

# Israel Open Astronomy Olympiad 2025

## Junior age group problems

### Ephemeris of Venus (90 p)

**Ephemeris** is the table with the predicted positions and other parameters of a celestial body as it is observed from certain place.

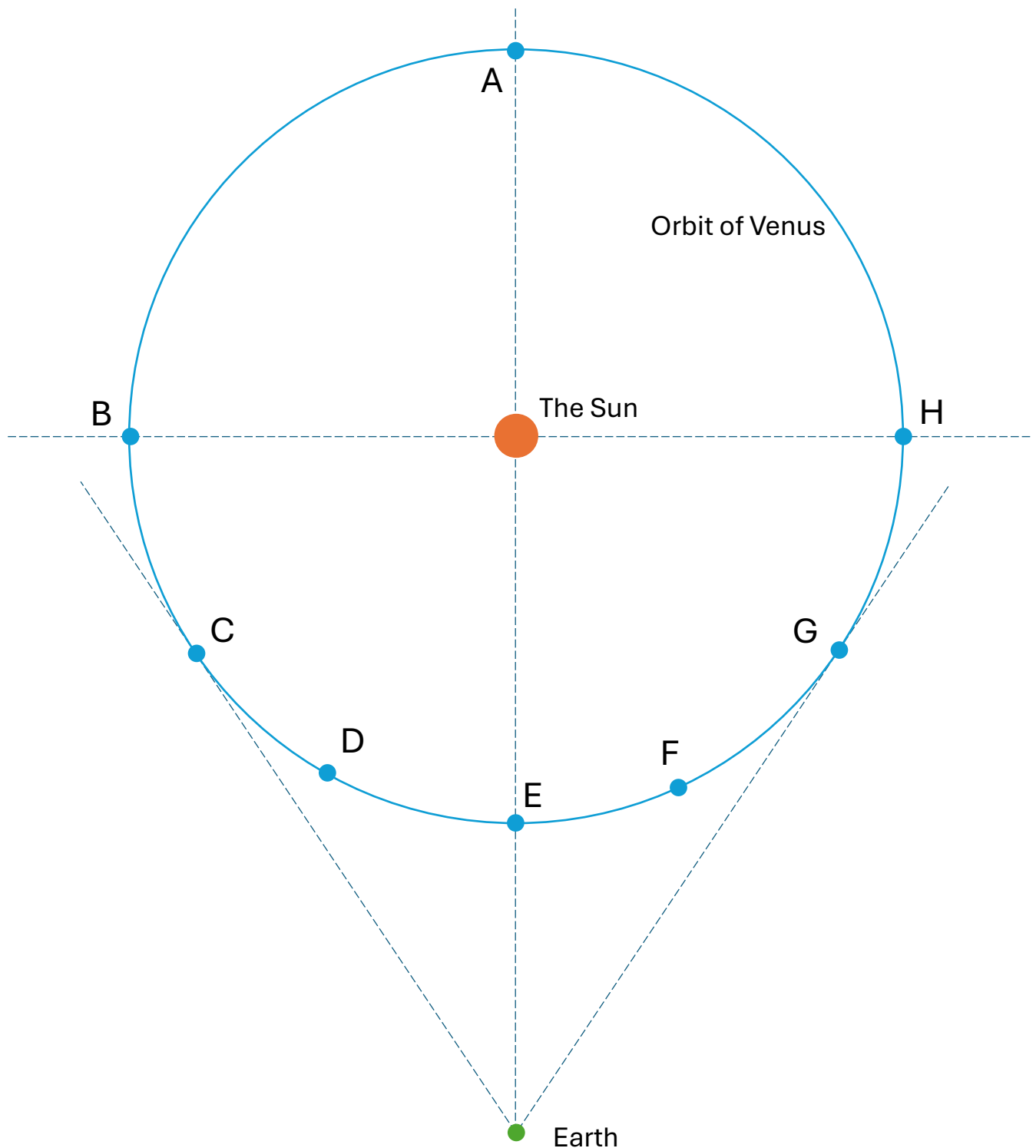
The Table after the text of the problem contains ephemeris of Venus for 25 months, from January 2025 to January 2027. Each row contains the set of data corresponding to a certain time. This Table contains the following columns:

- “Ordinal number of the row”
- “Date” for which all other data is computed (more exactly, the data correspond to the moment of midnight when this date starts).
- “Days since 01 January 2025” are given to ease up some calculations requiring computing time periods.
- “Right ascension” and “Declination” are equatorial coordinates of Venus. Note that right ascension is given in time hours, minutes and seconds, where  $1\text{ h} = 15^\circ$ ,  $1\text{ m} = 15'$  and  $1\text{ s} = 15''$ .
- “Change in Right Ascension per day” is given to compare the movement of Venus with movement of the Sun. The Sun changes the right ascension at angular speed of roughly 1 degree per day.
- “Rise time” and “Set time” determines the period when Venus is above the horizon for an observer in Netanya. Note that the Venus always rises after the midnight and always sets before the midnight.
- “Magnitude” is the apparent magnitude of Venus. Lower values mean higher brightness.
- “Phase” is the Venus phase, computed in the same way as the Moon phase. Phase equals the illuminated fraction of the Venus disk, and the illuminated fraction of its diameter. When phase equals 50%, the angle between the Sun and the Earth, as seen from the object, equals  $90^\circ$ .
- “Distance to Earth” and “Distance to Sun” are given in astronomical units, au.
- “Angular diameter” of the Venus disk is given in arcseconds.
- “Elongation” is angular separation from the Sun, as seen from the Earth, in degrees.
- The “Sun rise time” and “Sun set time” are given to determine whether Venus is seen in the morning or in the evening.

