
2	5 49 52	6 10 8	5 50 32	6 9 28	2
3	5 44 44	6 15 16	5 46 16	6 13 44	3
4	5 39 40	6 20 20	5 41 40	6 18 20	4
5	5 34 32	6 25 28	5 37 0	6 23 0	5
6	5 29 20	6 30 40	5 32 20	6 27 40	6
7	5 24 8	6 35 52	5 27 40	6 32 20	7
8	5 18 56	6 41 4	5 22 56	6 37 4	8
9	5 13 36	6 46 24	5 18 12	6 41 48	2
10	5 7 40	6 52 20	5 13 28	6 46 32	10
11	5 2 52	6 57 8	5 8 36	6 51 24	11
12	4 57 24	7 2 36	5 3 40	6 56 20	12
13	4 51 52	7 8 8	4 58 44	7 1 16	13
14	4 46 12	7 13 48	4 53 40	7 6 20	14
15	4 40 28	7 19 32	4 48 36	7 11 24	15
16	4 34 40	7 25 20	4 43 24	7 16 36	16
17	4 28 40	7 31 20	4 38 4	7 21 56	17
18	4 22 44	7 37 16	4 32 40	7 27 20	18
19	4 16 20	7 43 40	4 27 12	7 32 48	19
20	4 9 56	7 50 4	4 21 32	7 38 28	20
21	4 3 32	7 56 28	4 15 48	7 44 12	21
22	3 56 36	8 3 24	4 9 52	7 50 8	22
23	3 49 36	8 10 24	4 3 44	7 56 16	23
23½	3 46 8	8 13 52	4 0 40	7 59 20	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual TABLE of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Rome.		St. Christopher's.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
°	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	°
1	5 56 24	6 3 36	5 58 44	6 1 16	1
2	5 52 40	6 7 20	5 57 28	6 2 32	2
3	5 46 48	6 13 12	5 56 12	6 3 48	3
4	5 45 36	6 14 24	5 55 0	6 5 0	4
5	5 42 4	6 17 56	5 53 40	6 6 20	5
6	5 38 24	6 21 36	5 52 24	6 7 36	6
7	5 34 48	6 25 12	5 51 8	6 8 52	7
8	5 31 8	6 28 52	5 49 52	6 10 8	8
9	5 27 24	6 32 36	5 48 32	6 11 28	9
10	5 23 40	6 36 20	5 47 16	6 12 44	10
11	5 19 56	6 40 4	5 45 56	6 14 4	11
12	5 16 8	6 43 52	5 44 36	6 15 24	12
13	5 12 20	6 47 40	5 43 16	6 16 44	13
14	5 8 24	6 51 36	5 41 56	6 18 4	14
15	5 4 28	6 55 32	5 40 36	6 19 24	15
16	5 0 32	6 59 28	5 39 16	6 20 44	16
17	4 56 28	7 3 32	5 37 12	6 22 48	17
18	4 52 24	7 7 36	5 36 28	6 23 32	18
19	4 48 12	7 11 48	5 35 4	6 24 56	19
20	4 43 56	7 16 4	5 33 36	6 26 24	20
21	4 39 36	7 20 24	5 32 12	6 27 48	21
22	4 35 12	7 24 48	5 31 44	6 29 16	22
23	4 30 40	7 29 20	5 29 16	6 30 44	23
23½	4 28 24	7 31 36	5 28 28	6 31 32	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual TABLE of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Stockholm.		Vienna.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
°	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	°
1	5 53 12	6 6 48	5 55 32	6 4 28	1
2	5 46 28	6 13 32	5 51 4	6 8 56	2
3	5 39 40	6 20 20	5 46 48	6 13 12	3
4	5 32 38	6 27 22	5 42 8	6 17 52	4
5	5 25 56	6 34 4	5 37 32	6 22 28	5
6	5 19 0	6 41 0	5 33 4	6 26 56	6
7	5 13 8	6 46 52	5 28 36	6 31 24	7
8	5 4 56	6 55 4	5 24 4	6 35 56	8
9	4 57 48	7 2 12	5 19 28	6 40 32	9
10	4 50 32	7 9 28	5 14 28	6 45 32	10
11	4 43 16	7 16 44	5 11 0	6 49 0	11
12	4 35 40	7 24 20	5 5 4	6 54 56	12
13	4 27 56	7 32 4	5 0 4	6 59 56	13
14	4 20 8	7 39 52	4 55 16	7 4 44	14
15	4 12 4	7 47 56	4 50 12	7 9 48	15
16	4 3 52	7 56 8	4 45 24	7 14 36	16
17	3 55 16	8 4 44	4 40 16	7 19 44	17
18	3 46 28	8 13 32	4 34 40	7 25 20	18
19	3 37 20	8 22 40	4 28 12	7 31 48	19
20	3 27 48	8 32 12	4 23 48	7 36 12	20
21	3 17 52	8 42 8	4 18 12	7 41 48	21
22	3 7 20	8 52 40	4 12 24	7 47 36	22
23	2 56 12	9 3 48	4 6 32	7 53 28	23
23½	2 50 20	9 9 40	4 3 28	7 56 32	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A Perpetual TABLE of the Sun's Rising and Setting for these Places.

