



100 PROBLEMS IN
Celestial Navigation

Self-Contained — with Answers

LEONARD GRAY

100 Problems
In Celestial Navigation

Leonard Gray

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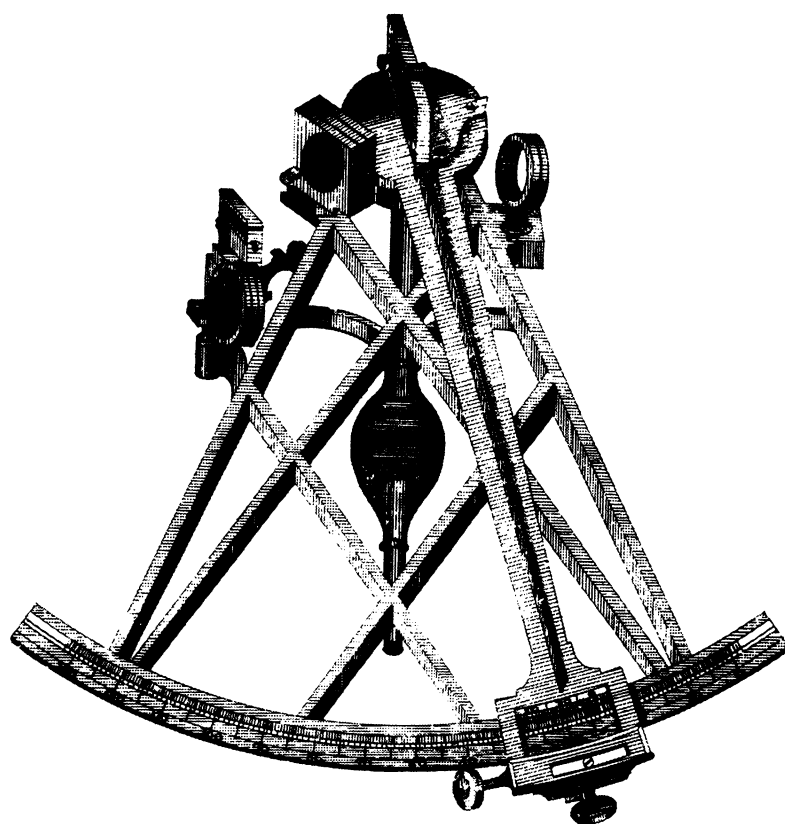
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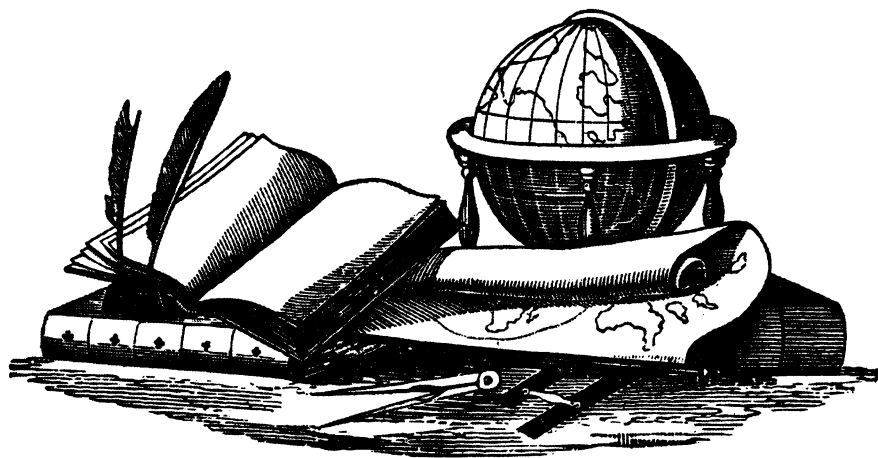
Foreword

GPS is the siren that tempts us to leave the sextant in its box. Too often voyages end with the words, “you know, I don’t think we ever did get the sextant out”. Yet the mandate to maintain navigational skills remains. A discipline should be established for turning off the GPS for awhile and navigating celestially to hone skills, verify proper GPS operation, and to gain an understanding of the forces affecting your passage. To the extent this is not done at sea it should certainly be done ashore! This is where Leonard Gray’s book comes in. It puts you back at sea in a realistic way with problems designed to review, instruct, and as a bonus giving you vicarious enjoyment of actually being there.

This second edition reprint corrects a few errors in the first, but the problems remain basically unchanged. What has changed since then is the alternative. Virtually every other book of this kind has gone out of print. Thus, this book is not only a joy to use, but can be thought of as a treasure too. Where else can you go to get this kind of challenge?

—Kenneth Gebhart
July 1999

Kenneth Gebhart is President of Celestaire, Inc., and is well known for his seminars on celestial navigation presented at most major sailboat shows.



Introduction

Navigation can be thought of as an attempt to reduce location uncertainties and evaluate the remaining ones. Since dealing with errors is a big part of the navigator's job, sighting inaccuracies and an occasional blunder have been added to these problems to make them authentic. Things go wrong, as in real life. When this happens, the reader might try reworking the problem using a different method—say, H.O. 249 Vol. 2, instead of Vol. 1—and should not rule out mistakes in time, identification, or sighting. Good preparation is important in navigation, and is included here, as in a real situation. Readers are urged to figure out twilight times and what bodies to shoot, as well as working the sights.

A navigator with a computer and a navigation program can do similar twilight planning for a cruise, at home before leaving, using two guesses—one for a boat speed slower than expected and the other for a slightly faster one—and put the printouts in a loose-leaf notebook for use at sea.

These problems can be worked with either the Government version or the commercial version of the *Nautical Almanac*. For sight reduction, the easiest method is H.O. 249 Vol. 1, and Vol. 2 or 3. (Vols. 2 and 3 overlap at 40° latitude.) H.O. 229 Vol. 3 can be used, if preferred—or another method, such as H.O. 208 or H.O. 211—or a computer program or navigation calculator. (H.O. 249 and H.O. 229 have been renamed Pub. No. 249 and Pub. No. 229, but some navigators still use the old designations.) *Nautical Almanac* and H.O. 249 excerpts are included in the appendices.

The problems can be done in any order, but 1-1 has a few hints that are not repeated for the others. The exercises are realistic from a navigation standpoint, but any political reasons for avoiding certain destinations are ignored.

The usual conventions are followed—for example, if neither limb is stated for a sun sight, the lower limb is assumed; but LL or UL is always specified for the moon. Times, unless otherwise stated, are GMT. (UT, the new name, means the same thing.)

Celestial navigation is not difficult, but it has lots of routines and conventions to remember—and many opportunities to go wrong. It helps to use as many bodies as possible during a round of sights—at least six—and, for sun and moon shots, at least four shots for each body.

In rounding off, some people (including the author) deal with .5 by dropping the .5 if it's preceded by an even number, but raising if the .5 is preceded by an odd number. For example, 34.5 would round to 34, and 35.5 would round to 36. This improves the chances that rounding errors will cancel each other.

The invention of the marine chronometer must have seemed like a miracle to eighteenth-century British navigators. Each one cost a substantial sum, and was treated like a jewel, with rituals for winding and protecting it. Now we have an even greater marvel, the crystal-controlled digital watch, and it may be that only old-time navigators appreciate it properly. The type with a digital read-out is not so common now, but is greatly preferred for navigation. These are still relatively cheap, so three of them should be taken on a cruise, each tagged with its weekly error (having been checked for a month or so in advance).

Introduction

One should be set to boat time, and changed as time zones are crossed, and the others set to GMT. They should be compared every day or so to the constant time signals from WWV (on 20, 15, 10, 5, or 2.5 MHz) or CHU (14.667, 7.335, or 3.333 MHz), or the hourly ones from the BBC or another station.

The problems in this book have been validated with several computer programs, mainly StarPilot (available from Celestaire, Inc., 1-800-727-9785), which is simple, intuitive, and well-illustrated. It performs all common navigation functions, including planning.

The sight-reduction form in Appendix F may be copied for personal, non-commercial use.



Chapter 1

New York to Flores (I)

Problem 1-1

We are sailing from New York to the Azores in a 37-foot ketch. It is early in the morning of Thursday, May 13, 1993, and we are up before daylight to prepare a plan for morning twilight. We are on a course of 090° , making 5.5 knots in a light following wind. Stars are visible, and an occasional thin cloud crosses the moon. Our DR position at 0730 (GMT) will be $40^\circ 10' \text{N}$, $50^\circ 15' \text{W}$.

Planning for a round of twilight sights makes things much easier at sighting time. Then, for each body, the navigator pre-sets the sextant scale to the predicted altitude, turns to the predicted azimuth, and, if all goes well, spots the body without much searching. Identification errors are more easily avoided, and the sighting goes a lot faster.

From the right-hand daily page of the *Nautical Almanac*, we find the LMT of nautical twilight, civil twilight, and sunrise. On the first yellow page in the almanac, we note that $50^\circ 15'$ longitude equals 3h 21m time, which we add to each LMT to get GMT. (We do all of our navigating and plotting with GMT.)

	LMT	GMT
Nautical twilight	0337	0658
Civil twilight	0414	0735
Sunrise	0446	0807

This table gives us the approximate time to be ready for sights (0658), the middle of the sighting period (0735), and the time when stars will no longer be visible (0807).

Next we need the LHA Υ at 0414 LMT. The easiest way to get this is to look on the left-hand white page of the almanac, under GMT (not LMT), and take out the GHA Υ (not LHA Υ). Adding to this the 14-minute increment from the yellow pages ($3^\circ 31'$) gives 294° (rounded to the nearest degree).

From H.O. 249 Vol. 1, for latitude 40°N , on the line for LHA Υ 294° , we list for our sighting plan the predicted altitude (rounded) and azimuth of each of the seven stars. From the *Nautical Almanac* separator page we get the magnitudes of these stars.

Now we need to add the moon and planets to the plan, using the star finder, 2102D. We find the RA of each body (stated in degrees) = GHA Υ minus GHA body. With the red template on the base, we turn it to this RA (figures on the outer scale of the base), and put a pencil-mark at the declination. In north latitude (N side of the finder): for north declination use the upper figures; for south declination the lower. On the S side: upper figures for south declination, lower for north. It helps to mark the spot for the sun, to be sure that it shows just below the horizon at sighting time. We replace the red template with the blue one for 35°N or 45°N , turn it to our LHA Υ at sighting time, 294° , and record the expected altitudes and azimuths for the moon and planets. We check one or two stars to see that their 2102D altitudes and azimuths approximate those found in H.O. 249 Vol. 1.

Now we make up our twilight plan, listing the bodies in sighting order, from dimmest to brightest:

MAG.	BODY	ALT.	AZ.
2.5	Enif	49°	128°
2.2	Alpheratz	34°	079°
2.2	Kochab	43°	339°
2.1	Rasalhague	52°	233°
0.9	Altair	59°	173°
0.2	Arcturus	20°	279°
-4.5	Venus	14°	097°
-	Moon	34°	148°

We'd prefer to shoot Alpheratz, Kochab, Rasalhague, Alkaid, Altair, and Arcturus, for good azimuth spacing, and because all these sights can be worked with H.O. 249 Vol. 1.

We are on deck at 0700 GMT with the sextant, our digital watch set to GMT, and a small hand-bearing compass to check azimuths. When the horizon becomes visible, Enif and Alpheratz have faded, so we start with Kochab. We get sights as follows:

BODY	GMT	Hs
Kochab	07-33-45	43°23'.8
Rasalhague	07-35-16	51°05'.2
Alkaid	07-37-15	30°15'.9
Altair	07-39-02	58°38'.0
Venus	07-41-24	15°15'.3
Moon (LL)	07-44-08	34°05'.6

Our height of eye was 7 feet, and the sextant I.C. was -1'.2. We work these sights with H.O. 249 Vol. 1 and Vol. 3 (or with H.O. 229, or an electronic method). The plot looks good (although not perfect), and we pick the apparent center of the figure. What was our May 13 0744 fix? How reliable do we consider it?

Problem 1-2

Later on Thursday morning, May 13, 1993, our course is still 090°, speed 5.5 knots. Our last fix, at 0744 this morning, was at 40°14'N, 49°58'W. We note, on the right daily page of the Nautical Almanac, that the moon is near last quarter—so we can get a sun-moon fix between morning and early afternoon. The height of eye is again 7 feet, but the I.C. this time is -1'.0. The increased waves are giving us some pitching, but we get sights as follows:

BODY	GMT	Hs
Sun	12-20-04	46°42'.2
Sun	12-21-31	47°02'.6
Sun	12-23-06	47°21'.8
Moon (UL)	12-26-14	24°54'.7
Moon (UL)	12-27-49	24°42'.4
Moon (UL)	12-29-16	24°33'.4

What is our May 13 1229 fix? How reliable is it?

Problem 1-3

Our last fix, at 1229 May 13, 1993, was $40^{\circ}13'N$, $49^{\circ}19'W$. The boat is pitching badly, but we'd like an afternoon fix. Our course is still 090° , speed 5.5 knots. Since the moon is down, we will try for more sun sights to cross with the 12-21-31 sun sight (whose LOP was the middle of the three). The height of eye is still 7 feet, but the I.C. is again $-1'.2$. Results are:

BODY	GMT	Hs
Sun	12-21-31	$47^{\circ}02'.6$
Sun	15-25-17	$67^{\circ}53'.5$
Sun	15-26-36	$67^{\circ}57'.6$
Sun	15-28-02	$67^{\circ}50'.2$

What is our May 13 1222-1528 running fix? How reliable is it?

Problem 1-4

Our last reliable fix, at 1229 May 13, 1993, was $40^{\circ}13'N$, $49^{\circ}19'W$. There is still some pitching as we approach evening twilight, and some clouds are moving in. We decide to plan for a round of sights anyway. Course and speed are still $090^{\circ}/5.5$ knots, the I.C. is now $-1'.4$, and the height of eye still 7 feet. Our plan is similar to the one for morning twilight.

	LMT	GMT
Sunset	1908	2220
Civil twilight	1939	2251
Nautical twilight	2017	2329

LHA γ at 1939 LMT = 166° . As before, we get the predicted altitudes and azimuths for selected stars from H.O. 249 Vol. 1, and for the other bodies from the Star-Finder 2102D. For evening twilight we list them from brightest to dimmest, the order in which we will sight them:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	46°	152°
0.2	Capella	29°	307°
0.2	Arcturus	44°	103°
0.5	Procyon	32°	247°
1.2	Pollux	48°	270°
1.2	Spica	29°	140°
1.3	Regulus	59°	208°
2.1	Polaris	40°	359°
2.2	Kochab	47°	020°

Our preferred bodies from this list are Capella, Arcturus, Procyon, Spica, Regulus, and Polaris.

At sunset, the sea is still rough, and the sky is about half covered with cirrocumulus, but we decide to do our best. We spot Jupiter in the southeast and get a fair shot. When Capella and Arcturus become visible, we shoot them quickly, but we can't find Procyon, Pollux, or any of the others on the plan. We need something in the northeast or southwest—Kochab or Procyon—but they aren't visible, and the horizon is fading. We find Polaris, hastily preset the sextant scale to 40° and shoot, but that's the last star we see. Results are:

BODY	GMT	Hs
Jupiter	22-35-30	$44^\circ 07'.8$
Capella	22-48-11	$29^\circ 42'.0$
Arcturus	22-50-10	$44^\circ 23'.5$
Polaris	22-51-47	$39^\circ 42'.9$

What is our May 13 2252 fix? Is it usable?

Problem 1-5

From our May 13, 1993, 2252 fix, at $40^\circ 09'N$, $48^\circ 02'W$, we continue on course 090° at 5.5 knots. Our I.C. is $-1'.2$, height of eye still 7 feet. Early in the morning, May 14, 1993, the visibility has improved, and we prepare for a round of sights at A.M. twilight.

	LMT	GMT
Nautical twilight	0338	0646
Civil twilight	0415	0723
Sunrise	0446	0754

The LHA γ at 0415 LMT is 296° . Using the star-finder and H.O. 249 Vol. 1, we make up the sighting plan:

MAG.	BODY	ALT.	AZ.	
2.5	Enif	50°	130°	X
2.2	Alpheratz	36°	080°	
2.2	Kochab	43°	339°	
2.1	Rasalhague	50°	235°	
1.9	Alkaid	30°	311°	
0.9	Altair	59°	177°	
0.2	Arcturus	18°	280°	
-4.5	Venus	14°	096°	X
-	Moon	32°	135°	X

We have more bodies than we need on this list. We will probably skip Enif (whose azimuth is close to Alkaid's reciprocal), Venus (close to Arcturus's reciprocal), and the moon (close to Alkaid's reciprocal).

By the time the horizon appears, some of the dimmer stars have faded, and the first one we shoot is Rasalhague. We spot Altair, then can see only Venus and the moon. Results are:

Rasalhague	07-18-45	51°09'.4
Altair	07-20-01	58°40'.1
Altair	07-21-12	58°44'.9
Venus	07-23-02	14°36'.9
Venus	07-23-55	14°47'.3
Moon (LL)	07-26-37	32°39'.8

What is our May 14 0727 fix? How reliable is it?

Problem 1-6

From our May 14, 1993, 0727 fix, at 40°09'N, 46°46'W, we continue on 090°/5.5 knots, with I.C. -1'.2, and height of eye 7 feet. We decide to get a sun-moon fix.

Results are:

BODY	GMT	Hs
Sun	12-15-30	48°26'.4
Sun	12-18-00	48°55'.0
Sun	12-19-41	49°15'.2
Moon (UL)	12-22-06	33°11'.4
Moon (UL)	12-23-31	32°54'.9
Moon (UL)	12-25-03	32°42'.3

What is our May 14 1225 fix?

Problem 1-7

There is a discussion among the crew. A and B say we should get a noonsight, but C says the noonsight is archaic—from the days before accurate time was available at sea—and H.O. 249 is so easy to use that the simple noonsight computations are no real advantage. Also, a running fix on the sun would give more information. B argues that the noonsight can give longitude as well as latitude. The decision is made to get a noonsight and see how it works out.

The navigator has compared our DR positions with our fixes for the last two days, and decided that we should have been allowing for an eastward-setting current of about 1 knot. We will use 6.5 knots, instead of 5.5, as our estimated speed since the last fix (40°09'N, 46°04'W, at 1225 May 14, 1993). Our I.C. is still -1'.2, height of eye 7 feet.

To plan for the noonsight, we need to estimate the GMT of LAN at our DR position at the time of LAN.

LMT of LAN	1200	(by definition)
Eq. of time	-0004	(from daily page; add if meridian passage is after 1200; subtract if before)
Longitude (W)	+0302	(time equivalent of 45°30'—a guess; need not be precise)
GMT of LAN	1458	

The noonsight formulas are:

d contrary to L: $L = 90^\circ - Ho - d$
 d same name, <L: $L = 90^\circ - Ho + d$
 d same name, >L: $L = Ho + d - 90^\circ$

The middle formula is the one we want. Rearranging and solving for Ho (or, in this case, the predicted altitude), we get:

$$90^\circ - 40^\circ 09' + 18^\circ 43' = 68^\circ 34'$$

Ten or fifteen minutes before 1500 GMT, we set our sextant to about 69° and go on deck. The boat is steady, moving nicely on a reach, and the sky is clear. We start shooting once a minute, and before the altitude begins to level off we shoot and read the scale as rapidly as we can. Results are:

GMT	Hs
14-53-04	$68^\circ 19'.3$
14-54-10	$68^\circ 20'.6$
14-54-32	$68^\circ 21'.9$
14-55-41	$68^\circ 22'.5$
14-56-40	$68^\circ 23'.0$
14-57-24	$68^\circ 23'.7$
14-58-15	$68^\circ 23'.7$
14-59-08	$68^\circ 23'.6$
14-59-52	$68^\circ 23'.8$
15-00-38	$68^\circ 23'.1$
15-02-37	$68^\circ 22'.1$
15-03-55	$68^\circ 21'.4$

The best way to find the greatest Hs is to plot GMT on the x axis and Hs on the y axis of a piece of graph paper, then draw a curve through the points, smoothing out the small sighting errors. Our curve shows Hs to be about $68^\circ 23'.8$, at 14-59-07.

An Hs of $68^\circ 23'.8$ results in an Ho of $68^\circ 35'.6$. With the same formula we used for planning, we solve for L this time, and get $90^\circ - 68^\circ 35'.6 + 18^\circ 43'.6 = 40^\circ 08'.0$ (north latitude).

Finding the longitude is simple. The GMT of LAN (the time at the highest point of our curve) was 14-59-07. At that time, the GHA of the sun was its longitude—therefore *our* longitude. (In east longitude, we would use $360^\circ - \text{GHA of the sun.}$) The almanac gives this figure as $45^\circ 42'.4$.

What is our May 14 noonsight-determined position? How reliable is it?

Problem 1-8

Our last good fix, May 14, 1993, at 1225, was $40^\circ 09'N$, $46^\circ 04'W$. Our course is still 090° , speed 6.5 knots, I.C. -1'.2, height of eye 7 feet. Well before sunset, we plot our expected DR position at the time of yesterday's GMT of P.M. civil twilight as an approximation to tonight's, and use this position to calculate tonight's predicted times:

	LMT	GMT
Sunset	1907	2158
Civil twilight	1939	2230
Nautical twilight	2017	2308

The LHA Υ at 1939 LMT is 167° . We make up our twilight plan as before, using H.O. 249 Vol. 1 for stars and the marked-up star-finder for other bodies.

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	46°	154°
0.2	Capella	29°	308°
0.2	Arcturus	45°	103°
0.5	Procyon	32°	248°
1.2	Pollux	47°	270°
1.2	Spica	30°	141°
1.3	Regulus	59°	210°
2.1	Polaris	40°	359°
2.2	Kochab	47°	019°

We skipped Mars because it's within 1° of Procyon and not as bright, and added Polaris to include a body near 000° azimuth.

Two crew members will be shooting tonight, at the same time, and they agree to divide the list. No. 1 chooses Pollux, Regulus, and Polaris, and No. 2 picks Jupiter, Capella, Procyon, and Kochab. The results are:

Navigator No. 1		
BODY	GMT	Hs
Pollux	22-36-06	$46^\circ 54'.5$
Regulus	22-37-48	$58^\circ 49'.1$
Polaris	22-39-39	$39^\circ 40'.6$
Regulus	22-43-02	$58^\circ 15'.7$

Navigator No. 2		
BODY	GMT	Hs
Jupiter	22-30-04	$45^\circ 21'.3$
Capella	22-35-12	$29^\circ 00'.2$
Procyon	22-37-50	$31^\circ 25'.9$
Kochab	22-39-44	$47^\circ 54'.6$

What is Navigator No. 1's May 14 2243 fix? How reliable is it?
 What is Navigator No. 2's May 14 2240 fix? How reliable is it?

Problem 1-9

Since our last fix, $40^\circ 07'N$, $44^\circ 37'W$, at 2243 May 14, we continue on course 090° , speed 6.5 knots. Our I.C. is still $-1'.2$, and height of eye 7 feet. We figure the A.M. twilight times:

	LMT	GMT
Nautical twilight	0337	0631
Civil twilight	0414	0708
Sunrise	0446	0740

We find that the LHA γ at 0414 LMT is 296° . Our twilight plan is:

MAG.	BODY	ALT.	AZ.
2.2	Alpheratz	36°	080°
2.2	Kochab	43°	339°
2.1	Rasalhague	50°	235°
1.9	Alkaid	30°	311°
0.9	Altair	59°	177°
0.9	Saturn	28°	140°
0.2	Arcturus	18°	280°
-4.5	Venus	14°	096° X
-	Moon	30°	122°

The azimuth of Venus is close to the reciprocal of Arcturus, so we will probably skip it. We go on deck at 0630, and find that the dimmer stars are obscured by haze, although we can see the moon and planets and Arcturus. Luckily, the horizon becomes visible, and we get two shots of Saturn. But we can't find Arcturus, so we get two each of Venus and the Moon.

BODY	GMT	Hs
Saturn	07-16-31	$28^\circ 42'.6$
Saturn	07-19-10	$29^\circ 03'.1$
Venus	07-21-08	$17^\circ 08'.8$
Venus	07-22-41	$17^\circ 20'.6$
Moon (LL)	07-26-03	$32^\circ 26'.2$
Moon (LL)	07-27-53	$32^\circ 46'.1$

What is our May 15 0728 fix? How reliable is it?

Problem 1-10

From our May 15, 1993, 0728 position, $40^\circ 08'N$, $43^\circ 24'W$, with our course and speed unchanged at 090° and 6.5 knots, I.C. -1'.2, and height of eye 7 feet, we will plan a morning sun-and-moon fix. We get the following:

BODY	GMT	Hs
Sun	12-29-30	$53^\circ 29'.7$
Sun	12-30-59	$53^\circ 47'.1$
Sun	12-32-25	$54^\circ 01'.8$
Moon (UL)	12-35-17	$38^\circ 51'.2$
Moon (UL)	12-36-51	$38^\circ 37'.1$
Moon (UL)	12-38-16	$38^\circ 25'.8$

What is our May 15 1238 fix? How reliable is it?

Problem 1-11

After our sun-moon fix, $40^{\circ}07'N$, $42^{\circ}41'W$, at 1238 May 15, 1993, the wind shifted and dropped. We are now on course 080° , speed 4.0 knots. Our I.C. is still -1'.2, and height of eye 7 feet. The crew member who argued for the noonsight yesterday wants to take another one today, and has pointed out that it isn't necessary to have the exact time. Using the same formula we used yesterday, we could plan for the expected altitude at LAN: $H_p = 90^{\circ} - L + d$. But we know that the altitude won't be much different today, so we assume that the H_s will be about $68^{\circ}24'$. (Our latitude will be greater—therefore the sun's altitude will be lower—but not by much.)

We go on deck with the sextant and watch the sun. Before its altitude begins to level off, we start shooting. An assistant gives us a "Mark" at one-minute intervals, and when the sun approaches its peak, we record each one—just the sextant reading, without the time.

Sun's H_s
 $68^{\circ}37'.4$
 $68^{\circ}37'.7$
 $68^{\circ}38'.3$
 $68^{\circ}38'.6$
 $68^{\circ}38'.5$
 $68^{\circ}38'.5$
 $68^{\circ}38'.0$
 $68^{\circ}37'.3$

What is our latitude at LAN May 15? How reliable is it? Was the crew member correct in saying that we could get a noonsight without knowing the time?

