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 h = 15°, 1 m = 15' and 1 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°.
- "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.

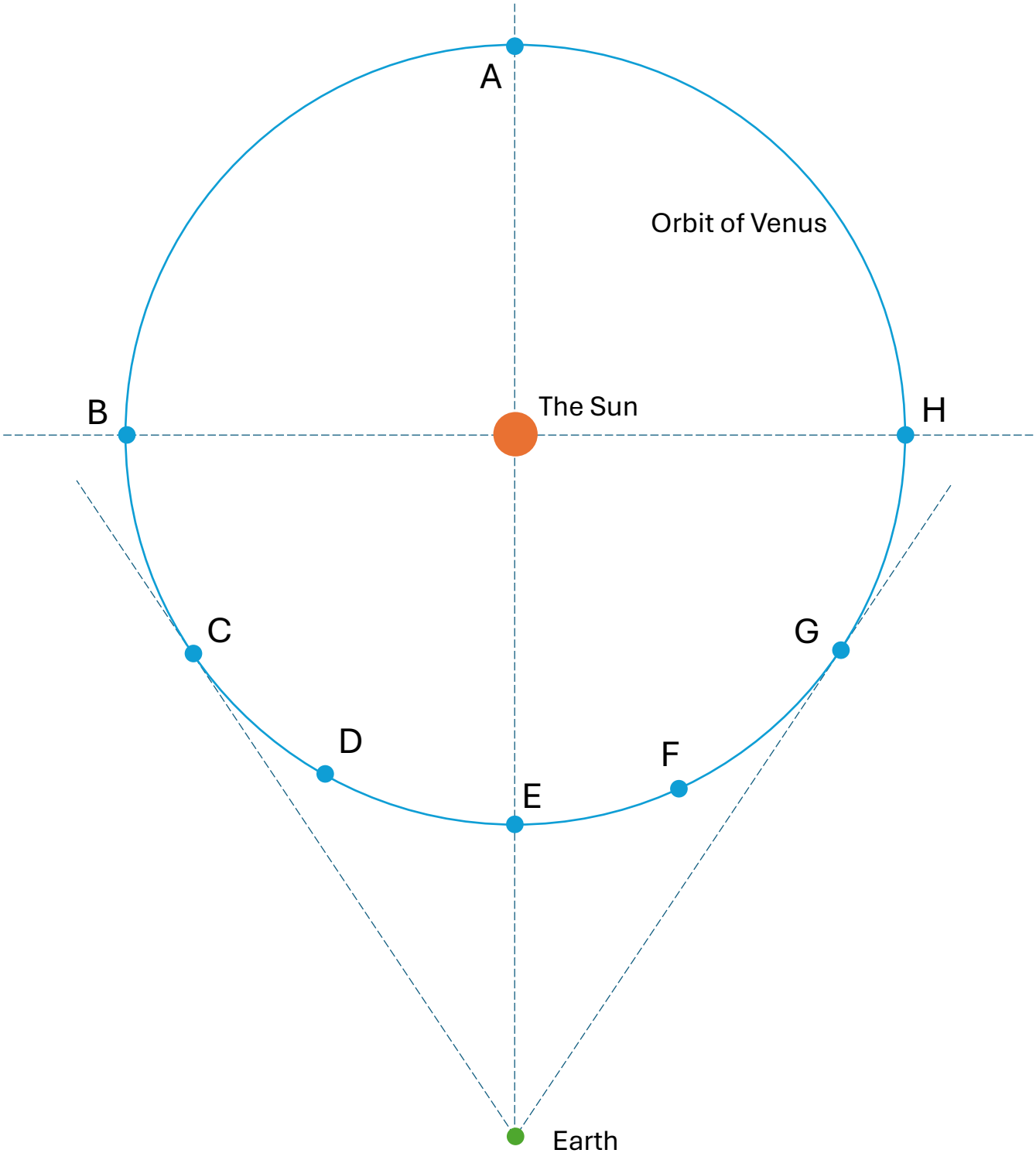
Only four data rows are given per month, but in some of the questions you will be asked for a specific date. For these cases **try to infer the exact date**, even if just by a reasonable guess.

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° 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.)

Solution: The ephemeris tells that on March 15, 2025 the elongation will diminish to 15.3 degrees. The elongation changes by approximately 1 degree per day so the last day of evening visibility will then be March 14, 2025. Accepted range: March 14-16.

The next period of evening visibility starts in March 2026. On March 08 and 15 the elongations are respectively 14.6° and 16.3°. We conclude that elongation changes by about ¼° per day and the first day of evening visibility will be about March 10. Accepted range: March 07-12.



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.)

