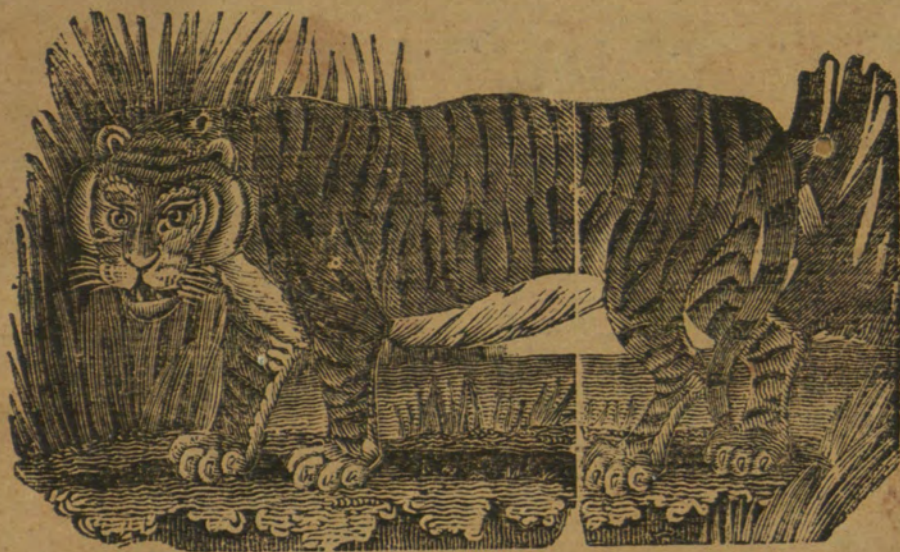
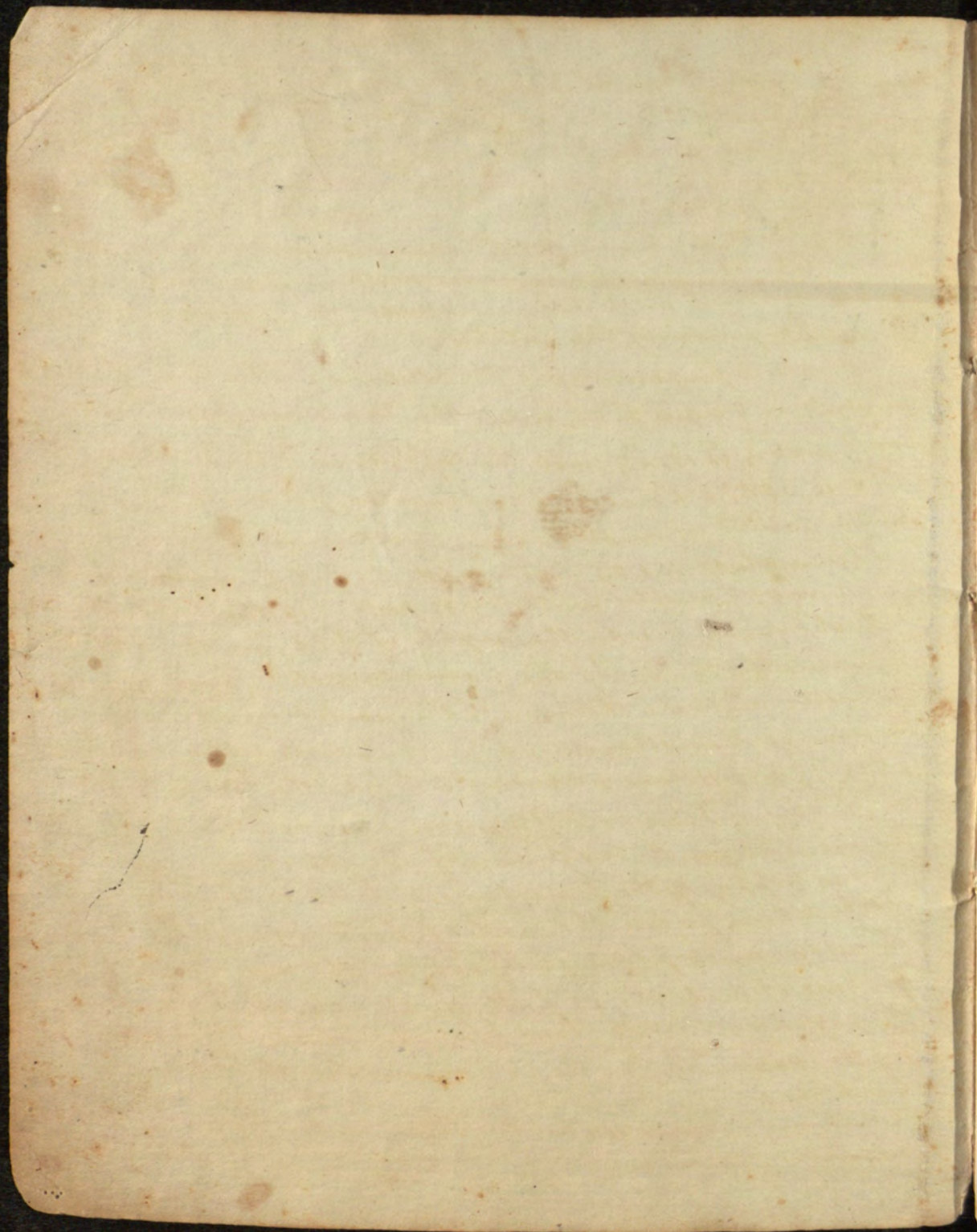




THE TIGER.

Printed by Richardson and Handford, Derby.



To calculate an Eclipse of the Moon

After finding the difference between the true time Full Moon and the mean, extract δ 's distance from the node taking the Sun's mean anomaly as an argument. Then if the true time Full Moon is later than the mean, add the number answering to the difference of the hours and minutes between the true and mean time, to the distance from the node; if earlier subtract, and that increased by 6 signs* is the argument for finding the latitude.

Make a proportion for the add minutes thus; if the argument is 6 signs $2^{\circ} 55'$, enter the table and for $6^{\circ} 2'$, is 10.35 ; for 6 and 3, is 15.45 ; and the difference is 5.15 . Then, as $60 = 1^{\circ} 5.15 :: 55.4.48$, which subtracted from 15.45 , gives 10.35 for the latitude; and so of any other number.

The angle of the δ 's path with the Eclip. must always be at right angles with the δ 's path. If the latitude is S. E. it must be on the right; if S. W., on the left hand. The same if South. If the hours exceed 12, add 12, and the over will be the hour of the next day at midnight[†]; therefore add another day. # e.g. If it were the 10th day and 14th h. $12 + = 11$ day 2 hours. If less, it is the true time of the same day 11. Then add 18^{ms}. in Voris, and - 4^h. 4^h 4^{ms}. in Lingen for the difference of longitude. In finding the time, supposing the true time of Full δ is August 20th 2^h 25. Take 25^{ms}. from the scale of hourly motion in the circles, and place one foot on the axis of the Ecliptick where it cuts the δ 's path, and extend towards the right hand and there place 2, O'clock. Then the time of

* For the Moon only, for the δ 6 signs must not be added.

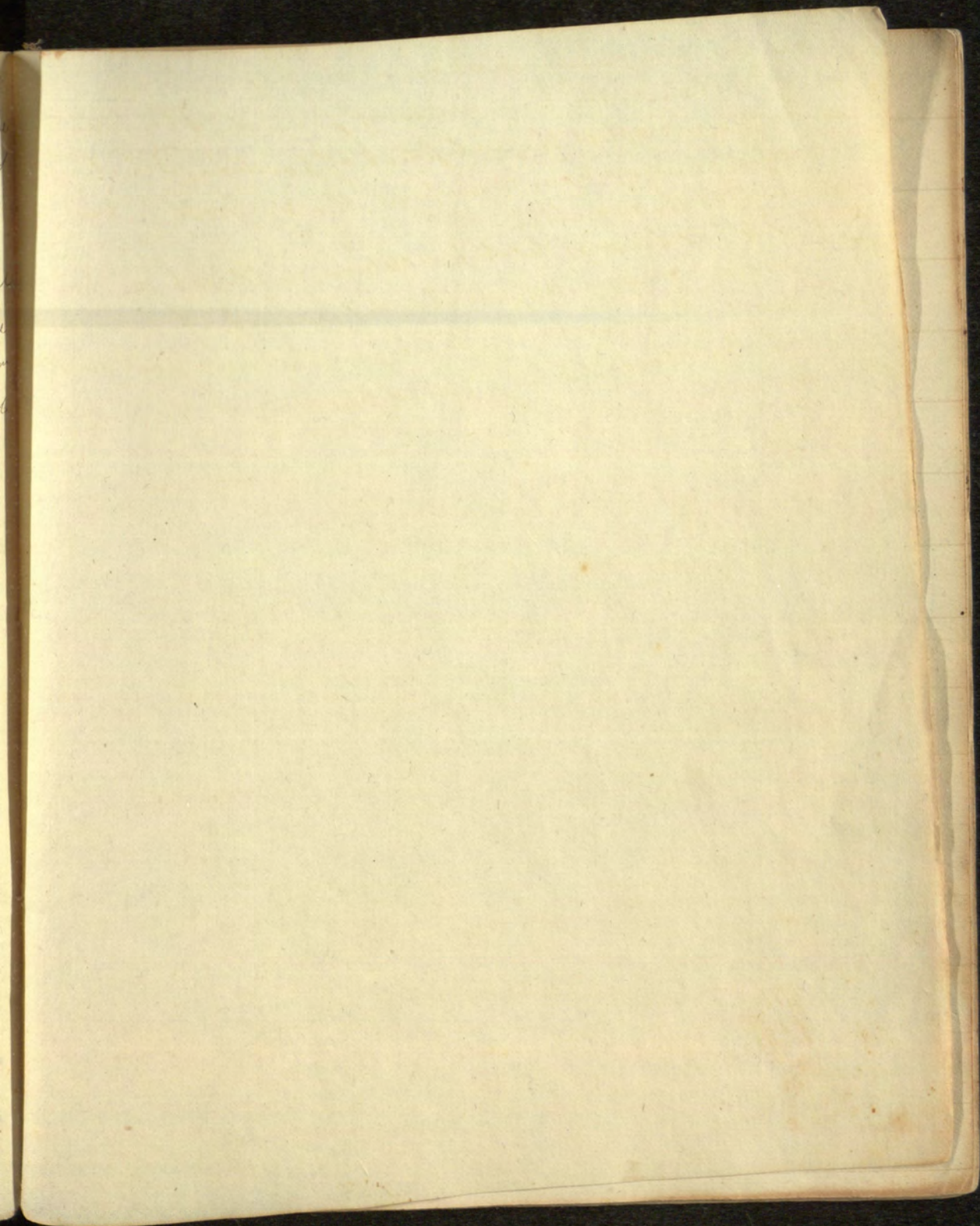
† Civil time

It need not be added till the argument is found for the lat.