Problem 1-12

Our DR plot from $40^{\circ}07'N$, $42^{\circ}41'W$, at 1238 May 15, 1993, is 080° , 4.0 knots. Our I.C. is -1'.0, and height of eye 7 feet. P.M. twilight times, from the almanac, are:

	LMT	GMT
Sunset	1908	2155
Civil twilight	1939	2226
Nautical twilight	2017	2304

The LHA ∇ at 1939 LMT is 169° . Our twilight plan is:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	46°	155°
0.2	Capella	28°	308°
0.2	Arcturus	46°	105°
0.5	Procyon	30°	249°
1.2	Pollux	45°	271°
1.2	Spica	31°	143°
1.3	Regulus	58°	213°
2.1	Polaris	40°	359°
2.2	Kochab	48°	019°

We skipped Mars, because it has about the same azimuth as Procyon, and isn't as bright. We added Polaris because we can use a body near 000° azimuth. Here's what we get:

BODY	GMT	Hs
Jupiter	22-30-35	46°39'.6
Capella	22-32-01	27°17'.3
Arcturus	22-33-44	47°24'.1
Procyon	22-35-16	29°03'.4
Regulus	22-36-45	57°15'.4
Polaris	22-38-18	39°46'.0

What is our May 15 2238 fix? How reliable is it?

Chapter 2

Wellington to Valparaiso

Problem 2-1

We left Wellington, New Zealand, on Friday, and it is now December 18, 1993. From our fix at 1600 December 17, $40^{\circ}55'S$, $176^{\circ}05'E$, we changed course to 070° , making 7.5 knots. Our height of eye is 9 feet, and our sextant I.C. is $+0'.5$. We decide to get a late-afternoon sun-moon fix.

BODY	GMT	Hs
Sun	05-31-17	$20^{\circ}40'.1$
Sun	05-32-47	$20^{\circ}23'.0$
Sun	05-34-30	$20^{\circ}01'.7$
Moon (LL)	05-37-00	$50^{\circ}43'.0$
Moon (LL)	05-38-41	$50^{\circ}32'.3$
Moon (LL)	05-40-42	$50^{\circ}23'.9$

What is our December 18 0541 fix? How reliable is it?

Problem 2-2

From our December 18, 1993, 0541 fix at $40^{\circ}35'S$, $178^{\circ}18'E$, we continue on 070° at 7.5 knots, with height of eye 9 feet and I.C. $+0'.5$, and make plans for a round of sights at P.M. twilight. We find the LMT of civil twilight for $40^{\circ}S$ from the almanac, 2001, and make a rough estimate of what our longitude will be around then: $179^{\circ}E$. The time equivalent of this is 11 hours 56 minutes, which (since we are in east longitude) we subtract from the LMT, to get 0805 GMT. Then, to get more accurate figures for the twilight times, we plot our DR position at 0805 ($40^{\circ}29'S$, $178^{\circ}40'E$), and enter the almanac again. Now we get:

	LMT	GMT
Sunset	1930	0735
Civil twilight	2003	0808
Nautical twilight	2045	0850

We find from the almanac that the LHA Υ at 2003 LMT is 28° , and with this we enter H.O. 249 Vol. 1 and the star finder, and make up a twilight plan.

MAG.	BODY	ALT.	AZ.
-	Moon	27°	285°
-1.6	Sirius	23°	093°
-0.9	Canopus	43°	129°
0.3	Rigel	35°	069°
0.8	Saturn	33°	280° X
1.1	Aldebaran	22°	043°
1.3	Fomalhaut	53°	272° X
2.1	Peacock	37°	223° X
2.2	Hamal	26°	004°
2.2	Alpheratz	17°	336°

We added Sirius to the H.O. 249 Vol. 1 list, because it's so bright. We will probably not use Fomalhaut or Saturn, whose azimuths are close to the reciprocal of Sirius's, or Peacock, whose azimuth is close to the reciprocal of Aldebaran's.

The sky is clear at sunset, and we get a moon shot, then the stars, as they appear.

BODY	GMT	Hs
Moon (LL)	07-49-13	30°02'.7
Sirius	08-01-35	21°58'.0
Canopus	08-03-12	42°44'.4
Rigel	08-04-52	34°00'.8
Aldebaran	08-06-27	21°12'.3
Hamal	08-08-04	26°00'.2
Alpheratz	08-09-39	16°29'.3

What is our December 18 0810 fix? How reliable is it?

Problem 2-3

From our December 18, 1993, 0810 fix at 40°30'S, 178°41'E, we are making 6.8 knots on course 070°, with the wind on our starboard quarter. After a few hours' sleep, we plan for a round of A.M. twilight sights. Our sextant I.C. is still + 0'.5, and our height of eye 9 feet.

The crew argued through supper about what will happen when we cross the international date line. The line runs down the 180th meridian, then jogs to the east, so that it's at 172°30'W as it passes New Zealand. Some of the crew are not sure what day it will be when we cross the line. There are jokes about the A Team skipping a day on watch while the B Team serves two days in a row.

The navigator asserts that crossing the line will have no effect on the time or date in GMT (which we are using for navigation). But the LMT and LZT—and therefore the boat time—will change. In a few hours, when we cross from east longitude to west longitude, the local hour will not change, but the local day will suddenly go from Sunday to Saturday. The navigator will relabel Sunday's watch schedule as Saturday, because, in local time, while yesterday was Saturday, today will also be Saturday.

At twilight, we will still be in east longitude (but barely), and the times will be:

	LMT	GMT
Nautical twilight	0311 (12/19)	1512 (12/18)
Civil twilight	0353 (12/19)	1554 (12/18)
Sunrise	0426 (12/19)	1627 (12/18)

Note that if we had used a DR position a few minutes away, in west longitude, to compute these times, the result in the GMT column would have been the same as we got above.

The LHA γ at 0353 (12/19) LMT is 146° . We use H.O. 249 Vol. 1 and the star finder 2102D to get predicted altitudes and azimuths of the best bodies to sight, as usual.

MAG.	BODY	ALT.	AZ.
1.3	Regulus	38°	007°
1.2	Spica	34°	075° X
1.1	Acrux	57°	147° X
0.5	Procyon	36°	320°
0.5	Betelgeuse	19°	298° X
0.3	Rigel	22°	278° X
-0.9	Canopus	54°	232°
-1.8	Jupiter	24°	087°
-1.6	Sirius	45°	288°

We will probably not use Rigel or Betelgeuse, whose azimuths are close to that of Sirius; Acrux, close to the reciprocal of Procyon; or Spica, close to Jupiter; but we will leave them in the plan. (Note that we might have elected to sight only H.O. 249 Vol. 1 stars, for easy sight-reduction, skipping Jupiter and Sirius. The choice depends partly on the visibility.)

A little after 1500 GMT, we go on deck and prepare to shoot Regulus as soon as the horizon appears. We get the following sights:

BODY	GMT	Hs
Regulus	15-44-01	$37^\circ 15'.6$
Procyon	15-45-39	$37^\circ 30'.1$
Canopus	15-48-02	$55^\circ 20'.3$
Jupiter	15-49-50	$22^\circ 54'.2$
Sirius	15-51-35	$45^\circ 35'.3$

What is our December 18 1552 fix? How reliable is it?

Problem 2-4

During the morning, still on course 070° , speed 6.8 knots, we decide to get a running fix on the sun. Our I.C. remains at $+0'.5$ and height of eye 9 feet. We start a new DR from our 1552 fix, at $40^\circ 10'S$, $179^\circ 53'E$, remembering that last night when we converted the almanac's LMT twilight times to GMT, the date changed from Sunday, December 19, to Saturday, December 18.

Another way of saying this is that when we crossed the international date line this morning from east longitude to west, the GMT date didn't change, but the LMT date (and zone-time date) changed from Sunday, December 19, to Saturday, December 18.

We shoot the sun before LAN, then get more sights when it has passed the meridian and is about 90° in azimuth from where we shot it earlier. Our results are:

	GMT	Hs
Sun	22-05-08 (12/18)	61°35'.9
Sun	22-06-42 (12/18)	61°52'.8
Sun	22-08-20 (12/18)	62°09'.3
Sun	00-30-13 (12/19)	71°30'.3
Sun	00-31-47 (12/19)	71°23'.9
Sun	00-33-05 (12/19)	71°14'.3

What is our 2208 (12/18)-0033 (12/19) running fix? How reliable is it?

Problem 2-5

From our 0033 December 19, 1993, running fix, at 39°48'S, 178°49'W, we continue on course 070°, speed 6.8 knots. Our I.C. is still +0'.5, and height of eye 9 feet. We decide to get an afternoon sun-moon fix. The results are:

BODY	GMT	Hs
Sun	02-12-43	55°47'.7
Sun	02-14-16	55°29'.2
Sun	02-15-50	55°15'.5
Moon (UL)	02-18-40	43°21'.8
Moon (UL)	02-20-08	43°30'.9
Moon (UL)	02-21-38	43°42'.7

What is our December 19 0222 fix? How reliable is it?

Problem 2-6

After the December 19, 1993, 0222 sun-moon fix, at 39°44'S, 178°31'W, we changed course to 095°, and our speed dropped to 5.5 knots. Our height of eye is still 9 feet and our I.C. still +0'.5. Our P.M. twilight-time plan is:

	LMT	GMT
Sunset	1927 (12/18)	0719 (12/19)
Civil twilight	1959 (12/18)	0751 (12/19)
Nautical twilight	2040 (12/18)	0832 (12/19)

Our LHA Υ at 1959 LMT is 27°, and our twilight plan, made up using H.O. 249 Vol. 1 and the star finder, is:

MAG.	BODY	ALT.	AZ.
-	Moon	32°	297°
-1.6	Sirius	23°	093°
-0.9	Canopus	43°	130°
0.3	Rigel	35°	070°
1.1	Aldebaran	22°	043°
2.1	Peacock	37°	222°
2.2	Hamal	27°	004°
2.2	Alpheratz	18°	337°

Note that we skipped Fomalhaut (listed in H.O. 249 Vol. 1 for this LHA and location) and substituted Sirius. We might have added Saturn, but it has a similar azimuth and is not as bright as Sirius.

We go on deck ready to shoot just after sunset, and are disappointed to find that cirrus clouds have moved in. We get an early shot of the moon, then search for anything else as the sky darkens. We are able to shoot Sirius and Peacock, but no other bodies are visible. We repeat the moon shot, but now we can no longer see Sirius.

BODY	GMT	Hs
Moon (LL)	07-35-16	34°31'.3
Sirius	07-47-18	22°38'.5
Peacock	07-50-31	36°43'.7
Moon (LL)	07-52-03	31°39'.5

What is our December 19 0752 fix? How reliable is it?

Problem 2-7

At the time of our 0752 December 19, 1993, fix, at 39°46'S, 177°45'W, we changed course and speed to 085°/7.0 knots. Our height of eye is still 9 feet, but our I.C. is now 0. We plan our A.M. twilight sights:

	LMT	GMT
Nautical twilight	0314	1500
Civil twilight	0355	1541
Sunrise	0428	1614

The LHA γ at 0355 LMT is 146°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
1.3	Regulus	38°	007°
1.2	Spica	34°	075°
1.1	Acrux	57°	147°
0.5	Procyon	36°	320°
0.5	Betelgeuse	19°	298°
0.3	Rigel	22°	278°
-0.9	Canopus	54°	232°
-1.8	Jupiter	25°	087°
-1.6	Sirius	44°	286°

When we go on deck a little after 1500, the sky is completely clear, and the boat is gliding along smoothly on course. We have an assistant to record for us, and as soon as the horizon appears, we start shooting rapidly. We are pleased to be able to include every body on our list.

BODY	GMT	Hs
Regulus	15-36-03	38°06'.8
Spica	15-37-21	33°49'.1
Acrux	15-38-58	56°44'.3
Procyon	15-40-33	36°16'.6
Betelgeuse	15-42-15	18°29'.6
Rigel	15-43-48	21°17'.6
Canopus	15-45-29	52°34'.3
Jupiter	15-47-01	25°48'.3
Sirius	15-48-40	42°51'.5

What is our December 19 1549 fix? How reliable is it?

Problem 2-8

We run a new DR from 39°38'S, 176°27'W, at 1549 December 19, 1993. Our course is 090°, speed 6.0 knots, height of eye still 9 feet, and I.C. 0. We get sights for an afternoon sun-moon fix as follows:

BODY	GMT	Hs
Sun	01-15-17	63°30'.5
Sun	01-16-50	63°13'.8
Moon (UL)	01-20-04	26°25'.3
Moon (UL)	01-21-44	26°40'.1

What is our December 20 0122 fix? How reliable is it?

Problem 2-9

From 39°44'S, 175°01'W, at 0122 December 20, 1993, we change course to 105°, and our speed becomes 4.0 knots. Our height of eye is 9 feet, and I.C. 0. We plan for a round of P.M. twilight sights.

	LMT	GMT
Sunset	1928 (12/19)	0706 (12/20)
Civil twilight	2001 (12/19)	0739 (12/20)
Nautical twilight	2042 (12/19)	0820 (12/20)

The LHA Υ at 2001 LMT is 29° , and our twilight plan is:

MAG.	BODY	ALT.	AZ.
-	Moon	35°	310°
-1.6	Sirius	24°	092°
-0.9	Canopus	44°	129°
0.3	Rigel	36°	068°
1.1	Aldebaran	22°	042°
2.1	Peacock	36°	222°
2.2	Hamal	27°	003°
2.2	Alpheratz	17°	336°

A few clouds are moving in, so we shoot the moon early, and Sirius as soon as it's visible. We shoot the rest of the sights through breaks in the clouds.

BODY	GMT	Hs
Moon (LL)	07-15-20	$38^\circ 07'.7$
Sirius	07-21-04	$20^\circ 50'.5$
Canopus	07-38-17	$43^\circ 50'.9$
Rigel	07-45-13	$18^\circ 50'.2$
Peacock	07-46-49	$35^\circ 06'.0$
Hamal	07-48-42	$26^\circ 47'.0$

What is our December 20 0749 fix? How reliable is it?

Problem 2-10

We continue from our last fix, $39^\circ 53'S$, $174^\circ 28'W$, at 0749 December 20, 1993, with course and speed still 105° and 4.0 knots, I.C. 0, and height of eye 9 feet. From the radio forecast, we expect cirrus clouds to build up, changing to cirrostratus and altostratus, but we plan for A.M. twilight sights, just in case. We take yesterday's A.M. civil twilight time (1541) as a rough guide, extend our DR, and find more exact times as follows:

	LMT	GMT
Nautical twilight	0312	1447
Civil twilight	0354	1529
Sunrise	0427	1602

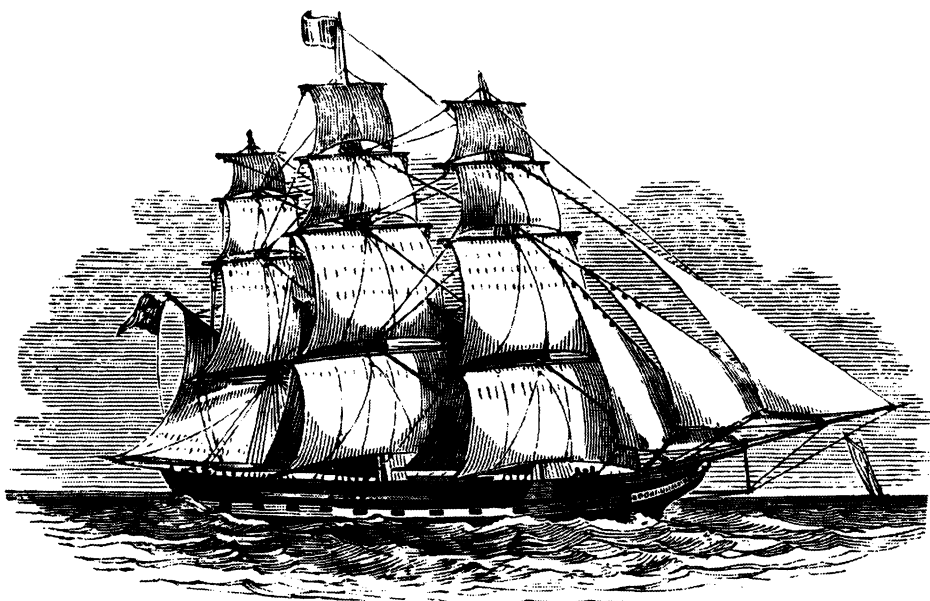
The LHA Υ at 0354 LMT is 147° . With this we enter H.O. 249 Vol. 1, and we set our star finder (having already penciled in the sun, moon, and planet positions on the base), for the plan:

MAG.	BODY	ALT.	AZ.
1.3	Regulus	38°	006°
1.2	Spica	34°	074°
1.1	Acrux	57°	148°
0.5	Procyon	36°	319°
0.5	Betelgeuse	18°	297°
0.3	Rigel	22°	278°
-0.9	Canopus	53°	232°
-1.8	Jupiter	25°	086°
-1.6	Sirius	44°	286°

At the time of nautical twilight, the dimmer stars are not visible, but we see some of the brighter ones, so we stay on deck with the sextant as the horizon becomes visible. We shoot Betelgeuse, then three of the brightest bodies, and, with nothing else available repeat our sights of Sirius and Jupiter.

BODY	GMT	Hs
Betelgeuse	15-35-01	16°54'.9
Jupiter	15-36-35	26°36'.8
Canopus	15-38-07	51°38'.3
Sirius	15-39-54	41°38'.3
Sirius	15-41-00	41°24'.5
Jupiter	15-42-26	27°40'.2

What is our December 20 1542 fix? How reliable is it?



Chapter 3

Anchorage to Hilo

Problem 3-1

We are moving along smoothly on course 185° in the late afternoon of May 14, 1993, on a glassy sea. Our speed has dropped to 3.6 knots. The forecast is for cirrostratus clouds to move in, but we decide to plan for a round of P.M. twilight sights, anyway. Our DR position at 0100 May 14 was $40^\circ 41' \text{N}$, $153^\circ 12' \text{W}$. Our sextant I.C. is $-1'.0$, and height of eye 8 feet.

Using a rough guess of 40°N and 153°W , we enter the almanac and take out 1938 for the LMT of civil twilight. Adding the time equivalent of 153° (1012) from the first yellow page, we get 0550 for the GMT of civil twilight. We get a refined DR position, at 0550, of $40^\circ 24' \text{N}$, $153^\circ 14' \text{W}$, and for this position get a complete set of more accurate twilight times:

	LMT	GMT
Sunset	1908 (5/13)	0521 (5/14)
Civil twilight	1940 (5/13)	0553 (5/14)
Nautical twilight	2018 (5/13)	0631 (5/14)

The LHA Υ at 1940 LMT is 167° . Using the star finder and H.O. 249 Vol. 1, we make up a sighting plan:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	46°	153°
0.2	Capella	29°	308°
0.2	Arcturus	45°	103°
0.5	Procyon	32°	248°
1.2	Pollux	47°	270°
1.2	Spica	30°	141° X
1.3	Regulus	59°	210°
2.2	Kochab	47°	019° X

We mark, as not very desirable, Spica (close to Jupiter's azimuth and Capella's reciprocal) and Kochab (close to the reciprocal of Regulus), but leave them on the list in case the more favorable bodies are obscured. We omit Mars, which has the same azimuth as Procyon, and is not as bright.

At sighting time, the visibility is, in fact, poor, but we manage to shoot a few of the brighter bodies:

BODY	GMT	Hs
Jupiter	05-55-04	45°48'.0
Pollux ?	05-57-12	30°47'.5 (about 250° az.)
Capella	05-58-49	28°15'.9
Arcturus	05-59-13	46°06'.0
Jupiter	06-00-31	46°15'.1
Pollux ?	06-02-15	29°51'.5 (about 250° az.)

What was the unknown body we shot twice? What is our May 14 0602 fix? How reliable is it?

Problem 3-2

We have someone wake us early in the morning of May 14 so we can make up a plan for A.M. twilight, hoping the sky will be clear by then. Our May 14, 1993, 0602 fix was at 40°31'N, 153°08'W, and our course and speed are still 185°/3.6 knots, I.C. -1'.0, and height of eye 8 feet. Our planned times (using a first guess, then refining it, as before) are:

	LMT	GMT
Nautical twilight	0338	1351
Civil twilight	0415	1428
Sunrise	0446	1459

The LHA γ at 0415 LMT is 296°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
2.5	Enif	50°	130° X
2.2	Alpheratz	36°	080°
2.2	Kochab	43°	339°
2.1	Rasalhague	50°	235°
1.9	Alkaid	30°	311° X
0.9	Altair	59°	177°
0.9	Saturn	28°	140° X
0.2	Arcturus	18°	280° X
-4.5	Venus	15°	097°
-	Moon	32°	131°

We have more bodies than we need. We list them all, but mark those that we probably won't use because their azimuths are close to those of other bodies or their reciprocals: Enif (same azimuth as moon), Alkaid (reciprocal of moon), Saturn (close to moon), and Arcturus (close to reciprocal of Venus).

Around the time of civil twilight we sight the following:

BODY	GMT	Hs
Alpheratz	14-28-17	36°05'.1
Kochab	14-29-52	42°40'.1
Rasalhague	14-31-20	49°54'.2
Altair	14-33-01	58°56'.1
Venus	14-37-04	16°18'.6
Moon (LL)	14-39-33	33°15'.8

What is our May 14 1440 fix? How reliable is it?

Problem 3-3

From our May 14, 1993, 1440 fix, at 40°01'N, 153°09'W, we continue on course 185°, but now our speed indicator is not functioning. Crew members' estimates range from 2.5 to 5 knots—but we can do better than that. We will drop a balled-up piece of paper at the bow and time its passage to the stern. Our boat is known to be 33 feet on the water line, and we use 6080 feet in a nautical mile, and 3600 seconds in an hour, to write a formula for computing the boat's speed through the water:

Knots = (.592 x feet) divided by seconds

We time the passage of the object from bow to stern at 5 seconds; this gives us: $(.592 \times 33) / 5 = 3.9$ knots, our speed estimate. Our I.C. is still -1'.0, and height of eye 8 feet. We get the following sights for a morning sun-moon fix:

BODY	GMT	Hs
Moon (UL)	20-01-13	32°00'.4
Moon (UL)	20-02-51	31°42'.7
Moon (UL)	20-04-40	31°29'.4
Sun	20-07-30	56°19'.0
Sun	20-08-56	56°31'.3
Sun	20-09-45	56°43'.1

What is our May 14 2010 fix? How reliable is it?



Chapter 4

New York to Flores (II)

Problem 4-1

It is early in the morning of July 6, 1993, and we are headed for the Azores. The sky has been overcast for a week, and we badly need a fix. Light winds have alternated with flat calms and hot, humid weather, straining the gear and making the crew queasy. But now a cold front has passed, and we are moving nicely at 6 knots on course 090°. Our 0700 DR position was 40°00'N, 51°20'W. The sextant I.C. is 0, and the height of eye 9 feet. We compute the times for A.M. twilight:

	LMT	GMT
Nautical twilight	0325	0650
Civil twilight	0406	0731
Sunrise	0438	0803

The LHA Υ at 0406 LMT is 346E. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	153°
1.3	Fomalhaut	20°	182°
0.9	Altair	37°	248°
0.6	Saturn	36°	196°
0.2	Capella	25°	050°
0.1	Vega	40°	292°
-4.1	Venus	24°	087°
-	Moon	28°	217°

This is an excellent plan, with nine bodies to sight, nicely spaced in azimuth. We omitted Aldebaran from the H.O. 249 Vol. 1 recommendations (it's close to Venus in azimuth), and added the solar-system bodies from the star finder.

But when we go on deck with the sextant at nautical twilight, the boat's motion is unsteady, and spray is coming aboard now and then. We stay, anyway, to see what we can get. We manage to shoot one star and the brighter bodies:

BODY	GMT	Hs
Altair	07-41-13	34°52'.1
Saturn	07-43-10	34°40'.0
Venus	07-44-45	27°21'.7
Moon (LL)	07-47-36	25°25'.3
Moon (LL)	07-51-12	25°02'.4
Moon (LL)	07-59-53	23°53'.7

What is our July 6 0800 fix?

Problem 4-2

From our July 6, 1993, 0800 fix, at 40°11'N, 50°31'W, we continue on 090° at 6.0 knots, with the same I.C. (0) and height of eye (9 feet). A few hours after sunrise, the boat's motion is steadier, and we plan for a running fix on the sun. Then we have a better idea. We use the star finder to determine that Venus is far enough in azimuth from the sun to give us a fix, if we can spot it in daylight. We pre-set the sextant to the predicted altitude, and go on deck with a hand-bearing compass. We search a few degrees up and down, left and right, but don't see Venus. We try to relax our eyes to focus for distance, then suddenly we see the planet. We shoot it, then the sun:

BODY	GMT	Hs
Venus	13-58-17	58°28'.3
Venus	13-59-51	58°15'.6
Venus	14-01-42	57°59'.2
Sun	14-04-17	65°41'.2
Sun	14-05-47	65°54'.7
Sun	14-07-21	66°09'.6

What is our July 6 1407 fix?

Problem 4-3

From our July 6, 1993, 1407 fix, at 40°10'N, 49°27'W, we continue on course 090° at 6.0 knots. Our I.C. is still 0, and our height of eye 9 feet. We make plans for P.M. twilight:

	LMT	GMT
Sunset	1932	2245
Civil twilight	2005	2318
Nautical twilight	2046	2349

The LHA Υ at 2005 LMT is 226°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	35°	231°
0.1	Vega	50°	074°
0.2	Arcturus	67°	210°
0.9	Altair	20°	095°
1.2	Spica	34°	210° X
1.2	Antares	21°	160°
1.3	Deneb	31°	055° X
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	47°	119°

Note that we included Spica and Deneb in the list, but will probably not shoot them, because of duplications in azimuth. We skipped Mars, whose azimuth is close to Vega's reciprocal, and we added Polaris, because we need a body near 000° or 180°.

This is a good list, with bodies whose azimuths look like spokes in a wheel.