The Sun's Declination North.	Virginia.		Jamaica.		The Sun's Declination South.
	Sun rises	Sun sets	Sun rises	Sun sets	
0	h. ′ ″	h. ′ ″	h. ′ ″	h. ′ ″	0
1	5 56 48	6 3 12	5 58 40	6 1 20	1
2	5 53 40	6 6 20	5 57 24	6 2 36	2
3	5 50 24	6 9 36	5 56 8	6 3 52	3
4	5 47 16	6 12 44	5 54 52	6 5 8	4
5	5 44 36	6 15 24	5 53 28	6 6 32	5
6	5 41 8	6 18 52	5 52 0	6 8 0	6
7	5 38 0	6 22 0	5 50 44	6 9 16	7
8	5 35 0	6 25 0	5 49 20	6 10 40	8
9	5 31 56	6 28 4	5 48 0	6 12 0	9
10	5 27 52	6 32 8	5 46 40	6 13 20	10
11	5 24 36	6 35 24	5 45 20	6 15 40	11
12	5 21 12	6 38 48	5 43 48	6 16 12	12
13	5 17 48	6 42 12	5 42 32	6 17 28	13
14	5 14 24	6 45 36	5 41 0	6 19 0	14
15	5 10 56	6 49 4	5 39 40	6 20 20	15
16	5 7 32	6 52 28	5 38 8	6 21 52	16
17	5 3 52	6 56 8	5 36 44	6 23 16	17
18	5 0 16	6 59 44	5 35 16	6 24 44	18
19	4 57 0	7 3 0	5 33 48	6 26 12	19
20	4 52 52	7 7 8	5 32 12	6 27 48	20
21	4 49 24	7 10 36	5 30 40	6 29 20	21
22	4 46 12	7 13 48	5 29 12	6 30 48	22
23	4 42 52	7 17 8	5 27 28	6 32 32	23
23½	4 39 16	7 20 44	5 26 44	6 33 16	23½
	Sun sets	Sun rises	Sun sets	Sun rises	

A TABLE of Amplitudes for these Latitudes North and South.

Dec.	2	4	6	8	10	12	14
°	′	° ′	° ′	° ′	°	° ′	° ′
1	1 0	1 0	1 0	1 0	1 1	1 1	1 1
2	2 0	2 0	2 0	2 1	2 2	2 2	2 2
3	3 0	3 0	3 1	3 1	3 2	3 3	3 4
4	4 0	4 1	4 1	4 4	4 3	4 7	4 9
5	5 0	5 1	5 2	5 5	5 4	5 7	5 10
6	6 0	6 1	6 3	6 5	6 5	6 9	6 13
7	7 0	7 1	7 3	7 5	7 6	7 9	7 13
8	8 0	8 1	8 3	8 5	8 7	8 9	8 13
9	9 0	9 1	9 3	9 5	9 7	9 9	9 14
10	10 0	10 1	10 3	10 6	10 8	10 12	10 18
11	11 0	11 1	11 4	11 6	11 9	11 13	11 17
12	12 0	12 1	12 5	12 7	12 11	12 16	12 22
13	13 0	13 1	13 5	13 7	17 12	13 18	13 26
14	14 0	14 2	14 5	14 9	14 13	14 19	14 26
15	15 0	15 2	15 5	15 9	15 14	15 20	15 28
16	16 1	16 2	16 6	16 10	16 15	16 22	16 30
17	17 1	17 3	17 6	17 10	17 16	17 24	17 32
18	18 1	18 3	18 6	18 11	18 17	18 25	18 35
19	19 1	19 3	19 6	19 12	19 18	19 27	19 37
20	20 1	20 3	20 7	20 12	20 19	20 28	20 38
21	21 1	21 4	21 7	21 13	21 20	21 29	21 40
22	22 1	22 4	22 8	22 13	22 21	22 31	22 42
23	23 2	23 4	23 9	23 15	23 22	23 33	23 44
23½	23 31	23 34	23 38	23 45	23 53	24 3	24 16

A TABLE of Amplitudes for these Latitudes North and South.