|| Astronomical time

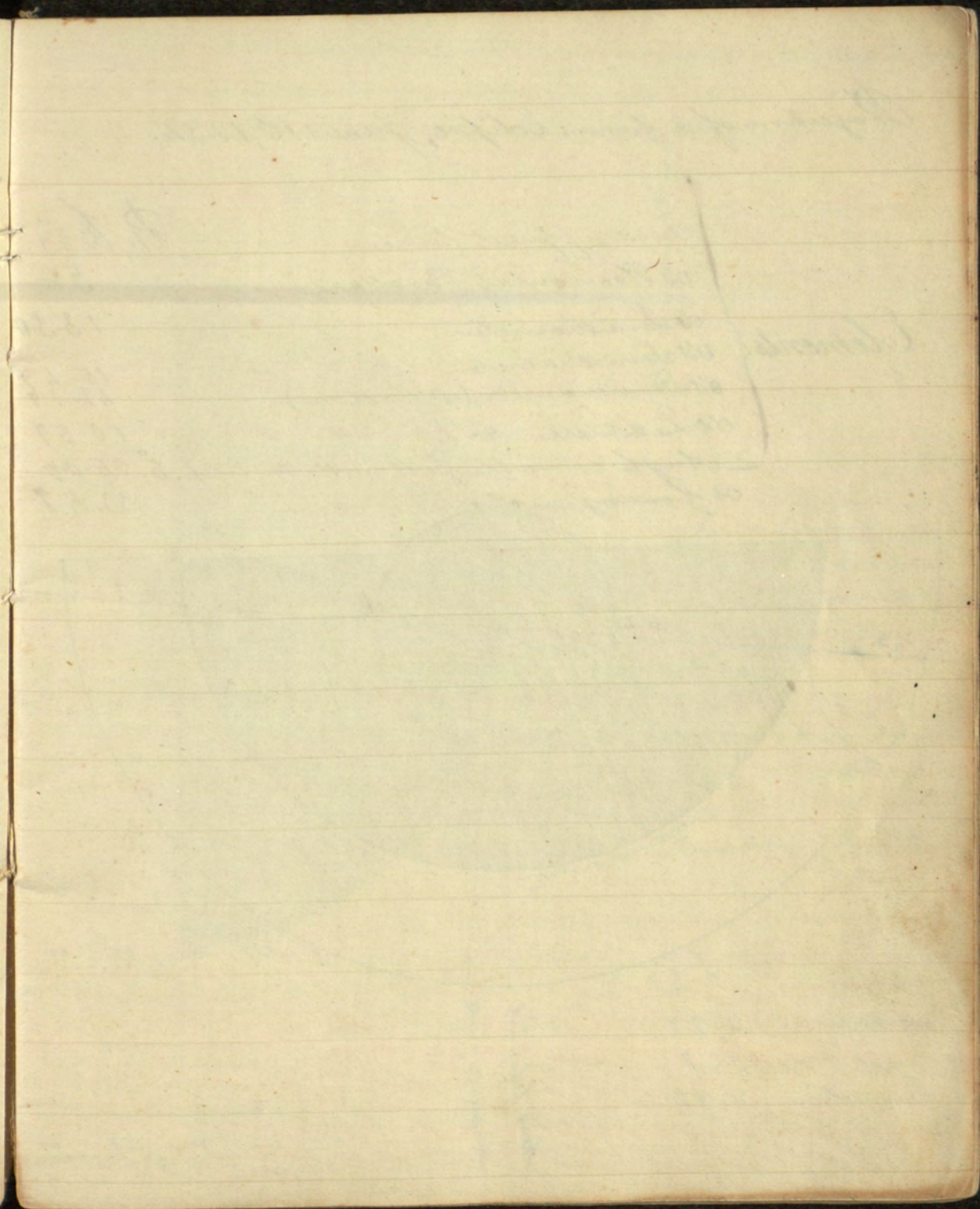
take the heavenly motion over place to the right
and left and the time is easily found. The time time
of Full π is called the ecliptic opposition. The time of
greatest obliquation, is where the ν 's path intersects
the axis of the ν 's orbit.

 It is always best to use on instrument as the case
may require, for the difference of longitude
and the equation of time for the sun's fast or slow
of the clock after finding the day of the proposed
month.



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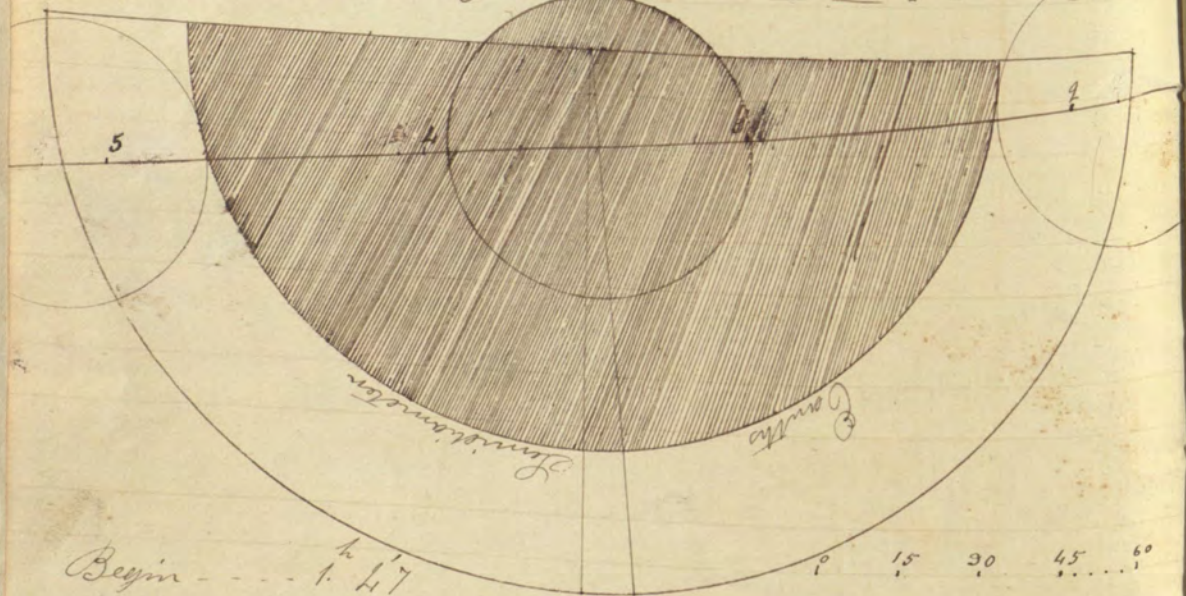
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Projection of a lunar Eclipse, June 21st, 1834.

Elements

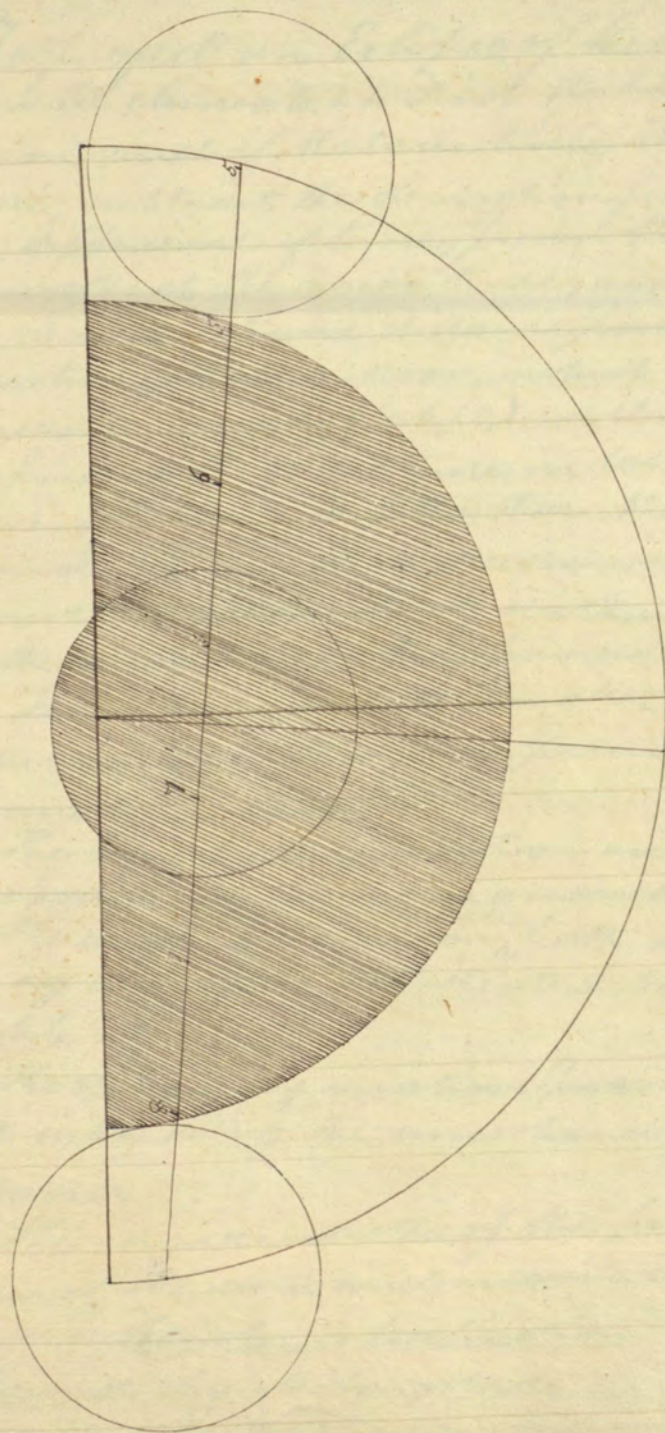
Inue apparent time 0 - - - -	$P. 1^h 5.39''$
O's Horizontal Parallax - - - -	58
O's Semidiameter - - - - -	15.50
O's Semidiameter - - - - -	15.49
O's Semidiameter (its shadow) - - - -	42.19
O's Latitude S. I. - - - - -	10.57
Angle of visible path with the Eclip. 5° 35.00	
O's Hourly motion - - - - -	33.59



Begin - - - -	$1^h 47'$
End of - - - -	3.27
End - - - -	5.7
Duration - - - -	3.22