At sighting, time, alas, we get sights of the three brightest bodies, but as the horizon fades, we can't find any of the dimmer objects. We can still see Jupiter, so we shoot it again.

BODY	GMT	Hs
Jupiter	23-14-17	35°16'.6
Vega	23-15-52	49°39'.7
Arcturus	23-17-40	66°28'.1
Jupiter	23-19-03	34°37'.5

This is a disappointing result from such an ambitious plan. Can we get a usable fix from these few shots?

Problem 4-4

From our July 6, 1993, 2319 fix, 40°08'N, 47°50'W, we proceed on course 090° at 6.0 knots, with I.C. still 0 and height of eye 9 feet. We make up a plan for A.M. twilight. The times are:

	LMT	GMT
Nautical twilight	0324	0631
Civil twilight	0405	0712
Sunrise	0437	0744

The LHA γ at 0405 is 346°. The sighting plan is:

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	153°
1.3	Fomalhaut	20°	182°
0.9	Altair	37°	248°
0.2	Capella	26°	050°
0.1	Vega	40°	292°
-4.1	Venus	24°	086°
-	Moon	36°	208°

We skipped Saturn and Aldebaran, because of duplications in azimuth. Note that, except for the different twilight times and the slightly different predicted altitude and azimuth for the moon, we could have used yesterday's plan instead of making up a new one for today.

Just before civil twilight, the horizon becomes visible, and sighting conditions are perfect. We shoot every body we had in the plan.

BODY	GMT	Hs
Kochab	07-09-13	30°25'.0
Diphda	07-10-54	27°42'.0
Fomalhaut	07-12-30	20°19'.0
Altair	07-14-10	36°13'.3
Capella	07-15-45	26°48'.6
Vega	07-17-42	38°09'.9
Venus	07-20-03	25°38'.5
Moon (LL)	07-22-29	35°07'.1

What is our July 7 0722 fix?

Problem 4-5

From our 0722 July 7, 1993, fix, 40°04'N, 46°36'W, we continue on course 090° at 6.0 knots, with I.C. 0 and height of eye 9 feet. Using the almanac and the star-finder, we note that we have a rare opportunity to get a three-body fix during the day—sun, moon, and Venus—if the visibility is good. We find predicted altitudes and azimuths, and in a clear sky we spot and shoot Venus, and proceed. Our results are:

BODY	GMT	Hs
Venus	09-40-16	52°04'.8
Venus	09-43-12	52°36'.1
Moon (UL)	09-45-53	16°07'.3
Moon (UL)	09-47-31	15°52'.1
Sun	09-50-11	21°36'.4
Sun	09-51-44	21°55'.8

What is our July 7 0952 fix?

Problem 4-6

From our 0952 July 7, 1993, fix, at 40°03'N, 46°12'W, we continue on course 090° at 6.0 knots. Our I.C. is still 0, and height of eye 9 feet. For P.M. twilight, we compute the following times:

	LMT	GMT
Sunset	1931	2229
Civil twilight	2004	2302
Nautical twilight	2045	2343

The LHA γ at 2004 LMT is 227°. We could use these times and yesterday's sighting plan (list of predicted altitudes and azimuths), since the changes are slight, but here is the way the new plan would look:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	35°	232°
0.1	Vega	50°	074°
0.9	Altair	21°	096°
1.2	Spica	34°	211°
1.2	Antares	21°	161°
1.3	Deneb	31°	055° X
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	48°	120°
2.2	Denebola	40°	254° X

We added Vega (because of its brightness) and Polaris (because of its azimuth). We listed Deneb and Denebola, but will probably not sight them (because of azimuth duplications), unless we have plenty of time.

At sighting time, conditions are as good as they were for A.M. twilight, and we again shoot all the bodies in the plan.

BODY	GMT	Hs
Jupiter	22-49-13	36°20'.8
Vega	22-50-48	48°25'.1
Altair	22-52-29	18°54'.6
Spica	22-54-02	34°23'.1
Antares	22-56-01	20°43'.0
Deneb	22-57-45	30°43'.4
Dubhe	22-59-12	48°07'.9
Polaris	23-00-50	39°19'.2
Rasalhague	23-02-25	47°57'.5
Denebola	23-04-09	39°18'.5

What is our July 7 2304 fix?

Problem 4-7

From our July 7, 1993, 2304 fix, at 39°59'N, 44°12'W, we continue on course 090° at 6.0 knots. Our I.C. is still 0, and height of eye 9 feet. We plan for A.M. twilight sights.

	LMT	GMT
Nautical twilight	0325	0618
Civil twilight	0406	0659
Sunrise	0438	0731

The LHA Υ at 0406 LMT is 348°. Our plan is similar to yesterday's:

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	155°
1.3	Fomalhaut	20°	183°
0.9	Altair	36°	249°
0.2	Capella	27°	051°
0.1	Vega	38°	292°
-4.1	Venus	24°	086°
-	Moon	44°	197°

At twilight, the sky is clear, but the horizon is obscured, except toward the southwest. We shoot the few bodies available.

BODY	GMT	Hs
Fomalhaut	07-10-17	20°10'.1
Altair	07-12-03	33°16'.1
Saturn	07-13-48	34°09'.1
Moon (LL)	07-19-16	42°00'.5

What is our July 8 0719 fix?

Problem 4-8

From our 0719 July 8, 1993, fix, at 40°00'N, 42°58'W, we continue on course 090° at 6.0 knots. Our height of eye is still 9 feet, but we check the sextant and find that its I.C. is now -2'.0. We'd like another fix when the haze clears. The moon and sun are nearly opposite in the sky, so we won't get a sun-moon fix. We will have to rely on a running fix of the sun.

When the sun rises, the horizon under it is still obscured, and stays that way all morning, although it is clear in the opposite direction. We decide to get a backsight—point the sextant toward the horizon opposite the sun, and measure the angle from there past the zenith to the sun. What we will be measuring is an angle that equals 180° minus the altitude of the sun. Therefore, the body we are backsighting must be high enough so that 180° - Hs is not beyond the range of our sextant (120° or so). We get three backsights of the sun, and three hours later, when the sun has moved to the southwest, get three regular lower-limb sights.

BODY	GMT	Hs
Sun (backsight*)	14-10-05	109°31'.6
Sun (backsight*)	14-11-46	109°19'.5
Sun (backsight*)	14-13-23	109°13'.6
- Sun	17-01-39	57°07'.3
Sun	17-03-20	56°46'.9
Sun	17-04-55	56°30'.0

*Appears in the horizon glass to be a lower-limb sight.

There are two ways to work a backsight. We will use the easier, more logical one: apply the normal I.C. and dip corrections to Hs, subtract the result from 180° , then apply the S.D. correction, but in reverse. If the sight appeared to be on the lower limb (as in this case), use the UL correction. If it looked like an upper-limb sight, use the LL correction. (For a star or a planet, apply the normal refraction correction in this third step.) What is our July 8 1413-1705 R. fix?

Problem 4-9

We'd like another fix, to confirm the backsights we took, so we plan for evening twilight. From our July 8, 1993, 1413-1705 R. fix, at $39^\circ 59'N$, $41^\circ 27'W$, we continue on course 090° , speed 6.0 knots. Our height of eye is still 9 feet, and I.C. $-2'.0$. We find the twilight times:

	LMT	GMT
Sunset	1931	2214
Civil twilight	2004	2247
Nautical twilight	2045	2328

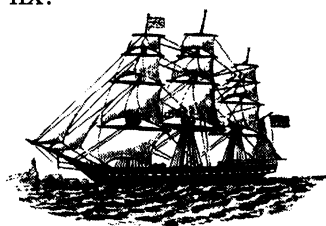
The LHA Υ at 2004 LMT is 228° . We make up our sighting plan:

MAG.	BODY	ALT.	AZ.
-1.5	Jupiter	34°	232°
0.9	Altair	21°	096°
1.2	Spica	33°	212°
1.2	Antares	21°	162°
1.3	Deneb	32°	055°
2.0	Dubhe	47°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	48°	121°
2.2	Denebola	39°	255°

Our sights are:

BODY	GMT	Hs
Altair	22-40-03	$20^\circ 04'.1$
Spica	22-41-49	$33^\circ 49'.9$
Antares	22-43-40	$21^\circ 14'.0$
Dubhe	22-45-21	$47^\circ 34'.7$
Polaris	22-46-59	$39^\circ 13'.9$
Rasalhague	22-48-55	$48^\circ 50'.5$

What is our July 8 2249 fix?



Chapter 5

Furneaux Islands to Wanganui

Problem 5-1

It is early afternoon (local time) of December 18, 1993—a beautiful clear day in late spring—and we are making good time in a calm sea, a third of the way in our cruise from the Furneaux Group, off the north coast of Tasmania, to the North Island of New Zealand. Our 0300 December 18 DR position was at $40^{\circ}18'S$, $157^{\circ}02'E$. Our course is 090° , speed 7.5, sextant I.C. $-1'.0$, and height of eye 8 feet. We decide to get an afternoon sun-and-moon fix. Results are:

BODY	GMT	Hs
Moon (LL)	05-15-44	$56^{\circ}47'.8$
Moon (LL)	05-17-20	$56^{\circ}51'.8$
Moon (LL)	05-18-41	$56^{\circ}53'.3$
Sun	05-21-03	$38^{\circ}17'.5$
Sun	05-22-37	$37^{\circ}58'.1$
Sun	05-24-12	$37^{\circ}39'.0$

What is our December 18 0524 fix?

Problem 5-2

From our 0524 December 18, 1993, fix, at $40^{\circ}18'S$, $157^{\circ}26'E$, we proceed on 090° at 7.5 knots, with the same I.C. ($-1'.0$) and height of eye (8 feet). We plan for a round of sights at P.M. twilight, and find the following times:

	LMT	GMT
Sunset	1928	0856
Civil twilight	2002	0930
Nautical twilight	2043	1011

The LHA γ at 2002 LMT is 28° . Our sighting plan is:

MAG.	BODY	ALT.	AZ.
-	Moon	28°	286°
-1.6	Sirius	23°	093°
-0.9	Canopus	43°	129°
0.3	Rigel	35°	069°
1.1	Aldebaran	22°	043°
1.3	Fomalhaut	53°	272°
2.1	Peacock	37°	223° X
2.2	Hamal	26°	004°
2.2	Alpheratz	17°	336°

Peacock's azimuth is the reciprocal of Aldebaran's, so we probably won't use it. At sighting time, we get a few sights of the moon and Sirius, but conditions are so good that we shoot six of the seven stars listed in H.O. 249 Vol. 1, and decide to work these for our fix.

BODY	GMT	Hs
Canopus	09-41-17	44°55'.8
Rigel	09-43-01	36°57'.7
Aldebaran	09-44-40	23°24'.5
Fomalhaut	09-46-16	50°19'.2
Hamal	09-47-50	26°21'.0
Alpheratz	09-49-32	15°13'.5

What was our December 18 0950 fix?

Problem 5-3

From our December 18, 1993, 0950 fix, at 40°17'S, 158°06'E, we continue on 090° at 7.5 knots, I.C. -1'.0, height of eye 8 feet, and plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0311 (12/19)	1634 (12/18)
Civil twilight	0353 (12/19)	1716 (12/18)
Sunrise	0426 (12/19)	1749 (12/18)

The LHA Υ at 0353 (12/19) LMT is 146°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
1.3	Regulus	38°	007°
1.2	Spica	34°	075°
1.1	Acrux	57°	147° X
0.5	Procyon	36°	320°
0.5	Betelgeuse	19°	298°
0.3	Rigel	22°	278°
-0.9	Canopus	54°	232°
-1.8	Jupiter	24°	087°
-1.6	Sirius	45°	288°

Acrux's azimuth is close to Procyon's reciprocal, so we will probably skip it. Our sights are:

BODY	GMT	Hs
Regulus	17-20-35	37°34'.3
Spica	17-22-04	34°25'.8
Procyon	17-23-44	35°31'.2
Canopus	17-25-16	53°09'.9
Jupiter	17-26-50	25°42'.5
Sirius	17-29-01	42°46'.9

What is our December 18 1729 fix?

Problem 5-4

We plan for a sun-and-moon fix today, noting that the moon has moved closer to the sun since yesterday. Since our December 18, 1993, 1729 fix, at 40°17'S, 159°17'E, we are still on course 090° at 7.5 knots, and our I.C. is still -1'.0 and height of eye 8 feet. We get a few sun shots first, and wait two hours before sighting the moon, so the LOPs will cross at a better angle.

BODY	GMT	Hs
Sun	03-04-10	61°12'.7
Sun	03-05-50	60°51'.8
Sun	03-07-41	60°32'.4
Moon (UL)	05-15-06	51°55'.6
Moon (UL)	05-16-45	51°58'.7
Moon (UL)	05-18-29	52°02'.7

What is our December 19 0308-0518 R. fix?

Problem 5-5

From our December 19, 1993, 0518 fix, at 40°16'S, 161°06'E, we continue on 090°, making 7.5 knots, I.C. -1'.0, height of eye 8 feet, and plan for a round of sights at P.M. twilight. We find the twilight times, as usual, interpolating in the almanac.

	LMT	GMT
Sunset	1929	0842
Civil twilight	2002	0915
Nautical twilight	2044	0957

The LHA γ at 2002 LMT is 29°. Except for the moon, we could use last night's plan, but here is the new one:

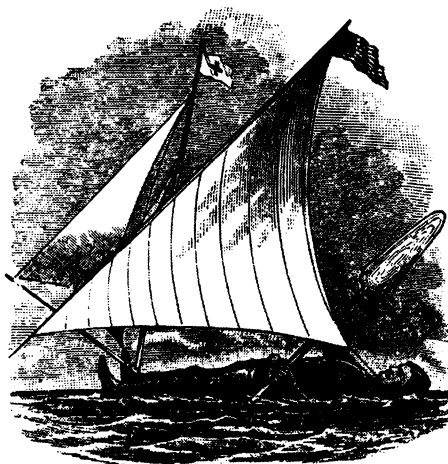
MAG.	BODY	ALT.	AZ.
-	Moon	32°	298°
-1.6	Sirius	24°	092° X
-0.9	Canopus	44°	129°
0.3	Rigel	36°	068°
1.1	Aldebaran	22°	042°
1.3	Fomalhaut	53°	272°
2.1	Peacock	36°	222° X
2.2	Hamal	27°	003°
2.2	Alpheratz	17°	336°

We left Sirius and Peacock in the plan, in case we need them, but will probably not use them, because of azimuth duplications. We prefer Fomalhaut to Sirius, because we can work the Fomalhaut sight with H.O. 249 Vol. 1.

At sighting time, there's a haze, and we may not get any stars or planets. We get a good moon sight, then luckily are able to find Sirius and Canopus. No other bodies are visible by the time the horizon has faded.

BODY	GMT	Hs
Moon (LL)	09-10-15	32°21'.0
Sirius	09-20-13	24°47'.4
Canopus	09-21-52	44°49'.6
Moon (LL)	09-24-01	30°00'.8
Sirius	09-25-40	25°51'.5
Canopus	09-27-12	45°35'.3

What is our December 19 0927 fix?



Chapter 6

San Francisco to Kushiuro

Problem 6-1

On July 6, 1993, we are near the middle of a long cruise to Japan, with no checkpoints along the way, except for the international date line a couple of weeks from now. We are outside the limits of accurate loran coverage and have no GPS, so we need to rely on celestial navigation. Our 0400 DR position was $39^{\circ}31'N$, $156^{\circ}53'W$. Our course is 270° , speed 6.5 knots, I.C. $-1'.5$, and height of eye 9 feet. We plan for P.M. twilight:

	LMT	GMT
Sunset	1930 (7/5)	0559 (7/6)
Civil twilight	2002 (7/5)	0631 (7/6)
Nautical twilight	2043 (7/5)	0712 (7/6)

The LHA Υ at 2002 (7/5) LMT is 227° . Our plan, from H.O. 249 Vol. 1 and the star-finder, is:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	36°	230°
0.9	Altair	21°	096°
1.2	Spica	34°	211°
1.2	Antares	21°	161°
1.3	Deneb	31°	055°
1.6	Mars	25°	262°
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	48°	120°
2.2	Denebola	40°	254°

Around civil twilight, we get the following sights:

BODY	GMT	Hs
Spica	06-33-17	$34^{\circ}43'.9$
Mars	06-34-53	$20^{\circ}11'.8$
Deneb	06-35-45	$30^{\circ}25'.8$
Dubhe	06-37-25	$47^{\circ}49'.3$
Polaris	06-38-50	$38^{\circ}52'.7$
Rasalhague	06-40-07	$48^{\circ}02'.6$

What is our July 6 0640 fix?

Problem 6-2

From our July 6, 1993, 0640 fix, at $39^{\circ}31'N$, $157^{\circ}16'W$, we continue on course 270° , speed 6.5 knots. Our sextant I.C. is $-1'.5$, and height of eye 9 feet. We plan for A.M.

twilight sights, and interpolate in the almanac for the times:

	LMT	GMT
Nautical twilight	0327	1401
Civil twilight	0408	1442
Sunrise	0439	1513

The LHA γ at 0408 LMT is 346° . Our sighting plan is:

MAG.	BODY	ALT.	AZ
2.2	Kochab	30°	345°
2.2	Diphda	28°	153°
1.3	Fomalhaut	20°	182°
1.1	Aldebaran	16°	082°
0.9	Altair	37°	248°
0.6	Saturn	36°	197°
0.2	Capella	26°	050°
0.1	Vega	40°	292°
-4.1	Venus	24°	087° X
-	Moon	31°	215°

If we shoot Aldebaran, we will not need Venus. At sighting time, visibility is excellent, and we get six good shots of stars listed in H.O. 249 Vol. 1.

BODY	GMT	Hs
Kochab	14-35-16	$30^\circ 06'.3$
Diphda	14-36-51	$27^\circ 49'.7$
Fomalhaut	14-38-33	$20^\circ 52'.0$
Aldebaran	14-40-02	$16^\circ 10'.9$
Capella	14-41-37	$26^\circ 01'.0$
Vega	14-43-05	$38^\circ 47'.7$

What is our July 6 1443 fix?

Problem 6-3

We continue on course 270° , 6.5 knots, from our July 6, 1993, 1443 fix, at $39^\circ 35'N$, $158^\circ 16'W$. Our I.C. is still $-1'.5$, and height of eye 9 feet. The sky remains clear, the humidity is low, and the boat is moving smoothly with no pounding.

We decide to try for a sun-Venus fix at around 2100. We set up the star-finder, 2102D, to confirm that the Venus and sun LOPs will cross at a suitable angle. We could use the star finder to get the predicted altitude and azimuth, but it's easy (and more accurate) to use H.O. 249 Vol. 2. We look up the GHA of Venus ($180^\circ 29'$, rounded) in the almanac, and subtract the DR longitude ($159^\circ 10'$), at 2100, to get the LHA ($21^\circ 19'$). The declination is $N17^\circ 42'$, and our DR latitude is $39^\circ 35'N$. We enter H.O. 249 Vol. 2 with latitude, declination, and LHA, and take out the predicted altitude, $61^\circ 30'$, and azimuth, 226° . We could interpolate for H_p , but it's hardly necessary.

At 2100, we set the sextant to $61^{\circ}30'$, turn to 226° true, and with a little looking spot Venus and get three shots, plus three of the sun.

BODY	GMT	Hs
Venus	21-03-49	$60^{\circ}47'.5$
Venus	21-05-25	$60^{\circ}36'.3$
Venus	21-08-01	$60^{\circ}13'.1$
Sun	21-09-40	$64^{\circ}01'.1$
Sun	21-11-03	$64^{\circ}16'.3$
Sun	21-12-42	$64^{\circ}32'.3$

What is our July 6 2113 fix?

Problem 6-4

From our July 6, 1993, 2113 fix, at $39^{\circ}38'N$, $159^{\circ}04'W$, we continue on $270^{\circ}/6.5$ knots, with I.C. $-1'.5$ and height of eye 9 feet, and plan for P.M. twilight.

	LMT	GMT
Sunset	1930 (7/6)	0612 (7/7)
Civil twilight	2003 (7/6)	0645 (7/7)
Nautical twilight	2043 (7/6)	0725 (7/7)

The LHA Υ at 2003 (7/6) LMT is 227° . Our sighting plan is:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	35°	231°
0.9	Altair	21°	096°
1.2	Spica	34°	211°
1.2	Antares	21°	161°
1.3	Deneb	31°	055° X
1.6	Mars	25°	262°
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	48°	120°
2.2	Denebola	40°	254° X

We added Polaris, because we needed a body at its azimuth. We will probably not use Deneb or Denebola, but leave them in the plan.

Our sights are:

BODY	GMT	Hs
Jupiter	06-35-18	36°41'.6
Altair	06-42-13	19°31'.2
Spica	06-43-55	34°21'.8
Antares	06-45-31	21°09'.3
Dubhe	06-47-02	47°48'.2
Polaris	06-48-42	39°02'.2

What is our July 7 0649 fix?

Problem 6-5

After our July 7, 1993, 0649 fix, at 39°42'N, 160°18'W, our course changed to 265° and speed dropped to 6.0 knots. Our I.C. is still -1'.5, and height of eye 9 feet. We plan for A.M. twilight:

	LMT	GMT
Nautical twilight	0327	1413
Civil twilight	0407	1453
Sunrise	0439	1525

The LHA Υ at 0407 is 347°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	154°
1.3	Fomalhaut	20°	183°
1.1	Aldebaran	17°	082°
0.9	Altair	36°	249°
0.2	Capella	26°	051°
0.1	Vega	39°	292°
-4.1	Venus	24°	086° X
-	Moon	39°	205°

If we get a good shot of Aldebaran, we may skip Venus, because the two are close in azimuth.

During nautical twilight, the visibility worsens, and by the time the horizon becomes usable, only the brightest objects can be seen. But we are able to shoot three bodies:

BODY	GMT	Hs
Vega	15-10-17	35°29'.5
Vega	15-12-05	35°11'.0
Venus	15-15-39	28°56'.4
Venus	15-17-16	29°12'.6
Moon (LL)	15-19-14	36°20'.4
Moon (LL)	15-20-51	36°09'.3

What is our July 7 1521 fix?

Problem 6-6

From our July 7, 1993, 1521 fix, at $39^{\circ}46'N$, $161^{\circ}20'W$, our course and speed are unchanged: $265^{\circ}/6.0$ knots. Our I.C. is still $-1'.5$, and height of eye 9 feet. We mark the positions of the sun, moon, and Venus on the star-finder, and note that they are not well positioned for a good three-body fix during the day. A moon-Venus fix might be possible. But during the morning, cirrus clouds move in, precluding a daytime Venus shot. We will try for a running fix on the sun, instead.

Here's what we get:

BODY	GMT	Hs
Sun	21-30-17	$65^{\circ}04'.5$
Sun	21-31-55	$65^{\circ}19'.7$
Sun	23-02-04	$72^{\circ}23'.8$
Sun	23-03-49	$72^{\circ}19'.4$
Sun	00-31-28	$63^{\circ}00'.2$
Sun	00-33-12	$62^{\circ}44'.9$

What is our July 7/8 2132-0033 running fix?

Problem 6-7

From our 0033 July 7/8, 2132-1993 R. fix, at $39^{\circ}51'N$, $162^{\circ}31'W$, we continue on $265^{\circ}/6.0$ knots, I.C. $-1'.5$, height of eye 9 feet, and plan for P.M. twilight:

	LMT	GMT
Sunset	1930 (7/7)	0624 (7/8)
Civil twilight	2003 (7/7)	0657 (7/8)
Nautical twilight	2044 (7/7)	0738 (7/8)

The LHA Υ at 2003 (7/7) LMT is 227° . Our plan is:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	35°	232°
0.9	Altair	21°	096°
1.2	Spica	34°	211°
1.2	Antares	21°	161°
1.3	Deneb	31°	055° X
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	48°	120°
2.2	Denebola	40°	254°

We may not use Deneb, whose azimuth is close to the reciprocal of Jupiter's. We included Polaris to give us complete azimuth coverage.

Our shots are:

BODY	GMT	Hs
Jupiter	06-50-30	35°34'.7
Altair	06-52-08	19°48'.8
Spica	06-53-49	33°57'.3
Antares	06-55-31	21°03'.9
Deneb	06-57-10	31°29'.7
Polaris	06-58-42	39°15'.4
Rasalhague	07-00-23	48°27'.6
Denebola	07-01-59	38°56'.8

What is our July 8 0702 fix?

Problem 6-8

From 39°56'N, 163°22'W, our July 8, 1993, 0702 fix, we change course to 275°. Our speed is still 6.0 knots, I.C. -1'.5, height of eye 9 feet. We plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0325	1423
Civil twilight	0406	1504
Sunrise	0438	1536

The LHA γ at 0406 LMT is 348°. Our plan is:

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	155°
1.3	Fomalhaut	20°	183°
1.1	Aldebaran	17°	083°
0.9	Altair	36°	249°
0.6	Saturn	35°	199°
0.2	Capella	27°	051°
0.1	Vega	38°	292°
-4.1	Venus	24°	086° X
-	Moon	46°	192° X

We note that the moon and Saturn are close in azimuth, as are Venus and Aldebaran.

At sighting time, the sky is clear, and we get six good shots:

BODY	GMT	Hs
Diphda	15-11-06	28°55'.9
Fomalhaut	15-12-48	20°13'.6
Aldebaran	15-14-31	19°38'.5
Saturn	15-16-05	34°19'.0
Capella	15-17-41	29°10'.9
Vega	15-19-15	35°31'.7

What is our July 8 1519 fix?

Problem 6-9

After our July 8, 1993, 1519 fix, at $40^{\circ}01'N$, $164^{\circ}26'W$, our course changes to 280° and speed drops to 5.0 knots. Our I.C. is still -1'.5, and height of eye 9 feet. The moon and sun are not well placed for a fix, but if we can spot Venus this morning, we will try for a Venus-sun or Venus-moon fix.

We set up the star-finder, and see that a Venus-moon fix is feasible, so we precompute for Venus's altitude and azimuth at our 1900 DR position: $65^{\circ}/146^{\circ}$.