Dec.	16	18	20	22	24	26	28
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1	1 2	1 3	1 4	1 5	1 6	1 7	1 8
2	2 4	2 5	2 7	2 8	2 10	2 12	2 15
3	3 5	3 8	3 10	3 13	3 15	3 19	3 22
4	4 11	4 14	4 17	4 21	4 25	4 29	4 34
5	5 12	5 16	5 19	5 23	5 28	5 33	5 39
6	6 14	6 19	6 24	6 29	6 35	6 41	6 48
7	7 16	7 21	7 26	7 32	7 40	7 48	7 56
8	8 17	8 24	8 31	8 38	8 46	8 55	9 5
9	9 20	9 26	9 35	9 43	9 51	10 1	10 12
10	10 24	10 31	10 38	10 48	10 58	11 9	11 21
11	11 27	11 34	11 39	11 53	12 0	12 16	12 30
12	12 30	12 38	12 47	12 59	13 9	13 23	13 37
13	13 32	13 41	13 51	14 3	14 15	14 29	14 45
14	14 35	14 45	14 55	15 8	15 22	15 37	15 55
15	15 37	15 48	16 0	16 14	16 28	16 44	17 3
16	16 40	16 52	17 3	17 18	17 33	17 51	18 10
17	17 42	17 54	18 7	18 24	18 40	18 59	19 21
18	18 46	18 58	19 12	19 29	19 47	20 7	20 29
19	19 47	20 0	20 16	20 33	20 53	21 4	21 38
20	20 50	21 4	21 21	21 39	21 59	22 22	22 47
21	21 54	22 10	22 28	22 46	23 6	23 28	23 55
22	22 56	23 11	23 30	23 50	24 13	24 38	25 7
23	23 58	24 13	24 34	24 56	25 21	25 49	26 18
23½	24 30	24 47	25 7	25 28	25 53	26 20	26 51

A TABLE of Amplitudes for these Latitudes North and South.

Dec.	30	31	32	33	34	35	36
	o ′	o ′	o ′	o ′	o ′	o ′	o ′
0							
1	1 9	1 10	1 11	1 12	1 12	1 13	1 14
2	2 17	2 19	2 21	2 23	2 25	2 26	2 28
3	3 26	3 29	3 31	3 34	3 37	3 40	3 43
4	4 39	4 41	4 44	4 48	4 52	4 55	4 57
5	5 46	5 50	5 54	5 58	6 2	6 6	6 11
6	6 57	7 1	7 6	7 11	7 15	7 20	7 25
7	8 5	8 10	8 15	8 20	8 25	8 32	8 40
8	9 15	9 21	9 27	9 33	9 40	9 47	9 54
9	10 24	10 31	10 38	10 45	10 53	11 1	11 9
10	11 34	11 42	11 50	11 58	12 6	12 17	12 24
11	12 44	12 51	12 59	13 8	13 17	13 27	13 38
12	13 53	14 2	14 12	14 22	14 32	14 42	14 53
13	15 3	15 11	15 22	15 33	15 44	15 56	16 4
14	16 13	16 24	16 35	16 46	16 58	17 11	17 24
15	17 23	17 34	17 46	17 59	18 11	18 25	18 40
16	18 33	18 45	18 58	19 11	19 25	19 40	19 55
17	19 44	19 57	20 10	20 24	20 39	20 55	21 11
18	20 54	21 8	21 22	21 37	21 53	22 10	22 27
19	22 5	22 19	22 34	22 50	23 7	23 25	23 44
20	23 16	23 31	23 47	24 4	24 22	24 41	25 0
21	24 25	24 41	25 1	25 19	25 37	25 57	26 18
22	25 38	25 55	26 13	26 32	26 52	27 13	27 35
23	26 49	27 7	27 26	27 46	28 7	28 29	28 53
23½	27 25	27 43	28 3	28 23	28 45	29 8	29 32

A TABLE of Amplitudes for these Latitudes North and South.