Axis Eclipse
Angle of path

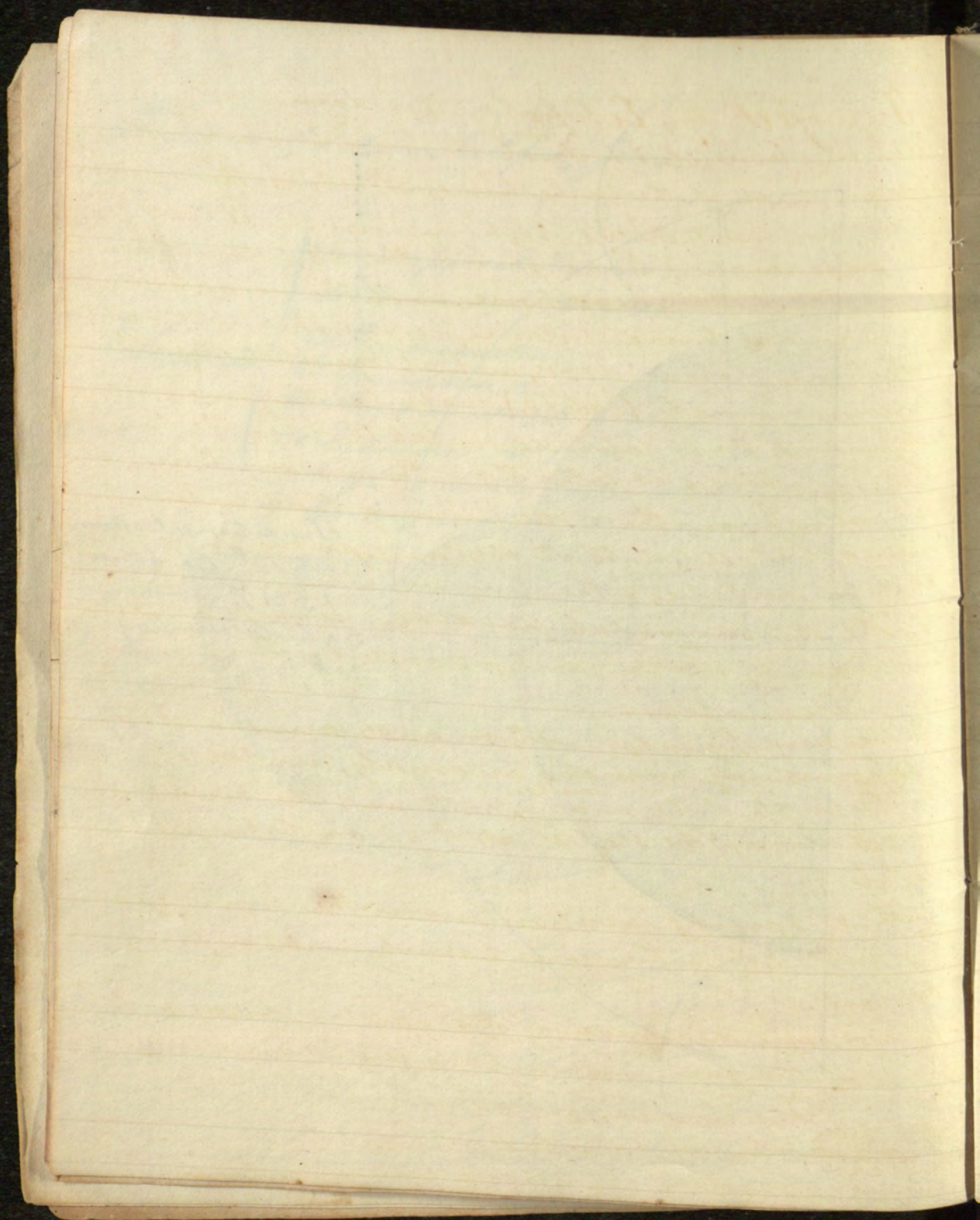
0	15	30	45	60
0	15	30	45	60



P 15 30 45 60

True time Noon
Oct. 13th 6. h. 45. m.
1897. —
Calculated May
30th, 1833.

	h. m.
Begin	4. 59
Middle	6. 45
End	2. 31
Duration	3. 32



To project an Eclipse of the Sun.

For the elements. 1. Find the true time of New Moon, and if the true time is before the mean time, subtract the $\odot$'s motion from the $\odot$'s node for the difference of time, from the $\odot$'s distance from the node at the mean time, and the remainder is the $\odot$'s mean time distance from the node at the true time of New Moon, which equated by the $\odot$'s mean anomaly (tab. 13,) will be the true distance for finding the $\odot$'s latitude in tab. 14. When the true time of New $\odot$ is later than the mean time, the $\odot$'s motion from the node during that interval must be added to its distance from the node at the mean time, & then proceed as before.

2. The $\odot$'s horizontal parallax, semidiameter, and hourly motion, are found by the $\odot$'s mean anomaly, in tab. 15

3. The suns hourly motion and semidiameter are found by his mean anomaly, in tab. 15

4. The angle of the moon's ^{visible} path with the ecliptic, may always be stated at $5^{\circ} 35'$, or taken from table 17.

5. The $\odot$'s hourly motion from the sun, is found by subtracting the suns hourly motion from the $\odot$'s.

6. The semidiameter of the penumbra is the sum of the sun's and moon's semidiameter.

The Suns Declination

is found by its longitude, in table. 12, after finding its longitude, or more conveniently

in a table of the ☉ declination. x

The co-latitude of a place is what the lat. of the place wants of 90°

The ☉ distance from the nearest solstice.

1. When the ☉ longitude is less than 3 sig., subtract the longitude from the 3 signs the rem. r. is the distance from the nearest solstice, viz, the summer solstice on the beginning of Cancer, (♋). Also, when the sun's longitude is between 3 sig. and 6, subtract 3 signs from it, and the rem. will be the ☉ distance from the same solstice.
2. When the ☉ longitude is between 6 and 9 signs, subtract it from 9 sig. and the rem. r. is the sun's distance from the winter solstice, viz, the beginning of Capricorn, (♑). When the sun's longitude is between 9 and 12 signs (12 sig. is written 0 signs) subtract 9 signs from it, and the rem. r. is the ☉ distance from the same solstice.

* From the 24th Sept. to the 24th of March the dec. is S. vice versa

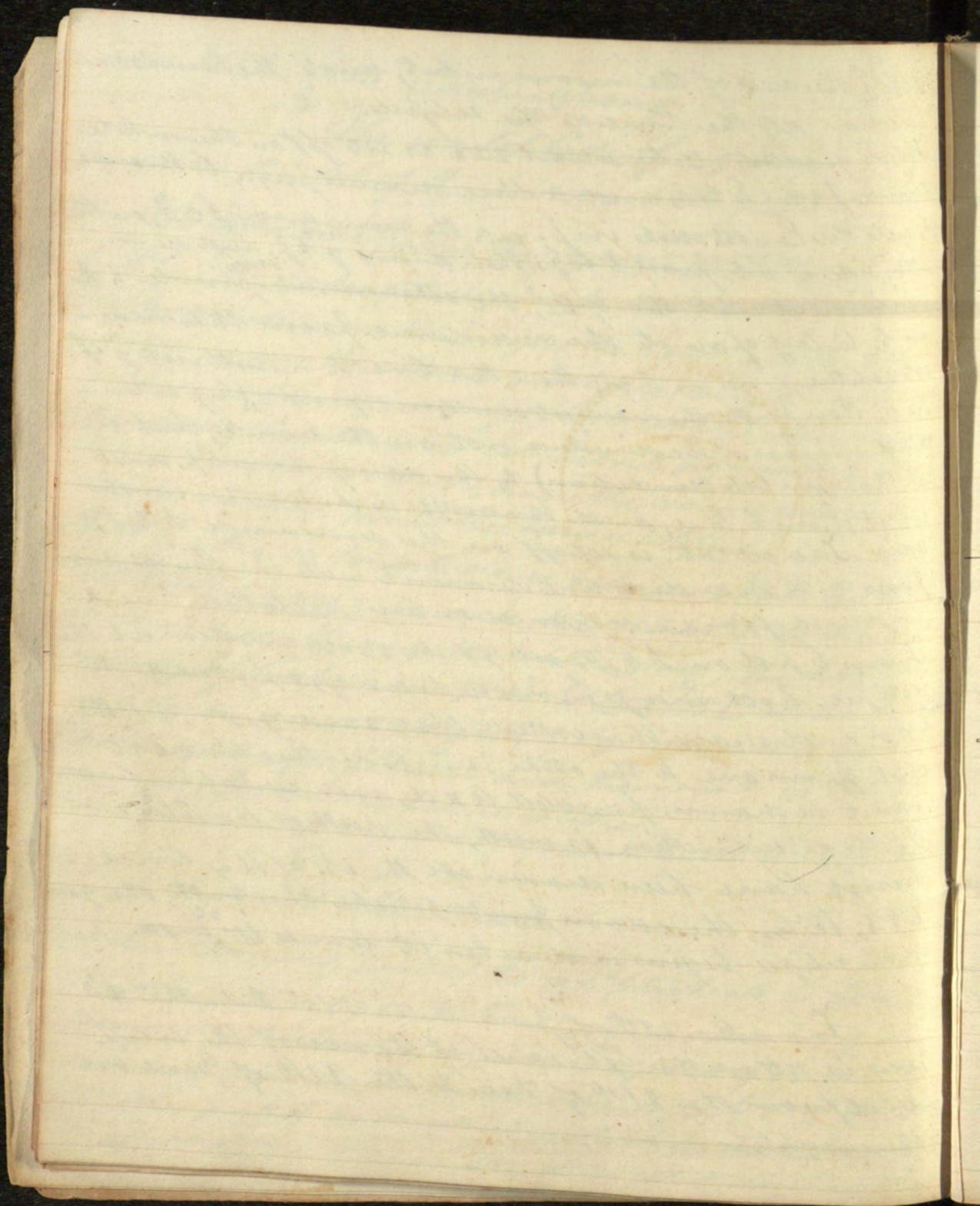
Explanations

After drawing part of the ecliptic A C B, and the axis of the ellip. and Earths semicircle C A G H then with the chord of 60° , and one foot of the dividers in C describe the arch of the semicircle C D E. From the other foot of the dividers, which is used for setting off the co-latitude the ☉ greatest declination