We spot Venus a few minutes ahead of time, and get our shots:

BODY	GMT	Hs
Venus	18-55-01	$64^{\circ}14'.8$
Venus	18-57-03	$64^{\circ}30'.6$
Venus	18-59-14	$64^{\circ}43'.6$
Moon (UL)	19-01-45	$16^{\circ}13'.8$
Moon (UL)	19-03-20	$15^{\circ}59'.1$
Moon (UL)	19-04-51	$15^{\circ}40'.7$

What is our July 8 1905 fix?



Chapter 7

Petropavlovsk Kamchatskiy to Wake Island

Problem 7-1

We are halfway on our cruise south to Wake Island the evening of May 15, 1993, on a calm sea with very light wind. Our course is 170° , speed 3.5 knots. Our DR position at 0700 May 15 was $40^\circ 30' \text{N}$, $162^\circ 30' \text{E}$. Our I.C. is $+1'.0$ and height of eye 10 feet. We plan for P.M. twilight:

	LMT	GMT
Sunset	1908	0818
Civil twilight	1939	0849
Nautical twilight	2018	0928

The LHA γ at 1939 LMT is 168° . Our plan is:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	46°	155°
0.2	Capella	28°	308°
0.2	Arcturus	46°	104°
0.5	Procyon	31°	249°
1.2	Pollux	46°	271°
1.2	Spica	30°	142°
1.3	Regulus	59°	211°
2.1	Polaris	40°	359°
2.2	Kochab	48°	019°

We skipped Mars, because its azimuth is close to Procyon's, and we added Polaris because we had nothing else near its azimuth.

Our sights are:

BODY	GMT	Hs
Jupiter	08-42-13	$45^\circ 22'.8$
Capella	08-43-49	$29^\circ 18'.1$
Arcturus	08-45-36	$44^\circ 53'.0$
Procyon	08-47-04	$31^\circ 17'.5$
Regulus	08-48-39	$58^\circ 24'.4$
Polaris	08-50-16	$39^\circ 58'.2$

What is our May 15 0850 fix?

Problem 7-2

From our 0850 May 15, 1993, fix, at $40^\circ 26' \text{N}$, $162^\circ 34' \text{E}$, we continue on 170° at 3.5 knots, I.C. still $+1'.0$. height of eye 10 feet. We plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0338 (5/16)	1647 (5/15)
Civil twilight	0415 (5/16)	1724 (5/15)
Sunrise	0446 (5/16)	1755 (5/15)

The LHA Υ at 0415 (5/16) LMT is 297° . Our plan is:

MAG.	BODY	ALT.	AZ.
2.5	Enif	50°	132° X
2.2	Alpheratz	37°	080°
2.2	Kochab	42°	339°
2.1	Rasalhague	50°	236°
1.9	Alkaid	29°	312°
0.9	Altair	59°	179°
0.9	Saturn	28°	140°
0.2	Arcturus	17°	281°
-4.5	Venus	15°	096° X
-	Moon	28°	117°

We note the azimuth duplications: Enif-Alkaid, and Venus-Arcturus.

At sighting time, a haze prevents us from seeing any but the brightest bodies. Here is what we get:

BODY	GMT	Hs
Arcturus	17-37-17	$14^\circ 46'.4$
Arcturus	17-38-50	$14^\circ 26'.6$
Venus	17-41-04	$18^\circ 07'.7$
Venus	17-42-39	$18^\circ 24'.1$
Moon (LL)	17-46-10	$32^\circ 04'.6$
Moon (LL)	17-47-51	$32^\circ 22'.3$

Do these sights give us a useful fix?

Problem 7-3

From our May 15, 1993, 1748 fix, at $39^\circ 55'N$, $162^\circ 45'E$, we proceed on course 170° at 3.5 knots, with I.C. still $+1'.0$ and height of eye 10 feet. We get some shots for a sun-moon fix:

BODY	GMT	Hs
Moon (LL)	21-03-42	$50^\circ 31'.8$
Moon (LL)	21-05-21	$50^\circ 31'.1$
Moon (LL)	21-07-01	$50^\circ 31'.5$
Sun	21-09-33	$35^\circ 36'.7$
Sun	21-11-12	$35^\circ 51'.5$
Sun	21-12-44	$36^\circ 08'.6$

What is our May 15 2107-2113 R. fix?

Chapter 8

Valencia to Genoa

Problem 8-1

We left Valencia yesterday, and are moving nicely in a moderate sea. There are scattered cumulus clouds, but we hope to get a round of star sights, so we plan for P.M. twilight. It is May 13, 1993, and our latest fix, at 1800, was $39^{\circ}35'N$, $1^{\circ}05'E$. Our course is 060° , speed 7.0 knots, I.C. $-0'.6$, and height of eye 12 feet. We interpolate in the almanac to get the twilight times:

	LMT	GMT
Sunset	1906	1901
Civil twilight	1937	1932
Nautical twilight	2015	2010

The LHA γ at 1937 LMT is 166° . Our plan is:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	46°	151°
0.2	Capella	29°	307°
0.2	Arcturus	44°	103°
0.5	Procyon	32°	247°
1.2	Pollux	48°	270°
1.2	Spica	29°	140°
1.3	Regulus	59°	208°
2.1	Polaris	39°	359°
2.2	Kochab	47°	020°

At twilight, the sky is clear, and we get our sights:

BODY	GMT	Hs
Jupiter	19-23-08	$45^{\circ}00'.8$
Capella	19-30-17	$29^{\circ}41'.4$
Arcturus	19-31-58	$44^{\circ}08'.8$
Procyon	19-33-41	$32^{\circ}31'.5$
Regulus	19-35-24	$59^{\circ}31'.1$
Polaris	19-37-05	$39^{\circ}16'.2$

What is our May 13 1937 fix?

Problem 8-2

From our May 13, 1993, 1937 fix, at $39^{\circ}41'N$, $1^{\circ}12'E$, we continue toward Genoa on course 060° at 7.0 knots, I.C. still $-0'.6$, height of eye 12 feet, and plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0337	0328
Civil twilight	0414	0405
Sunrise	0446	0437

The LHA Υ at 0414 LMT is 296° . Our plan is:

MAG.	BODY	ALT.	AZ.
2.5	Enif	50°	130° X
2.2	Alpheratz	36°	080°
2.2	Kochab	43°	339°
2.1	Rasalhague	50°	235°
1.9	Alkaid	30°	311°
0.9	Altair	59°	177°
0.2	Arcturus	18°	280°
-4.5	Venus	14°	097° X
-	Moon	33°	137° X

We plan to skip Enif (a dim star, whose azimuth is close to the reciprocal of Alkaid's), and will not need Venus and the moon, if our other sights are good.

Our results are:

BODY	GMT	Hs
Alpheratz	03-55-17	$33^\circ 31'.9$
Kochab	03-56-59	$43^\circ 37'.6$
Rasalhague	03-58-45	$51^\circ 52'.9$
Alkaid	04-00-25	$30^\circ 57'.7$
Altair	04-02-03	$58^\circ 37'.0$
Arcturus	04-03-44	$18^\circ 59'.0$

We got six good shots, all of which can be worked by H.O. 249 Vol. 1, so we didn't need Venus or the moon, whose sights we would have had to work by H.O. 249 Vol. 2. What is our May 14 0404 fix?

Problem 8-3

From our May 14, 1993, 0404 fix, at $40^\circ 10'N$, $2^\circ 09'E$, we proceed on 060/7.0 knots, with I.C. still 0'.6. and height of eye 12 feet. We get sights for a morning sun-moon fix:

BODY	GMT	Hs
Sun	09-15-18	$50^\circ 59'.8$
Sun	09-16-53	$51^\circ 18'.4$
Sun	09-18-41	$51^\circ 34'.8$
Moon (UL)	09-21-04	$29^\circ 43'.1$
Moon (UL)	09-22-39	$29^\circ 31'.2$
Moon (UL)	09-24-05	$29^\circ 17'.0$

What is our May 14 0924 fix?

At the time of the last sun sight, a crew member put the shadow pin on the compass and checked the bearing of the sun, for a check on the compass error. The shadow-pin bearing was 115° , and the variation in this locality was 7°W . What was our compass deviation on that heading?



Chapter 9

Hungnam to Akita

Problem 9-1

On the morning of July 6, 1993, we are halfway across the Sea of Japan on a cruise from North Korea to Honshu. We are sailing smoothly at 7.0 knots on course 095°. Our sextant I.C. is -1'.0, and height of eye 9 feet. Our DR position at 0100 was 39°50'N, 134°40'E, but we need to confirm this with a fix, because we haven't had clear weather for several days, until this morning.

We get some morning sun sights, then more in the afternoon, for a running fix:

BODY	GMT	Hs
Sun	01-53-32	66°54'.5
Sun	01-55-16	67°10'.0
Sun	01-56-58	67°21'.5
Sun	04-12-03	67°21'.1
Sun	04-13-50	67°07'.9
Sun	04-15-35	66°50'.2

What is our July 6 0157-0416 running. fix?

Problem 9-2

From our July 6, 1993, 0416 fix, at 39°52'N, 135°15'E, we continue on course 095°, at 7.0 knots. Our I.C. is still -1'.0, and height of eye 9 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1930	1025
Civil twilight	2003	1058
Nautical twilight	2044	1139

The LHA Υ at 2003 LMT is 226°. Our plan is:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	36°	230° X
0.9	Altair	20°	095°
1.2	Spica	34°	210°
1.2	Antares	21°	160°
1.3	Deneb	31°	055°
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	47°	119°
2.2	Denebola	41°	254°

We will skip Jupiter, unless we are unable to shoot Deneb. We omitted Mars, and added Polaris, because of azimuth considerations.

At twilight, the sighting conditions are nearly perfect, and we get the following sights:

BODY	GMT	Hs
Altair	10-57-06	19°14'.7
Spica	10-58-51	34°19'.6
Antares	11-00-38	18°51'.3
Deneb	11-02-14	30°58'.5
Polaris	11-03-50	39°10'.7
Rasalhague	11-05-29	48°03'.8

What is our July 6 1105 fix?

Problem 9-3

From our July 6, 1993, 1105 fix, at 39°50'N, 136°30'E, we continue across the Sea of Japan, now on course 090°, and with our speed increased to 8.5 knots. Our height of eye is still 9 feet.

As we begin our plan for A.M. twilight, the boat rolls, and the sextant bangs to the cabin sole. We examine it, and find a broken horizon mirror. This is not a disaster, since we have a spare mirror, but there isn't time to replace it and adjust the sextant before twilight.

We decide to try something unusual—a sight of the sun, without using a sextant, when the lower limb is exactly on the horizon. (An upper-limb sight would be much harder.)

From the almanac, we find that the time of sunrise is 0438 (7/7) LMT, 1926 (7/6) GMT, and we get ready at about 1920. We hold up the sextant so we can squint through the next-to-strongest sun filter, and when the upper limb breaks the horizon, we wait. The sun looks slightly squashed, but as the lower limb touches the horizon, we record the time.

BODY	GMT	Hs
Sun	19-29-15	00°00'.0

We note the air temperature, 63°F, and the barometer, 30.2 inches Hg (important at low altitudes).

What was the LOP we got from this sight, and what can we do with it?

Problem 9-4

Our sun LOP, at 1929 July 6, 1993, was 1'.0 away from 060°, with an A.P. of 40°N, 137°53'E. (Our last fix, at 1105 July 6, 1993, was at 39°50'N, 136°30'E.) We continue on 090°, at 8.5 knots, with our height of eye still 9 feet.

We repair and check the sextant, getting a new I.C. of +1'.3. We plan for some sun sights later this morning to cross with the 1929 sun LOP for a running fix.

We get:

BODY	GMT	Hs
Sun	02-04-44	70°16'.6
Sun	02-06-26	70°28'.4
Sun	02-08-13	70°37'.9
Sun	02-10-06	70°45'.4

What is our 1929 (7/6)-0210 (7/7) R. fix?

Problem 9-5

Our last fix, at 0210 July 7, 1993, was at 39°48'N, 139°14'E. It depended on the one sun sight we took, without a sextant (an inexact method, because of the uncertainties of refraction at low altitudes). Also, as we approach our landfall, we'd like to check our repaired sextant. We'd like another fix, so we plan for P.M. twilight. Our course is still 090, but our speed is now 4.2 knots. The height of eye is still 9 feet, I.C. +1'.3.

	LMT	GMT
Sunset	1930	1010
Civil twilight	2003	1043
Nautical twilight	2044	1124

The LHA Υ at 2003 LMT is 227°. Our plan is:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	35°	231°
0.9	Altair	21°	096°
1.2	Spica	34°	211°
1.2	Antares	21°	161°
1.3	Deneb	31°	055° X
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	48°	120°
2.2	Denebola	40°	254°

With more bodies available than we need, we will shoot Jupiter, but not bother to work the sight if we get Deneb (whose azimuth is close to Jupiter's reciprocal). We expect to shoot, and work the sights of, Altair, Spica, Antares, Deneb, Dubhe, and Polaris—all listed in H.O. 249 Vol. 1.

At sighting time, there's an unfortunate haze, and we see only the brightest bodies. We shoot Jupiter, Arcturus, and Altair, then repeat the first two. We'd like to get a body to the NE or SW, to give us good azimuth coverage. Just before the horizon fades, we spot Antares, and get one good shot.

BODY	GMT	Hs
Jupiter	10-51-01	34°03'.9
Arcturus	10-54-09	65°42'.9
Altair	10-55-48	22°18'.6
Jupiter	10-57-17	33°04'.0
Arcturus	10-58-50	65°12'.0
Antares	11-00-38	21°59'.5

What is our July 7 1101 fix?



Chapter 10

Barcelona to Tunis

Problem 10-1

We are in the Mediterranean, a few miles NE of Minorca, the afternoon of December 18, 1993, course 120°, speed 6.5 knots. Our 1200 DR position was 40°30'N, 5°05'E. Our sextant I.C. is -1'.0, and height of eye 10 feet. We take some sights for a sun-moon fix.

BODY	GMT	Hs
Sun	13-45-23	19°16'.2
Sun	13-47-02	19°07'.8
Sun	13-48-43	18°54'.7
Moon (UL)	13-50-21	34°58'.5
Moon (UL)	13-51-58	35°09'.2
Moon (UL)	13-53-37	35°23'.3

What is our December 18 1354 fix?

Problem 10-2

From our December 18, 1993, 1354 fix, at 40°23'N, 5°17'E, we continue on 120°/6.5 knots, with I.C. still -1'.0, and height of eye 10 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1636	1613
Civil twilight	1707	1644
Nautical twilight	1741	1718

The LHA Υ at 1707 LMT is 344°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
-	Moon	42°	196° X
0.1	Vega	41°	291°
0.2	Capella	25°	050°
0.8	Saturn	34°	198° X
0.9	Altair	38°	246°
1.3	Fomalhaut	20°	180°
2.2	Hamal	47°	098°
2.2	Diphda	27°	151°
2.2	Kochab	31°	344°

This is a big list. We won't need both Saturn and the moon (which are very close in azimuth), and we can skip both if we shoot Fomalhaut.

We get an early moon sight; then, at twilight, we shoot the other bright bodies, and continue down the list. But we work only those included in H.O. 249 Vol. 1.

BODY	GMT	Hs
Vega	16-47-18	40°42'.2
Capella	16-48-54	25°25'.3
Altair	16-50-31	37°19'.6
Fomalhaut	16-52-02	20°11'.2
Diphda	16-53-40	27°32'.1
Kochab	16-55-11	30°24'.5

What is our December 18 1655 fix?

Problem 10-3

From our December 18, 1993, 1655 fix, at 40°14'N, 5°35'E, we stay on course 120°, but now at 6.0 knots, with I.C. still -1'.0 and height of eye 10 feet. We plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0612	0544
Civil twilight	0646	0618
Sunrise	0716	0648

The LHA γ at 0646 LMT is 189°. Our plan is:

MAG.	BODY	ALT.	AZ.
2.3	Alphecca	51°	096° X
2.1	Polaris	39°	000°
1.3	Regulus	47°	240° X
1.2	Pollux	30°	283°
1.2	Spica	38°	165°
0.2	Arcturus	60°	127°
0.2	Capella	16°	317°
0.1	Vega	24°	058°
-1.8	Jupiter	32°	149°

H.O. 249 Vol. 1 did not have a perfect round of stars to select from, for 40°N latitude and 189° LHA, and there are some near-reciprocals: Vega-Regulus and Pollux-Alphecca. We add Polaris for better azimuth coverage.

Sighting conditions are good at twilight, and we shoot the following:

BODY	GMT	Hs
Polaris	06-25-13	38°54'.7
Pollux	06-26-53	28°17'.1
Spica	06-28-31	38°41'.2
Arcturus	06-30-11	62°36'.0
Capella	06-31-50	14°10'.3
Vega	06-33-07	26°09'.4

What is our December 19 0633 fix?



Chapter 11

Hilo to Seattle

Problem 11-1

It is late afternoon, May 13, 1993, and we are 600 miles or so off the Northern California coast, on our way from the Hawaiian Islands to Seattle. We are heading 040°, making 5.2 knots. Our sextant I.C. is -1'.3, and height of eye 8 feet. Our last DR position was 39°40'N, 134°38'W, at 0400 May 13. It may not be accurate, because we got it from a running fix on the sun, with the last sights shot from a rolling deck. The sea is calm now, and the few cumulus clouds from the afternoon are dissipating—but we need a good fix. We plan for P.M. twilight.

	LMT	GMT
Sunset	1906 (5/12)	0404 (5/13)
Civil twilight	1937 (5/12)	0435 (5/13)
Nautical twilight	2015 (5/12)	0513 (5/13)

The LHA γ at 1937 (5/12) LMT is 165°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	45°	150°
0.2	Capella	30°	307°
0.2	Arcturus	43°	102°
0.5	Procyon	33°	246°
1.2	Pollux	48°	269°
1.2	Spica	29°	139°
1.3	Regulus	60°	206°
2.1	Polaris	40°	359°
2.2	Kochab	46°	020° X

We omitted Mars (its azimuth is close to Procyon's), and included Polaris. We will probably not sight Kochab (its azimuth is close to Regulus's reciprocal). We would like to get Jupiter, Capella, Arcturus, Procyon, Regulus, and Polaris, for good azimuth distribution.

At twilight, sighting conditions are good, and we sight the preferred bodies:

BODY	GMT	Hs
Jupiter	04-27-12	44°55'.7
Capella	04-31-42	30°11'.6
Arcturus	04-33-38	43°32'.1
Procyon	04-35-01	33°10'.2
Regulus	04-36-40	59°56'.6
Polaris	04-38-20	39°12'.4

What is our May 13 0438 fix?

Problem 11-2

From our last fix, at 0438 May 13, 1993, 39°37'N, 134°26'W, we continue on 040°, 5.2 knots, with I.C. -1'.3, and height of eye 8 feet. A thin veil of cirrostratus has moved in during the night, but we plan for A.M. twilight, hoping to be able to get some sights.

	LMT	GMT
Nautical twilight	0337	1232
Civil twilight	0414	1309
Sunrise	0445	1340

The LHA Υ at 0414 LMT is 294°. We make up our sighting plan.

MAG.	BODY	ALT.	AZ.
2.5	Enif	49°	128° X
2.2	Alpheratz	34°	079°
2.2	Kochab	43°	339°
2.1	Rasalhague	52°	233°
1.9	Alkaid	31°	311°
0.9	Altair	59°	173°
0.2	Arcturus	20°	279°
-4.5	Venus	14°	097° X
-	Moon	33°	145°

We have omitted Saturn (whose azimuth is close to that of the moon and to the reciprocal of Alkaid's), but included Enif and Venus (azimuths close to reciprocals of Alkaid's and Arcturus's, respectively), although we will probably not use them. With Altair available, we don't need Polaris. We'd like to shoot Alpheratz, Kochab, Rasalhague, Alkaid, Altair, and Arcturus.

As the horizon appears, we can't spot any stars or planets, so we get some moon shots. Then we see Venus, dimly, and quickly shoot it.

BODY	GMT	Hs
Moon (LL)	13-05-12	32°32'.6
Moon (LL)	13-06-53	32°46'.6
Moon (LL)	13-08-35	32°54'.9
Venus	13-15-01	15°01'.0
Venus	13-16-42	15°19'.1
Venus	13-18-20	15°39'.6

These LOPs make a very poor cut. Can we get a usable fix from them?

Problem 11-3

Since our fix, 40°05'N, 133°52'W, at 1318 May 13, 1993, the wind has picked up, and we have done some maneuvering while reducing sail. We are again on course 040°, making 5.0 knots. Our I.C. is still -1'.3, and height of eye 8 feet. The latest WWVH broadcast reported a storm building to our north, with 35-knot winds and 10-foot seas, moving SW. We want to stay out of its way, but before we decide on a new heading, we want a good fix. We got three moon sights an hour ago, and worked them while we waited for the sun to move in azimuth enough to give us a good cut.

Now we get our sun sights.

BODY	GMT	Hs
Moon (UL)	18-45-13	20°52'.4
Moon (UL)	18-46-55	20°35'.0
Moon (UL)	18-48-40	20°20'.7
Sun	19-51-03	64°32'.1
Sun	19-52-50	64°42'.5
Sun	19-54-29	64°55'.1

What is our May 13 1849-1954 R. fix?

Problem 11-4

From our May 13, 1993, 1954 fix, at 40°25'N, 133°25'W, we want to change course to the one that will give us the maximum distance from the storm, which is now at 43°55'N, 133°25'W, moving SW at 20 knots. We test the boat, and find that we can make 6 knots on any heading between ESE and S.

We figure the best course by the quick method. (See Appendix B.) What is the new course?

After we have turned away from the storm, we work the complete maneuvering-board solution (see Appendix B), which gives us:

The best avoidance course (as above)

The closest point of approach (CPA) of the storm

The time of the CPA

Problem 11-5

From our 1954 May 13, 1993, fix, at 40°25'N, 133°25'W, we turned to course 150°, and are making 6.0 knots, as we expected. Our I.C. is still -1'.3, and height of eye 8 feet. The boat is taking some pounding, but we plan for P.M. twilight, hoping to get a few sights.

	LMT	GMT
Sunset	1906 (5/13)	0357 (5/14)
Civil twilight	1937 (5/13)	0428 (5/14)
Nautical twilight	2015 (5/13)	0506 (5/14)

The LHA Υ at 1937 (5/13) LMT is 166°. Our plan is:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	46°	152°
0.2	Capella	29°	307°
0.2	Arcturus	44°	103°
0.5	Procyon	32°	247°
1.2	Pollux	48°	270°
1.2	Spica	29°	140°
1.3	Regulus	59°	208°
2.1	Polaris	39°	359°
2.2	Kochab	47°	020°

At twilight the sea is even rougher, but another crew member helps to steady the navigator, and we get a few fair sights.

BODY	GMT	Hs
Jupiter	04-32-05	46°25'.8
Jupiter	04-34-31	46°33'.4
Capella	04-37-01	27°49'.7
Procyon	04-39-42	30°26'.7

What is our May 14 0440 fix?

Problem 11-6

The storm is still a concern, but it's behind us, now, and has not worsened. We decide to change course to ease the boat's motion. From our May 14, 1993, 0440 fix, at 39°40'N, 132°48'W, we head 090°, and make 6.5 knots, even with our reduced sail. Our I.C. is still -1'.3, height of eye 8 feet. Through the night there are scattered ragged clouds, but we hope for some sights at A.M. twilight.

	LMT	GMT
Nautical twilight	0340	1225
Civil twilight	0417	1303
Sunrise	0447	1333

The LHA Υ at 0417 LMT is 296°. Here is our plan:

MAG.	BODY	ALT.	AZ.
2.5	Enif	50°	130° X
2.2	Alpheratz	36°	080°
2.2	Kochab	43°	339°
2.1	Rasalhague	50°	235°
1.9	Alkaid	30°	311°
0.9	Altair	59°	177°
0.2	Arcturus	18°	280°
-4.5	Venus	15°	097°
-	Moon	32°	132°

We will probably skip Enif, whose azimuth is close to the moon's and to the reciprocal of Alkaid's. We omitted Saturn and Polaris, also because of azimuth duplications. We would like to get Alpheratz, Kochab, Rasalhague, Alkaid, Altair, and Arcturus—all H.O. 249 Vol. 1 stars, nicely spaced in azimuth.

At sighting time, the sky is surprisingly clear, and we sight the preferred bodies:

BODY	GMT	Hs
Alpheratz	12-58-13	35°04'.3
Kochab	12-59-52	42°46'.4
Rasalhague	13-01-30	50°46'.0
Alkaid	13-03-17	29°27'.7
Altair	13-04-57	59°04'.9
Arcturus	13-06-10	17°21'.3

What is our May 14 1306 fix?



Chapter 12

Tristan da Cunha to Punta Delgada

Problem 12-1

It is September 10, 1993, a mild night near the end of winter, in the middle of a featureless ocean. Our 0600 DR was 39°35'S, 30°40'W, and we are making 6.5 knots on a heading of 270°. Our sextant I.C. is +1'.5, and height of eye 11 feet. We plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0509	0713
Civil twilight	0541	0745
Sunrise	0608	0812

The LHA γ at 0541 LMT is 74°.

Our plan is:

MAG.	BODY	ALT.	AZ.
2.2	Hamal	15°	320°
2.2	Diphda	31°	272°
1.3	Fomalhaut	19°	247°
1.1	Aldebaran	33°	354°
1.1	Acrux	26°	152°
0.6	Achernar	54°	224°
0.5	Betelgeuse	41°	019°
-1.6	Sirius	57°	053°
-	Moon	27°	016° X

The H.O. 249 Vol. 1 stars leave a big gap in azimuth, which we have filled in with Diphda. We won't bother with the moon if we are able to shoot Betelgeuse, because their azimuths are nearly the same.

The two dimmer stars have faded by the time the horizon is visible, but we get six good sights:

BODY	GMT	Hs
Fomalhaut	07-50-05	17°17'.5
Aldebaran	07-51-41	33°32'.1
Acrux	07-53-19	26°49'.9
Achernar	07-54-57	52°01'.8
Betelgeuse	07-56-41	41°55'.7
Sirius	07-58-32	59°31'.9

What is our September 10 0759 fix?