Only four data rows are given per month, but in some of the questions you will be asked for a specific date. For these cases **try to infer the exact date**, even if just by a reasonable guess.

**A** In January 2025, Venus was seen in the evenings. When does this period of evening visibility end? When will Venus become visible in the evenings next time? Venus is observable in the evenings if it sets at least 1 hour after the Sun (corresponding to  $15^\circ$  angular separation).

**Answer:** The period of evening visibility will end on [    ] (day) of [Jan]/[Feb]/etc. (month) 2025. (5 p.) The next period of evening visibility will start on [    ] (day) of [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7]. (5 p.)



The orbital diagram above shows orbit of Venus around the Sun. In this view, positions of both the Sun and the Earth are fixed (assuming circular orbits of both planets). The points on this diagram are Venus configurations:

- superior conjunction A, when the Sun is located between the Earth and Venus,
- greatest eastern elongation C,
- maximum brightness during evening visibility D,
- inferior conjunction E, when Venus is located between the Earth and the Sun,
- maximum brightness during morning visibility F, and

- greatest western elongation G.

During each of the greatest elongations, the angular distance between Venus and the Sun is the largest. One of these events occurs in period of evening visibility; another – during morning visibility.

**B** Estimate the synodic period of Venus, that is, the period of repeating its configurations, as the time between two inferior conjunctions.

**Answer:**

The date of the first inferior conjunction is [ ] (day) of March 2025. (5 p.)

The date of the second inferior conjunction is [ ] (day) of [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7]. (5 p.)

The synodic period, that is, the difference of the dates is [ ] days (3 p.)

**C** Determine the dates for each of the points indicated on the planetary configuration diagram. If this configuration repeats during the time covered by the ephemeris table, give the date of the first such configuration.

**Answer:**

The date of superior conjunction is [ ] (day) of [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7] (5 p.) and Venus angular diameter at that date is [ ]" (3 p.)

The date of greatest eastern elongation is [ ] (day) of [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7] (5 p.) and Venus elongation is [ ]° (3 p.)

The maximum evening brightness occurs during [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7] (5 p.) and is [ ]m. (3 p.)

The date of inferior conjunction is [ ] (day) of [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7] (3 p.) and the angular diameter is [ ]" (3 p.)

The maximum morning brightness occurs during [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7] (5 p.) and is [ ]m. (3 p.)

The date of greatest western elongation is [ ] (day) of [Jan]/[Feb]/etc. (month) 202[5]/[6]/[7] (5 p.) and Venus elongation is [ ]° (3 p.)

Let us assume that both Venus and Earth move around the Sun on circular orbits, and estimate the radius of the Venus orbit in several ways:

1. From the angle of maximum elongation
2. The ratio of angular diameter in superior to inferior conjunction
3. From the synodic period and Kepler's laws

*Note: for your computations in this question use the values given below. They may differ from the values you obtained before or from the correct values.*

**D** Draw a triangle Sun-C-Earth on the configuration diagram. Knowing that the maximum elongation angle is  $47.0^\circ$ , determine the radius of orbit of Venus in astronomical units. Give three digits after comma.

**Answer:** As determined from the maximum elongation angle, the radius of the orbit of Venus is [   ] au. (5 p.)

**E** Determine the Venus orbit radius from comparing the angular diameter of Venus in superior conjunction ( $60''$ ) and in inferior conjunction ( $10''$ ). Assume that angular diameter is inversely proportional to the distance to Venus.

**Answer:** As determined from change in the angular diameter, the radius of the orbit of Venus is [   ] au. (5 p.)

**F** Determine the Venus sidereal (orbital) period from the measured synodic period of 578 days. As the next step, apply Kepler's laws and find the Venus orbit radius from the sidereal period.

**Answer:** The sidereal period of Venus is [   ] days. (4 p.) The radius of Venus orbit from Kepler's laws is [   ] au. (4 p.)