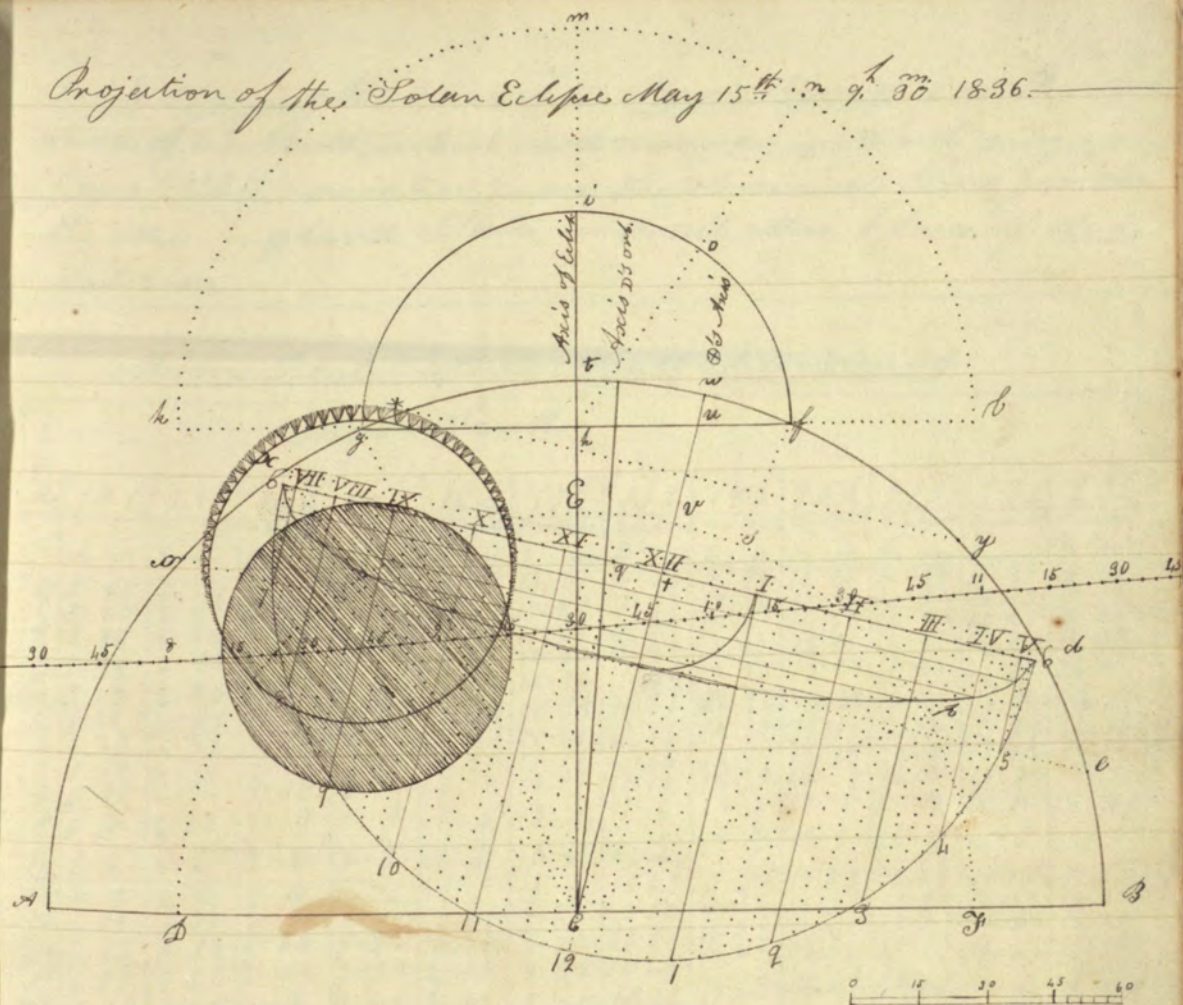
($23\frac{1}{2}^\circ$), the axis of the moons orbit, and the sun's declination at the time of the eclipse.

The $\odot$'s greatest declination $23\frac{1}{2}^\circ$ is set off on the white circle from E to S, and a line drawn from E through S, cuts the Earth's disk in f; set the same angle f E b, on the other side of E b, from b to g; then draw g h ^{semi}, and describe on it with the $\odot$'s distance from the nearest solstice from m to n; then the line h n will cut g if in o; then find the nearest distance from o, (by extending one foot of the dividers not on the circle, but in a horizontal direction) to the axis of the elip. and set it from h to u, and through u draw the earth's axis. The co-lat. is set off on the semicircle D E F, from u to h, and a line drawn E cuts the Earth's disk in d; set off on x = u d, and draw the dotted line x d. From b p d on D E F, set off the $\odot$'s declination at the eclipse, both ways from d to c & y, & from x to * & o; and draw the dotted line * and y, o c, & $\frac{1}{2}$ the dist. from one to the other is where the line b + b must be drawn, parallel to x d, and equal in length. If the $\odot$'s declination is south, the path of the plane must have been drawn off the N. of the line b + b. When the moon first touches the Earth, the general eclipse begins and when it leaves it ^{it} ends.

From the 21st of June to the 21st Dec. the $\odot$'s axis is set on the left hand of the axis of the elip. and from the 21st of Dec. to the 21st of June on the right.



Projection of the Solar Eclipse May 15th 9^h 30^m 1836.



Beginning of the eclipse	h. m.
.....	7. 33
Greatest obscuration	8. 43
Middle	8. 53
End	10. 13
Duration	2. 40
Digits eclipsed 8. 7.	

11 11
3

True apparent time	h. m.
.....	9. 30
of Horizontal Parallax	54. 59
of Distance from S. Solstice	7. 4. 34
of Declination	0. 19. 5. 9
Angle Moon with Ecliptic	0. 5. 17. 0
of Latitude	0. 0. 29. 20
of Hourly motion	0. 0. 28. 17
of Semidiameter	0. 0. 15. 55
of Ditto	0. 0. 15. 00
Semi Annulus	0. 0. 30. 55

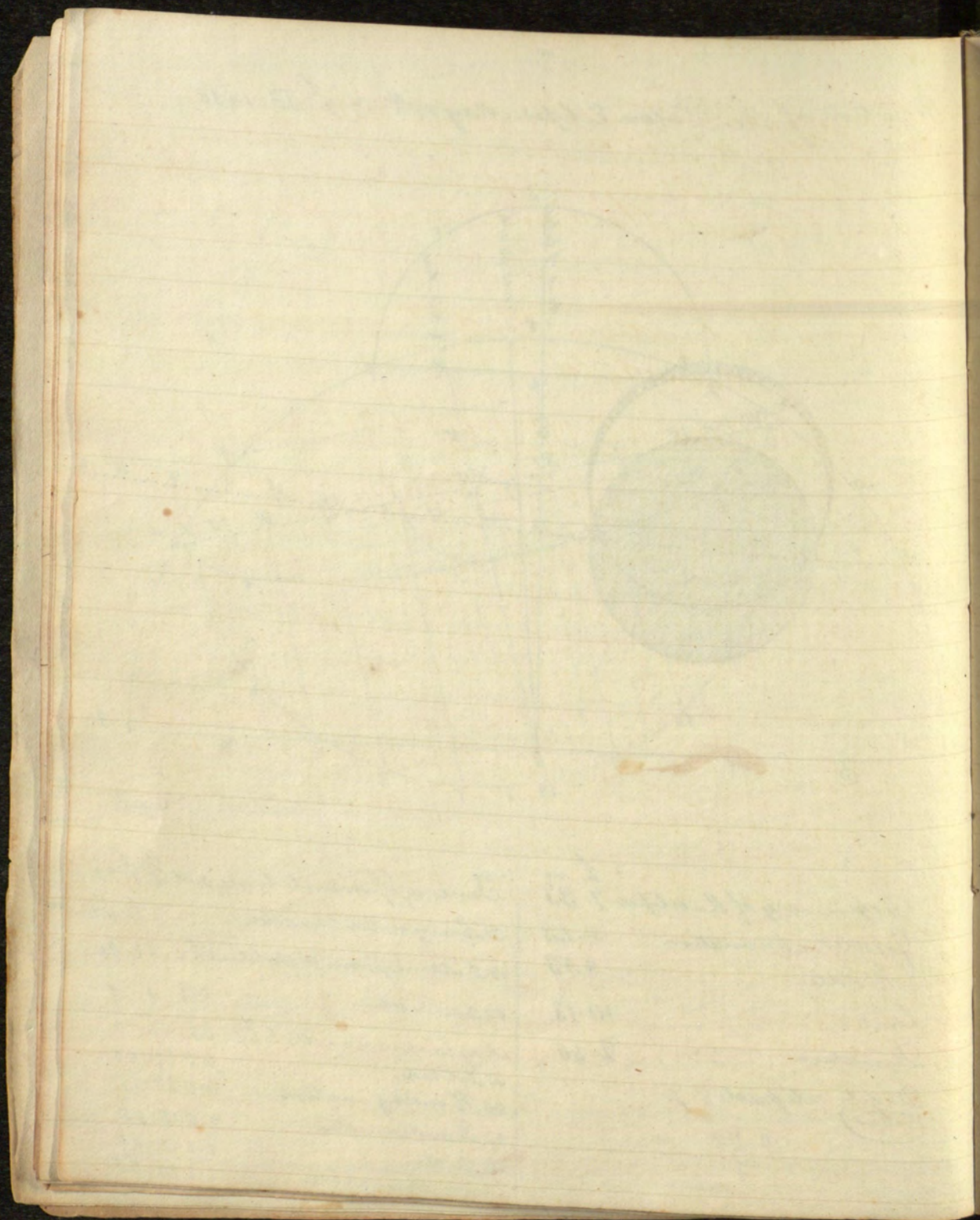


Table showing the time of the Moon's Rising, for the latitude of 43° North, which will answer without any very perceptible variation from the observed time, for all the New-England States, and all other places of the same Latitude