Problem 12-2

From our September 10, 1993, 0759 fix, at 39°36'S, 30°55'W, we continue on course 270°, speed 6.5 knots, with I.C. still +1'.5, height of eye 11 feet. We check the position of the moon with the star-finder, and decide to get a sun-moon fix this morning.

BODY	GMT	Hs
Moon (UL)	11-15-03	20°25'.6
Moon (UL)	11-17-46	20°09'.9
Moon (UL)	11-19-31	19°56'.2
Sun	11-21-14	31°50'.7
Sun	11-22-50	32°08'.2
Sun	11-24-29	32°23'.1

What is our September 10 1124 fix?

Problem 12-3

From our September 10, 1993, 1124 fix, at 39°38'S, 31°23'W, we stay on course 270°, with speed 6.5 knots, I.C. +1'.5, and height of eye 11 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1746	1957
Civil twilight	1813	2024
Nautical twilight	1845	2056

The LHA γ at 1813 LMT is 263°. Our plan is:

MAG.	BODY	ALT.	AZ.
-1.7	Jupiter	21°	281° X
0.1	Rigil Kent.	56°	217°
0.2	Arcturus	15°	312°
0.4	Saturn	28°	086°
0.6	Achernar	19°	151°
0.9	Altair	32°	041°
1.2	Spica	29°	280°
1.3	Fomalhaut	25°	109°
2.1	Rasalhague	37°	001°

Mars and Spica are lined up on nearly the same azimuth as Jupiter, 3° and 8° higher, respectively. We have omitted Mars from the plan, and will probably not use the Jupiter shot.

Sighting conditions are very good at twilight, and we get the following:

BODY	GMT	Hs
Rigil Kent.	20-28-01	55°39'.2
Arcturus	20-29-43	14°24'.5
Saturn	20-31-32	29°57'.3
Achernar	20-33-04	19°48'.8
Spica	20-34-50	26°35'.4
Rasalhague	20-36-30	37°38'.3

What is our September 10 2036 fix?

Problem 12-4

From our September 10, 1993, 2036 fix, at 39°45'S, 32°34'W, we continue as before: 270°, 6.5 knots, I.C. +1'.5, height of eye 11 feet. We prepare for A.M. twilight.

	LMT	GMT
Nautical twilight	0509	0725
Civil twilight	0541	0757
Sunrise	0608	0824

The LHA γ at 0541 is 75°. Our plan is:

MAG.	BODY	ALT.	AZ.
2.2	Suhail	45°	116°
2.2	Diphda	31°	272°
1.1	Aldebaran	33°	353°
1.1	Acrux	26°	152°
0.6	Achernar	53°	225° X
0.5	Betelgeuse	41°	018°
-1.6	Sirius	57°	052°
-	Moon	24°	030° X

This is a good plan, from which we can pick half a dozen nicely spaced stars, all listed in H.O. 249 Vol. 1. We won't bother with the moon if we shoot Betelgeuse.

Here's what we get:

BODY	GMT	Hs
Suhail	08-05-13	46°38'.6
Diphda	?	28°42'.7
Aldebaran	08-08-34	32°54'.2
Acrux	08-10-15	27°54'.3
Betelgeuse	08-11-55	41°54'.4
Sirius	08-13-40	60°18'.7

When we finish shooting, we are appalled to find that we forgot to record the time for the Diphda sight—and when we go back on deck, we can no longer see the star. That's too bad, because we needed a body near that azimuth. Do we have to discard the sight? What is our September 11 0814 fix?

Problem 12-5

From our September 11, 1993, 0814 fix, at 39°56'S, 33°56'W, we continue on 265°, 6.0 knots, with I.C. still +1'.5, height of eye 11 feet, and plan for a sun-moon fix this morning.

We get these sights:

BODY	GMT	Hs
Moon (UL)	10-16-25	29°48'.2
Moon (UL)	10-18-01	29°47'.2
Moon (UL)	10-19-38	29°46'.9
Sun	10-22-04	20°44'.5
Sun	10-23-40	21°02'.0
Sun	10-25-10	21°14'.5

What is our September 11 1025 fix?

Problem 12-6

We proceed from our Sept. 11, 1993, 1025 fix, at 39°58'S, 34°09'W, on course 265°, speed 6.0 knots. Our I.C. is still +1'.5 and height of eye 11 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1746	2008
Civil twilight	1813	2035
Nautical twilight	1845	2107

The LHA γ at 1813 LMT is 264°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
-1.7	Jupiter	21°	280° X
0.1	Rigil Kent.	56°	217°
0.2	Arcturus	15°	311°
0.4	Saturn	29°	085°
0.6	Achernar	19°	150°
0.9	Altair	32°	040° X
1.2	Spica	28°	279°
1.3	Fomalhaut	26°	108°
2.1	Rasalhague	37°	000°

Jupiter and Altair are both redundant in azimuth. The bodies we would prefer are Rigil Kentaurus, Arcturus, Saturn, Achernar, Fomalhaut, and Rasalhague.

At twilight, there is a thin deck of cirrostratus blocking out all but the brightest bodies, but we get a few:

BODY	GMT	Hs
Jupiter	20-41-14	19°27'.8
Rigil Kent.	20-42-50	55°10'.5
Arcturus	20-44-35	13°00'.8
Saturn	20-46-18	31°21'.9
Jupiter	20-48-01	18°09'.4

What is our September 11 2048 fix?

Problem 12-7

From our 2048 fix on September 11, 1993, at $40^{\circ}13'S$, $35^{\circ}24'W$, we continue on course 265° . Our speed, according to the indicator, has increased to 7.8 knots, although some of the crew think we are going no faster than we were yesterday. We prepare for A.M. twilight. Our I.C. is still $+1'.5$, and height of eye 11 feet.

	LMT	GMT
Nautical twilight	0509	0738
Civil twilight	0541	0810
Sunrise	0608	0837

The LHA Υ at 0541 LMT is 76° . Our plan is similar to yesterday's, except for the GMT of civil twilight and the moon prediction.

MAG.	BODY	ALT.	AZ.
2.2	Suhail	45°	115°
2.2	Diphda	30°	271°
1.1	Aldebaran	33°	352°
1.1	Acrux	27°	152°
0.6	Achernar	53°	$225^{\circ} X$
0.5	Betelgeuse	41°	017°
-1.6	Sirius	58°	050°
-	Moon	20°	$044^{\circ} X$

We expect to skip Achernar and the moon, because of azimuth duplications. At twilight, viewing conditions are excellent, and we get the following:

BODY	GMT	Hs
Suhail	08-04-17	$45^{\circ}15'.2$
Diphda	08-05-59	$30^{\circ}21'.5$
Aldebaran	08-07-42	$32^{\circ}51'.1$
Acrux	08-09-21	$27^{\circ}26'.7$
Betelgeuse	08-11-01	$41^{\circ}13'.1$
Sirius	08-12-46	$58^{\circ}55'.4$

What is our September 12 0813 fix?

Problem 12-8

Our speed indicator was in error, but it's fixed now, and we are on course 270° , speed 6.0 knots, since our 0813 September 12, 1993, fix, at $40^{\circ}16'S$, $35^{\circ}51'W$. Our I.C. is still $+1'.5$, and height of eye 11 feet. The moon is closer to the sun than it was yesterday, and simultaneous sun-moon LOPs would not have a very good crossing angle. Therefore we shoot the sun first, and a couple of hours later the moon.

BODY	GMT	Hs
Sun	11-25-06	29°15'.6
Sun	11-26-39	29°28'.5
Sun	11-28-17	29°45'.5
Moon (UL)	13-10-13	26°22'.4
Moon (UL)	13-11-54	26°14'.0
Moon (UL)	13-13-39	26°01'.6

What is our 1128-1314 Sept 12 R. fix?

Problem 12-9

Since our September 12, 1993, 1128-1314 R. fix, at 40°20'S, 37°26'W, we continue on 270°, 6.0 knots, with I.C. +1'. 5, and height of eye 11 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1746	2020
Civil twilight	1813	2047
Nautical twilight	1845	2119

The LHA γ at 1813 LMT is 265°. Our plan is:

MAG.	BODY	ALT.	AZ.
-1.7	Jupiter	20°	279° X
0.1	Rigil Kent.	56°	218°
0.2	Arcturus	14°	311°
0.4	Saturn	30°	084°
0.6	Achernar	20°	150°
0.9	Altair	33°	039° X
1.2	Spica	27°	278°
1.3	Fomalhaut	26°	108°
1.6	Mars	23°	280° X
2.1	Rasalhague	37°	358°

We probably won't sight Mars or Jupiter if we get Spica, or Altair if we get Rigil Kentaurus; also, we may skip Saturn.

Unfortunately, the sky is thinly overcast at twilight, but we get two Jupiter shots, then spot and shoot Rigil Kentaurus and Achernar:

BODY	GMT	Hs
Jupiter	20-55-14	21°35'.6
Jupiter	20-57-35	21°11'.1
Rigil Kent.	21-00-03	54°11'.3
Achernar	21-01-49	21°41'.6

What is our September 12 2102 fix?

Chapter 13

Hamilton to Rotterdam

Problem 13-1

We are well into our cruise from Bermuda to the Netherlands early in the morning of July 6, 1993. The weather is mild, the sky is clear, and the wind is light. We should have good sighting conditions for A.M. twilight. Our 0600 DR position was 39°30'N, 40°00'W. We are drifting along at 3.2 knots on course 070°. Our I.C. is -2'.0, and height of eye 12 feet. We interpolate in the almanac to get the twilight times:

	LMT	GMT
Nautical twilight	0327	0607
Civil twilight	0408	0648
Sunrise	0439	0719

The LHA γ at 0408 LMT is 346°. Our plan is:

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	153°
1.3	Fomalhaut	20°	182°
1.1	Aldebaran	16°	082°
0.9	Altair	37°	248°
0.6	Saturn	36°	196°
0.2	Capella	26°	050°
0.1	Vega	40°	292°
-4.1	Venus	24°	087° X
-	Moon	28°	218° X

We will probably not shoot Venus (whose azimuth is close to Aldebaran's) or the moon.

Our actual sights are:

BODY	GMT	Hs
Kochab	06-51-13	29°35'.7
Diphda	06-53-59	28°47'.4
Fomalhaut	06-55-45	20°55'.0
Aldebaran	06-57-31	18°11'.0
Capella	06-59-02	?
Vega	07-00-48	36°51'.7

After twilight was over, we saw that we had carelessly forgotten to read the sextant for the Capella sight. What is our July 6 0701 fix from the other sights?

Problem 13-2

From our July 6, 1993, 0701 fix, at 39°29'N, 39°43'W, we continue on 070°/3.2 knots, I.C. -2'.0, and height of eye 12 feet. The moon is out of position for a sun-moon fix, but if we are lucky enough to spot Venus in daylight, we can get a sun-Venus fix. We mark the base of the star-finder with the sun and Venus positions, rotate the transparent disc until we get suitable altitudes for both, and note the LHA γ on the outer scale. In the almanac, we find the GMT for this LHA γ , and at that time go on deck and look for Venus, with the sextant set to the predicted altitude, and facing toward the predicted azimuth. After a little searching, we spot Venus and get our sights.

BODY	GMT	Hs
Venus	13-40-17	55°09'.3
Venus	13-41-59	54°55'.3
Venus	13-43-42	54°38'.5
Sun	13-45-11	69°02'.9
Sun	13-46-50	69°14'.4
Sun	13-48-35	69°29'.3

What is our July 6 1349 fix?

Problem 13-3

From our July 6, 1993, 1349 fix, at 39°37'N, 39°14'W, we continue on course 070°, speed 3.2 knots, with I.C. -2'.0, and height of eye 12 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1930	2205
Civil twilight	2003	2238
Nautical twilight	2044	2319

The LHA γ at 2003 LMT is 226°. Our plan includes more bodies than we need:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	36°	231° X
0.9	Altair	20°	095°
1.2	Spica	34°	210°
1.2	Antares	21°	160°
1.3	Deneb	31°	055°
1.6	Mars	25°	262° X
2.0	Dubhe	48°	322°
2.1	Polaris	39°	000°
2.1	Rasalhague	47°	119°
2.2	Denebola	41°	254°

From this list, we pick Altair, Spica, Antares, Deneb, Dubhe, Polaris, and Rasalhague as the best for our round of sights. But at sighting time, a haze obscures all but the brightest bodies. We get:

BODY	GMT	Hs
Jupiter	22-48-30	33°52'.1
Jupiter	22-50-02	33°39'.3
Altair	22-51-54	22°26'.2
Altair	22-53-39	22°45'.3
Antares	22-55-17	22°04'.9
Antares	22-56-51	22°07'.4

What is our July 6 2257 fix?

Problem 13-4

From our July 6, 1993, 2257 fix, at 39°46'N, 38°34'W, we maintain course 070°, but our speed picks up to 5.0 knots. Our I.C. is still -2'.0, and height of eye 12 feet. The night is cooler, the sky is clear, and many stars are visible as we plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0325	0556
Civil twilight	0406	0637
Sunrise	0438	0709

The LHA γ at 0406 LMT is 347°. We list a lot of bodies in the plan, including Venus, which we will probably not sight, because its azimuth is close to Aldebaran's.

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	154°
1.3	Fomalhaut	20°	183°
1.1	Aldebaran	17°	082°
0.9	Altair	36°	249°
0.6	Saturn	36°	197°
0.2	Capella	26°	051°
0.1	Vega	39°	292°
-4.1	Venus	24°	086° X
-	Moon	36°	208°

The incredible sighting conditions hold up, the boat is a steady platform, and we sight everything on the list:

BODY	GMT	Hs
Kochab	06-25-09	30°48'.2
Diphda	06-26-43	27°03'.5
Fomalhaut	06-28-21	20°30'.0
Aldebaran	06-30-01	15°18'.9
Altair	06-31-39	37°23'.1
Saturn	06-33-18	35°43'.3
Capella	06-34-55	26°04'.0
Vega	06-36-30	39°14'.6
Venus	06-38-08	24°32'.7
Moon (LL)	06-40-02	35°34'.4

What is our July 7, 0640 fix?

Problem 13-5

Since our July 7, 1993, 0640 fix, at 40°01'N, 37°37'W, we continue on 070°/5.0 knots, with I.C. -2'.0 and height of eye 12 feet. There are scattered cumulus, and we know we won't find Venus. We will be lucky to get a running fix on the sun.

We get three good sights in the late morning, and wait a little over two hours for the sun to get to a good azimuth to cross with our morning LOPs. Clouds obscure the lower part of the sun for the last two shots, and we use the upper limb.

BODY	GMT	Hs
Sun (LL)	13-31-07	67°57'.2
Sun (LL)	13-34-16	68°21'.2
Sun (LL)	13-37-05	68°40'.6
Sun (LL)	15-51-02	65°18'.3
Sun (UL)	15-56-27	65°01'.3
Sun (UL)	15-58-11	64°43'.6

What is our July 7 1337-1558 R. fix?

Problem 13-6

We continue on 070°/5.0 knots from our July 7, 1993, 1337-1558 R. fix, at 40°19'N, 36°30'W. Our I.C. is still -2'.0, and height of eye 12 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1933	2156
Civil twilight	2006	2229
Nautical twilight	2048	2311

The LHA Υ at 2006 LMT is 227°. Our sighting plan is:

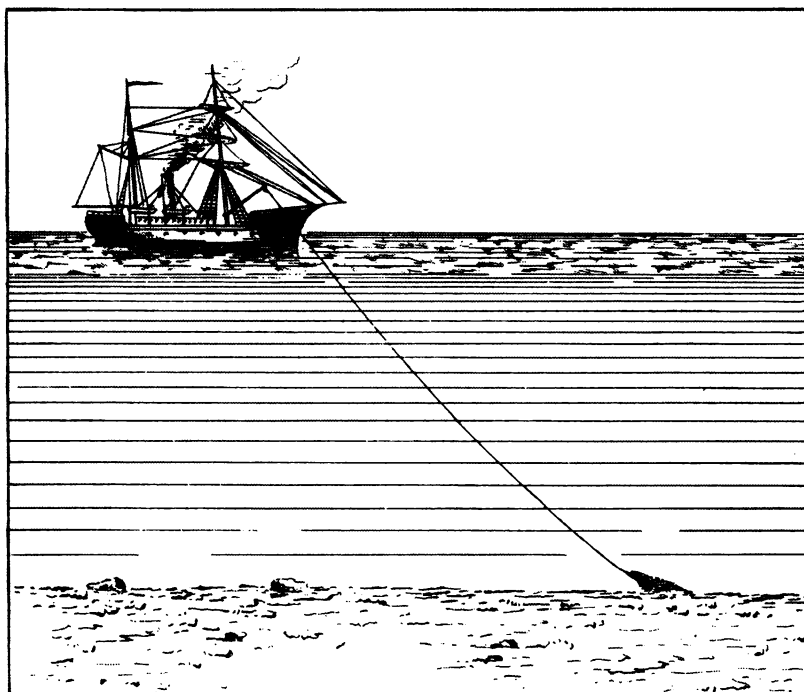
MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	34°	232° X
0.9	Altair	21°	096°
1.2	Spica	34°	211°
1.2	Antares	21°	161°
1.3	Deneb	31°	055°
1.6	Mars	24°	262° X
2.0	Dubhe	48°	322°
2.1	Polaris	40°	000°
2.1	Rasalhague	48°	120°
2.2	Denebola	40°	254°

We will probably skip Jupiter and Mars, because of azimuth duplications, unless we need them to complete our round of sights.

The sky is clear at twilight, and we get:

BODY	GMT	Hs
Altair	22-20-35	19°22'.8
Spica	22-22-12	33°41'.2
Antares	22-23-47	20°23'.8
Deneb	22-25-08	31°24'.5
Dubhe	22-26-41	48°21'.8
Polaris	22-28-20	39°49'.3
Rasalhague	22-30-05	48°03'.2

What is our July 7 2230 fix?



Chapter 14

Crozet Islands to Melbourne

Problem 14-1

We are approaching Australia's southern coast in a catamaran early in the morning of December 19 (GMT), 1993 (which is December 20, LMT). Our course is 090°, speed 14.0 knots, sextant I.C. -3'.0, and height of eye 10 feet. Our DR position at 2000 December 19 was 40°30'S, 110°00'E. We plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0309 (12/20)	1948 (12/19)
Civil twilight	0352 (12/20)	2031 (12/19)
Sunrise	0425 (12/20)	2104 (12/19)

The LHA Υ at 0352 (12/20) LMT is 146°. Our plan, from H.O. 249 Vol. 1 and the star-finder, is:

MAG.	BODY	ALT.	AZ.
1.3	Regulus	38°	007°
1.2	Spica	34°	075°
1.1	Acrux	57°	147°
0.5	Procyon	36°	320°
0.5	Betelgeuse	19°	298°
0.3	Rigel	22°	278°
-0.9	Canopus	54°	232°
-1.8	Jupiter	24°	087°
-1.6	Sirius	45°	288° X

We note that Sirius is between, and close to, Rigel and Betelgeuse, and that Acrux is close to the reciprocal of Procyon—so we won't use all of these stars. We get:

BODY	GMT	Hs
Regulus	20-27-01	37°16'.5
Spica	20-28-42	33°28'.7
Acrux	20-30-19	57°27'.8
Betelgeuse	20-32-52	18°35'.9
Rigel	20-33-35	21°45'.5
Canopus	20-35-08	53°31'.5

What is our December 19 2035 fix?

Problem 14-2

From our December 19, 1993, 2035 fix, at 40°30'S, 110°17'E, we continue moving nicely at 14.0 knots on course 090°. Our I.C. is still -3'.0, and height of eye 10 feet. We'd like a running fix on the sun or, better, a sun-moon fix.

Because the moon is a little too far from the sun for an optimum cut, we decide to shoot the sun first, then wait a couple of hours before getting our moon sights. The results are:

BODY	GMT	Hs
Sun	06-02-10	63°08'.5
Sun	06-03-48	62°54'.1
Sun	06-05-32	62°34'.7
Moon (UL)	08-12-13	42°20'.0
Moon (UL)	08-14-00	42°30'.5
Moon (UL)	08-15-39	42°42'.5

What is our December 20 0606-0816 R. fix?

Problem 14-3

From our running fix at 0606-0816 December 20, at 40°20'S, 114°06'E, we maintain our 090° course, at 14.0 knots, with I.C. still -3'.0 and height of eye 10 feet. We plan for P.M. twilight.

	LMT	GMT
Sunset	1929	1148
Civil twilight	2002	1221
Nautical twilight	2044	1303

The LHA Υ at 2002 LMT is 30°. Our plan is:

MAG.	BODY	ALT.	AZ.
-	Moon	35°	312° X
-1.6	Sirius	25°	091°
-0.9	Canopus	44°	129°
0.3	Rigel	36°	067°
1.1	Aldebaran	23°	041°
1.3	Fomalhaut	52°	271° X
2.1	Peacock	36°	222° X
2.2	Hamal	27°	002°

There are a number of azimuth duplications in this list: the moon and Canopus; Saturn (which we didn't bother to list), Fomalhaut, and Sirius; Peacock and Aldebaran.

We get the following sights:

BODY	GMT	Hs
Sirius	12-15-42	23°51'.6
Canopus	12-17-21	44°04'.1
Rigel	12-18-59	35°55'.1
Aldebaran	12-20-39	22°41'.5
Hamal	12-22-03	26°25'.3

What is our December 20 1222 fix?

Chapter 15

New York to Lisbon

Problem 15-1

The passenger airship has been revived, as a leisurely but reasonably fast means of ocean travel, and we are navigating to Portugal in one. It is early in the morning of May 15, 1993, and our last DR position was 40°15'N, 59°10'W, at 0700 today. Our course is 095°, speed 75 knots. The airship has an observation platform set into a small depression on top, and we hope to get a round of A.M. twilight sights from there, using an ordinary marine sextant (I.C. -2'.0), since we don't have a bubble sextant available. From higher altitudes, the horizon is often obscured by haze, so we will descend to 1000 feet for the sights. The *Nautical Almanac* "Explanations" section gives the formula for height-of-eye corrections as $0.97 \sqrt{H.E.}$ (in feet). We find the twilight times as usual:

	LMT	GMT
Nautical twilight	0337	0727
Civil twilight	0415	0805
Sunrise	0446	0836

The LHA γ at 0415 LMT is 297°. Our sighting plan is:

MAG.	BODY	ALT.	AZ.
2.5	Enif	50°	132° X
2.2	Alpheratz	37°	080°
2.2	Kochab	42°	339°
2.1	Rasalhague	50°	236°
1.9	Alkaid	29°	312°
0.9	Altair	59°	179°
0.9	Saturn	28°	140°
0.2	Arcturus	17°	281°
-4.5	Venus	15°	096° X
-	Moon	30°	122°

We note that Enif has nearly the same azimuth as the reciprocal of Alkaid, and ditto for Venus and Arcturus. We'd like to get Alpheratz, Kochab, Rasalhague, Alkaid, Altair, and Arcturus.

But at twilight we find that observation conditions are far from optimum. We do see the brightest bodies, however, and shoot the following:

BODY	GMT	Hs
Altair	08-15-32	59°05'.9
Saturn	08-17-19	29°45'.3
Venus	08-19-02	18°07'.4
Moon (LL)	08-21-05	32°45'.7

What is our May 15 0821 fix?

Problem 15-2

From our May 15, 1993, 0821 fix, at $40^{\circ}16'N$, $57^{\circ}08'W$, we continue on course 095° at 75 knots. Our I.C. is still -2'.0, and for the next group of sights we will drop to 800 feet. We make plans for a sun-moon fix.

When the bodies have moved into position, we get the following sights:

BODY	GMT	Hs
Moon (UL)	11-17-31	$49^{\circ}06'.9$
Moon (UL)	11-19-08	$49^{\circ}02'.5$
Moon (UL)	11-20-45	$49^{\circ}00'.3$
Sun	11-24-03	$34^{\circ}45'.5$
Sun	11-25-38	$35^{\circ}04'.9$
Sun	11-27-22	$35^{\circ}28'.3$

What is our May 15 1127 fix?

Problem 15-3

We expect to over-fly the Azores during the night. From our May 15, 1993, 1127 fix, at $40^{\circ}09'N$, $52^{\circ}13'W$, we change course to 092° , maintaining 75 knots, and for our P.M. twilight sights we will fly at 1500 feet. Our I.C. is still -2'.0.

	LMT	GMT
Sunset	1906	2126
Civil twilight	1937	2157
Nautical twilight	2015	2235

The LHA γ at 1937 LMT is 168° . Our plan is:

MAG.	BODY	ALT.	AZ.
-2.3	Jupiter	47°	155°
0.2	Capella	28°	308°
0.2	Arcturus	46°	104°
0.5	Procyon	31°	249°
1.2	Pollux	46°	271°
1.2	Spica	30°	142°
1.3	Regulus	59°	211°
2.1	Polaris	40°	359°
2.2	Kochab	48°	019°

The weather is fair at sighting time, and we get six clear sights:

BODY	GMT	Hs
Capella	21-56-40	28°26'.4
Arcturus	21-58-16	47°15'.8
Procyon	21-59-57	30°23'.5
Spica	22-01-32	31°52'.5
Regulus	22-03-12	58°03'.0
Polaris	22-05-01	40°18'.2

What is our May 15 2205 fix?



Chapter 16

Oporto to Dover

Problem 16-1

We are sailing from Portugal to Delaware, early in the morning of July 8, 1993. After a week of overcast weather, a cold front has passed, shaking up the boat a little, but leaving us with clear skies. We are moving nicely at 7.0 knots on course 270°. Our DR is doubtful, but somewhere near 40°N, 40°W, at 0700. Our sextant I.C. is -1'.0, and height of eye 9 feet. We prepare for A.M. twilight.

	LMT	GMT
Nautical twilight	0325	0605
Civil twilight	0406	0646
Sunrise	0438	0718

The LHA Υ at 0406 LMT is 348°. Our plan is:

MAG.	BODY	ALT.	AZ.
2.2	Kochab	30°	345°
2.2	Diphda	28°	155°
1.3	Fomalhaut	20°	183°
1.1	Aldebaran	17°	083°
0.9	Altair	36°	249°
0.2	Capella	27°	051°
0.1	Vega	38°	292°
-4.1	Venus	24°	086° X
-	Moon	44°	197°

We note that Saturn will be visible just below the moon. If we shoot enough of the other bodies, we won't bother with Venus, whose azimuth is close to Aldebaran's.