| #  | Date        | Days -<br>01 Jan<br>2025 | Right ascension<br>RA, h m s | Declination,<br>° ' " | Change<br>in RA,<br>°/day | Rise time | Set time | Magni-<br>tude | Phase | Distance<br>to Earth,<br>au | Distance<br>to Sun,<br>au | Angular<br>diameter,<br>" | Elon-<br>gation, ° | Sun rise<br>time | Sun set<br>time |
|----|-------------|--------------------------|------------------------------|-----------------------|---------------------------|-----------|----------|----------------|-------|-----------------------------|---------------------------|---------------------------|--------------------|------------------|-----------------|
| 1  | 01 Jan 2025 | 0                        | 22h 00m 14s                  | -13° 42' 17"          | 0.980                     | 9:27      | 20:21    | -4.0           | 55.5% | 0.7509                      | 0.7225                    | 22.2                      | 46.9               | 6:39             | 16:45           |
| 2  | 08 Jan 2025 | 7                        | 22h 27m 40s                  | -10° 34' 16"          | 0.912                     | 9:19      | 20:30    | -4.1           | 52.1% | 0.6991                      | 0.7216                    | 23.9                      | 47.2               | 6:40             | 16:51           |
| 3  | 15 Jan 2025 | 14                       | 22h 53m 13s                  | -07° 18' 35"          | 0.840                     | 9:08      | 20:36    | -4.1           | 48.4% | 0.6472                      | 0.7207                    | 25.8                      | 47.1               | 6:39             | 16:57           |
| 4  | 22 Jan 2025 | 21                       | 23h 16m 44s                  | -04° 00' 12"          | 0.738                     | 8:56      | 20:40    | -4.1           | 44.4% | 0.5955                      | 0.7200                    | 28.0                      | 46.6               | 6:37             | 17:03           |
| 5  | 01 Feb 2025 | 31                       | 23h 46m 15s                  | 00° 37' 30"           | 0.613                     | 8:34      | 20:42    | -4.0           | 38.0% | 0.5226                      | 0.7191                    | 31.9                      | 45.1               | 6:32             | 17:13           |
| 6  | 08 Feb 2025 | 38                       | 00h 03m 24s                  | 03° 39' 49"           | 0.477                     | 8:16      | 20:40    | -3.9           | 32.9% | 0.4730                      | 0.7187                    | 35.3                      | 43.2               | 6:27             | 17:19           |
| 7  | 15 Feb 2025 | 45                       | 00h 16m 46s                  | 06° 24' 08"           | 0.305                     | 7:55      | 20:33    | -3.8           | 27.2% | 0.4255                      | 0.7185                    | 39.2                      | 40.4               | 6:21             | 17:25           |
| 8  | 22 Feb 2025 | 52                       | 00h 25m 19s                  | 08° 41' 08"           | 0.090                     | 7:30      | 20:20    | -3.4           | 21.1% | 0.3814                      | 0.7185                    | 43.8                      | 36.3               | 6:14             | 17:31           |
| 9  | 01 Mar 2025 | 59                       | 00h 27m 50s                  | 10° 18' 24"           | -0.158                    | 7:01      | 19:59    | -2.9           | 14.6% | 0.3423                      | 0.7186                    | 48.7                      | 30.8               | 6:06             | 17:37           |
| 10 | 08 Mar 2025 | 66                       | 00h 23m 24s                  | 11° 00' 33"           | -0.394                    | 6:27      | 19:29    | -1.9           | 8.4%  | 0.3107                      | 0.7189                    | 53.7                      | 23.7               | 5:57             | 17:42           |
| 11 | 15 Mar 2025 | 73                       | 00h 12m 22s                  | 10° 33' 39"           | -0.536                    | 5:50      | 18:49    | -0.1           | 3.4%  | 0.2892                      | 0.7194                    | 57.7                      | 15.3               | 5:48             | 17:47           |
| 12 | 22 Mar 2025 | 80                       | 23h 57m 22s                  | 08° 57' 13"           | -0.480                    | 5:11      | 18:03    | +2.3           | 1.1%  | 0.2807                      | 0.7201                    | 59.5                      | 8.6                | 5:39             | 17:52           |
| 13 | 01 Apr 2025 | 90                       | 23h 38m 10s                  | 05° 30' 52"           | -0.229                    | 5:22      | 17:55    | -0.2           | 3.7%  | 0.2933                      | 0.7213                    | 56.9                      | 15.7               | 6:26             | 18:59           |