Moon's Declination <u>South</u> <u>Increasing</u>													Declination.
Moon South													
25 Dec.	12h.	13h.	14h.	15h.	16h.	17h.	18h.	19h.	20h.	21h.	22h.	23h.	
	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	Omiss. h. m.	
0°	5.45	6.44	7.43	8.43	9.44	10.41	11.40	12.39	13.38	14.38	15.37	16.36	0
1	5.40	6.39	7.39	8.39	9.38	10.37	11.36	12.35	13.34	14.34	15.33	16.32	1
2	5.36	6.36	7.35	8.35	9.34	10.33	11.32	12.31	13.31	14.30	15.29	16.29	2
3	5.32	6.32	7.31	8.31	9.30	10.30	11.28	12.27	13.27	14.26	15.25	16.25	3
4	5.29	6.28	7.28	8.27	9.26	10.26	11.24	12.23	13.23	14.22	15.21	16.21	4
5	5.26	6.25	7.25	8.23	9.23	10.22	11.21	12.20	13.20	14.19	15.18	16.18	5
6	5.23	6.22	7.21	8.20	9.20	10.19	11.18	12.17	13.17	14.15	15.15	16.14	6
7	5.19	6.18	7.17	8.16	9.16	10.16	11.14	12.14	13.13	14.12	15.12	16.11	7
8	5.15	6.14	7.13	8.13	9.12	10.12	11.10	12.10	13.09	14.08	15.08	16.07	8
9	5.11	6.10	7.10	8.09	9.09	10.08	11.06	12.06	13.05	14.04	15.04	16.03	9
10	5.07	6.06	7.06	8.05	9.05	10.04	11.03	12.02	13.01	14.00	15.00	16.00	10
11	5.03	6.02	7.02	8.01	9.01	10.00	10.59	11.58	12.57	13.56	14.56	15.56	11
12	4.59	5.58	6.58	7.57	8.57	9.56	10.55	11.54	12.53	13.52	14.52	15.52	12
13	4.55	5.54	6.54	7.53	8.53	9.52	10.51	11.50	12.49	13.48	14.48	15.48	13
14	4.51	5.51	6.50	7.50	8.49	9.48	10.48	11.47	12.46	13.46	14.45	15.45	14
15	4.46	5.47	6.46	7.46	8.45	9.44	10.44	11.43	12.42	13.42	14.41	15.41	15
16	4.42	5.43	6.42	7.42	8.41	9.40	10.40	11.39	12.38	13.38	14.37	15.37	16
17	4.39	5.39	6.38	7.38	8.37	9.36	10.36	11.35	12.35	13.34	14.34	15.34	17
18	4.35	5.35	6.34	7.33	8.33	9.32	10.32	11.31	12.31	13.30	14.30	15.30	18
19	4.31	5.31	6.30	7.29	8.29	9.28	10.29	11.28	12.28	13.27	14.27	15.27	19
20	4.28	5.27	6.26	7.25	8.26	9.25	10.25	11.25	12.25	13.24	14.24	15.24	20
21	4.23	5.23	6.22	7.22	8.22	9.21	10.22	11.21	12.21	13.21	14.21	15.21	21
22	4.19	5.18	6.18	7.17	8.17	9.17	10.18	11.17	12.17	13.17	14.16	15.16	22
23	4.15	5.14	6.14	7.13	8.13	9.13	10.13	11.13	12.12	13.12	14.12	15.12	23
24	4.10	5.09	6.09	7.08	8.09	9.09	10.08	11.09	12.08	13.07	14.08	15.07	24
25	4.05	5.04	6.04	7.04	8.04	9.04	10.03	11.04	12.03	13.03	14.03	15.02	25
26	4.00	4.59	5.58	7.00	7.58	8.58	9.58	10.58	11.58	12.57	13.57	14.57	26
27	3.54	4.54	5.54	6.55	7.54	8.54	9.54	10.53	11.53	12.53	13.53	14.53	27
28	3.49	4.49	5.49	6.50	7.49	8.49	9.49	10.48	11.48	12.48	13.47	14.48	28
29	3.44	4.44	5.44	6.45	7.44	8.44	9.44	10.44	11.44	12.44	13.44	14.44	29

Continued
Moons Declination North Decreasing
Moon South

D. Decl.	12h.	13h.	14h.	15h.	16h.	17h.	18h.	19h.	20h.	21h.	22h.	23h.	24h.
	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.	on rise h. m.
0	5.54	6.55	7.56	8.56	9.57	10.58	11.59	13.0	14.1	15.1	16.2	17.3	18.4
1	5.50	6.51	7.52	8.52	9.53	10.54	11.55	12.56	13.57	14.57	15.58	16.59	18.0
2	5.46	6.47	7.48	8.48	9.49	10.50	11.51	12.52	13.52	14.53	15.54	16.54	18.1
3	5.42	6.43	7.44	8.44	9.45	10.46	11.47	12.48	13.48	14.49	15.50	16.50	18.2
4	5.38	6.39	7.40	8.40	9.41	10.42	11.43	12.44	13.44	14.45	15.46	16.46	18.3
5	5.34	6.35	7.36	8.36	9.37	10.37	11.39	12.39	13.40	14.40	15.41	16.42	18.4
6	5.31	6.32	7.32	8.33	9.33	10.34	11.35	12.35	13.36	14.37	15.37	16.38	18.5
7	5.27	6.28	7.28	8.29	9.29	10.30	11.31	12.31	13.32	14.33	15.34	16.34	19.0
8	5.23	6.23	7.24	8.25	9.25	10.26	11.27	12.27	13.28	14.29	15.30	16.30	19.1
9	5.19	6.19	7.20	8.21	9.21	10.22	11.23	12.23	13.24	14.25	15.26	16.26	19.2
10	5.15	6.15	7.16	8.17	9.17	10.18	11.19	12.19	13.20	14.21	15.22	16.22	19.3
11	5.11	6.11	7.12	8.13	9.13	10.14	11.15	12.15	13.16	14.17	15.18	16.18	19.4
12	5.7	6.7	7.8	8.9	9.9	10.10	11.11	12.11	13.12	14.12	15.14	16.14	19.5
13	5.2	6.2	7.3	8.4	9.4	10.5	11.6	12.6	13.7	14.7	15.8	16.9	20.0
14	4.58	5.58	6.59	8.1	9.0	10.0	11.1	12.1	13.2	14.2	15.4	16.4	20.1
15	4.53	5.53	6.54	7.56	8.56	9.56	10.57	11.57	12.58	13.58	15.0	16.0	20.2
16	4.49	5.49	6.50	7.51	8.51	9.52	10.52	11.53	12.54	13.54	14.55	15.55	20.3
17	4.45	5.45	6.46	7.47	8.47	9.47	10.48	11.48	12.50	13.49	14.50	15.50	20.4
18	4.40	5.40	6.41	7.41	8.42	9.42	10.43	11.43	12.45	13.44	14.45	15.44	20.5
19	4.36	5.36	6.36	7.36	8.37	9.37	10.38	11.38	12.40	13.39	14.39	15.39	21.0
20	4.31	5.31	6.31	7.31	8.32	9.31	10.32	11.32	12.34	13.33	14.33	15.34	21.1
21	4.26	5.26	6.26	7.27	8.27	9.26	10.27	11.27	12.27	13.27	14.28	15.28	21.2
22	4.22	5.21	6.22	7.22	8.22	9.22	10.23	11.22	12.22	13.22	14.22	15.23	21.3
23	4.17	5.17	6.17	7.17	8.18	9.17	10.18	11.17	12.18	13.17	14.18	15.18	21.4
24	4.12	5.12	6.11	7.12	8.18	9.12	10.13	11.12	12.13	13.12	14.13	15.13	21.5
25	4.7	5.7	6.6	7.6	8.7	9.7	10.7	11.7	12.7	13.7	14.7	15.7	22.0
26	4.2	5.2	6.1	7.1	8.2	9.1	10.1	11.2	12.2	13.1	14.2	15.2	22.1
27	3.55	4.57	5.55	6.55	7.56	8.55	9.56	10.56	11.56	12.55	13.56	14.56	22.2
28	3.50	4.52	5.50	6.56	7.51	8.56	9.51	10.51	11.50	12.50	13.50	14.51	22.3
29	3.44	4.45	5.44	6.45	7.45	8.44	9.45	10.45	11.45	12.54	13.45	14.55	22.4

Continued

Moon's Declination South Increasing

Moon South

	12h.	13h.	14h.	15h.	16h.	17h.	18h.	19h.	20h.	21h.	22h.	23h.	24h.
	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.	0 miles. h. m.
0	5.54	6.55	7.56	8.57	9.57	10.58	11.59	12.00	13.01	14.02	15.03	16.04	17.05
1	5.58	6.59	7.60	8.61	9.62	10.63	11.64	12.65	13.66	14.67	15.68	16.69	17.70
2	6.01	7.02	8.03	9.04	10.05	11.06	12.07	13.08	14.09	15.10	16.11	17.12	18.13
3	6.05	7.06	8.07	9.08	10.09	11.10	12.11	13.12	14.13	15.14	16.15	17.16	18.17
4	6.09	7.10	8.11	9.12	10.13	11.14	12.15	13.16	14.17	15.18	16.19	17.20	18.21
5	6.13	7.14	8.15	9.16	10.17	11.18	12.19	13.20	14.21	15.22	16.23	17.24	18.25
6	6.17	7.18	8.19	9.20	10.21	11.22	12.23	13.24	14.25	15.26	16.27	17.28	18.29
7	6.21	7.22	8.23	9.24	10.25	11.26	12.27	13.28	14.29	15.30	16.31	17.32	18.33
8	6.25	7.26	8.27	9.28	10.29	11.30	12.31	13.32	14.33	15.34	16.35	17.36	18.37
9	6.29	7.30	8.31	9.32	10.33	11.34	12.35	13.36	14.37	15.38	16.39	17.40	18.41
10	6.33	7.34	8.35	9.36	10.37	11.38	12.39	13.40	14.41	15.42	16.43	17.44	18.45
11	6.37	7.38	8.39	9.40	10.41	11.42	12.43	13.44	14.45	15.46	16.47	17.48	18.49
12	6.41	7.42	8.43	9.44	10.45	11.46	12.47	13.48	14.49	15.50	16.51	17.52	18.53
13	6.45	7.46	8.47	9.48	10.49	11.50	12.51	13.52	14.53	15.54	16.55	17.56	18.57
14	6.49	7.50	8.51	9.52	10.53	11.54	12.55	13.56	14.57	15.58	16.59	17.60	18.61
15	6.53	7.54	8.55	9.56	10.57	11.58	12.59	13.60	14.61	15.62	16.63	17.64	18.65
16	6.57	7.58	8.59	9.60	10.61	11.62	12.63	13.64	14.65	15.66	16.67	17.68	18.69
17	7.01	8.02	9.03	10.04	11.05	12.06	13.07	14.08	15.09	16.10	17.11	18.12	19.13
18	7.05	8.06	9.07	10.08	11.09	12.10	13.11	14.12	15.13	16.14	17.15	18.16	19.17
19	7.09	8.10	9.11	10.12	11.13	12.14	13.15	14.16	15.17	16.18	17.19	18.20	19.21
20	7.13	8.14	9.15	10.16	11.17	12.18	13.19	14.20	15.21	16.22	17.23	18.24	19.25
21	7.17	8.18	9.19	10.20	11.21	12.22	13.23	14.24	15.25	16.26	17.27	18.28	19.29
22	7.21	8.22	9.23	10.24	11.25	12.26	13.27	14.28	15.29	16.30	17.31	18.32	19.33
23	7.25	8.26	9.27	10.28	11.29	12.30	13.31	14.32	15.33	16.34	17.35	18.36	19.37
24	7.29	8.30	9.31	10.32	11.33	12.34	13.35	14.36	15.37	16.38	17.39	18.40	19.41
25	7.33	8.34	9.35	10.36	11.37	12.38	13.39	14.40	15.41	16.42	17.43	18.44	19.45
26	7.37	8.38	9.39	10.40	11.41	12.42	13.43	14.44	15.45	16.46	17.47	18.48	19.49
27	7.41	8.42	9.43	10.44	11.45	12.46	13.47	14.48	15.49	16.50	17.51	18.52	19.53
28	7.45	8.46	9.47	10.48	11.49	12.50	13.51	14.52	15.53	16.54	17.55	18.56	19.57
29	7.49	8.50	9.51	10.52	11.53	12.54	13.55	14.56	15.57	16.58	17.59	18.60	19.61