The air is clear and cool as twilight approaches, and we get some good sights:

BODY	GMT	Hs
Kochab	06-40-13	30°47'.1
Fomalhaut	06-41-52	20°02'.5
Aldebaran	06-43-39	16°29'.4
Altair	06-45-15	36°10'.4
Capella	06-47-00	26°58'.8
Vega	06-48-50	38°29'.6

What is our July 8 0649 fix?

Problem 16-2

From our July 8, 1993, 0649 fix, at $40^{\circ}25'N$, $40^{\circ}31'W$, we continue on course 270° at 7.0 knots. Our I.C. is still $-1'.0$, and height of eye 9 feet. We mark the star-finder base with the current positions of the sun, moon, and Venus, and check to see whether we can get a daylight shot of Venus (if the sky stays clear) and at least one other body.

For a better cut of LOPs, we decide to get our moon sights at about 1000, then wait an hour and a quarter for the sun and Venus to move to better azimuths. The sky is clear, and we are lucky to spot Venus.

BODY	GMT	Hs
Moon (UL)	10-05-45	$19^{\circ}23'.0$
Moon (UL)	10-07-30	$19^{\circ}06'.8$
Venus	11-14-38	$66^{\circ}56'.4$
Venus	11-17-03	$67^{\circ}02'.9$
Sun	11-20-05	$42^{\circ}27'.5$
Sun	11-21-48	$42^{\circ}50'.0$

What is our July 8 1008-1122 R. fix?

Problem 16-3

From our July 8, 1993, 1008-1122 R. fix, at $40^{\circ}23'N$, $41^{\circ}06'W$, we continue on course 270° at 7.0 knots. Our height of eye is still 9 feet. We have not checked the sextant I.C. recently, since we found it to be $-1'.0$. We plan for P.M. twilight.

	LMT	GMT
Sunset	1932	2223
Civil twilight	2006	2257
Nautical twilight	2047	2338

The LHA γ at 2006 LMT is 228° . Our plan is:

MAG.	BODY	ALT.	AZ.
-2.0	Jupiter	34°	232° X
0.9	Altair	21°	096°
1.2	Spica	33°	212°
1.2	Antares	21°	162°
1.3	Deneb	32°	055°
1.6	Mars	23°	262° X
2.0	Dubhe	47°	322°
2.1	Polaris	40°	000°
2.1	Rasalhague	48°	121°
2.2	Denebola	39°	255°

Azimuth duplicates are Jupiter-Deneb (reciprocal) and Mars-Denebola. The sky is clear at twilight, and we get the following sights:

BODY	GMT	Hs
Altair	23-01-04	22°22'.5
Spica	23-02-41	32°01'.9
Antares	23-04-19	21°26'.5
Deneb	23-05-55	33°46'.5
Dubhe	23-07-45	45°57'.5
Polaris	23-09-20	39°27'.7

What is our 2309 fix?



Chapter 17

The Great Australian Bight

Problem 17-1

We've just been through a terrible storm. Our boat sank, but all six of our crew made it into the life raft, with fresh water, one bottle of champagne, and a carton of sardines. The EPIRB emergency transmitter was lost, but the good sextant was saved, with two of the navigational watches, a copy of H.O. 211, the *Nautical Almanac*, one chart, and pencils and paper. There is no privacy in our eight-person raft, and we are crammed in with the equipment we salvaged. We have seen jet trails, but no search aircraft. After three days, we have five gallons of water left, 30 small tins of sardines, and the champagne.

Today, the seas are down to five or six feet, and no one is seasick. It is 0700 December 18, 1993. We think we are close to 40°S, 138°E, and we hope to get a sun-moon fix this afternoon. Our height of eye will be 3 feet, and our sextant I.C. is -3'.5. The wind is moderate, and we have rigged a sail. With the eastward-setting current, we estimate our course and speed over the bottom at 095°/3.0 knots.

We take some moon shots, then wait an hour, for a better cut, before shooting the sun.

BODY	GMT	Hs
Moon (UL)	07-03-15	57°39'.9
Moon (UL)	07-05-01	57°39'.2
Moon (UL)	07-06-42	57°38'.2
Sun	08-15-03	19°52'.3
Sun	08-16-40	19°30'.2
Sun	08-18-05	19°15'.4

What is our December 18 0707-0818 R. fix?

Problem 17-2

After our December 18, 1993, 0707-0818 R. fix, at 39°38'S, 138°13'E, the wind shifts to NE, and picks up to 20 knots, so we hastily drop the sail and rig a sea anchor. We estimate the current here at 105°/1.0 knots. The raft is reasonably steady now, and we make plans for P.M. twilight sights after our evening rations of one sardine and a sip of water each. The I.C. is -3'.5, and height of eye 3 feet.

	LMT	GMT
Sunset	1927	1014
Civil twilight	2000	1047
Nautical twilight	2040	1127

The LHA γ at 2000 LMT is 27°. Our plan is:

MAG.	BODY	ALT.	AZ.
-	Moon	29°	286°
-1.6	Sirius	22°	094° X
-0.9	Canopus	43°	130°
0.3	Rigel	34°	070°
1.1	Aldebaran	21°	043°
1.3	Fomalhaut	54°	273°
2.1	Peacock	37°	223° X
2.2	Alpheratz	17°	337°
2.2	Hamal	26°	005°

We note the azimuth duplications: Saturn (which we didn't list)-Sirius-Fomalhaut, and Aldebaran-Peacock.

We get the following:

BODY	GMT	Hs
Canopus	10-53-16	43°30'.7
Rigel	10-54-51	35°57'.2
Aldebaran	10-56-40	23°03'.1
Fomalhaut	10-58-31	51°40'.7
Alpheratz	11-00-12	16°27'.3
Hamal	11-01-47	27°02'.6

What is our December 18 1102 fix?

Problem 17-3

From our December 18, 1993, 1102 fix, at 39°40'S, 138°16'E, we estimate our course and speed over the bottom to be 110°/1.4 knots. Height of eye is still 3 feet, I.C. -3'.5 The waves are higher, and our motion is worse, but we will plan for a round of A.M. twilight sights.

	LMT	GMT
Nautical twilight	0313 (12/19)	1759 (12/18)
Civil twilight	0355 (12/19)	1841 (12/18)
Sunrise	0427 (12/19)	1913 (12/18)

The LHA γ at 0355 (12/19) LMT is 146°. Our plan is:

MAG.	BODY	ALT.	AZ.
1.3	Regulus	38°	007°
1.2	Spica	34°	075°
1.1	Acrux	57°	147°
0.5	Procyon	36°	320°
0.5	Betelgeuse	19°	298°
0.3	Rigel	22°	278°
-0.9	Canopus	54°	232°
-1.8	Jupiter	24°	087°

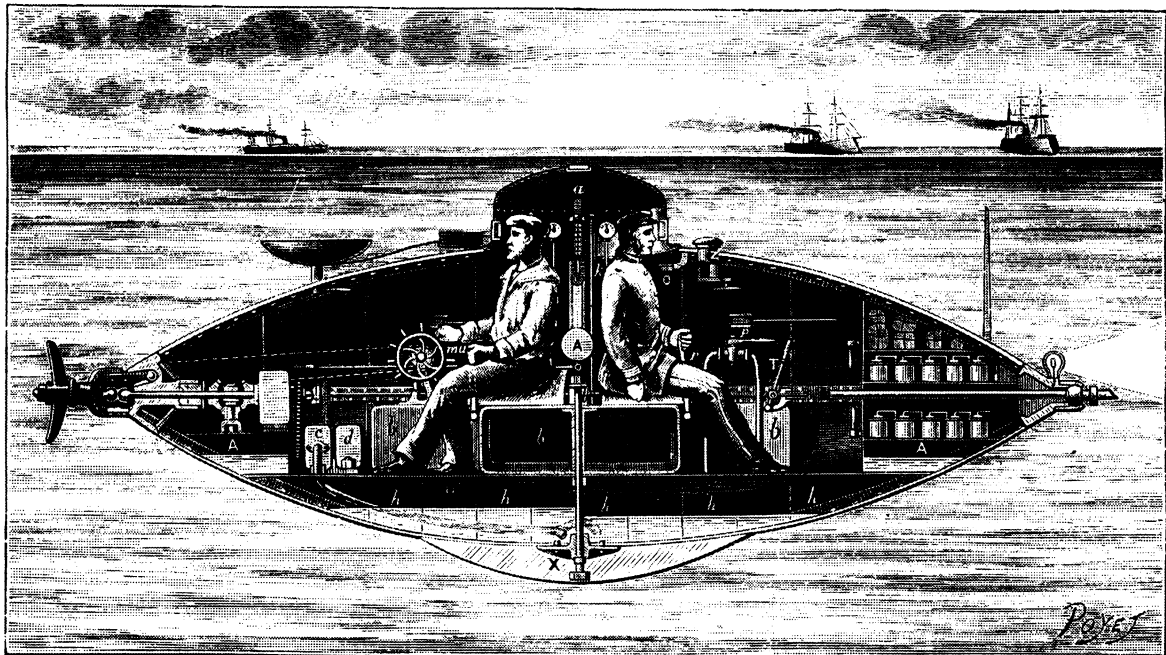
At twilight, the raft is no steadier, and we can't spot any of the first four stars on the list. But we manage to shoot Betelgeuse, then the other bright bodies.

BODY	GMT	Hs
Betelgeuse	18-50-31	17°36'.4
Rigel	18-52-00	20°23'.0
Canopus	18-54-12	51°50'.9
Jupiter	18-56-35	27°04'.1
Jupiter	18-58-15	27°23'.8

What is our December 18 1858 fix?

We note that we have been running along the coast, about 120 miles off, and are close to Mount Gambier. If the wind shifts back to W, or to S, we will hoist the sail and try to get closer to the mainland. If we get into the Bass Strait, we will have our choice of trying for the mainland or for Tasmania.

As we are planning our morning sights, a low-flying airplane is heard, and we try to flash it with our signaling mirrors. They see us, and make a low pass, wagglng their wings. They come back and drop a package, and we vote to drink the champagne and eat some of the rations from the drop (no sardines) for lunch.



Chapter 18

Tortoli to Naples

Problem 18-1

We are sailing from Sardinia to the Italian mainland early in the morning of September 11, 1993, on a course of 070° at 4.5 knots. Our DR position was $40^\circ 05'N$, $10^\circ 20'E$, at 0400. Our sextant I.C. is $+1'.0$, and height of eye 10 feet. We plan for A.M. twilight.

	LMT	GMT
Nautical twilight	0437	0355
Civil twilight	0510	0428
Sunrise	0537	0455

The LHA γ at 0510 LMT is 68° . Our plan is:

MAG.	BODY	ALT.	AZ.
2.5	Schedar	49°	314°
2.2	Hamal	55°	253°
2.1	Polaris	41°	000°
2.0	Dubhe	31°	033°
1.2	Pollux	49°	092°
0.5	Procyon	36°	117°
0.3	Rigel	41°	166°
-1.6	Sirius	25°	145°
-4.0	Venus	24°	$088^\circ X$
-	Moon	54°	$114^\circ X$

Our sights are:

BODY	GMT	Hs
Polaris	04-35-18	$40^\circ 47'.9$
Dubhe	04-37-05	$32^\circ 06'.4$
Pollux	04-38-46	$50^\circ 35'.9$
Procyon	04-40-12	$37^\circ 21'.0$
Rigel	04-41-55	$41^\circ 16'.6$
Sirius	04-43-47	$26^\circ 53'.8$

What is our September 11 0444 fix?

Problem 18-2

From our September 11, 1993, 0444 fix, at $40^\circ 06'N$, $10^\circ 24'E$, we continue on $070^\circ/4.5$ knots, with I.C. $+1'.0$, and height of eye 10 feet. Conditions are a little rough, but we decide to try a sun-moon fix this morning. The results are:

BODY	GMT	Hs
Moon (UL)	08-55-13	56°51'.8
Moon (UL)	08-57-04	56°29'.6
Moon (UL)	08-58-48	56°14'.5
Sun	09-01-05	43°21'.1
Sun	09-02-47	43°34'.2
Sun	09-04-22	43°43'.2

What is our September 11 0904 fix?

Problem 18-3

Since our September 11, 1993, 0904 fix, at 40°11'N, 10°48'E, we continue on 070°/4.5 knots, with I.C. +1'.0, and height of eye 10 feet. We prepare for P.M. twilight, hoping the sea will be calmer by then.

	LMT	GMT
Sunset	1816	1730
Civil twilight	1843	1757
Nautical twilight	1915	1829

The LHA γ at 1843 LMT is 272°. Our plan is:

MAG.	BODY	ALT.	AZ.
0.2	Arcturus	36°	265°
0.4	Saturn	14°	124° X
0.9	Altair	51°	137°
1.2	Antares	20°	204°
1.9	Alkaid	44°	305°
2.1	Polaris	40°	000°
2.1	Nunki	23°	169°
2.2	Alpheratz	18°	067°
2.2	Kochab	49°	342°

We may skip Saturn, because its azimuth is close to the reciprocal of Alkaid's.

But at sighting time, the sky and horizon are so clear that we decide to shoot everything we can, for the practice. In fact, we get every body in the plan:

BODY	GMT	Hs
Arcturus	17-52-03	37°42'.6
Saturn	17-53-42	13°41'.3
Altair	17-55-13	50°42'.8
Antares	17-56-57	19°36'.8
Alkaid	17-58-39	44°28'.2
Polaris	18-01-03	39°59'.3
Nunki	18-02-47	22°42'.0
Alpheratz	18-04-25	19°23'.1
Kochab	18-06-12	18°57'.1

What is our September 11 1806 fix?

Chapter 19

Capetown to Gough Island

Problem 19-1

We are sailing from South Africa to the tiny island of Gough (Diego Alvarez) in the Tristan da Cunha Group, late in the afternoon of December 18, 1993. Our course is 250° , speed 7.2 knots, sextant I.C. $-2'.1$, and height of eye 8 feet. Our 1900 DR position is $39^\circ 35'S$, $7^\circ 39'W$. A good fix is important as we approach the island. Its height is shown as 2986 feet, so it should be visible from 65 miles away in clear weather, but we want to be prepared in case the visibility is poor. We prepare for P.M. twilight.

	LMT	GMT
Sunset	1927	1959
Civil twilight	2000	2032
Nautical twilight	2040	2112

The LHA γ at 2000 LMT is 27° . Our plan is:

MAG.	BODY	ALT.	AZ.
-	Moon	30°	291°
-1.6	Sirius	23°	$093^\circ X$
-0.9	Canopus	43°	130°
0.3	Rigel	34°	070°
1.1	Aldebaran	21°	043°
1.3	Fomalhaut	54°	273°
2.1	Peacock	37°	$223^\circ X$
2.2	Hamal	26°	005°
2.2	Alpheratz	17°	337°

This gives us more bodies than we need, and Sirius-Fomalhaut and Aldebaran-Peacock are azimuth duplicates (their reciprocals). We'd like to get Canopus, Rigel, Aldebaran, Fomalhaut, Hamal, and Alpheratz.

But the sky is hazy at twilight time, and we shoot only the three brightest bodies:

BODY	GMT	Hs
Moon (LL)	20-27-03	$30^\circ 42'.5$
Moon (LL)	20-28-41	$30^\circ 25'.6$
Sirius	20-30-22	$22^\circ 50'.9$
Sirius	20-32-04	$23^\circ 11'.4$
Canopus	20-33-48	$43^\circ 06'.7$
Canopus	20-35-33	$43^\circ 25'.1$

What is our December 18 2036 fix?

Problem 19-2

From our December 18, 1993, 2036 fix, at $39^{\circ}34'S$, $7^{\circ}51'W$, we continue on $250^{\circ}/7.2$ knots, with I.C. still $-2'.1$, and height of eye 8 feet. We'd like to get a sun-moon fix after the moon rises, but we're concerned that the visibility will be worse by then. We decide to get some sun sights now—possibly to use for a running fix.

BODY	GMT	Hs
Sun	06-58-12	$19^{\circ}00'.3$
Sun	06-59-48	$19^{\circ}20'.4$
Sun	07-02-01	$19^{\circ}45'.7$
Sun	07-03-44	$19^{\circ}57'.7$
Sun	07-05-20	$20^{\circ}19'.9$

These sights were not great, but we did the best we could, with a sky already hazy and an indistinct horizon.

We plot the sights, and are pleased to find that they are reasonably close to our DR position (we are heading for a point several miles north of Gough)—but we want to give ourselves a better chance. We draw a line on the chart from Gough (at $40^{\circ}19'S$, $9^{\circ}55'W$) roughly northward, parallel to the 07-05-20 sun LOP.

At 0745, after we finish working and plotting the sights, we turn to 284° (to get more distance to the north, in case we are farther south than our DR shows us to be), and we make 7.0 knots on this heading. When we intersect the line we drew from Gough parallel to the sun LOP, we turn onto that line—that is, to 194° —and expect to make 6.0 knots on the new heading.

When do we turn to 194° , and what time do we expect to arrive at Gough?



Appendix A
Answers to Problems

Appendix A

Answers to Problems

- 1-1 Our 0744 fix is 40°14'N, 49°58'W, with good reliability.
- 1-2 Our 1229 fix is 40°13'N, 49°19'W. The LOPs have more spread than we would like, but we rate the reliability as good.
- 1-3 Our 1222-1528 R. fix is 40°10'N, 48°58'W. This is a poor fix, because of the excessive spread in the LOPs. In fact, there was little point in getting it, in such bad conditions, because we had a good sun-moon fix 3 hours ago.
- 1-4 Our 2252 fix is 40°09'N, 48°02'W. Three of the LOPs form a good (if not perfect) triangle, and the other is borderline. But we will use the fix, since it's all we will have until morning twilight—or later, if the visibility doesn't improve.
- 1-5 Our 0727 fix is 40°09'N, 46°46'W. This is a good fix. We will use it to update our DR.
- 1-6 Our 1225 fix is 40°09'N, 46°04'W. This is a good fix. Only the first moon sight was far from the central point.
- 1-7 Our noonsight-determined position is 40°08'N, 45°42'W. The latitude is very reliable, but the longitude is not. The top of our curve was easily determined, but we could have drawn it slightly to the left or right, and it would have seemed to match the points just as well. Crew member C was right—it would have been better to get a running fix on the sun, with sights before and after local apparent noon.
- 1-8 No. 1's 2243 fix is 40°07'N, 44°37'W. No. 2's 2240 fix is 40°10'N, 44°38'W. No. 2's fix was good; No. 1's was excellent, because of its tight grouping of LOPs.
- 1-9 Our 0728 fix is 40°08'N, 43°24'W. This is a dubious fix, because all of the LOPs are within 43° of azimuth. But it's close to our DR, and we decide to use it.
- 1-10 Our 1238 fix is 40°07'N, 42°41'W. This is an excellent fix—the best we've had on this cruise.
- 1-11 Our latitude at LAN is 40°07'N. We consider it very reliable. It was true that we worked the noonsight without knowing the exact time (using the formula $L = 90^\circ - Ho + d$). We needed only the approximate time to look up the sun's declination. But it would have been better to record the times, so we could plot Hs against GMT, draw a curve, and pick the highest point. (Also, the time is needed to plot the resulting LOP.) Still better would have been to get a running fix, with sun sights before, at, and after LAN—or in the actual situation to get a sun-moon fix while the sun was still visible.

- 1-12 Our 2238 fix is $40^{\circ}14'N$, $41^{\circ}47'W$. We consider it very reliable. The Regulus LOP is a little off, but the others form a tight pattern, and are well spaced in azimuth.
- 2-1 Our 0541 fix is $40^{\circ}35'S$, $178^{\circ}18'E$. It appears reliable, but it would have been better to get the sun-moon fix a few hours earlier, when the crossing angle would have been closer to 90° .
- 2-2 Our 0810 fix is $40^{\circ}30'S$, $178^{\circ}41'E$. The pattern of LOPs is reasonably tight, and the fix appears reliable.
- 2-3 Our 1552 fix is $40^{\circ}10'S$, $179^{\circ}53'E$. We consider it very reliable. It is close to our DR position, and the LOPs make a tight pattern.
- 2-4 Our 2208-0033 running fix is $39^{\circ}48'S$, $178^{\circ}49'W$. It looks like an excellent fix.
- 2-5 Our 0222 fix is $39^{\circ}44'S$, $178^{\circ}31'W$. This is a good fix, showing moderate, apparently random, sighting errors.
- 2-6 Our 0752 fix is $39^{\circ}46'S$, $177^{\circ}45'W$. It's a good fix, considering the poor sighting conditions.
- 2-7 Our 1549 fix is $39^{\circ}38'S$, $176^{\circ}27'W$. This is a very good result, with all of the LOPs falling within a couple of miles of the fix point.
- 2-8 Our 0122 fix is $39^{\circ}44'S$, $175^{\circ}01'W$, and looks very reliable—but we were lucky. It would have been better to get four sights of each body.
- 2-9 Something is obviously wrong with the Rigel sight. We found the star at about the predicted azimuth, but at a much lower altitude. When we check the star finder, we can see that we have shot Betelgeuse—not Rigel. We make this correction, and get a good plot. Our 0749 fix is $39^{\circ}53'S$, $174^{\circ}28'W$.
- 2-10 Our 1542 fix is $40^{\circ}02'S$, $173^{\circ}41'W$. This fix is only fair. The spread could be better, and we'd like at least one body near 000° or 180° azimuth. But it's all we have—and not too far from our DR position—so we decide to use it.
- 3-1 The unknown body was not Pollux, but Procyon. Our 0602 fix is $40^{\circ}31'N$, $153^{\circ}08'W$. We consider it good, because of the closely grouped LOPs and compatibility with the DR position.
- 3-2 Our 1440 fix is $40^{\circ}01'N$, $153^{\circ}09'W$. It appears reliable.
- 3-3 Our 2010 fix is $39^{\circ}42'N$, $153^{\circ}11'W$. This looks like a good fix.
- 4-1 Our 0800 fix is $40^{\circ}11'N$, $50^{\circ}31'W$. The LOP intercepts were long, because we were so far from our DR position—at least we hope that's the reason. This fix is only fair, as we had suspected, considering the poor sighting conditions. We will get another fix as soon as possible.
- 4-2 Our 1407 sun-Venus fix is $40^{\circ}10'N$, $49^{\circ}27'W$ —an excellent fix, confirming this morning's twilight fix.
- 4-3 Our 2319 fix is $40^{\circ}08'N$, $47^{\circ}50'W$. At first glance, this looks almost useless, because of the poor cut of the LOPs, but we see that the first three sights form a very small triangle, and the Arcturus and Vega lines cross at 45° . The second Jupiter sight helps to confirm the others. This is a usable fix.
- 4-4 Our 0722 fix is $40^{\circ}04'N$, $46^{\circ}36'W$. The grouping is fairly good, and we consider the fix reliable.
- 4-5 Our 0952 fix is $40^{\circ}03'N$, $46^{\circ}12'W$. The fix looks reliable. Although we could have used a simple two-body fix, the sun LOPs give us some additional assurance.

- 4-6 Our 2304 fix is 39°59'N, 44°12'W. We were lucky to have shot so many sights. Eight of them look good, but the Spica and Deneb LOPs are too far from the center, so we delete these and rely on the others.
- 4-7 Our 0719 fix is 40°00'N, 42°58'W. The azimuth distribution is poor, and the Saturn and moon azimuths are the same, but the grouping of the LOPs is good, and the fix is usable.
- 4-8 Our 1413-1705 R. fix is 39°59'N, 41°27'W. It appears reliable.
- 4-9 Our 2249 fix is 39°54'N, 40°36'W. It appears reliable.
- 5-1 Our 0524 fix, at 40°18'S, 157°26'E, looks like a very good one.
- 5-2 Our 0950 fix is 40°17'S, 158°06'E. It appears reliable.
- 5-3 Our 1729 fix is 40°17'S, 159°17'E. Except for Spica, the LOPs make a tight pattern. But it might be the Canopus sight that's off, so we don't exclude the Spica LOP.
- 5-4 Our 0308-0518 R. fix is 40°16'S, 161°06'E. Except for the first sun sight, the LOPs are reasonably close together. This looks like a good fix.
- 5-5 Our 0927 fix is 40°17'S, 161°43'E. The azimuth coverage is not good, but, except for Canopus, each pair of LOPs is very close. The fix is mediocre, but usable.
- 6-1 Four of the LOPs meet in a point, and one is close—but there is something wrong with Mars: its altitude is about 5° off our predicted altitude. We recheck the computations and find nothing wrong. Then we notice, in the plan, that Regulus is close to Mars in altitude and azimuth. We rework the sight as Regulus, and it comes out right. Our 0640 fix is 39°31'N, 157°16'W. It looks reliable.
- 6-2 Our 1443 fix is 39°35'N, 158°16'W. The LOPs are grouped well, not too far from the fix point.
- 6-3 Our 2113 fix is 39°38'N, 159°04'W—apparently a good fix.
- 6-4 Our 0649 fix is 39°42'N, 160°18'W. The LOPs all look good, except for Spica's, which is slightly off.
- 6-5 Our 1521 fix is 39°46'N, 161°20'W. It appears reliable, in spite of the poor sighting conditions.
- 6-6 Our 0033 fix is 39°51'N, 162°31'W. It looks like a very good fix.
- 6-7 Our 0702 fix, 39°56'N, 163°22'W, looks very good. All eight LOPs are within 2 miles of the fix point.
- 6-8 Our 1519 fix is 40°01'N, 164°26'W. The Diphda LOP is slightly off, but the others look excellent.
- 6-9 Our 1905 fix is 40°02'N, 164°54'W. It appears reliable.
- 7-1 Our 0850 fix is 40°26'N, 162°34'E. The Capella LOP is a little off, but the others are nicely grouped. It looks like a good fix.
- 7-2 Our sights were good, in spite of the poor visibility, but the LOPs cross at such a small angle that the fix is of little value. The 1748 fix (for what it's worth) is 39°55'N, 162°45'E. We need to replace this with a more reliable fix as soon as possible.
- 7-3 Our 2113 fix is 39°48'N, 162°51'E. The first sun sight is slightly off, but the fix looks good.