| 14 | 08 Apr 2025 | 97                       | 23h 31m 45s                  | 03° 14' 32"           | 0.032                     | 4:53      | 17:15    | -1.9           | 8.7%  | 0.3180                      | 0.7222                    | 52.5                      | 23.9               | 6:17             | 19:04           |
| 15 | 15 Apr 2025 | 104                      | 23h 32m 38s                  | 01° 37' 56"           | 0.270                     | 4:31      | 16:45    | -2.8           | 14.8% | 0.3530                      | 0.7231                    | 47.3                      | 30.8               | 6:09             | 19:09           |
| 16 | 22 Apr 2025 | 111                      | 23h 40m 12s                  | 00° 50' 02"           | 0.482                     | 4:13      | 16:22    | -3.3           | 21.2% | 0.3954                      | 0.7241                    | 42.2                      | 36.1               | 6:01             | 19:14           |
| 17 | 01 May 2025 | 120                      | 23h 57m 34s                  | 00° 55' 38"           | 0.639                     | 3:54      | 16:04    | -3.7           | 28.9% | 0.4573                      | 0.7252                    | 36.5                      | 40.7               | 5:51             | 19:20           |
| 18 | 08 May 2025 | 127                      | 00h 15m 27s                  | 01° 43' 33"           | 0.738                     | 3:43      | 15:57    | -3.8           | 34.3% | 0.5093                      | 0.7261                    | 32.8                      | 43.1               | 5:45             | 19:26           |
| 19 | 15 May 2025 | 134                      | 00h 36m 07s                  | 03° 01' 13"           | 0.813                     | 3:32      | 15:53    | -3.9           | 39.2% | 0.5633                      | 0.7268                    | 29.6                      | 44.6               | 5:40             | 19:31           |
| 20 | 22 May 2025 | 141                      | 00h 58m 53s                  | 04° 41' 29"           | 0.884                     | 3:23      | 15:52    | -3.9           | 43.7% | 0.6186                      | 0.7274                    | 27.0                      | 45.5               | 5:35             | 19:35           |
| 21 | 01 Jun 2025 | 151                      | 01h 34m 15s                  | 07° 31' 11"           | 0.943                     | 3:12      | 15:56    | -3.9           | 49.5% | 0.6988                      | 0.7280                    | 23.9                      | 45.9               | 5:31             | 19:42           |
| 22 | 08 Jun 2025 | 158                      | 02h 00m 39s                  | 09° 40' 28"           | 0.988                     | 3:05      | 16:00    | -3.9           | 53.2% | 0.7550                      | 0.7282                    | 22.1                      | 45.7               | 5:30             | 19:45           |
| 23 | 15 Jun 2025 | 165                      | 02h 28m 18s                  | 11° 52' 19"           | 1.029                     | 2:59      | 16:06    | -3.9           | 56.6% | 0.8110                      | 0.7282                    | 20.6                      | 45.3               | 5:30             | 19:48           |
| 24 | 22 Jun 2025 | 172                      | 02h 57m 07s                  | 14° 01' 44"           | 1.077                     | 2:55      | 16:13    | -3.9           | 59.8% | 0.8665                      | 0.7280                    | 19.3                      | 44.6               | 5:31             | 19:50           |
| 25 | 01 Jul 2025 | 181                      | 03h 35m 53s                  | 16° 36' 57"           | 1.123                     | 2:51      | 16:23    | -3.9           | 63.7% | 0.9367                      | 0.7276                    | 17.8                      | 43.5               | 5:34             | 19:51           |
| 26 | 08 Jul 2025 | 188                      | 04h 07m 20s                  | 18° 23' 20"           | 1.162                     | 2:49      | 16:32    | -3.8           | 66.5% | 0.9901                      | 0.7270                    | 16.9                      | 42.5               | 5:37             | 19:50           |
| 27 | 15 Jul 2025 | 195                      | 04h 39m 52s                  | 19° 52' 31"           | 1.197                     | 2:50      | 16:42    | -3.8           | 69.2% | 1.0423                      | 0.7263                    | 16.0                      | 41.3               | 5:41             | 19:48           |