Continued
Moons Declination South Decreasing

Moons South

	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.	0. nirs. h. m.
0	5.45	6.44	7.43	8.43	9.42	10.41	11.40	12.39	13.39	14.38	15.37	16.36	
1	5.49	6.48	7.47	8.47	9.46	10.45	11.44	12.43	13.43	14.42	15.41	16.40	
2	5.53	6.52	7.51	8.51	9.50	10.49	11.47	12.47	13.46	14.45	15.44	16.43	
3	5.57	6.56	7.55	8.55	9.54	10.53	11.51	12.50	13.50	14.49	15.48	16.47	
4	6.1	7.0	7.59	8.59	9.58	10.57	11.55	12.54	13.54	14.54	15.52	16.51	
5	6.5	7.4	8.3	9.2	10.2	11.1	12.0	12.58	13.58	14.59	15.57	16.56	
6	6.9	7.8	8.7	9.6	10.6	11.5	12.4	13.3	14.2	15.3	16.1	17.1	
7	6.12	7.11	8.11	9.10	10.10	11.9	12.8	13.7	14.6	15.6	16.5	17.4	
8	6.16	7.15	8.15	9.14	10.14	11.13	12.12	13.11	14.10	15.10	16.9	17.8	
9	6.20	7.19	8.19	9.18	10.18	11.17	12.16	13.15	14.14	15.14	16.13	17.12	
10	6.24	7.23	8.23	9.22	10.22	11.21	12.20	13.19	14.18	15.18	16.17	17.16	
11	6.28	7.27	8.27	9.26	10.25	11.25	12.24	13.22	14.22	15.21	16.21	17.20	
12	6.33	7.32	8.31	9.31	10.30	11.30	12.29	13.27	14.27	15.26	16.26	17.24	
13	6.37	7.37	8.35	9.36	10.34	11.34	12.33	13.32	14.31	15.31	16.30	17.29	
14	6.41	7.41	8.40	9.40	10.39	11.38	12.37	13.36	14.36	15.35	16.34	17.34	
15	6.45	7.45	8.44	9.44	10.43	11.42	12.41	13.41	14.40	15.40	16.39	17.39	
16	6.49	7.49	8.48	9.48	10.47	11.46	12.45	13.45	14.44	15.44	16.43	17.43	
17	6.54	7.53	8.52	9.52	10.51	11.51	12.51	13.50	14.50	15.49	16.48	17.48	
18	6.58	7.58	8.57	9.57	10.56	11.56	12.56	13.55	14.54	15.53	16.52	17.52	
19	7.4	8.3	9.3	10.3	11.1	12.2	13.2	14.1	15.1	15.59	16.59	17.58	
20	7.9	8.8	9.8	10.8	11.7	12.7	13.7	14.6	15.6	16.5	17.5	18.4	
21	7.14	8.14	9.13	10.13	11.12	12.12	13.12	14.12	15.12	16.11	17.11	18.10	
22	7.19	8.19	9.19	10.18	11.18	12.18	13.18	14.18	15.17	16.17	17.17	18.16	
23	7.24	8.24	9.23	10.23	11.23	12.23	13.22	14.22	15.22	16.21	17.21	18.21	
24	7.29	8.29	9.29	10.28	11.28	12.28	13.28	14.28	15.28	16.27	17.27	18.27	
25	7.34	8.34	9.34	10.34	11.34	12.35	13.35	14.35	15.35	16.35	17.35	18.35	
26	7.40	8.39	9.39	10.39	11.39	12.39	13.39	14.38	15.37	16.38	17.37	18.37	
27	7.45	8.45	9.44	10.44	11.44	12.44	13.41	14.44	15.42	16.43	17.43	18.43	
28	7.51	8.50	9.50	10.50	11.50	12.50	13.50	14.50	15.49	16.48	17.50	18.49	
29	7.56	8.56	9.56	10.56	11.56	12.56	13.56	14.56	15.56	16.46	17.56	18.56	

4

Table showing the time of the Moons Setting, for the Latitude of 43° North, which with common suit out any very perceptible variation from the observed time, for all the New-England States, and all other places in the same Latitude.

Moons Declination North Increasing

23 Declination	Moon South												23 Declination
	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	
	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	
0	6.15	7.16	8.17	9.17	10.18	11.19	12.20	13.21	14.21	15.22	16.23	17.24	0
1	6.26	7.26	8.27	9.27	10.29	11.29	12.29	13.29	14.29	15.30	16.31	17.32	1
2	6.29	7.29	8.30	9.30	10.32	11.32	12.32	13.32	14.32	15.33	16.34	17.35	2
3	6.31	7.31	8.32	9.32	10.34	11.34	12.34	13.34	14.34	15.35	16.36	17.37	3
4	6.34	7.34	8.35	9.35	10.37	11.37	12.37	13.37	14.37	15.38	16.39	17.40	4
5	6.38	7.38	8.39	9.39	10.41	11.41	12.41	13.41	14.41	15.42	16.43	17.44	5
6	6.42	7.42	8.43	9.43	10.45	11.45	12.45	13.45	14.45	15.46	16.47	17.48	6
7	6.46	7.46	8.47	9.47	10.49	11.49	12.49	13.49	14.49	15.50	16.51	17.52	7
8	6.50	7.50	8.51	9.51	10.53	11.53	12.53	13.53	14.53	15.54	16.55	17.56	8
9	6.54	7.54	8.55	9.55	10.57	11.57	12.57	13.57	14.57	15.58	16.59	17.60	9
10	6.58	7.58	8.59	9.59	11.00	12.00	13.00	14.00	15.00	16.01	17.02	18.03	10
11	7.02	8.02	9.03	10.03	11.04	12.04	13.04	14.04	15.05	16.06	17.07	18.08	11
12	7.06	8.06	9.07	10.07	11.08	12.08	13.08	14.08	15.09	16.10	17.11	18.12	12
13	7.10	8.10	9.11	10.11	11.12	12.12	13.12	14.12	15.13	16.14	17.15	18.16	13
14	7.14	8.14	9.15	10.15	11.16	12.16	13.16	14.16	15.17	16.18	17.19	18.20	14
15	7.18	8.18	9.19	10.19	11.20	12.20	13.20	14.20	15.21	16.22	17.23	18.24	15
16	7.21	8.21	9.22	10.22	11.23	12.23	13.23	14.23	15.24	16.25	17.26	18.27	16
17	7.25	8.25	9.26	10.26	11.27	12.27	13.27	14.27	15.28	16.29	17.30	18.31	17
18	7.29	8.29	9.30	10.30	11.31	12.31	13.31	14.31	15.32	16.33	17.34	18.35	18
19	7.33	8.33	9.34	10.34	11.35	12.35	13.35	14.35	15.36	16.37	17.38	18.39	19
20	7.37	8.37	9.38	10.38	11.39	12.39	13.39	14.39	15.40	16.41	17.42	18.43	20
21	7.41	8.41	9.42	10.42	11.43	12.43	13.43	14.43	15.44	16.45	17.46	18.47	21
22	7.45	8.45	9.46	10.46	11.47	12.47	13.47	14.47	15.48	16.49	17.50	18.51	22
23	7.49	8.49	9.50	10.50	11.51	12.51	13.51	14.51	15.52	16.53	17.54	18.55	23
24	7.53	8.53	9.54	10.54	11.55	12.55	13.55	14.55	15.56	16.57	17.58	18.59	24
25	7.57	8.57	9.58	10.58	11.59	12.59	13.59	14.59	15.60	16.61	17.62	18.63	25
26	8.01	9.01	10.02	11.02	12.03	13.03	14.03	15.03	16.04	17.05	18.06	19.07	26
27	8.05	9.05	10.06	11.06	12.07	13.07	14.07	15.07	16.08	17.09	18.10	19.11	27
28	8.09	9.09	10.10	11.10	12.11	13.11	14.11	15.11	16.12	17.13	18.14	19.15	28
29	8.13	9.13	10.14	11.14	12.15	13.15	14.15	15.15	16.16	17.17	18.18	19.19	29
30	8.17	9.17	10.18	11.18	12.19	13.19	14.19	15.19	16.20	17.21	18.22	19.23	30

Continued
Moons Declination North Decreasing

Moon South

0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	Declination
sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	
h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	h.m.	
0	6.6	7.5	8.4	9.4	10.3	11.2	12.1	13.0	14.0	15.1	15.58	16.57 0
1	6.10	7.10	8.8	9.8	10.7	11.6	12.5	13.4	14.4	15.4	16.2	17.1 1
2	6.14	7.13	8.12	9.12	10.11	11.10	12.9	13.8	14.8	15.8	16.6	17.5 2
3	6.18	7.17	8.16	9.16	10.15	11.14	12.13	13.12	14.12	15.12	16.10	17.9 3
4	6.22	7.21	8.20	9.20	10.19	11.18	12.17	13.16	14.16	15.15	16.13	17.13 4
5	6.26	7.25	8.23	9.23	10.23	11.22	12.21	13.20	14.20	15.19	16.17	17.17 5
6	6.29	7.28	8.27	9.27	10.26	11.26	12.25	13.23	14.23	15.22	16.21	17.20 6
7	6.32	7.31	8.31	9.30	10.30	11.29	12.28	13.27	14.27	15.26	16.25	17.24 7
8	6.36	7.35	8.35	9.34	10.33	11.32	12.31	13.31	14.30	15.30	16.29	17.27 8
9	6.40	7.39	8.39	9.38	10.37	11.36	12.35	13.35	14.34	15.34	16.33	17.31 9
10	6.44	7.43	8.43	9.42	10.41	11.40	12.39	13.38	14.38	15.38	16.37	17.35 10
11	6.48	7.47	8.47	9.46	10.45	11.44	12.43	13.43	14.42	15.42	16.41	17.40 11
12	6.52	7.51	8.51	9.50	10.49	11.48	12.47	13.47	14.46	15.46	16.45	17.44 12
13	6.56	7.55	8.55	9.55	10.54	11.53	12.52	13.52	14.51	15.51	16.50	17.50 13
14	7.0	7.59	9.0	10.0	10.59	11.58	12.57	13.57	14.56	15.56	16.55	17.54 14
15	7.4	8.4	9.4	10.4	11.3	12.2	13.2	14.1	15.0	16.1	17.0	18.0 15
16	7.9	8.9	9.9	10.8	11.8	12.7	13.6	14.6	15.5	16.5	17.4	18.4 16
17	7.14	8.13	9.13	10.12	11.12	12.11	13.11	14.11	15.10	16.9	17.9	18.8 17
18	7.19	8.18	9.18	10.17	11.17	12.16	13.16	14.16	15.15	16.14	17.13	18.13 18
19	7.24	8.23	9.23	10.23	11.22	12.22	13.22	14.21	15.20	16.20	17.19	18.19 19
20	7.29	8.29	9.28	10.28	11.28	12.27	13.27	14.27	15.26	16.26	17.25	18.25 20
21	7.34	8.34	9.33	10.33	11.33	12.33	13.33	14.32	15.31	16.32	17.31	18.31 21
22	7.39	8.39	9.39	10.39	11.38	12.38	13.38	14.38	15.37	16.37	17.37	18.36 22
23	7.43	8.43	9.43	10.43	11.42	12.43	13.42	14.42	15.43	16.42	17.42	18.41 23
24	7.51	8.48	9.48	10.48	11.47	12.48	13.47	14.47	15.47	16.47	17.47	18.46 24
25	7.54	8.54	9.53	10.53	11.53	12.53	13.53	14.53	15.53	16.53	17.52	18.51 25
26	8.0	8.59	9.59	10.59	11.59	12.58	13.59	14.59	15.58	16.58	17.58	18.57 26
27	8.5	9.5	10.5	11.5	12.4	13.4	14.5	15.5	16.4	17.6	18.4	19.4 27
28	8.11	9.11	10.11	11.10	12.9	13.10	14.10	15.10	16.10	17.11	18.10	19.10 28
29	8.16	9.16	10.16	11.16	12.15	13.16	14.16	15.16	16.16	17.16	18.16	19.16 29

