

P R O B. XX.

The Latitude and Length of the Day given, to tell what other Day of the Year will be of the same Length.

Rule. Having found the sun's place for the given day, bring it to the Meridian, and observe well its declination; then turn the globe till some other degree of the Ecliptic comes under the same degree of declination under the Meridian; this being done, see what day of the month answers to the sun's place then under the Meridian, for that is the day required, which you may easily prove.

Thus you will find that July the 13th, and August the 20th, is of the same length as May the 26th; and April the 17th.

P R O B. XXI.

The Latitude and Day given, to tell its Beginning, Ending, and (consequent'y) the Length, or Continuance of Twilight.

Definition. Twilight is that faint light which begins immediately after the sun sets in the evening, and continues till he is 18° below the Horizon; and it begins in the morning when the sun comes within 18° of the Horizon on the east side, and ends when he rises: therefore it is plain, that twilight is not only longer when days encrease in length, but it is also much stronger, as you will see by the work of the Problem.

Observation. You were told that twilight begins and ends when the sun is 18° below the Horizon, and as the quadrant of Altitude reaches no lower than the Horizon, therefore the Rule is this:

Rectify the globe, and bring the opposite degree of the sun's place to the quadrant of altitude, so that it touches just 18° on the quadrant, (then it is plain that the sun's real place will be depressed 18° below the Horizon) then look on the index, for that will point (if among the morning hours) to the beginning or (if among the evening hours) ending of twilight.

Note 1. What is meant by the opposite place of the sun is this; it is that degree of the Ecliptic opposite to (or 180° from) the given place of the sun. Thus, suppose the sun was in α , then bring its opposite sign (viz. ω) to 18° on the quadrant, so will α be depressed 18° , and the index will shew the hour.

Note 2. There is no real night at London (but twilight) from May the 22d to July the 20th, the sun all that time being less than 18° below the Horizon.

Proceed then according to the Rule, and you will find that on March the 21st, and September the 22d, twilight begins about four in the morning, and ends about eight at night.

The sun on these days you know rises and sets at six. Add, therefore, the length of morning and evening twilight to twelve hours, (the length of the days then) and it gives sixteen hours; this subtracted from twenty-four hours, leaves eight hours, the length of the real or dark night.

So also on April the 24th twilight begins about half past two, and ends about half past nine, which is in all seven hours. But on December the 20th it begins at six, and ends at six, which is in all but three hours and forty minutes.

P R O B. XXII.

The Hour given, where you are to tell what Hour it is in any other Part of the World.

Rule. Bring the given place to the Meridian, and set the index at the given hour; then turn the globe till the other place, or places, come under the Meridian, and the index will point to the real time in the place required.

Example. When it is two o'clock in the afternoon at London, to know the time at Jerusalem, and at Port Royal in Jamaica.

Proceed according to the Rule, and you will find, that when it is two in the afternoon at London, it is twenty five minutes past four at Jerusalem; and but fifty-two minutes past eight in the morning at Port Royal.

Or thus, by *Prob. vi.* Jerusalem is $36^{\circ} 15'$ east longitude of London: divide therefore $36^{\circ} 15'$ by fifteen, and the quotient is two hours, and the remainder is six, which is six times four, or twenty-four minutes, and the odd fifteen minutes, or miles, is one minute; so that the difference is two hours twenty-five minutes: and as Jerusalem is east of London, it has its hour before us, therefore it is twenty-five minutes after four in the afternoon. And thus for other places.

P R O B. XXIII.

The Day of the Month given, to tell those Inhabitants that will have the Sun in their Zenith (or over their Heads) on that Day.

Observation. This cannot happen to any other inhabitants but in the Torrid Zones, that is, to all such as have not above 23° and a half of Latitude, either north or south.

Rule. Bring the sun's place to the Meridian, and observe exactly his declination for that day; then turn the globe any way, and observe what places pass under that degree of declination on the Meridian; for all such will have the sun right over their heads some time or other on that day.

To know what inhabitants, or places, will have the sun in their Zenith on May the 21st.

Proceed as directed by the Rule, you will find St. Jago in Hispaniola, St. Jago in Cuba, Campeachy, and many other places will pass under that degree of declination, (viz. 20° north) and will have the sun in their Zenith that day.