| #  | Date        | Days -<br>01 Jan<br>2025 | Right ascension<br>RA, h m s | Declination,<br>° ' " | Change<br>in RA,<br>°/day | Rise time | Set time | Magni-<br>tude | Phase | Distance<br>to Earth,<br>au | Distance<br>to Sun,<br>au | Angular<br>diameter,<br>" | Elon-<br>gation, ° | Sun rise<br>time | Sun set<br>time |
|----|-------------|--------------------------|------------------------------|-----------------------|---------------------------|-----------|----------|----------------|-------|-----------------------------|---------------------------|---------------------------|--------------------|------------------|-----------------|
| 28 | 22 Jul 2025 | 202                      | 05h 13m 23s                  | 21° 00' 39"           | 1.232                     | 2:52      | 16:51    | -3.8           | 71.7% | 1.0932                      | 0.7255                    | 15.3                      | 40.0               | 5:45             | 19:44           |
| 29 | 01 Aug 2025 | 212                      | 06h 02m 39s                  | 21° 55' 03"           | 1.255                     | 2:59      | 17:03    | -3.8           | 75.1% | 1.1632                      | 0.7242                    | 14.3                      | 38.1               | 5:52             | 19:38           |
| 30 | 08 Aug 2025 | 219                      | 06h 37m 47s                  | 21° 59' 44"           | 1.264                     | 3:07      | 17:11    | -3.7           | 77.4% | 1.2102                      | 0.7233                    | 13.8                      | 36.6               | 5:57             | 19:31           |
| 31 | 15 Aug 2025 | 226                      | 07h 13m 11s                  | 21° 35' 17"           | 1.263                     | 3:16      | 17:18    | -3.7           | 79.5% | 1.2554                      | 0.7223                    | 13.3                      | 35.1               | 6:01             | 19:24           |
| 32 | 22 Aug 2025 | 233                      | 07h 48m 32s                  | 20° 41' 27"           | 1.250                     | 3:26      | 17:23    | -3.7           | 81.6% | 1.2986                      | 0.7214                    | 12.9                      | 33.6               | 6:06             | 19:17           |
| 33 | 01 Sep 2025 | 243                      | 08h 38m 33s                  | 18° 35' 19"           | 1.229                     | 3:43      | 17:27    | -3.7           | 84.3% | 1.357                       | 0.7202                    | 12.3                      | 31.3               | 6:12             | 19:04           |
| 34 | 08 Sep 2025 | 250                      | 09h 12m 58s                  | 16° 35' 10"           | 1.208                     | 3:55      | 17:28    | -3.7           | 86.1% | 1.3953                      | 0.7196                    | 12.0                      | 29.6               | 6:17             | 18:55           |
| 35 | 15 Sep 2025 | 257                      | 09h 46m 47s                  | 14° 11' 51"           | 1.187                     | 4:08      | 17:28    | -3.7           | 87.8% | 1.4315                      | 0.7190                    | 11.7                      | 27.9               | 6:21             | 18:46           |
| 36 | 22 Sep 2025 | 264                      | 10h 20m 01s                  | 11° 28' 38"           | 1.165                     | 4:21      | 17:26    | -3.6           | 89.3% | 1.4655                      | 0.7187                    | 11.4                      | 26.2               | 6:26             | 18:37           |
| 37 | 01 Oct 2025 | 273                      | 11h 01m 58s                  | 07° 35' 25"           | 1.150                     | 4:38      | 17:22    | -3.6           | 91.2% | 1.5059                      | 0.7184                    | 11.1                      | 24.0               | 6:31             | 18:25           |
| 38 | 08 Oct 2025 | 280                      | 11h 34m 10s                  | 04° 20' 41"           | 1.143                     | 4:51      | 17:19    | -3.6           | 92.5% | 1.5348                      | 0.7185                    | 10.9                      | 22.3               | 6:36             | 18:16           |
| 39 | 15 Oct 2025 | 287                      | 12h 06m 10s                  | 00° 58' 40"           | 1.143                     | 5:04      | 17:14    | -3.6           | 93.7% | 1.5613                      | 0.7187                    | 10.7                      | 20.6               | 6:41             | 18:07           |
| 40 | 22 Oct 2025 | 294                      | 12h 38m 11s                  | -02° 26' 30"          | 1.154                     | 5:17      | 17:10    | -3.6           | 94.7% | 1.5857                      | 0.7192                    | 10.5                      | 18.8               | 6:46             | 17:59           |