Dec.	37	38	39	40	41	42	43
	° ′	° ′	° ′	° ′	° ′	° ′	° ′
0							
1	1 15	1 16	1 17	1 18	1 19	1 20	1 21
2	2 30	2 32	2 34	2 37	2 39	2 42	2 44
3	3 45	3 48	3 51	3 55	3 58	4 2	4 6
4	5 0	5 4	5 8	5 13	5 17	5 22	5 28
5	6 16	6 21	6 26	6 32	6 38	6 44	6 51
6	7 31	7 37	7 44	7 51	7 58	8 6	8 13
7	8 47	8 54	9 1	9 9	9 17	9 26	9 35
8	10 2	10 10	10 19	10 28	10 37	10 47	10 58
9	11 18	11 27	11 37	11 47	11 57	12 9	12 21
10	12 33	12 43	12 54	12 6	12 18	13 31	13 44
11	13 49	14 1	14 13	14 26	14 39	14 52	15 7
12	15 5	15 18	15 31	15 45	16 0	16 15	16 31
13	16 22	16 35	16 49	17 5	17 20	17 37	17 55
14	17 38	17 53	18 8	18 25	18 42	19 0	19 19
15	18 55	19 10	19 27	19 45	19 3	19 23	20 44
16	20 11	20 28	20 40	21 5	21 25	21 46	22 8
17	21 28	21 46	22 6	22 20	22 47	23 10	23 34
18	22 48	22 5	23 26	23 48	24 16	24 34	25 0
19	24 3	24 24	24 46	25 9	25 33	25 59	26 26
20	25 21	25 43	26 6	26 31	26 57	27 24	27 53
21	26 39	27 3	27 27	27 53	28 20	28 49	29 20
22	27 58	28 23	28 49	29 17	29 45	30 16	30 49
23	29 17	29 43	30 11	30 40	31 10	31 43	32 17
23½	29 57	30 24	30 52	31 22	31 54	32 27	33 2

A TABLE of Amplitudes for these Latitudes North and South.

Dec.	44	45	46	47	48	49	50
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1	1 23	1 25	1 26	1 27	1 29	1 31	1 33
2	2 47	2 50	2 53	2 56	2 59	3 3	3 7
3	4 10	4 15	4 19	4 25	4 29	4 24	4 40
4	5 34	5 40	5 46	5 52	5 59	6 6	6 14
5	6 58	7 5	7 12	7 20	7 29	7 38	7 48
6	8 21	8 30	8 39	8 49	8 59	9 9	9 21
7	9 45	9 55	10 6	10 18	10 30	10 43	10 56
8	10 9	11 21	11 33	11 46	12 0	12 15	12 31
9	12 33	12 47	13 1	13 16	13 31	13 47	14 5
10	12 58	14 13	14 28	14 44	15 2	15 21	15 40
11	15 22	15 39	15 57	16 15	16 34	16 54	17 19
12	16 48	17 6	17 25	17 45	18 6	18 28	18 52
13	18 14	18 33	18 54	19 15	19 49	19 5	20 29
14	19 39	20 0	20 23	20 46	21 12	21 38	22 6
15	19 5	21 28	21 53	22 19	22 45	23 14	23 45
16	22 32	22 56	23 23	23 50	24 20	24 51	25 24
17	23 59	24 25	24 53	25 22	25 54	26 27	27 3
18	25 26	25 54	26 25	26 50	27 30	28 6	28 42
19	26 54	27 24	27 57	28 30	29 6	29 45	30 20
20	28 23	28 56	29 30	30 6	30 43	32 9	32 55
21	29 54	30 27	31 3	31 42	32 23	33 6	33 53
22	31 24	31 59	32 38	33 19	34 5	34 49	35 39
23	32 54	33 32	34 13	34 57	35 44	36 33	37 26
23½	33 40	34 20	35 2	35 48	36 34	37 26	38 21

A TABLE of Amplitudes for theſe Latitudes North and South.

Dec.	51	52	53	54	55	56	57
	° ′	° ′	° ′	° ′	° ′	° ′	° ′
0							
1	1 35	1 37	1 39	1 42	1 45	1 47	1 50
2	3 11	3 15	3 19	3 24	3 29	3 35	3 41
3	4 46	4 52	4 59	5 6	5 14	5 22	5 31
4	6 22	6 30	6 39	6 49	6 59	7 10	7 22
5	7 58	8 9	8 20	8 31	8 44	8 57	9 12
6	9 33	9 46	10 0	10 14	10 30	10 46	11 3
7	11 10	11 25	11 41	11 58	12 16	12 35	12 56
8	12 47	13 4	13 22	13 41	14 3	14 24	14 48
9	14 24	14 44	15 4	15 26	15 50	16 15	16 42
10	16 1	16 23	16 46	17 11	17 37	18 6	18 36
11	17 39	18 3	18 29	18 56	19 29	19 56	20 29
12	19 17	19 41	20 11	20 42	21 15	21 50	22 27
13	20 55	21 26	21 57	22 30	23 5	23 44	24 24
14	22 36	23 6	23 42	24 18	24 57	25 38	26 22
15	24 17	24 52	25 28	26 7	26 45	27 35	28 22
16	25 58	26 35	27 15	27 58	28 43	29 32	30 24
17	27 40	28 21	29 4	29 48	30 39	31 32	32 28
18	29 24	30 8	30 54	31 43	32 38	33 33	34 34
19	31 9	31 55	32 44	33 38	34 35	35 36	36 42
20	33 45	34 38	35 35	36 37	36 39	37 43	38 54
21	34 42	35 36	36 32	37 34	38 40	39 51	41 11
22	36 32	37 29	38 30	39 26	40 47	42 5	43 27
23	38 3	39 23	40 29	41 40	42 56	43 45	45 50
23½	39 19	40 32	41 30	42 43	44 3	45 29	46 55