Continued

Moons Declination South Increasing

Moon South

Declination	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	Declination
	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	sets. h. m.	
0°	6.6	7.5	8.4	9.4	10.3	11.2	12.1	13.0	14.0	15.1	15.58	16.57	0°
1	6.9	7.1	8.0	9.0	9.59	10.58	11.57	12.56	13.55	14.55	15.54	16.53	1
2	5.58	6.57	7.56	8.56	9.55	10.54	11.53	12.52	13.51	14.51	15.50	16.50	2
3	5.54	6.53	7.53	8.52	9.51	10.50	11.49	12.49	13.48	14.47	15.46	16.46	3
4	5.50	6.49	7.49	8.48	9.47	10.46	11.45	12.45	13.44	14.43	15.42	16.42	4
5	5.47	6.45	7.45	8.44	9.44	10.43	11.42	12.41	13.40	14.40	15.38	16.38	5
6	5.43	6.41	7.41	8.40	9.40	10.39	11.38	12.37	13.36	14.36	15.35	16.34	6
7	5.39	6.38	7.37	8.36	9.36	10.35	11.34	12.33	13.33	14.32	15.32	16.31	7
8	5.35	6.34	7.33	8.33	9.32	10.31	11.30	12.29	13.29	14.28	15.27	16.27	8
9	5.31	6.30	7.29	8.29	9.28	10.27	11.27	12.26	13.25	14.24	15.24	16.23	9
10	5.27	6.26	7.26	8.25	9.25	10.24	11.23	12.22	13.21	14.20	15.20	16.19	10
11	5.23	6.22	7.22	8.21	9.21	10.20	11.18	12.18	13.17	14.17	15.16	16.15	11
12	5.19	6.18	7.18	8.17	9.16	10.16	11.14	12.14	13.13	14.12	15.12	16.11	12
13	5.14	6.14	7.14	8.13	9.12	10.12	11.11	12.10	13.9	14.9	15.8	16.8	13
14	5.10	6.10	7.10	8.10	9.9	10.8	11.8	12.7	13.6	14.6	15.5	16.5	14
15	5.7	6.7	7.7	8.6	9.5	10.4	11.4	12.3	13.2	14.1	15.1	16.1	15
16	5.3	6.3	7.3	8.2	9.1	10.0	11.0	12.0	13.0	14.0	15.0	16.0	16
17	5.0	6.0	6.59	7.58	8.57	9.56	10.57	11.56	12.55	13.55	14.54	15.54	17
18	4.55	5.56	6.55	7.54	8.53	9.52	10.52	11.52	12.52	13.50	14.50	15.50	18
19	4.51	5.51	6.51	7.50	8.50	9.49	10.49	11.49	12.48	13.47	14.47	15.47	19
20	4.47	5.47	6.47	7.46	8.46	9.46	10.45	11.45	12.45	13.45	14.44	15.43	20
21	4.42	5.42	6.42	7.41	8.41	9.42	10.40	11.40	12.40	13.40	14.39	15.39	21
22	4.37	5.37	6.37	7.36	8.37	9.36	10.35	11.35	12.35	13.35	14.34	15.34	22
23	4.32	5.32	6.32	7.32	8.32	9.31	10.31	11.31	12.31	13.30	14.30	15.30	23
24	4.27	5.28	6.27	7.27	8.27	9.26	10.26	11.26	12.26	13.25	14.25	15.25	24
25	4.22	5.23	6.22	7.22	8.22	9.22	10.21	11.21	12.21	13.21	14.20	15.20	25
26	4.18	5.18	6.18	7.18	8.18	9.17	10.16	11.17	12.17	13.16	14.16	15.16	26
27	4.13	5.13	6.13	7.13	8.13	9.13	10.12	11.13	12.12	13.12	14.12	15.12	27
28	4.8	5.8	6.8	7.8	8.8	9.8	10.8	11.9	12.7	13.7	14.7	15.7	28
29	4.3	5.3	6.4	7.3	8.3	9.4	10.3	11.4	12.3	13.2	14.3	15.2	29

Continued

Moons Declination South Decreasing

Moon South

Declination	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.
sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.	sets.
h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.
0°	6.15	7.16	8.17	9.17	10.18	11.19	12.20	13.21	14.21	15.22	16.23	17.24
1	6.11	7.12	8.13	9.13	10.14	11.15	12.16	13.17	14.18	15.18	16.19	17.20
2	6.7	7.8	8.10	9.10	10.11	11.11	12.13	13.13	14.14	15.14	16.15	17.16
3	6.3	7.5	8.5	9.6	10.7	11.7	12.9	13.9	14.10	15.10	16.11	17.12
4	5.59	7.0	8.1	9.2	10.3	11.3	12.5	13.5	14.6	15.6	16.7	17.8
5	5.55	6.56	7.57	8.58	9.58	10.59	12.0	13.0	14.1	15.1	16.3	17.3
6	5.52	6.52	7.53	8.53	9.54	10.55	11.56	12.56	13.57	14.57	15.58	16.59
7	5.48	6.49	7.49	8.50	9.50	10.51	11.52	12.53	13.54	14.55	15.55	16.56
8	5.44	6.45	7.45	8.46	9.46	10.48	11.48	12.49	13.50	14.50	15.51	16.52
9	5.40	6.41	7.41	8.42	9.42	10.44	11.44	12.44	13.46	14.46	15.47	16.48
10	5.36	6.36	7.37	8.38	9.38	10.39	11.40	12.40	13.41	14.42	15.42	16.43
11	5.31	6.32	7.33	8.34	9.34	10.35	11.36	12.36	13.37	14.37	15.38	16.39
12	5.26	6.27	7.28	8.29	9.29	10.30	11.31	12.31	13.32	14.33	15.33	16.34
13	5.22	6.23	7.24	8.24	9.24	10.25	11.26	12.26	13.27	14.28	15.28	16.29
14	5.18	6.18	7.19	8.19	9.20	10.21	11.21	12.21	13.23	14.23	15.23	16.24
15	5.14	6.14	7.14	8.15	9.16	10.17	11.17	12.17	13.19	14.19	15.20	16.20
16	5.9	6.10	7.10	8.11	9.12	10.12	11.13	12.13	13.14	14.15	15.16	16.16
17	5.5	6.6	7.6	8.7	9.8	10.8	11.8	12.9	13.10	14.11	15.11	16.11
18	5.1	6.1	7.1	8.2	9.3	10.3	11.4	12.4	13.5	14.5	15.6	16.6
19	4.56	5.56	6.56	7.57	8.57	9.57	11.0	11.58	12.59	13.59	15.0	16.0
20	4.50	5.51	6.51	7.51	8.51	9.52	10.54	11.53	12.53	13.53	14.54	15.54
21	4.45	5.45	6.45	7.46	8.46	9.46	10.49	11.46	12.47	13.48	14.48	15.49
22	4.40	5.40	6.40	7.41	8.40	9.41	10.42	11.41	12.41	13.42	14.43	15.43
23	4.35	5.35	6.35	7.36	8.36	9.36	10.36	11.37	12.37	13.37	14.38	15.38
24	4.30	5.30	6.30	7.31	8.31	9.31	10.31	11.31	12.32	13.32	14.32	15.32
25	4.25	5.25	6.25	7.25	8.25	9.26	10.26	11.25	12.26	13.26	14.26	15.27
26	4.20	5.21	6.20	7.20	8.20	9.21	10.21	11.21	12.21	13.21	14.21	15.22
27	4.15	5.15	6.15	7.15	8.15	9.15	10.15	11.15	12.15	13.15	14.16	15.16
28	4.9	5.9	6.9	7.8	8.9	9.9	10.9	11.9	12.9	13.9	14.9	15.10
29	4.4	5.4	6.4	7.3	8.3	9.4	10.4	11.3	12.4	13.4	14.4	15.4

Construction of the following Table,

It has been found by observation that it is high water at Portsmouth on the day of New and Full Moon, at 11 h. 15 m. From the time of H. W. at any day, to the next, either before or after, is about 12 h. 24 m. To find the time of H. W. on the any day the rule is, to add the time of H. W. on the full and change days to the time of the D's southing, after first correcting the time of southing on account of the disturbing power of the $\odot$ upon the tides, which sometimes causes the tide time of H. W. to be about 1 h. 9 m. earlier, and at other times about 2 h. m. later than if the tides were caused by the attraction of the Moon only. This difference is caused by, or depends upon the D's distance from the $\odot$. At the N. & F. Moon, the correction is nothing. At the first and last quarter it is greatest of all, and as the time of the D's southing decreases on the D's distance from the $\odot$, the correction of the D's southing for finding the time of H. W. decreases on the D's southing itself. When the D souths at 5 h. the correction is greatest, and subtract, and the time of H. W. was found by subtracting 1 h. 49 m. from the time and the result 9 h. 51 m. was the corrected time, to which 11 h. 15 m. was added, and the sum 15 h. 6 m. was the time of H. W. past noon, from which 12 h. 24 m. were subtracted and the result 2 h. 42 m. was the time of H. W. immediately preceding the D's southing, which was the time required. In the same manner the time of H. W. was found

For every time of southing in the table.

1. V.B. As the time of H. W. at Portsmouth is always before the D's southing when the D souths earlier than 12. 38 m. P.M., the time of H. W. is in the morning. When the D souths earlier than 12. 38 m. in the morning, the time of H. W. is in the evening of the preceding day.

2. N.B. If 10 m. is added to a this table, it will give the middle time of slack water.

Knowing the time of H. W. at Portsmouth to find the time at other places, add to or subtract from the time at Portsmouth, as follows

Boston, +	0. 75
Pontland -	1. 0
Rhode Island -	5. 0
New-Haven -	1. 29
New-York -	2. 51
Quebec -	2. 45
Halifax -	4. 15
London -	8. 59

Time of High Water at Pontmouth.