| 41 | 01 Nov 2025 | 304                      | 13h 24m 21s                  | -07° 16' 44"          | 1.176                     | 4:36      | 16:05    | -3.6           | 96.1% | 1.6165                      | 0.7200                    | 10.3                      | 16.3               | 5:55             | 16:49           |
| 42 | 08 Nov 2025 | 311                      | 13h 57m 17s                  | -10° 31' 51"          | 1.202                     | 4:50      | 16:02    | -3.6           | 96.9% | 1.6353                      | 0.7208                    | 10.2                      | 14.6               | 6:01             | 16:44           |
| 43 | 15 Nov 2025 | 318                      | 14h 30m 56s                  | -13° 35' 11"          | 1.233                     | 5:04      | 16:00    | -3.6           | 97.6% | 1.6520                      | 0.7217                    | 10.1                      | 12.8               | 6:07             | 16:39           |
| 44 | 22 Nov 2025 | 325                      | 15h 05m 27s                  | -16° 22' 12"          | 1.272                     | 5:19      | 15:59    | -3.6           | 98.2% | 1.6665                      | 0.7226                    | 10.0                      | 11.1               | 6:13             | 16:36           |
| 45 | 01 Dec 2025 | 334                      | 15h 51m 15s                  | -19° 25' 35"          | 1.312                     | 5:38      | 16:00    | -3.5           | 98.9% | 1.6820                      | 0.7238                    | 9.9                       | 8.9                | 6:21             | 16:34           |
| 46 | 08 Dec 2025 | 341                      | 16h 27m 59s                  | -21° 18' 24"          | 1.341                     | 5:52      | 16:04    | -3.5           | 99.3% | 1.6918                      | 0.7248                    | 9.9                       | 7.1                | 6:26             | 16:34           |
| 47 | 15 Dec 2025 | 348                      | 17h 05m 32s                  | -22° 40' 53"          | 1.364                     | 6:06      | 16:10    | -3.5           | 99.6% | 1.6995                      | 0.7256                    | 9.8                       | 5.4                | 6:31             | 16:36           |
| 48 | 22 Dec 2025 | 355                      | 17h 43m 43s                  | -23° 30' 01"          | 1.374                     | 6:19      | 16:18    | -3.5           | 99.8% | 1.7052                      | 0.7264                    | 9.8                       | 3.8                | 6:35             | 16:39           |
| 49 | 01 Jan 2026 | 365                      | 18h 38m 41s                  | -23° 38' 42"          | 1.367                     | 6:35      | 16:33    | -3.5           | 100%  | 1.7099                      | 0.7274                    | 9.8                       | 1.4                | 6:39             | 16:45           |
| 50 | 08 Jan 2026 | 372                      | 19h 16m 58s                  | -23° 01' 12"          | 1.349                     | 6:44      | 16:45    | -3.5           | 100%  | 1.7109                      | 0.7278                    | 9.8                       | 0.8                | 6:40             | 16:50           |
| 51 | 15 Jan 2026 | 379                      | 19h 54m 44s                  | -21° 49' 07"          | 1.320                     | 6:51      | 16:59    | -3.5           | 99.9% | 1.7100                      | 0.7281                    | 9.8                       | 2.2                | 6:39             | 16:57           |
| 52 | 22 Jan 2026 | 386                      | 20h 31m 41s                  | -20° 04' 53"          | 1.278                     | 6:55      | 17:13    | -3.5           | 99.8% | 1.7072                      | 0.7282                    | 9.8                       | 3.8                | 6:37             | 17:03           |
| 53 | 01 Feb 2026 | 396                      | 21h 22m 48s                  | -16° 47' 03"          | 1.233                     | 6:57      | 17:35    | -3.5           | 99.5% | 1.6997                      | 0.7281                    | 9.8                       | 6.2                | 6:32             | 17:12           |
| 54 | 08 Feb 2026 | 403                      | 21h 57m 20s                  | -13° 59' 57"          | 1.200                     | 6:56      | 17:49    | -3.5           | 99.1% | 1.6922                      | 0.7277                    | 9.9                       | 7.9                | 6:27             | 17:19           |