A TABLE of Amplitudes for these Latitudes North and South.

Dec.	58	59	60
°	° ′	° ′	° ′
1	1 53	1 56	2 0
2	3 47	3 53	4 0
3	5 40	5 50	6 1
4	7 34	7 47	8 1
5	9 28	9 45	10 2
6	11 22	11 42	12 4
7	13 18	13 41	14 6
8	15 14	15 40	16 10
9	17 10	17 40	18 14
10	19 8	19 42	20 19
11	21 6	21 46	22 26
12	23 6	23 48	24 34
13	25 7	25 54	26 44
14	27 10	28 1	28 56
15	29 14	30 11	31 10
16	31 20	32 21	33 27
17	33 29	34 36	35 47
18	35 40	36 52	38 10
19	38 2	39 12	40 37
20	40 12	41 36	43 9
21	42 33	44 5	45 46
22	44 59	46 40	48 31
23	47 30	49 20	51 23
23½	48 48	50 44	52 54

Enter with the Sun's Declination on the Left-Hand, and the Latitude of your Place on the Top, and in the Place of meeting is the Amplitude the Sun has then at that Time and Place, and it is always of the same Name with the Declination, *viz.* North or South. In Page 29, you have the Method of making this Table.

Table 1 — This Table shews the Cycle of the Sun Perpetual.

YEARS																											
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99												

CENTURYS																												
	2100	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8
1500	2200	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1600	2300	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12
1700	2400	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1800		17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1900		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4
2000		21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Table 2 — This Table shews ye Charks for finding ye Grego: Domini: Letter together with ye Difference of Days in Account

Centurys	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Characteristicks	1	1	2	3	4	4	5	6	7	7
Days Diff: in Accou:	10	Bissex	11	12	13	Bissex	14	15	16	Bissex

Table 3 — This Table by haueing ye Cycle of ye Sun and Charac: shews ye Gregorian Dominical Letters Perpetually

Cycle of ye ☉	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	CB	A	G	F	ED	C	B	A	GF	E	D	C	BA	G	F	E	DC	B	A	G	FE	D	C	B	AG	F	E	D
2	DC	B	A	G	FE	D	C	B	AG	F	E	D	CB	A	G	F	ED	C	B	A	GF	E	D	C	BA	G	F	E
3	ED	C	B	A	GF	E	D	C	BA	G	F	E	DC	B	A	G	FE	D	C	B	AG	F	E	D	CB	A	G	F
4	FE	D	C	B	AG	F	E	D	CB	A	G	F	ED	C	B	A	GF	E	D	C	BA	G	F	E	DC	B	A	G
5	GF	E	D	C	BA	G	F	E	DC	B	A	G	FE	D	C	B	AG	F	E	D	CB	A	G	F	ED	C	B	A
6	AG	F	E	D	CB	A	G	F	ED	C	B	A	GF	E	D	C	BA	G	F	E	DC	B	A	G	FE	D	C	B
7	BA	G	F	E	DC	B	A	G	FE	D	C	B	AG	F	E	D	CB	A	G	F	ED	C	B	A	GF	E	D	C

Characteristicks

Julian Dom:

Table 4 — This Table shews the Golden Number Perpetually

B. Scott Fecit

YEARS																												
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99												

CENTURYS																												
1500		19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1600		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12
1700		10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1800		15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1900		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
2000		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2
2100		11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2200		16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
2300		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9
2400		7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Table 5 — This Table shews the Gregorian Epacts for a 1000 Years Compleat.