M.	0 h.	1 h.	2 h.	3 h.	4 h.	5 h.	6 h.	7 h.	8 h.	9 h.	10 h.	11 h.	M.
	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	H. W. h. m.	
0	10.51	11.34	0.13	1.1	1.48	2.42	3.43	5.16	6.53	8.14	9.15	10.5	0
2	10.52	11.35	0.19	1.3	1.50	2.44	3.51	5.19	6.55	8.16	9.16	10.7	2
4	10.53	11.37	0.26	1.4	1.51	2.46	3.54	5.22	6.58	8.18	9.18	10.8	4
6	10.54	11.38	0.21	1.6	1.53	2.48	3.57	5.25	7.1	8.20	9.20	10.10	6
8	10.56	11.39	0.22	1.7	1.55	2.50	4.0	5.28	7.2	8.22	9.21	10.12	8
10	10.58	11.41	0.24	1.9	1.57	2.52	4.2	5.32	7.6	8.24	9.23	10.14	10
12	11.0	11.42	0.25	1.10	1.58	2.55	4.5	5.35	7.9	8.26	9.24	10.15	12
14	11.1	11.44	0.27	1.12	2.0	2.57	4.8	5.39	7.12	8.28	9.26	10.16	14
16	11.2	11.46	0.28	1.13	2.1	2.59	4.11	5.42	7.15	8.30	9.28	10.17	16
18	11.4	11.47	0.29	1.15	2.3	3.1	4.14	5.45	7.18	8.32	9.30	10.18	18
20	11.5	11.48	0.31	1.17	2.4	3.4	4.17	5.49	7.20	8.34	9.32	10.21	20
22	11.6	11.50	0.32	1.18	2.6	3.5	4.20	5.52	7.23	8.36	9.33	10.21	22
24	11.8	11.51	0.34	1.26	2.8	3.7	4.23	5.55	7.26	8.38	9.35	10.23	24
26	11.9	11.53	0.35	1.21	2.10	3.9	4.26	5.58	7.28	8.40	9.36	10.25	26
28	11.11	11.54	0.37	1.23	2.12	3.12	4.29	6.1	7.31	8.42	9.38	10.26	28
30	11.12	11.55	0.39	1.25	2.15	3.15	4.32	6.5	7.33	8.44	9.40	10.28	30
32	11.14	11.57	0.40	1.26	2.17	3.17	4.35	6.8	7.35	8.46	9.41	10.29	32
34	11.15	11.58	0.42	1.28	2.18	3.19	4.38	6.11	7.38	8.49	9.43	10.30	34
36	11.17	11.59	0.43	1.29	2.20	3.21	4.41	6.14	7.41	8.51	9.44	10.32	36
38	11.18	ene. 1	0.44	1.30	2.22	3.23	4.44	6.17	7.44	8.53	9.46	10.34	38
40	11.20	0.2	0.46	1.32	2.24	3.26	4.47	6.21	7.47	8.55	9.48	10.36	40
42	11.21	0.4	0.47	1.33	2.25	3.28	4.50	6.24	7.49	8.57	9.50	10.37	42
44	11.22	0.5	0.48	1.35	2.27	3.30	4.53	6.27	7.52	8.59	9.51	10.39	44
46	11.24	0.7	0.50	1.36	2.29	3.32	4.56	6.30	7.55	9.1	9.53	10.41	46
48	11.26	0.8	0.51	1.38	2.31	3.34	4.59	6.33	7.58	9.3	9.55	10.42	48
50	11.26	0.10	0.53	1.40	2.33	3.37	5.1	6.37	8.1	9.5	9.57	10.43	50
52	11.28	0.12	0.54	1.41	2.35	3.39	5.3	6.40	8.3	9.6	9.58	10.45	52
54	11.29	0.13	0.56	1.43	2.36	3.41	5.6	6.43	8.5	9.8	10.6	10.46	54
56	11.30	0.14	0.57	1.44	2.38	3.43	5.8	6.46	8.7	9.10	10.1	10.47	56
58	11.32	0.15	0.58	1.45	2.40	3.45	5.11	6.49	8.12	9.12	10.2	10.48	58
59	11.33	0.17	1.0	1.47	2.41	3.47	5.14	6.51	8.12	9.14	10.4	10.50	59

Time of High Water at Portsmouth.

South.

	12h.	13h.	14h.	15h.	16h.	17h.	18h.	19h.	20h.	21h.	22h.	23h.	
M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	M.
0	10.51	11.04	12.18	13.1	13.48	14.42	15.48	17.16	18.59	20.14	20.14	22.5	0
2	10.52	11.05	12.19	13.0	13.50	14.44	15.51	17.19	18.55	20.15	20.15	22.7	2
4	10.53	11.07	12.20	13.1	13.51	14.46	15.54	17.22	18.58	20.18	20.18	22.8	4
6	10.54	11.08	12.21	13.0	13.52	14.48	15.57	17.25	19.1	20.20	20.20	22.10	6
8	10.55	11.09	12.22	13.1	13.53	14.50	16.0	17.28	19.2	20.22	20.22	22.12	8
10	10.58	11.11	12.24	13.1	13.57	14.53	16.2	17.32	19.6	20.24	20.24	22.14	10
12	11.0	11.12	12.25	13.1	13.58	14.55	16.5	17.35	19.9	20.26	20.26	22.15	12
14	11.1	11.14	12.27	13.1	14.0	14.57	16.8	17.39	19.12	20.28	20.28	22.16	14
16	11.2	11.16	12.28	13.1	14.1	14.59	16.11	17.42	19.15	20.30	20.30	22.17	16
18	11.4	11.17	12.29	13.1	14.0	15.1	16.14	17.45	19.18	20.32	20.32	22.18	18
20	11.5	11.18	12.31	13.1	14.1	15.0	16.17	17.49	19.20	20.34	20.34	22.20	20
22	11.6	11.50	12.32	13.1	14.6	15.5	16.20	17.52	19.23	20.36	20.36	22.21	22
24	11.8	11.51	12.34	13.2	14.8	15.7	16.23	17.55	19.26	20.38	20.38	22.23	24
26	11.9	11.53	12.35	13.2	14.10	15.9	16.26	17.58	19.28	20.40	20.40	22.25	26
28	11.11	11.54	12.37	13.2	14.12	15.12	16.29	18.1	19.31	20.42	20.42	22.26	28
30	11.12	11.55	12.39	13.2	14.15	15.15	16.32	18.5	19.33	20.44	20.44	22.28	30
32	11.14	11.57	12.40	13.2	14.17	15.17	16.35	18.8	19.35	20.46	20.46	22.29	32
34	11.15	11.58	12.42	13.2	14.18	15.19	16.38	18.11	19.38	20.49	20.49	22.30	34
36	11.17	11.59	12.43	13.2	14.20	15.21	16.41	18.14	19.41	20.51	20.51	22.32	36
38	11.18	12.1	12.44	13.2	14.22	15.23	16.44	18.17	19.44	20.53	20.53	22.34	38
40	11.20	12.2	12.46	13.2	14.25	15.25	16.47	18.21	19.47	20.55	20.55	22.36	40
42	11.21	12.4	12.47	13.2	14.25	15.28	16.50	18.24	19.49	20.57	20.57	22.37	42
44	11.22	12.5	12.48	13.2	14.27	15.30	16.53	18.27	19.52	20.59	20.59	22.39	44
46	11.24	12.7	12.50	13.2	14.29	15.32	16.56	18.30	19.55	21.1	21.1	22.41	46
48	11.25	12.8	12.51	13.2	14.31	15.34	16.59	18.33	20.58	21.3	21.3	22.42	48
50	11.26	12.10	12.53	13.2	14.33	15.37	17.1	18.37	20.1	21.5	21.5	22.43	50
52	11.28	12.12	12.54	13.2	14.35	15.39	17.3	18.40	20.3	21.6	21.6	22.45	52
54	11.29	12.13	12.56	13.2	14.36	15.41	17.6	18.43	20.5	21.8	21.8	22.46	54
56	11.30	12.14	12.57	13.2	14.38	15.43	17.8	18.46	20.7	21.10	21.10	22.47	56
58	11.32	12.15	12.58	13.2	14.40	15.45	17.11	18.49	20.10	21.12	21.12	22.48	58
59	11.33	12.17	13.0	13.2	14.41	15.47	17.14	18.51	20.12	21.14	21.14	22.50	59

To find the time of the Days Breaking and Twilight Ending.

Rule.—Add together the co-latitude* of the place, the polar distance on co-declination† of the Sun, and 10° ‡, and from half the sum subtract the co-latitude, and also the polar distance, and find the sines of the remainders in any table of logarithmick sines. Find also the arithmetick complement of the Sines of the co-latitude and polar distance; then add all the four Sines together, and half the sum will be the Sine of half the hour angle, from noon when the twilight begins in the morning and in the evening. This in degrees &c. reduces to time, reckoning 15° to an hour, will give the hours and minutes that the day breaks before and ends after 12 O'clock at noon.

Example

At what time does the day break and twilight end at Cambridge, in New-England, Lat. $42^{\circ} 28'$ N. June 24th the second year after Bissextile when the suns declination found in Table XXX. is 23.28

* The co-latitude, that is, the complement of the lat. is what it amounts 90° .

† The polar distance, or co declination is what the $\odot$'s declination is less than 90° .

‡ 10° is the Sun's distance from the Zenith when it is 18° below the horizon at which distance it is when the twilight begins and ends

Co-latitude of $42^{\circ} 23'$ - - - - -	47.97
$\odot$'s co-declination - - - - -	66.32
$\odot$'s zenith dist. when twilight begins - - -	108.00
Sum - - - - -	222.9
Half sum - - - - -	111.4
Co-latitude of Cambridge, subtracted - - -	47.97
Diff of $\frac{1}{2}$ sum and co-latitude - - -	63.27
Diff of $\frac{1}{2}$ sum and $\odot$'s co-declination - - -	44.32

Then by logarithms.

Line of $63^{\circ} 27'$ - - - - -	9.95160
Line of 44.32 - - - - -	9.84592
Co-ar. of sine of $47^{\circ} 34'$ - - - - -	0.19156
Co-ar. of sine of 66.32 - - - - -	0.09749
Sum - - - - -	19.96657
Half sum - - - - -	9.98328

Answering to this last half sum in the table of sines is $7^h. 12'$ half the hour angle, and which doubled is $14^h. 24'$. This reduced to time by saying,

As $15^{\circ} 1'$ is $14^h. 24'$ to the time from noon gives $9^h. 59^m. 36^s$; which is the time of the twilight's ending, and this subtracted from 12 hours gives $2^h. 6^m. 24^s$ the time at which the day breaks