- 8-1 Our 1937 fix is $39^{\circ}41'N$, $1^{\circ}12'E$. This looks like an excellent fix.
- 8-2 Our 0404 fix is $40^{\circ}10'N$, $2^{\circ}09'E$. The Kochab LOP is slightly off, but it looks like a very good fix.
- 8-3 Our 0924 fix is $40^{\circ}27'N$, $2^{\circ}43'E$. It appears to be very reliable. The compass deviation on this heading is $6^{\circ}E$.
- 9-1 Our 0416 fix is $39^{\circ}52'N$, $135^{\circ}15'E$. It looks reliable.
- 9-2 Something looks wrong with the Antares sight, even after double-checking. It seemed to be at the right altitude and azimuth when we shot it; the only clue to something odd is that it looked too dim for 1.2 magnitude. We suspect a misidentification—and when we check the list of stars for 1993, in the back of the almanac, we find a 2.9-magnitude star, Tau Scorpii, close to Antares, with SHA $111^{\circ}07'.2$ and declination $S28^{\circ}12'.2$. We work the sight with these figures, and get a reasonable LOP. The 1105 fix, at $39^{\circ}50'N$, $136^{\circ}30'E$, now looks excellent.
- 9-3 From an A.P. of $40^{\circ}N$, $137^{\circ}53'E$, we get an intercept of 1.0 away from 060° . We need to be careful about algebraic signs here; note that, for example, if the Hc is $-2'.1$ and the Ho is $-2'.0$, the Ho is *greater*, and the intercept is *toward*. Although this sight is close to the DR, and considered reliable, such sights are not always reliable, because of uncertain refraction at low altitudes.
- 9-4 Combining our morning sun sights with the sunrise sight, we get a 1929 (7/6)-0210 (7/7) running fix at $39^{\circ}48'N$, $139^{\circ}14'E$. This fix appears reliable.
- 9-5 Our 1101 fix is $39^{\circ}49'N$, $139^{\circ}54'E$. It looks good, in spite of the poor sighting conditions.
- 10-1 Our 1354 fix is $40^{\circ}23'N$, $5^{\circ}17'E$. It looks good.
- 10-2 Our 1655 fix, at $40^{\circ}14'N$, $5^{\circ}35'E$, looks very good.
- 10-3 Our 0633 fix, at $39^{\circ}31'N$, $6^{\circ}55'E$, looks very good.
- 11-1 Our 0438 fix is $39^{\circ}37'N$, $134^{\circ}26'W$. It looks like an excellent fix.
- 11-2 Our 1318 fix is $40^{\circ}05'N$, $133^{\circ}52'W$. Except for the second moon shot, the LOPs are tightly grouped. The angle of cut, 46° , is at about the limit for a reliable fix, but we consider this one usable.
- 11-3 Our 1954 fix is $40^{\circ}25'N$, $133^{\circ}25'W$, and it looks like a very good one.
- 11-4 The quick solution to our new course is $72\frac{1}{2}^{\circ}$ from the storm's course (on the opposite side), or $152\frac{1}{2}^{\circ}$. The complete maneuvering-board solution confirms this, and also gives the CPA as 133 miles, at 2332 May 13. (See Appendix B.)
- 11-5 Our 0440 fix is $39^{\circ}40'N$, $132^{\circ}48'W$. At least one of the Jupiter LOPs is off (and possibly the star sights), but the fix looks fairly good, considering the difficult sighting conditions.
- 11-6 Our 1306 fix is $39^{\circ}49'N$, $131^{\circ}47'W$. It looks like an excellent fix.
- 12-1 Our 0759 fix is $39^{\circ}36'S$, $30^{\circ}55'W$. It looks very good.
- 12-2 Our 1124 fix is $39^{\circ}38'S$, $31^{\circ}23'W$. The last sun sight is a little off; otherwise, it looks like a very good fix.
- 12-3 Something is wrong with the Spica LOP. It's possible that we misread the sextant scale as $35'.4$, instead of $25'.4$. We delete this LOP and plot the others to get what looks like a good 2036 fix at $39^{\circ}45'S$, $32^{\circ}34'W$.

- 12-4 We note the times for the Suhail and Aldebaran sights, and take the time halfway between (08-06-54) for the Diphda sight. We could hardly be more than a few seconds off, because we were shooting as fast as we could, and the time between Suhail and Aldebaran was only 3 minutes 21 seconds. Now our 0814 fix is $39^{\circ}56'S$, $33^{\circ}56'W$, and it looks like a good one.
- 12-5 Our 1025 fix, $39^{\circ}58'S$, $34^{\circ}09'W$, looks very good.
- 12-6 Our 2048 fix is $40^{\circ}13'S$, $35^{\circ}24'W$. It appears reliable.
- 12-7 Our 0813 fix is $40^{\circ}16'S$, $36^{\circ}51'W$. It shows that our speed indicator registered too high, as we had suspected.
- 12-8 Our 1314 fix is $40^{\circ}20'S$, $37^{\circ}26'W$. It seems to be a very good fix, though suspiciously far from our DR position after a run of only 3 hours.
- 12-9 Something is wrong with our Jupiter sights. We note that Jupiter, Mars, and Spica are all near 279° azimuth, and very close in altitude. We rework the "Jupiter" sights as Mars sights, and get a good 2102 fix, $40^{\circ}23'S$, $38^{\circ}22'W$.
- 13-1 Our 0701 fix, $39^{\circ}29'N$, $39^{\circ}43'W$, looks good, in spite of the loss of the Capella sight.
- 13-2 Our 1349 fix is $39^{\circ}37'N$, $39^{\circ}14'W$. It appears to be reliable.
- 13-3 Our 2257 fix, at $39^{\circ}46'N$, $38^{\circ}34'W$, looks very good.
- 13-4 Our 0640 fix is $40^{\circ}01'N$, $37^{\circ}37'W$. The Altair LOP is a little off, but the fix looks very good.
- 13-5 Our 1558 fix looks excellent. It is $40^{\circ}19'N$, $36^{\circ}30'W$.
- 13-6 Our 2230 fix is $40^{\circ}30'N$, $35^{\circ}37'W$. All the sights except Altair and Polaris meet almost in a point.
- 14-1 Something is wrong with the Betelgeuse LOP, but when we recheck the computations, we get the same answer. Then we note that the time from the Acrux sight to the Betelgeuse one was 2m 33s, while the time from Betelgeuse to Rigel was only 0m 53s. It isn't possible to read the sextant, record the time and altitude, reset the sextant, and shoot another star in such a short time—so we conclude that we wrote down the GMT for Betelgeuse a minute later than the correct time. We rework the sight using 20-31-52, and get a reasonable LOP. Our 2035 fix is $40^{\circ}30'S$, $110^{\circ}17'E$.
- 14-2 Our 0816 fix is $40^{\circ}20'S$, $114^{\circ}06'E$. It looks reliable.
- 14-3 Our 1222 fix is $40^{\circ}16'S$, $115^{\circ}28'E$. This looks like an excellent fix.
- 15-1 In spite of the poor sighting conditions, our 0821 fix, $40^{\circ}16'N$, $57^{\circ}08'W$, looks good.
- 15-2 Our 1127 fix is $40^{\circ}09'N$, $52^{\circ}13'W$. It looks very good.
- 15-3 The intercepts are long, but our 2205 fix, $40^{\circ}10'N$, $33^{\circ}44'W$, looks like a good one.
- 16-1 Our 0649 fix, at $40^{\circ}25'N$, $40^{\circ}31'W$, looks only fair (Aldebaran is off).
- 16-2 Our 1008-1122 R. fix, at $40^{\circ}23'N$, $41^{\circ}06'W$, looks fair.
- 16-3 Something is wrong with these sights. The LOPs make a circle around an imaginary point, about 10' away. We conclude that our I.C. (which we forgot to check before or after the twilight sights) must be off. We rework the sights, using an I.C. of $+10'.0$, and find that we get a nice 2309 fix, at $40^{\circ}17'N$,

42°35'W. We also need to check the sextant to see if anything is loose or broken.

17-1 Our 0818 fix, at 39°38'S, 138°13'E, looks good.

17-2 Our 1102 fix, at 39°40'S, 138°16'E, is fair (Alpheratz is off).

17-3 Our 1858 fix is 39°46'S, 138°32'E. It's a poor fix (not surprising, considering the rough sea), but usable.

18-1 Our 0444 fix, at 40°06'N, 10°24'E, appears reliable.

18-2 Our 0904 fix is 40°11'N, 10°48'E. The LOPs are not closely grouped, but we consider the fix fairly good, considering the poor conditions we had for sighting.

18-3 At last we have a round of sights for which every LOP passes through nearly the same point. Our 1806 fix is 40°20'N, 11°32'E.

19-1 These LOPs make a poor cut, but our 2036 fix, such as it is, is at 39°34'S, 7°51'W. It looks plausible, compared to our DR position, so we decide to use it.

19-2 We turn to 194° at 1006 (at DR position 39°58'S, 9°48'W). Our ETA Gough is 1346.

Appendix B

Procedures

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Procedures

A.M. Twilight

A navigator should not just go on deck at twilight and start shooting. Proper planning makes star identification easier, and is important for spotting planets. It also speeds up the work at sighting time, so more bodies can be observed.

1. On the right-hand daily page of the almanac, enter the upper half of the table (A.M.) with the expected DR latitude at the time of twilight. (Interpolate for latitude, either by eye or mathematically.) Take out the times of nautical twilight (time to get ready to sight), civil twilight (approximate time of sights), and sunrise (end of sighting period). These times are LMT. Convert each LMT to GMT by adding (if in W longitude) or subtracting (if in E longitude) the time equivalent of the expected DR longitude—found on the first yellow page in the back of the almanac.
2. Find the LHA Υ at the LMT of civil twilight. The easiest way to do this is to enter the first column [labeled 'UT/ (GMT)'] of the left-hand almanac daily page with the LMT of civil twilight, and from the next column (labeled 'Aries/ G.H.A.'), take out the LHA Υ . Add the correction for minutes of LMT, from the yellow pages.
3. Enter H.O. 249 Vol. 1 with the nearest whole degree of latitude and LHA Υ and take out the name, altitude (rounded to the nearest whole degree), and azimuth of each of the seven stars. List them in order of magnitude, from dimmest to brightest—the order in which they will be sighted.
4. Set up the star finder, 2102-D, by marking the positions of the moon and planets on the base, for the day in question. It helps, also, to mark the sun's position, for reference. (The RA, in degrees, equals the GHA Υ minus the GHA of the body. Use the RA and the declination, with the red template, to mark the base.) Then use the LHA Υ found in 2, above, to set the blue template, and read the altitude and azimuth of each available planet, and the moon, and add them to the list made in 3, above. Include Polaris if you need a body at that azimuth. (Approximate altitude equals latitude; azimuth is about 000°.)
5. Now, we have more bodies than we need for a good round of sights. Circle six or seven of the best ones, and put an "X" next to each one whose azimuth is the same as another body's (or its reciprocal). Considerations are: H.O. 249 Vol. 1 stars are preferred; bright bodies are preferred; azimuth duplicates should usually be avoided, as should those objects below about 15° and above about 70°.

P.M. Twilight

Preparations are similar to those for a.m. twilight, except that now we list the LMT and GMT of sunset, civil twilight, and nautical twilight (from the bottom of the right-hand daily page), and we make up our sighting plan listing bodies from brightest to dimmest—the way we will sight them.

Sun-Moon Fix

When the moon is close to first quarter (age 7 days) or last quarter (age 21 days), the navigator should plan for a sun-moon fix in the morning (near last quarter) or afternoon (near first quarter). Mark the positions of the sun and moon on the star-finder base, as was done with the moon and planets for twilight preparations, and rotate the blue template until the bodies are suitably placed in altitude. Read the LHA Υ on the outer scale, and find its LMT from the left-hand daily page of the almanac; add the minutes correction from the yellow pages. Convert this to GMT: $\text{LMT} + \text{W longitude (or - east longitude)} = \text{GMT}$.

Venus in Daylight

A rare navigation feat is to spot and shoot Venus in daylight. It can be done only when Venus is about 30° or more (2 hours) from the sun in GHA. (This is shown graphically on p. 9 of the Nautical Almanac.) Also, the sky must be clear and the boat steady, and the navigator must know where to look. The star-finder, or H.O. 249 Vol. 2 or 3 (or another method), can be used to find the expected altitude and azimuth for the current GMT, latitude, and longitude. Then the sextant (with the telescope in place) is preset to the computed altitude, and the navigator turns to the computed azimuth and looks. It helps to know Venus is there, and to relax one's eyes so they can focus for distance.

The Noonsight

The noonsight is an anachronism—it is not recommended as useful for practical navigation. It's better to get a running fix of the sun, with sights before and after local apparent noon. If you want to do it anyway, as a connection with your pre-chronometer ancestors, or just for the fun of it, here's how:

1. Find the predicted GMT of LAN: The local apparent time (LAT) of local apparent noon (LAN) is 1200 (by definition). Convert the DR longitude to time (first yellow page in the almanac), and add (for W longitude) or subtract (for E longitude). Then add or subtract the equation of time (bottom right of the right-hand daily page): Add it if the sun's meridian passage is after 1200; if before, subtract. The result is the predicted GMT of LAN.
2. Find the predicted altitude (needed in cloudy weather): Solve the proper formula (No. 4, below) for H_p (instead of H_o), using the DR latitude and the sun's declination.
3. Start sighting well before the time of LAN, and continue for eight or ten sights after the sun's altitude has increased to its peak and started to drop. Plot the points on graph paper (GMT on the x axis, H_s on the y axis), draw a smooth curve through them, and select the peak H_s and its GMT (not necessarily one of the actual sights).

4. Find the latitude with the appropriate formula:
 d contrary to L: $L = 90^\circ - Ho - d$
 d same as L, and <L: $L = 90^\circ - Ho + d$
 d same as L, and >L: $L = Ho + d - 90^\circ$
5. Some recklessly inclined navigators go on from there to deducing the longitude (a highly inaccurate procedure). If everything is perfect, the longitude, if W, equals the GHA of the sun at the time of LAN (when its altitude was highest). E longitude equals 360° minus the GHA of the sun at LAN. But everything won't be perfect. Expect a big longitude error if you try this.

The Backsight

The backsight is rarely needed (and can't always be used), but can be handy if a body is visible, but the horizon under it is obscured. It's described in Bowditch and other texts. The way you do it is to turn your back to the sun (or moon, planet, or star) and measure the angle from the opposite horizon up and over to the body.

There are two things to note. First, the result of 180° minus the actual altitude must not exceed the range of your sextant (probably close to 120°). Second, if the sight looks like an upper-limb one, it's lower limb, and vice-versa. A rough diagram should make both of these things clear.

Working the sight is not complicated, but it has some traps. There are two ways to find Ho. The one the author likes better is:

- (a) Apply the normal I.C. and dip corrections to Hs.
- (b) Subtract the result from 180° .
- (c) If it looked like a normal sun or moon LL sight, apply the UL corrections, and vice versa. For a star or planet, apply the normal refraction correction for the actual altitude.

Estimating Speed

Speed can be estimated fairly well by throwing a bio-degradable floating object (like a crumpled paper towel) overboard at the bow, and timing its passage to the stern, using the boat's length for the distance traveled; then converting feet per second to miles per hour. The formula is:

$$\text{Knots} = .592 \times \text{feet traveled} \div \text{seconds}$$

Storm Avoidance

WWV, in Fort Collins, Colorado, broadcasts brief storm warnings for the North Atlantic and the Caribbean, with its time signals, on 2500, 5000, 10000, 15000, and 20000 KHz, at 8, 9, and 10 minutes after each hour, using information obtained at 0500, 1100, 1700, and 2300 GMT. WWVH, in Hawaii, does the same for the North Pacific, at 48, 49, and 50 minutes, using data obtained at 0000, 0600, 1200, and 1800 GMT. Other stations broadcast weather forecasts and storm warnings on various frequencies, in Morse code or plain language.

A vessel that finds itself close to a storm's path has two problems: finding the best avoidance course in a hurry, then calculating the storm's closest approach and the time it will be there.

The first step is simple, if you have trig tables or a scientific calculator, and the second step can be done with a maneuvering board or a diagram. (An ordinary geographic plot can then be used to confirm the results.) Let's use Problem 11-4

as an example. Given: A developing storm is 150 miles, 000° from the boat, moving SW (225°) at 20 knots. The boat can make 6 knots on a heading between ESE and S. Find (a) the boat's best course to avoid the storm; (b) the storm's closest point of approach (CPA), in miles, and the time it will be there.

- (a) The difference between the storm's course and the boat's best course is:

$$C = \arccos (6 \div 20)$$

$$C = 72^\circ.5$$

The best course is $225^\circ - 72^\circ.5 = 152^\circ.5$

- (b) The maneuvering-board solution of the complete problem is:

1. From the boat's position, R, at the center, draw the storm vector, RA, 225°/20.
2. From A, draw a line tangent to the 6-knot circle, on the side opposite the storm—in this case, on the south side. This line is AB extended.
3. From R, draw a line perpendicular to AB extended, locating point B. RB is the boat's vector, measured as 152°/6 knots. (This confirms the result in a, above.)
4. BA is the relative-movement vector, measured as 242°/19.
5. On another plot, locate C, 000°, 150 miles from R.
6. Draw a line CD parallel to BA, and a line RD perpendicular to CD, locating point D. Measure CD:69, the miles of relative movement.
7. Measure RD, 133 miles, locating the closest point of approach.
8. Find the time of the CPA: $69 \div 19 = 3.63$ hours, or 3 hours 38 minutes—that is, at 2332.

The maneuvering-board solution can be confirmed with a geographic plot.

Appendix C
Nautical Almanac Excerpts

A2 ALTITUDE CORRECTION TABLES 10°-90°—SUN, STARS, PLANETS

OCT.—MAR. SUN			APR.—SEPT.			STARS AND PLANETS				DIP			
App. Alt.	Lower Limb	Upper Limb	App. Alt.	Lower Limb	Upper Limb	App. Alt.	Corr ⁿ	App. Alt.	Additional Corr ⁿ	Ht. of Eye	Corr ⁿ	Ht. of Eye	Ht. of Eye
°			°			°				m		ft.	m
9 34	+10.8	-21.5	9 39	+10.6	-21.2	9 56	-5.3		1993	2.4	-2.8	8.0	1.0-1.8
9 45	+10.9	-21.4	9 51	+10.7	-21.1	10 08	-5.2		VENUS	2.6	-2.9	8.6	1.5-2.2
9 56	+11.0	-21.3	10 03	+10.8	-21.0	10 20	-5.1		Jan. 1-Feb. 2	2.8	-3.0	9.2	2.0-2.5
10 08	+11.1	-21.2	10 15	+10.9	-20.9	10 33	-5.0		May 28-July 15	3.0	-3.1	9.8	2.5-2.8
10 21	+11.2	-21.1	10 27	+11.0	-20.8	10 46	-4.9		°	3.2	-3.2	10.5	3.0-3.0
10 34	+11.3	-21.0	10 40	+11.1	-20.7	11 00	-4.8		0 +0.2	3.4	-3.3	11.2	See table
10 47	+11.4	-20.9	10 54	+11.2	-20.6	11 14	-4.7		41 +0.1	3.6	-3.4	11.9	←
11 01	+11.5	-20.8	11 08	+11.3	-20.5	11 29	-4.6		76 +0.1	3.8	-3.4	12.6	
11 15	+11.6	-20.7	11 23	+11.4	-20.4	11 45	-4.5		Feb. 3-Feb. 26	4.0	-3.5	13.3	m
11 30	+11.7	-20.6	11 38	+11.5	-20.3	12 01	-4.4		May 5-May 27	4.3	-3.6	14.1	20-7.9
11 46	+11.8	-20.5	11 54	+11.6	-20.2	12 18	-4.3		°	4.5	-3.7	14.9	22-8.3
12 02	+11.9	-20.4	12 10	+11.7	-20.1	12 35	-4.2		0 +0.3	4.7	-3.8	15.7	24-8.6
12 19	+12.0	-20.3	12 28	+11.8	-20.0	12 54	-4.1		34 +0.2	5.0	-3.9	16.5	26-9.0
12 37	+12.1	-20.2	12 46	+11.9	-19.9	13 13	-4.0		60 +0.1	5.2	-4.0	17.4	28-9.3
12 55	+12.2	-20.1	13 05	+12.0	-19.8	13 33	-3.9		80 +0.1	5.5	-4.1	18.3	
13 14	+12.3	-20.0	13 24	+12.1	-19.7	13 54	-3.8		Feb. 27-Mar. 14	5.8	-4.2	19.1	30-9.6
13 35	+12.4	-19.9	13 45	+12.2	-19.6	14 16	-3.7		Apr. 19-May 4	6.1	-4.3	20.1	32-10.0
13 56	+12.5	-19.8	14 07	+12.3	-19.5	14 40	-3.6		°	6.3	-4.4	21.0	34-10.3
14 18	+12.6	-19.7	14 30	+12.4	-19.4	15 04	-3.5		29 +0.4	6.6	-4.5	22.0	36-10.6
14 42	+12.7	-19.6	14 54	+12.5	-19.3	15 30	-3.4		51 +0.2	6.9	-4.6	22.9	38-10.8
15 06	+12.8	-19.5	15 19	+12.6	-19.2	15 57	-3.3		68 +0.1	7.2	-4.7	23.9	
15 32	+12.9	-19.4	15 46	+12.7	-19.1	16 26	-3.2		83 +0.1	7.5	-4.8	24.9	40-11.1
15 59	+13.0	-19.3	16 14	+12.8	-19.0	16 56	-3.1		°	7.9	-4.9	26.0	42-11.4
16 28	+13.1	-19.2	16 44	+12.9	-18.9	17 28	-3.0		0 +0.5	8.2	-5.0	27.1	44-11.7
16 59	+13.2	-19.1	17 15	+13.0	-18.8	18 02	-2.9		26 +0.4	8.5	-5.1	28.1	46-11.9
17 32	+13.3	-19.0	17 48	+13.1	-18.7	18 38	-2.8		46 +0.3	8.8	-5.2	29.2	48-12.2
18 06	+13.4	-18.9	18 24	+13.2	-18.6	19 17	-2.7		60 +0.2	9.2	-5.3	30.4	ft.
18 42	+13.5	-18.8	19 01	+13.3	-18.5	19 58	-2.6		73 +0.1	9.5	-5.4	31.5	2-1.4
19 21	+13.6	-18.7	19 42	+13.4	-18.4	20 42	-2.5		84 +0.1	9.9	-5.5	32.7	4-1.9
20 03	+13.7	-18.6	20 25	+13.5	-18.3	21 28	-2.4		°	10.3	-5.6	33.9	6-2.4
20 48	+13.8	-18.5	21 11	+13.6	-18.2	22 19	-2.3		0 +0.1	10.6	-5.7	35.1	8-2.7
21 35	+13.9	-18.4	22 00	+13.7	-18.1	23 13	-2.2		60 +0.1	11.0	-5.8	36.3	10-3.1
22 26	+14.0	-18.3	22 54	+13.8	-18.0	24 11	-2.1		MARS	11.4	-5.9	37.6	See table
23 22	+14.1	-18.2	23 51	+13.9	-17.9	25 14	-2.0		Jan. 1-Mar. 7	11.8	-6.0	38.9	←
24 21	+14.2	-18.1	24 53	+14.0	-17.8	26 22	-1.9		°	12.2	-6.1	40.1	ft.
25 26	+14.3	-18.0	26 00	+14.1	-17.7	27 36	-1.8		0 +0.2	12.6	-6.2	41.5	70-8.1
26 36	+14.4	-17.9	27 13	+14.2	-17.6	28 56	-1.7		41 +0.1	13.0	-6.3	42.8	75-8.4
27 52	+14.5	-17.8	28 33	+14.3	-17.5	30 24	-1.6		76 +0.1	13.4	-6.4	44.2	80-8.7
29 15	+14.6	-17.7	30 00	+14.4	-17.4	32 00	-1.5		°	13.8	-6.5	45.5	85-8.9
30 46	+14.7	-17.6	31 35	+14.5	-17.3	33 45	-1.4		0 +0.1	14.2	-6.6	46.9	90-9.2
32 26	+14.8	-17.5	33 20	+14.6	-17.2	35 40	-1.3		60 +0.1	14.7	-6.7	48.4	95-9.5
34 17	+14.9	-17.4	35 17	+14.7	-17.1	37 48	-1.2		°	15.1	-6.8	49.8	
36 20	+15.0	-17.3	37 26	+14.8	-17.0	40 08	-1.1		°	15.5	-6.9	51.3	100-9.7
38 36	+15.1	-17.2	39 50	+14.9	-16.9	42 44	-1.0		°	16.0	-7.0	52.8	105-9.9
41 08	+15.2	-17.1	42 31	+15.0	-16.8	45 36	-0.9		0 +0.2	16.5	-7.1	54.3	110-10.2
43 59	+15.3	-17.0	45 31	+15.1	-16.7	48 47	-0.8		41 +0.1	16.9	-7.2	55.8	115-10.4
47 10	+15.4	-16.9	48 55	+15.2	-16.6	52 18	-0.7		76 +0.1	17.4	-7.3	57.4	120-10.6
50 46	+15.5	-16.8	52 44	+15.3	-16.5	56 11	-0.6		°	17.9	-7.4	58.9	125-10.8
54 49	+15.6	-16.7	57 02	+15.4	-16.4	60 28	-0.5		°	18.4	-7.5	60.5	
59 23	+15.7	-16.6	61 51	+15.5	-16.3	65 08	-0.4		°	18.8	-7.6	62.1	130-11.1
64 30	+15.8	-16.5	67 17	+15.6	-16.2	70 11	-0.3		°	19.3	-7.7	63.8	135-11.3
70 12	+15.9	-16.4	73 16	+15.7	-16.1	75 34	-0.2		°	19.8	-7.8	65.4	140-11.5
76 26	+16.0	-16.3	79 43	+15.8	-16.0	81 13	-0.1		°	20.4	-7.9	67.1	145-11.7
83 05	+16.1	-16.2	86 32	+15.9	-15.9	87 03	0.0		°	20.9	-8.0	68.8	150-11.9
90 00			90 00			90 00			60 +0.1	21.4	-8.1	70.5	155-12.1