| #  | Date        | Days -<br>01 Jan<br>2025 | Right ascension<br>RA, h m s | Declination,<br>° ' " | Change<br>in RA,<br>°/day | Rise time | Set time | Magni-<br>tude | Phase | Distance<br>to Earth,<br>au | Distance<br>to Sun,<br>au | Angular<br>diameter,<br>" | Elon-<br>gation, ° | Sun rise<br>time | Sun set<br>time |
|----|-------------|--------------------------|------------------------------|-----------------------|---------------------------|-----------|----------|----------------|-------|-----------------------------|---------------------------|---------------------------|--------------------|------------------|-----------------|
| 55 | 15 Feb 2026 | 410                      | 22h 30m 56s                  | -10° 54' 16"          | 1.171                     | 6:54      | 18:03    | -3.5           | 98.7% | 1.6826                      | 0.7273                    | 9.9                       | 9.5                | 6:21             | 17:25           |
| 56 | 22 Feb 2026 | 417                      | 23h 03m 44s                  | -07° 34' 28"          | 1.149                     | 6:51      | 18:17    | -3.5           | 98.2% | 1.6709                      | 0.7266                    | 10.0                      | 11.2               | 6:14             | 17:31           |
| 57 | 01 Mar 2026 | 424                      | 23h 35m 55s                  | -04° 04' 54"          | 1.136                     | 6:46      | 18:31    | -3.5           | 97.6% | 1.6572                      | 0.7258                    | 10.1                      | 12.9               | 6:06             | 17:37           |
| 58 | 08 Mar 2026 | 431                      | 00h 07m 44s                  | -00° 29' 56"          | 1.131                     | 6:41      | 18:44    | -3.6           | 96.9% | 1.6412                      | 0.7250                    | 10.2                      | 14.6               | 5:57             | 17:42           |
| 59 | 15 Mar 2026 | 438                      | 00h 39m 24s                  | 03° 06' 13"           | 1.135                     | 6:36      | 18:57    | -3.6           | 96.2% | 1.6230                      | 0.7241                    | 10.3                      | 16.3               | 5:49             | 17:47           |
| 60 | 22 Mar 2026 | 445                      | 01h 11m 11s                  | 06° 39' 20"           | 1.150                     | 6:31      | 19:10    | -3.6           | 95.3% | 1.6025                      | 0.7231                    | 10.4                      | 17.9               | 5:40             | 17:52           |
| 61 | 01 Apr 2026 | 455                      | 01h 57m 11s                  | 11° 30' 13"           | 1.176                     | 7:25      | 20:30    | -3.6           | 93.8% | 1.5690                      | 0.7218                    | 10.6                      | 20.4               | 6:27             | 18:59           |
| 62 | 08 Apr 2026 | 462                      | 02h 30m 07s                  | 14° 38' 24"           | 1.204                     | 7:22      | 20:43    | -3.6           | 92.6% | 1.5426                      | 0.7209                    | 10.8                      | 22.1               | 6:18             | 19:04           |
| 63 | 15 Apr 2026 | 469                      | 03h 03m 49s                  | 17° 29' 01"           | 1.234                     | 7:20      | 20:57    | -3.6           | 91.4% | 1.5137                      | 0.7201                    | 11.0                      | 23.8               | 6:09             | 19:09           |
| 64 | 22 Apr 2026 | 476                      | 03h 38m 22s                  | 19° 57' 52"           | 1.268                     | 7:20      | 21:12    | -3.6           | 90.0% | 1.4823                      | 0.7194                    | 11.3                      | 25.5               | 6:01             | 19:14           |
| 65 | 01 May 2026 | 485                      | 04h 24m 01s                  | 22° 30' 51"           | 1.296                     | 7:22      | 21:29    | -3.6           | 88.0% | 1.4382                      | 0.7188                    | 11.6                      | 27.7               | 5:52             | 19:20           |
| 66 | 08 May 2026 | 492                      | 05h 00m 19s                  | 23° 55' 38"           | 1.313                     | 7:26      | 21:43    | -3.7           | 86.3% | 1.4011                      | 0.7185                    | 11.9                      | 29.3               | 5:45             | 19:25           |
| 67 | 15 May 2026 | 499                      | 05h 37m 05s                  | 24° 47' 35"           | 1.317                     | 7:32      | 21:55    | -3.7           | 84.5% | 1.3616                      | 0.7184                    | 12.3                      | 31.0               | 5:40             | 19:30           |
| 68 | 22 May 2026 | 506                      | 06h 13m 58s                  | 25° 05' 06"           | 1.306                     | 7:41      | 22:05    | -3.7           | 82.5% | 1.3198                      | 0.7185                    | 12.6                      | 32.6               | 5:36             | 19:35           |
| 69 | 01 Jun 2026 | 516                      | 07h 06m 12s                  | 24° 29' 59"           | 1.276                     | 7:55      | 22:16    | -3.7           | 79.5% | 1.2562                      | 0.7190                    | 13.3                      | 34.9               | 5:31             | 19:41           |
| 70 | 08 Jun 2026 | 523                      | 07h 41m 56s                  | 23° 24' 51"           | 1.239                     | 8:07      | 22:20    | -3.7           | 77.3% | 1.2093                      | 0.7195                    | 13.8                      | 36.4               | 5:30             | 19:45           |
| 71 | 15 Jun 2026 | 530                      | 08h 16m 38s                  | 21° 49' 03"           | 1.196                     | 8:19      | 22:23    | -3.8           | 74.9% | 1.1605                      | 0.7202                    | 14.4                      | 37.9               | 5:30             | 19:48           |
| 72 | 22 Jun 2026 | 537                      | 08h 50m 08s                  | 19° 45' 49"           | 1.143                     | 8:31      | 22:22    | -3.8           | 72.5% | 1.1101                      | 0.7210                    | 15.0                      | 39.3               | 5:31             | 19:50           |
| 73 | 01 Jul 2026 | 546                      | 09h 31m 16s                  | 16° 33' 10"           | 1.088                     | 8:46      | 22:19    | -3.8           | 69.1% | 1.0432                      | 0.7221                    | 16.0                      | 41.0               | 5:34             | 19:51           |
| 74 | 08 Jul 2026 | 553                      | 10h 01m 44s                  | 13° 41' 49"           | 1.041                     | 8:57      | 22:14    | -3.8           | 66.4% | 0.9897                      | 0.7230                    | 16.9                      | 42.2               | 5:37             | 19:50           |
| 75 | 15 Jul 2026 | 560                      | 10h 30m 53s                  | 10° 36' 04"           | 0.998                     | 9:07      | 22:07    | -3.9           | 63.5% | 0.9352                      | 0.7240                    | 17.8                      | 43.3               | 5:41             | 19:48           |
| 76 | 22 Jul 2026 | 567                      | 10h 58m 50s                  | 07° 19' 55"           | 0.948                     | 9:16      | 21:59    | -3.9           | 60.5% | 0.8800                      | 0.7249                    | 19.0                      | 44.2               | 5:45             | 19:44           |
| 77 | 01 Aug 2026 | 577                      | 11h 36m 46s                  | 02° 29' 17"           | 0.901                     | 9:27      | 21:45    | -3.9           | 55.9% | 0.8002                      | 0.7261                    | 20.9                      | 45.3               | 5:52             | 19:38           |
| 78 | 08 Aug 2026 | 584                      | 12h 02m 00s                  | -00° 56' 17"          | 0.862                     | 9:33      | 21:34    | -3.9           | 52.5% | 0.7441                      | 0.7269                    | 22.4                      | 45.7               | 5:56             | 19:32           |
| 79 | 15 Aug 2026 | 591                      | 12h 26m 08s                  | -04° 19' 30"          | 0.818                     | 9:38      | 21:22    | -3.9           | 48.8% | 0.6881                      | 0.7275                    | 24.3                      | 45.9               | 6:01             | 19:25           |
| 80 | 22 Aug 2026 | 598                      | 12h 49m 03s                  | -07° 36' 43"          | 0.753                     | 9:42      | 21:09    | -3.9           | 44.9% | 0.6325                      | 0.7279                    | 26.4                      | 45.7               | 6:06             | 19:17           |
| 81 | 01 Sep 2026 | 608                      | 13h 19m 11s                  | -12° 00' 35"          | 0.666                     | 9:44      | 20:48    | -3.9           | 38.8% | 0.5544                      | 0.7282                    | 30.1                      | 44.7               | 6:12             | 19:05           |