	Golden Numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	Julian Epacts	11	22	3	14	25	6	17	28	9	20	1	12	23	4	15	26	7	18	29
Gregorian Epacts	From 1500 to 1699	7	18	29	10	21	2	13	24	5	16	27	8	19	1	11	22	3	14	25
	From 1700 to 1899	6	17	28	9	20	1	12	23	4	15	26	7	18	29	10	21	2	13	24
	From 1900 to 2199	5	16	27	8	19	29	11	22	3	14	25	6	17	28	9	20	1	12	23
	From 2200 to 2299 & 2400 to 2499	4	15	26	7	18	29	10	21	2	13	24	5	16	27	8	19	1	11	22
	From 2300 to 2399	3	14	25	6	17	28	9	20	1	12	23	4	15	26	7	18	29	10	21

Table 6 — The Dominical Letter and Epact found this Table shews the N° of Direction.

Gregorian Dominical Letter Perpetual																												
	A	33	33	33	26	26	26	26	26	26	26	19	19	19	19	19	19	19	12	12	12	12	12	12	5	5	5	5	5
	B	34	34	27	27	27	27	27	27	27	20	20	20	20	20	20	20	13	13	13	13	13	13	13	6	6	6	6	6
	C	35	28	28	28	28	28	28	28	21	21	21	21	21	21	21	14	14	14	14	14	14	14	7	7	7	7	7	7
	D	29	29	29	29	29	29	29	22	22	22	22	22	22	22	15	15	15	15	15	15	15	8	8	8	8	8	8	1
	E	30	30	30	30	30	30	23	23	23	23	23	23	23	16	16	16	16	16	16	16	9	9	9	9	9	9	9	2
	F	31	31	31	31	31	24	24	24	24	24	24	24	17	17	17	17	17	17	17	10	10	10	10	10	10	10	3	3
	G	32	32	32	32	25	25	25	25	25	25	25	18	18	18	18	18	18	18	11	11	11	11	11	11	11	4	4	4
Gregorian Epa		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29

AN Alphabetical TABLE OF

Some of the moſt Eminent Cities and Towns in the World, with their Latitude, and Longitude from *London*.

	Lat. ° ′	Long. ° ′
Aberdeen - - - - - -	57 N. 6	1 W. 43
Adrianople, in Aſia minor	38 0	31 E. 0
Agra, in India - - -	28 30	78 50
Agaia, in Hungary - -	48 30	19 30
Aleppo - - - - - - -	35 30	38 0
Alexandria - - - - - -	30 30	31 30
Amſterdam - - - - -	52 29	5 15
Antioch - - - - - -	35 8	38 0
Antwerp - - - - - -	51 20	4 0
Aracta, in Syria - - -	36 0	41 15
Aſſumption, in Paragu -	25 S. 20	54 W. 20
Athens - - - - - - -	37 N. 25	24 E. 30

	Lat. °	'	Long. °	'
Babylon	32 N.	0	45 E.	0
Barbados Iſle Middle	13	24	61 W.	0
Berwick upon Tweed	55	47	1	40
Barcelona	40	34	2 E.	0
Bedford	52	8	0 W.	30
Bergen, in Norway	60	0	5 E.	30
Berlin, in Pruſſia	52	33	13	30
Bethelem	31	49	35	0
Bononia, in Italy	44	30	11	45
Boſton, in New England	42	25	70 W.	37
Bourdeaux	44	46	0	20
Bridgwater, in Somerſetſhire	51	10	3	6
Breſt, in France	47	58	4 W.	15
Briſtol	51	30	2	45
Bruges	51	17	3 E.	0
Brunſwick	52	26	10	50
Bruſſells	51	0	4	0
Buda	47	40	18	30
Cagliari, in Sardinia	39	0	9	30
Calcut, in Eaſt India	11	10	76	0
Calſhot-Caſtle, in Hampſh.	50	50	1 W.	28
Cambridge	52	17	0	5
Canterbury	51	18	1	15
Cairo, in Egypt, Cyro	30	30	31 E.	0
Charles-Town, in Carolina	32	30	81 W.	0
Cheſter	53	10	3	4
Coca, in Florida	33	0	90	0
Compeſtella, in Spain	43	6	7	35
Conſtantinople	41	6	28 E.	30
Copenhagen	55	43	12	0
Cork	51	45	9 W.	30
Coventry	52	26	1	32