Solution:

If the planetary orbits would lie in one plane, then in the inferior conjunction

- the Venus elongation would be zero,
- distance from Earth to Venus would be at minimum,
- right ascension of Venus would be the same as of the Sun (true for any conjunction),
- phase would equal zero (like for the New Moon),
- the brightness would have minimum.

In reality, the plane of orbit of Venus is slightly different from ecliptic, which is the plane of the Earth orbit. Therefore, some of these events do not happen (e.g., phase and elongation are not exactly zero), and some occur at slightly different moments.

The first such event occurs on 23 March 2025. From the ephemeris one can see a clear Earth distance, phase and brightness minimum on March 22 (80 days after January 01). The range of accepted answers is March 20-25.

The second such event occurs on 24 October 2026. Again, from the ephemeris table one sees that the Earth distance, brightness and phase have minimum near October 22 (659 days after January 01, 2025). They may infer that this happened slightly later. The range of correct answers is October 21 – 28, 2026.

The synodic period is the difference between these times. From this data, we obtain it as 661 – 81 = 580 days. The nominal value is 584 days. The accepted range is 575 – 585 days. However, if the student indicates a value between 583.9 and 584.1 as the synodic period, but the difference of days does not give 584, the answer is considered as incorrect.

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 dimeter 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.)

Solution:

In chronological order, the first of the events in 2025 is the greatest eastern elongation.

The actual date of the greatest eastern elongation is 12 January 2025 and Venus elongation at this date is 47.2°. The dates with the largest elongation in ephemeris are 08 and 15 January 2025, and the corresponding elongation values are 47.2° and 47.1°. The range of the accepted answers is from 08 to 15 January 2025 for the date, and only 47.2° for the elongation.

The range with the maximum evening brightness in ephemeris is 08-22 January 2025 and the brightness value is -4.1^{m}. The correct answer is January 2025.

The inferior conjunction date is discussed in previous question. The actual date is 23 March 2025 and the angular diameter is 59.5". The range of accepted answers is March 20 to 25, the range of accepted angular diameters is 59.0" – 59.6"

The maximum morning brightness (-3.9^{m}) occurs in the period from 15 May to 01 July 2025. The correct answers are May and June 2025.

The greatest wester elongation (45.9°) occurs on 02 June 2025. In the given ephemeris, the elongation is the largest on 01 June 2025. The range of accepted answers is 01-05 June 2025.

The actual superior conjunction of Venus occurs on 06 January 2026. There are various ways the students may determine the date: from maximum distance to Earth (08 January), phase being 100% (01 and 08 January), minimum elongation (08 January), minimum angular diameter (15 December – 01 February; the date in the middle of the range is 08 January). The accepted date range is January 02 – January 10. The minimum angular diameter is 9.8".

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°, 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.)

Solution: The triangle Sun-C-Earth is a right-angle triangle, since the tangent to the circle is perpendicular to its diameter. The Sun-C distance is then $a_{Venus} = \sin e_{max} = 0.7313$ au.

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.)

Solution: The minimum distance to Venus is $d_{min} = a_{Earth} - a_{Venus}$ and the maximum distance is $d_{max} = a_{Earth} + a_{Venus}$. Their ratio equals the ratio of the angular diameters, thus $\frac{d_{max}}{d_{min}} = 6$.

$$\frac{a_{Earth} + a_{Venus}}{a_{Earth} - a_{Venus}} = 6$$

$$a_{Earth} + a_{Venus} = 6(a_{Earth} - a_{Venus})$$

$$7a_{Venus} = 5a_{Earth}$$

$$a_{Venus} = \frac{5}{7} a_{Earth}$$

The answer is then 5/7 au = 0.7143 au.

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.)

Solution:

Venus is an inner planet, thus its orbital period *P* may be determined as

$$\frac{1}{P} = \frac{1}{S} + \frac{1}{E} = \frac{1}{578} + \frac{1}{365.25} = \frac{1}{223.8}$$

Inserting the orbital period 223.8 days or 0.6128 y into the third Kepler's law $T^2 = a^3$, we will obtain the orbit radius (same as semimajor axis for circular orbits) as $a = \sqrt[3]{T^2} = \sqrt[3]{0.6128^2} = 0.7214$ au.

#	Date	Days - 01 Jan 2025	Right ascension RA, h m s	Declination, ° ' "	Change in RA, °/day	Rise time	Set time	Magni-tude	Phase	Distance to Earth, au	Distance to Sun, au	Angular diameter, "	Elon-gation, °	Sun rise time	Sun set 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

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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

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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 - 01 Jan 2025	Right ascension RA, h m s	Declination, ° ' "	Change in RA, °/day	Rise time	Set time	Magni-tude	Phase	Distance to Earth, au	Distance to Sun, au	Angular diameter, "	Elon-gation, °	Sun rise time	Sun set 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