| #   | Date        | Days -<br>01 Jan<br>2025 | Right ascension<br>RA, h m s | Declination,<br>° ' " | Change<br>in RA,<br>°/day | Rise time | Set time | Magni-<br>tude | Phase | Distance<br>to Earth,<br>au | Distance<br>to Sun,<br>au | Angular<br>diameter,<br>" | Elon-<br>gation, ° | Sun rise<br>time | Sun set<br>time |
|-----|-------------|--------------------------|------------------------------|-----------------------|---------------------------|-----------|----------|----------------|-------|-----------------------------|---------------------------|---------------------------|--------------------|------------------|-----------------|
| 82  | 08 Sep 2026 | 615                      | 13h 37m 50s                  | -14° 47' 04"          | 0.563                     | 9:43      | 20:32    | -3.8           | 34.0% | 0.5013                      | 0.7282                    | 33.3                      | 43.2               | 6:17             | 18:56           |
| 83  | 15 Sep 2026 | 622                      | 13h 53m 36s                  | -17° 13' 00"          | 0.424                     | 9:38      | 20:13    | -3.7           | 28.7% | 0.4504                      | 0.7280                    | 37.1                      | 40.9               | 6:21             | 18:46           |
| 84  | 22 Sep 2026 | 629                      | 14h 05m 28s                  | -19° 11' 59"          | 0.204                     | 9:28      | 19:52    | -3.5           | 23.0% | 0.4025                      | 0.7277                    | 41.5                      | 37.6               | 6:25             | 18:37           |
| 85  | 01 Oct 2026 | 638                      | 14h 12m 49s                  | -20° 50' 49"          | -0.070                    | 9:05      | 19:19    | -2.9           | 15.0% | 0.3476                      | 0.7270                    | 48.0                      | 31.3               | 6:31             | 18:25           |
| 86  | 08 Oct 2026 | 645                      | 14h 10m 51s                  | -21° 09' 49"          | -0.320                    | 8:36      | 18:49    | -2.0           | 8.9%  | 0.3127                      | 0.7263                    | 53.4                      | 24.4               | 6:36             | 18:16           |
| 87  | 15 Oct 2026 | 652                      | 14h 01m 54s                  | -20° 23' 23"          | -0.493                    | 7:58      | 18:15    | -0.3           | 3.7%  | 0.2873                      | 0.7254                    | 58.1                      | 16.0               | 6:41             | 18:08           |
| 88  | 22 Oct 2026 | 659                      | 13h 48m 05s                  | -18° 28' 15"          | -0.486                    | 7:11      | 17:39    | +2.9           | 0.8%  | 0.2742                      | 0.7245                    | 60.9                      | 7.7                | 6:46             | 18:00           |
| 89  | 01 Nov 2026 | 669                      | 13h 28m 39s                  | -14° 31' 33"          | -0.265                    | 5:01      | 15:51    | +0.5           | 2.5%  | 0.2798                      | 0.7232                    | 59.7                      | 13.2               | 5:54             | 16:50           |
| 90  | 08 Nov 2026 | 676                      | 13h 21m 14s                  | -11° 55' 15"          | -0.006                    | 4:19      | 15:23    | -1.6           | 7.2%  | 0.2999                      | 0.7222                    | 55.7                      | 22.2               | 6:00             | 16:44           |
| 91  | 15 Nov 2026 | 683                      | 13h 21m 04s                  | -10° 05' 13"          | 0.240                     | 3:47      | 15:00    | -2.7           | 13.4% | 0.3306                      | 0.7213                    | 50.5                      | 29.8               | 6:07             | 16:39           |
| 92  | 22 Nov 2026 | 690                      | 13h 27m 48s                  | -09° 11' 24"          | 0.469                     | 3:23      | 14:42    | -3.4           | 19.9% | 0.3691                      | 0.7205                    | 45.2                      | 35.6               | 6:13             | 16:36           |
| 93  | 01 Dec 2026 | 699                      | 13h 44m 42s                  | -09° 16' 28"          | 0.646                     | 3:05      | 14:23    | -3.8           | 27.8% | 0.4265                      | 0.7196                    | 39.1                      | 40.8               | 6:21             | 16:34           |
| 94  | 08 Dec 2026 | 706                      | 14h 02m 48s                  | -10° 04' 55"          | 0.764                     | 2:58      | 14:11    | -3.9           | 33.3% | 0.4751                      | 0.7191                    | 35.1                      | 43.5               | 6:26             | 16:34           |
| 95  | 15 Dec 2026 | 713                      | 14h 24m 11s                  | -11° 20' 14"          | 0.860                     | 2:55      | 14:02    | -4.0           | 38.4% | 0.5258                      | 0.7187                    | 31.7                      | 45.2               | 6:31             | 16:36           |
| 96  | 22 Dec 2026 | 720                      | 14h 48m 15s                  | -12° 52' 27"          | 0.954                     | 2:55      | 13:54    | -4.1           | 42.9% | 0.5778                      | 0.7185                    | 28.9                      | 46.3               | 6:35             | 16:39           |
| 97  | 01 Jan 2027 | 730                      | 15h 26m 25s                  | -15° 16' 29"          | 1.035                     | 3:00      | 13:46    | -4.1           | 48.7% | 0.6534                      | 0.7185                    | 25.5                      | 46.9               | 6:39             | 16:45           |
| 98  | 08 Jan 2027 | 737                      | 15h 55m 24s                  | -16° 55' 32"          | 1.092                     | 3:06      | 13:43    | -4.1           | 52.4% | 0.7066                      | 0.7188                    | 23.6                      | 46.9               | 6:40             | 16:50           |
| 99  | 15 Jan 2027 | 744                      | 16h 25m 58s                  | -18° 25' 37"          | 1.143                     | 3:13      | 13:42    | -4.0           | 55.8% | 0.7597                      | 0.7192                    | 22.0                      | 46.6               | 6:39             | 16:56           |
| 100 | 22 Jan 2027 | 751                      | 16h 57m 58s                  | -19° 41' 03"          | 0.000                     | 3:21      | 13:43    | -4.0           | 59.0% | 0.8125                      | 0.7198                    | 20.5                      | 46.0               | 6:37             | 17:03           |

The data computed by Dominic Ford, in-the-sky.org

The rise and set times are given for Netanya