Cracow,

	Lat. ° ′	Long. ° ′
Cracow, in Poland - -	50 N. 10	19 E. 0
Cronton - - - - - -	53 22	2 W. 57
Damaſcus, in Syria - -	32 N. 30	36 E. 0
Dantzick, in Poliſh Pruſſia	54 13	19 0
Derby - - - - - - -	52 55	1 W. 36
Dartmouth, in Devonſhire	50 23	4 3
Dover - - - - - - -	51 10	1 E. 30
Dublin - - - - - - -	53 20	7 W. 3
Drontham, in Norway -	64 6	10 E. 30
Dunkirk - - - - -	51 2	2 30
Edenburgh - - - - -	56 7	3 W. 0
Epheſus - - - - -	38 30	28 E. 0
Falmouth, in Cornwall -	50 9	5 W. 30
Fee, in New Mexico -	35 0	106 W. 0
Fez, in Barbary - - -	34 30	4 30
Flamborough, in Yorkſhire	54 7	0 E. 12
Florence - - - - -	43 40	12 E. 15
Fort St. George, in India	13 0	80 0
Frankfort, on the Main -	50 10	8 0
Frankfort, on the Oder -	52 22	15 0
Geneva - - - - - -	46 15	6 45
Ghaunt - - - - - -	51 10	3 30
Gibraltar, in Spain - -	36 30	2 W. 0
Glaſcow - - - - -	55 50	4 10
Glouceſter - - - - -	51 53	2 15
Goures Gutt - - - -		
Gunfleet, in Eſſex - -	51 50	1 E. 10
Guernſey - - - - -	49 40	4 W. 30

Hague

	Lat. ° ′	Long. ° ′
Hague	52 N. 20	4 E. 0
Hamburgh, in Denmark	53 57	10 10
Hanover	52 35	9 54
Harborough, in Leiceſterſh.	52 30	1 W. 15
Harflew	49 40	
St. Helen's, in Iſle of Wight	50 N. 40	1 W. 18
Heidelburgh	49 N. 30	9 E. 0
Hereford	52 4	2 W. 50
Hull	53 46	0 15
Jamaica, Iſland middle	18 25	75 0
Jeruſalem	32 30	35 E. 30
James Town, in Virginia	37 47	77 W. 30
Jado, in Japon	35 0	139 E 30
Keſembazer, in India	24 0	86 30
Lancaſter	54 5	2 W. 50
Landaff, in Glamorganſh.	51 34	3 27
Leghorn	42 52	11 E. 0
Leiceſter	52 37	1 W. 12
Leith, in Scotland	55 58	3 0
Lepanto, in Greece	37 25	23 E. 0
Leverpoole	53 22	3 W. 4
Lima, in Peru	11 S. 50	75 20
Lincoln	53 N. 15	0 33
Lisbon	38 N. 45	8 W. 32
Litchfield	52 43	1 54
London	51 32	0 0
Leyden	52 24	4 E. 0
Lyons	47 50	2 0

Madras

	Lat. ° ′	Long. ° ′
Madras	13 N. 0	80 E. 0
Madrid	40 10	6 W. 38
Maes		
Malden, in Eſſex	51 44	0 E. 44
Mancheſter	53 32	2 W. 16
Margaret, in Kent	51 24	1 E. 28
Mexico, in New Spain	19 0	101 W. 15
Mecca, Mahomet's Birth Place	21 30	40 E. 30
Medina, Mahomet buried	24 15	39 30
Milford, in Pembrokeſhire	51 43	5 W. 7
Mocha, in Arabia by Red Sea	13 28	42 E. 0
Monomotapa, in Ethiopia	22 S. 30	22 W. 30
Mount Sinai	31 N. 0	36 30
Mount's Bay, in Cornwall	50 5	6 E. 0
Moſcow	55 25	39 E. 30
Naples	41 8	14 50
Narbone, in France	43 17	2 30
New Caſtle upon Tyne	54 57	1 W. 22
New York, joyn. to Maryland	41 40	77 0
Nineveh	35 50	45 E. 0
Northampton	52 50	1 W. 12
Norwich, in Norfolk	52 43	1 E. 16
Nuremburg	49 N. 24	11 E. 32
Orfordneſs, in Suffolk	52 12	1 E. 26
Orkney Iſle	60 6	3 W. 30
Orlence	47 50	2 E. 18
Oſtend	51 20	2 45
Oxford	51 45	1 W. 15

	Lat. ° ′	Long. ° ′
Padua, in Italy - - -	45 N. 30	12 E. 0
Paris - - - - - - - -	48 51	2 30
Patavium, in Italy - -	45 6	11 30
Pembroke - - - - - -	51 45	5 W. 7
Palermo, in Sicily - -	38 15	14 E. 0
Pekin, alias Quinſey, in China	39 54	115 40
Peterborough - - - - -	52 33	0 W. 20
Petersburg, in Ruſſia - -	60 4	39 E. 0
Philadelphia, in Penſilvania	39 0	78 W. 0
Port Royal, in Acadia, Amer.	45 0	63 0
Port Royal, in Jamaica -	17 40	76 0
Portland, joyn. to Dorſetſh.	50 32	2 37
Portſmouth, in Hampſhire	50 47	1 12
Prague, in Bohemia - -	50 0	9 E. 0
Presburg, in Hungary -	48 30	17 0
Preſton, in Lancaſhire -	53 48	2 W. 45
Quebec, in Canada - -	46 N. 20	71 W. 0
Ratisbonne, in Germany	48 55	11 E. 40
Red Sea, middle - - -	20 0	39 0
Richmond, in Yorkſhire -	54 25	1 W. 37
Roan, in France - - -	49 26	1 E. 28
Rochel - - - - - - -	46 15	0 W. 58
Rocheſter - - - - - -	51 25	0 E. 41
Rome - - - - - - -	41 50	13 0
Rotterdam - - - - -	52 8	4 0
Salamanca, in Spain - -	41 6	5 W. 15
Salvador, in India - -	21 30	71 E. 54
Salisbury - - - - - -	51 4	1 W. 56
Salisburg, in Bavaria - -	47 40	13 E. 15
Sardius, in Aſia minor -	38 36	36 0
Scanderoon, in Scilly - -	36 30	36 50

Seville,

	Lat. ° ′	Long. ° ′
Seville, in Spain - - -	37 34	5 W. 20
Shoram, in Suſſex - -	50 51	0 14
Shrewsbury - - - - -	52 44	2 50
Southampton, in Hampſhire	50 55	1 32
Spires, in Germany - -	49 11	8 E. 0
Stafford - - - - - -	52 50	2 W. 13
Stamford - - - - - -	52 37	0 33
Stockholm - - - - - -	59 26	17 E. 30
St. Chriſtopher's Iſle - -	17 30	63 W. 0
Surat, in India higher -	21 30	71 E. 54
Syracuſe, in Sicily - -	37 0	15 7
Tameſware, in Hungary	47 37	20 0
Tarragon, in Spain - -	40 45	1 20
Theſſalonica - - - - -	40 N. 0	28 E. 0
Tinmouth, Northumberland	55 4	1 W. 0
Toledo, in Spain - - -	39 54	3 W. 40
Tombute, in Africa - -	15 30	0 E. 20
Trent, in Germany - -	47 20	13 30
Tripoli, in Barbary, Algier	27 0	20 51
Tripoli, in Africa - -	32 45	13 30
Troy, in Greece - - -	41 15	26 0
Tunis, in Barbary - -	36 30	11 15
Turin, in Italy - - -	44 50	7 15
Valencia, in Spain - -	39 45	0 W. 20
Venice, in Italy - - -	45 36	13 E. 0
Vienna - - - - - - -	48 14	15 15
Ulim, in Germany - -	48 14	11 24
Ulliſpo, in Portugal - -	38 45	8 W. 45
Uraniburg, in Ween Iſle	55 54½	13 E. 0
Utrecht, in Holland - -	52 14	4 30

	Lat. ° ′	Long. ° ′
Warwick - - - - - -	52 N. 18	1 W. 38
Warington - - - - - -	53 22	2 41
Weymouth, in Dorſetſhire	50 36	2 39
Weymor, in Germany -	51 4	12 E. 46
Wiggan - - - - - -	53 34	2 W. 4
Winchelſea, in Suſſex -	50 54	0 E. 48
Wittenberg, in Germany -	51 54	14 E. 26
Worms, in Germany - -	49 32	9 24
Wolverhampton - - -	52 38	2 W. 14
Woodſtock, in Oxfordſhire	51 53	1 23
Wrexham - - - - - -	53 6	3 8
Yarmouth, in Iſle of Wight	50 41	1 40
Yarmouth, in Norfolk -	52 46	1 E. 40
York - - - - - - -	53 55	0 W. 57
Zamora, in Spain - -	41 45	4 W. 48
Zara, alias Sara, in Turkey	44 0	19 E. 20
Zell, in Germany - -	52 46	10 20
Zuenziga, in Saara Deſert	22 0	8 0

The END *of the* CATALOGUE.

ERRATA.

PAGE 10, Line 19, for 1′ 20″, read 1° 20′; and Line 24, for H, read S.

Page 22, Lines 18 and 19, for *Sector*, read *Factor*.

Page 37, Line 20, for Pag. , read Pag. 93.

Page 39, Line 5, for P. , read P. 93.