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

ALTITUDE CORRECTION TABLES 0°-10°-SUN, STARS, PLANETS A3

App. Alt.	OCT.-MAR. SUN		APR.-SEPT.		STARS PLANETS
	Lower Limb	Upper Limb	Lower Limb	Upper Limb	
0 00	-18.2	-50.5	-18.4	-50.2	-34.5
03	17.5	49.8	17.8	49.6	33.8
06	16.9	49.2	17.1	48.9	33.2
09	16.3	48.6	16.5	48.3	32.6
12	15.7	48.0	15.9	47.7	32.0
15	15.1	47.4	15.3	47.1	31.4
0 18	-14.5	-46.8	-14.8	-46.6	-30.8
21	14.0	46.3	14.2	46.0	30.3
24	13.5	45.8	13.7	45.5	29.8
27	12.9	45.2	13.2	45.0	29.2
30	12.4	44.7	12.7	44.5	28.7
33	11.9	44.2	12.2	44.0	28.2
0 36	-11.5	-43.8	-11.7	-43.5	-27.8
39	11.0	43.3	11.2	43.0	27.3
42	10.5	42.8	10.8	42.6	26.8
45	10.1	42.4	10.3	42.1	26.4
48	9.6	41.9	9.9	41.7	25.9
51	9.2	41.5	9.5	41.3	25.5
0 54	- 8.8	-41.1	- 9.1	-40.9	-25.1
0 57	8.4	40.7	8.7	40.5	24.7
1 00	8.0	40.3	8.3	40.1	24.3
03	7.7	40.0	7.9	39.7	24.0
06	7.3	39.6	7.5	39.3	23.6
09	6.9	39.2	7.2	39.0	23.2
1 12	- 6.6	-38.9	- 6.8	-38.6	-22.9
15	6.2	38.5	6.5	38.3	22.5
18	5.9	38.2	6.2	38.0	22.2
21	5.6	37.9	5.8	37.6	21.9
24	5.3	37.6	5.5	37.3	21.6
27	4.9	37.2	5.2	37.0	21.2
1 30	- 4.6	-36.9	- 4.9	-36.7	-20.9
35	4.2	36.5	4.4	36.2	20.5
40	3.7	36.0	4.0	35.8	20.0
45	3.2	35.5	3.5	35.3	19.5
50	2.8	35.1	3.1	34.9	19.1
1 55	2.4	34.7	2.6	34.4	18.7
2 00	- 2.0	-34.3	- 2.2	-34.0	-18.3
05	1.6	33.9	1.8	33.6	17.9
10	1.2	33.5	1.5	33.3	17.5
15	0.9	33.2	1.1	32.9	17.2
20	0.5	32.8	0.8	32.6	16.8
25	- 0.2	32.5	0.4	32.2	16.5
2 30	+ 0.2	-32.1	- 0.1	-31.9	-16.1
35	0.5	31.8	+ 0.2	31.6	15.8
40	0.8	31.5	0.5	31.3	15.5
45	1.1	31.2	0.8	31.0	15.2
50	1.4	30.9	1.1	30.7	14.9
2 55	1.6	30.7	1.4	30.4	14.7
3 00	+ 1.9	-30.4	+ 1.7	-30.1	-14.4
05	2.2	30.1	1.9	29.9	14.1
10	2.4	29.9	2.1	29.7	13.9
15	2.6	29.7	2.4	29.4	13.7
20	2.9	29.4	2.6	29.2	13.4
25	3.1	29.2	2.9	28.9	13.2
3 30	+ 3.3	-29.0	+ 3.1	-28.7	-13.0

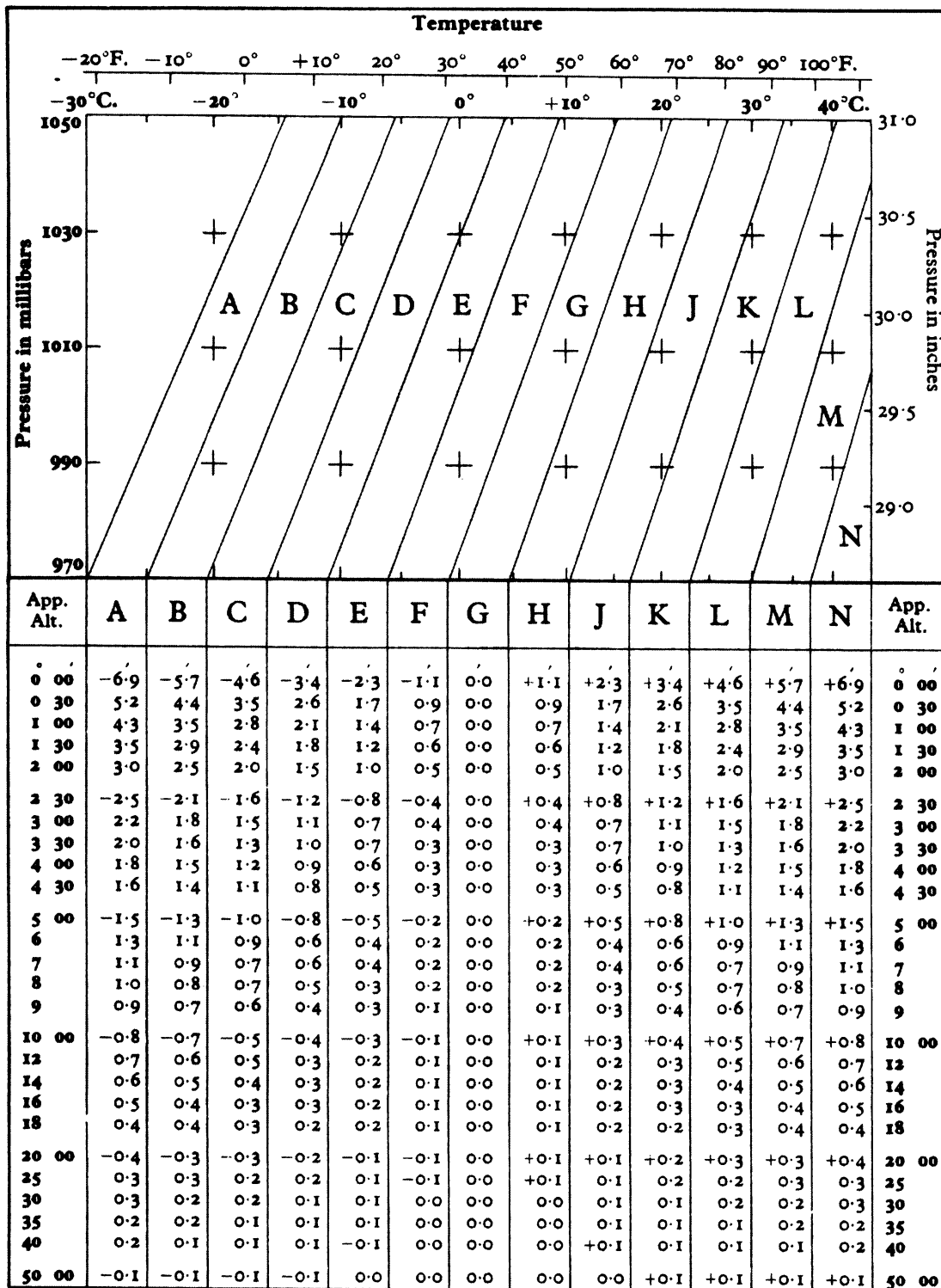
App. Alt.	OCT.-MAR. SUN		APR.-SEPT.		STARS PLANETS
	Lower Limb	Upper Limb	Lower Limb	Upper Limb	
0 30	+ 3.3	-29.0	+ 3.1	-28.7	-13.0
35	3.6	28.7	3.3	28.5	12.7
40	3.8	28.5	3.5	28.3	12.5
45	4.0	28.3	3.7	28.1	12.3
50	4.2	28.1	3.9	27.9	12.1
3 55	4.4	27.9	4.1	27.7	11.9
4 00	+ 4.5	-27.8	+ 4.3	-27.5	-11.8
05	4.7	27.6	4.5	27.3	11.6
10	4.9	27.4	4.6	27.2	11.4
15	5.1	27.2	4.8	27.0	11.2
20	5.2	27.1	5.0	26.8	11.1
25	5.4	26.9	5.1	26.7	10.9
4 30	+ 5.6	-26.7	+ 5.3	-26.5	-10.7
35	5.7	26.6	5.5	26.3	10.6
40	5.9	26.4	5.6	26.2	10.4
45	6.0	26.3	5.8	26.0	10.3
50	6.2	26.1	5.9	25.9	10.1
4 55	6.3	26.0	6.0	25.8	10.0
5 00	+ 6.4	-25.9	+ 6.2	-25.6	- 9.9
05	6.6	25.7	6.3	25.5	9.7
10	6.7	25.6	6.4	25.4	9.6
15	6.8	25.5	6.6	25.2	9.5
20	6.9	25.4	6.7	25.1	9.4
25	7.1	25.2	6.8	25.0	9.2
5 30	+ 7.2	-25.1	+ 6.9	-24.9	- 9.1
35	7.3	25.0	7.0	24.8	9.0
40	7.4	24.9	7.2	24.6	8.9
45	7.5	24.8	7.3	24.5	8.8
50	7.6	24.7	7.4	24.4	8.7
5 55	7.7	24.6	7.5	24.3	8.6
6 00	+ 7.8	-24.5	+ 7.6	-24.2	- 8.5
10	8.0	24.3	7.8	24.0	8.3
20	8.2	24.1	8.0	23.8	8.1
30	8.4	23.9	8.1	23.7	7.9
40	8.6	23.7	8.3	23.5	7.7
6 50	8.7	23.6	8.5	23.3	7.6
7 00	+ 8.9	-23.4	+ 8.6	-23.2	- 7.4
10	9.1	23.2	8.8	23.0	7.2
20	9.2	23.1	9.0	22.8	7.1
30	9.3	23.0	9.1	22.7	7.0
40	9.5	22.8	9.2	22.6	6.8
7 50	9.6	22.7	9.4	22.4	6.7
8 00	+ 9.7	-22.6	+ 9.5	-22.3	- 6.6
10	9.9	22.4	9.6	22.2	6.4
20	10.0	22.3	9.7	22.1	6.3
30	10.1	22.2	9.8	22.0	6.2
40	10.2	22.1	10.0	21.8	6.1
8 50	10.3	22.0	10.1	21.7	6.0
9 00	+ 10.4	-21.9	+ 10.2	-21.6	- 5.9
10	10.5	21.8	10.3	21.5	5.8
20	10.6	21.7	10.4	21.4	5.7
30	10.7	21.6	10.5	21.3	5.6
40	10.8	21.5	10.6	21.2	5.5
9 50	10.9	21.4	10.6	21.2	5.4
10 00	+ 11.0	-21.3	+ 10.7	-21.1	- 5.3

Additional corrections for temperature and pressure are given on the following page.

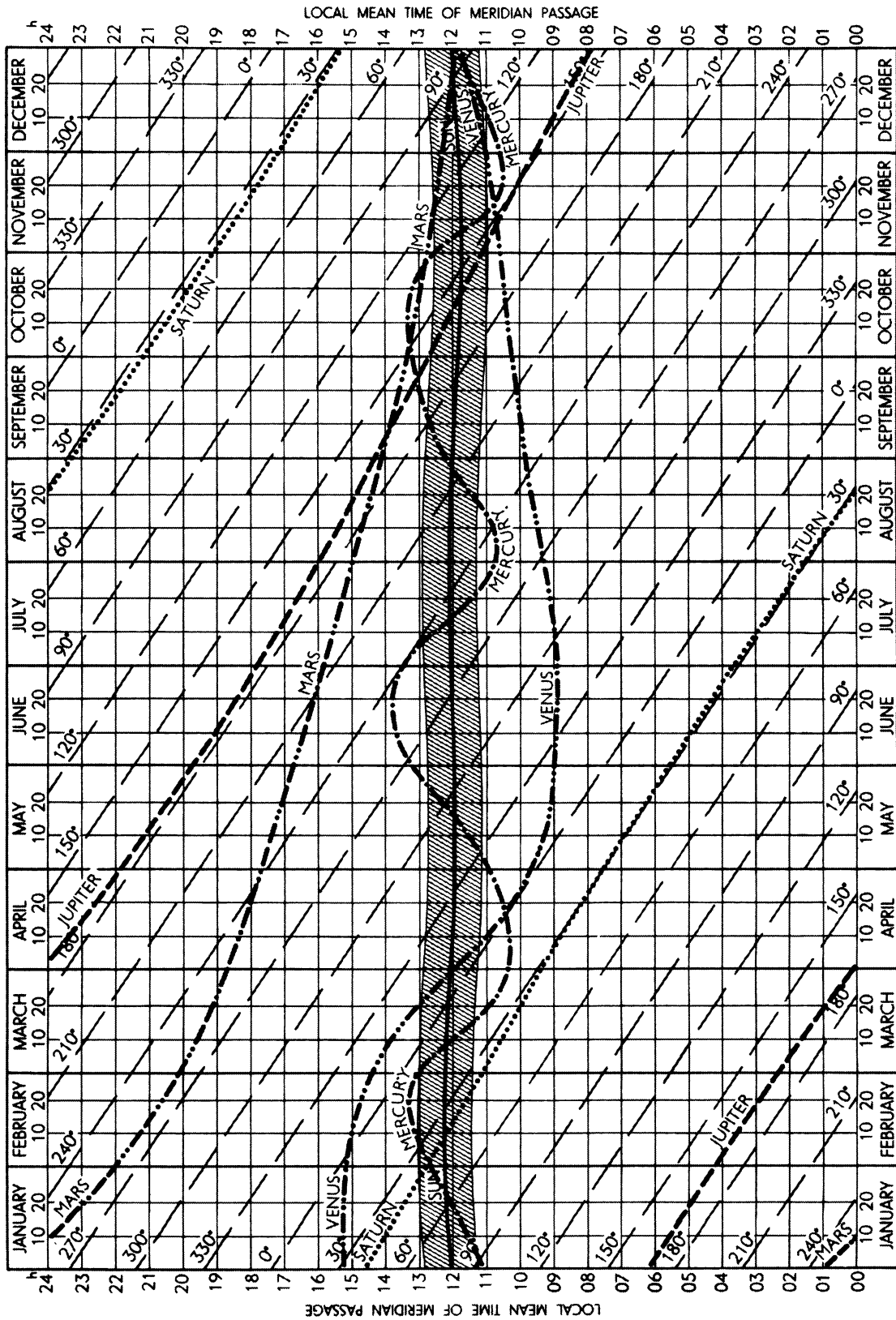
For bubble sextant observations ignore dip and use the star corrections for Sun, planets, and stars.

A4 ALTITUDE CORRECTION TABLES—ADDITIONAL CORRECTIONS

ADDITIONAL REFRACTION CORRECTIONS FOR NON-STANDARD CONDITIONS



The graph is entered with arguments temperature and pressure to find a zone letter; using as arguments this zone letter and apparent altitude (sextant altitude corrected for dip), a correction is taken from the table. This correction is to be applied to the sextant altitude in addition to the corrections for standard conditions (for the Sun, stars and planets from page A2 and for the Moon from pages xxxiv and xxxv).



UT (GMT)	ARIES			VENUS -4.5			MARS +1.2			JUPITER -2.3			SATURN +0.9			STARS		
d h	G.H.A.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	G.H.A.	Dec.	Name	S.H.A.	Dec.				
MONDAY	1000	227 48.4	219 44.4 N 3	48.8	99 03.8 N20	32.6	42 10.1 S 0	47.1	255 42.9 S12	47.3	Acamar	315 30.1 S40	19.9					
	01	242 50.8	234 45.4	49.0	114 05.0	32.2	57 12.7	47.0	270 45.3	47.3	Achernar	335 38.4 S57	16.1					
	02	257 53.3	249 46.5	49.2	129 06.2	31.9	72 15.4	47.0	285 47.6	47.3	Acruz	173 25.7 S63	04.1					
	03	272 55.7	264 47.5	49.4	144 07.3	31.5	87 18.0	46.9	300 50.0	47.2	Adhara	255 24.6 S28	58.0					
	04	287 58.2	279 48.6	49.6	159 08.5	31.2	102 20.6	46.8	315 52.3	47.2	Aldebaran	291 07.0 N16	29.7					
	05	303 00.7	294 49.6	49.8	174 09.7	30.8	117 23.2	46.8	330 54.6	47.1								
	06	318 03.1	309 50.7 N 3	50.0	189 10.8 N20	30.5	132 25.8 S 0	46.7	345 57.0 S12	47.1	Alioth	166 33.3 N55	59.8					
	07	333 05.6	324 51.7	50.1	204 12.0	30.1	147 28.4	46.7	0 59.3	47.1	Alkaid	153 10.2 N49	20.8					
	08	348 08.1	339 52.8	50.3	219 13.2	29.8	162 31.1	46.6	16 01.7	47.0	Al Na'ir	28 02.6 S46	59.3					
	09	3 10.5	354 53.8	50.5	234 14.4	29.4	177 33.7	46.6	31 04.0	47.0	Anilam	276 01.9 S 1	12.5					
	10	18 13.0	9 54.8	50.7	249 15.5	29.1	192 36.3	46.5	46 06.4	47.0	Alphard	218 10.9 S 8	38.0					
	11	33 15.5	24 55.9	50.9	264 16.7	28.7	207 38.9	46.5	61 08.7	46.9								
	12	48 17.9	39 56.9 N 3	51.1	279 17.9 N20	28.3	222 41.5 S 0	46.4	76 11.0 S12	46.9	Alphecca	126 23.3 N26	44.1					
	13	63 20.4	54 58.0	51.3	294 19.0	28.0	237 44.1	46.3	91 13.4	46.9	Alpheratz	357 59.3 N29	03.1					
	14	78 22.9	69 59.0	51.5	309 20.2	27.6	252 46.7	46.3	106 15.7	46.8	Altair	62 22.7 N 8	51.0					
	15	93 25.3	85 00.0	51.7	324 21.4	27.3	267 49.4	46.2	121 18.1	46.8	Ankaa	353 30.8 S42	20.3					
	16	108 27.8	100 01.0	51.9	339 22.5	26.9	282 52.0	46.2	136 20.4	46.8	Antares	112 44.4 S26	25.1					
	17	123 30.2	115 02.1	52.1	354 23.7	26.6	297 54.6	46.1	151 22.8	46.7								
	18	138 32.7	130 03.1 N 3	52.3	9 24.9 N20	26.2	312 57.2 S 0	46.1	166 25.1 S12	46.7	Arcturus	146 09.1 N19	12.9					
	19	153 35.2	145 04.1	52.5	24 26.0	25.9	327 59.8	46.0	181 27.5	46.6	Atria	107 59.2 S69	00.9					
	20	168 37.6	160 05.1	52.7	39 27.2	25.5	343 02.4	46.0	196 29.8	46.6	Avior	234 24.4 S59	29.7					
	21	183 40.1	175 06.1	52.9	54 28.4	25.1	358 05.0	45.9	211 32.1	46.6	Bellatrix	278 48.4 N 6	20.5					
	22	198 42.6	190 07.2	53.2	69 29.5	24.8	13 07.6	45.9	226 34.5	46.5	Betelgeuse	271 17.8 N 7	24.3					
	23	213 45.0	205 08.2	53.4	84 30.7	24.4	28 10.2	45.8	241 36.8	46.5								
TUESDAY	1100	228 47.5	220 09.2 N 3	53.6	99 31.9 N20	24.1	43 12.9 S 0	45.8	256 39.2 S12	46.5	Canopus	264 03.2 S52	41.8					
	01	243 50.0	235 10.2	53.8	114 33.0	23.7	58 15.5	45.7	271 41.5	46.4	Capella	280 57.1 N45	59.5					
	02	258 52.4	250 11.2	54.0	129 34.2	23.3	73 18.1	45.6	286 43.9	46.4	Deneb	49 41.6 N45	15.2					
	03	273 54.9	265 12.2	54.2	144 35.4	23.0	88 20.7	45.6	301 46.2	46.4	Denebola	182 48.8 N14	36.4					
	04	288 57.4	280 13.2	54.4	159 36.5	22.6	103 23.3	45.5	316 48.6	46.3	Diphda	349 11.2 S18	01.3					
	05	303 59.8	295 14.2	54.7	174 37.7	22.3	118 25.9	45.5	331 50.9	46.3								
	06	319 02.3	310 15.2 N 3	54.9	189 38.9 N20	21.9	133 28.5 S 0	45.4	346 53.3 S12	46.3	Dubhe	194 09.7 N61	47.3					
	07	334 04.7	325 16.2	55.1	204 40.0	21.6	148 31.1	45.4	1 55.6	46.2	Elnath	278 32.0 N28	36.1					
	08	349 07.2	340 17.2	55.3	219 41.2	21.2	163 33.7	45.3	16 58.0	46.2	Eltanin	90 52.7 N51	29.2					
	09	4 09.7	355 18.2	55.5	234 42.4	20.8	178 36.3	45.3	32 00.3	46.2	Enif	34 01.9 N 9	50.6					
	10	19 12.1	10 19.2	55.8	249 43.5	20.5	193 38.9	45.2	47 02.6	46.1	Fomalhaut	15 40.6 S29	39.3					
	11	34 14.6	25 20.2	56.0	264 44.7	20.1	208 41.6	45.2	62 05.0	46.1								
	12	49 17.1	40 21.1 N 3	56.2	279 45.9 N20	19.8	223 44.2 S 0	45.1	77 07.3 S12	46.1	Gacrux	172 17.3 S57	04.9					
	13	64 19.5	55 22.1	56.5	294 47.0	19.4	238 46.8	45.1	92 09.7	46.0	Gienah	176 07.6 S17	30.6					
	14	79 22.0	70 23.1	56.7	309 48.2	19.0	253 49.4	45.0	107 12.0	46.0	Hadar	149 08.7 S60	20.7					
	15	94 24.5	85 24.1	56.9	324 49.4	18.7	268 52.0	45.0	122 14.4	46.0	Hamal	328 18.1 N23	25.8					
	16	109 26.9	100 25.1	57.1	339 50.5	18.3	283 54.6	44.9	137 16.7	45.9	Kaus Aust.	84 03.4 S34	23.2					
	17	124 29.4	115 26.1	57.4	354 51.7	18.0	298 57.2	44.9	152 19.1	45.9								
	18	139 31.8	130 27.0 N 3	57.6	9 52.9 N20	17.6	313 59.8 S 0	44.8	167 21.4 S12	45.9	Kochab	137 18.1 N74	10.9					
	19	154 34.3	145 28.0	57.9	24 54.0	17.2	329 02.4	44.8	182 23.8	45.8	Markab	13 53.4 N15	10.1					
	20	169 36.8	160 29.0	58.1	39 55.2	16.9	344 05.0	44.7	197 26.1	45.8	Menkar	314 31.1 N 4	03.8					
	21	184 39.2	175 30.0	58.3	54 56.4	16.5	359 07.6	44.7	212 28.5	45.8	Menkent	148 25.0 S36	20.5					
	22	199 41.7	190 30.9	58.6	69 57.5	16.1	14 10.2	44.6	227 30.8	45.7	Miaplacidus	221 42.9 S69	41.8					
	23	214 44.2	205 31.9	58.8	84 58.7	15.8	29 12.8	44.6	242 33.2	45.7								
WEDNESDAY	1200	229 46.6	220 32.9 N 3	59.1	99 59.9 N20	15.4	44 15.4 S 0	44.5	257 35.5 S12	45.7	Mirfak	309 02.4 N49	50.2					
	01	244 49.1	235 33.8	59.3	115 01.0	15.1	59 18.0	44.5	272 37.9	45.6	Nunki	76 16.7 S26	18.2					
	02	259 51.6	250 34.8	59.5	130 02.2	14.7	74 20.6	44.4	287 40.2	45.6	Peacock	53 42.6 S56	45.1					
	03	274 54.0	265 35.7	59.8	145 03.3	14.3	89 23.2	44.4	302 42.6	45.6	Pollux	243 46.2 N28	02.5					
	04	289 56.5	280 36.7	60.0	160 04.5	14.0	104 25.8	44.3	317 44.9	45.5	Procyon	245 15.6 N 5	14.4					
	05	304 59.0	295 37.6	60.3	175 05.7	13.6	119 28.5	44.3	332 47.3	45.5								
	06	320 01.4	310 38.6 N 4	00.5	190 06.8 N20	13.2	134 31.1 S 0	44.2	347 49.6 S12	45.5	Rasalhague	96 20.1 N12	33.8					
	07	335 03.9	325 39.6	00.8	205 08.0	12.9	149 33.7	44.2	2 52.0	45.4	Regulus	207 59.4 N11	59.9					
	08	350 06.3	340 40.5	01.0	220 09.2	12.5	164 36.3	44.1	17 54.3	45.4	Rigel	281 26.8 S 8	12.7					
	09	5 08.8	355 41.4	01.3	235 10.3	12.1	179 38.9	44.1	32 56.7	45.4	Rigel Kent.	140 11.6 S60	48.6					
	10	20 11.3	10 42.4	01.6	250 11.5	11.8	194 41.5	44.0	47 59.0	45.3	Sabik	102 29.5 S15	43.0					
	11	35 13.7	25 43.3	01.8	265 12.7	11.4	209 44.1	44.0	63 01.4	45.3								
	12	50 16.2	40 44.3 N 4	02.1	280 13.8 N20	11.1	224 46.7 S 0	43.9	78 03.7 S12	45.3	Schedar	349 58.2 N56	29.9					
	13	65 18.7	55 45.2	02.3	295 15.0	10.7	239 49.3	43.9	93 06.1	45.2	Shaula	96 42.0 S37	05.9					
	14	80 21.1	70 46.2	02.6	310 16.1	10.3	254 51.9	43.8	108 08.4	45.2	Sirius	258 47.2 S16	42.6					
	15	95 23.6	85 47.1	02.9	325 17.3	10.0	269 54.5	43.8	123 10.8	45.2	Spica	158 46.8 S11	07.8					
	16	110 26.1	100 48.0	03.1	340 18.5	09.6	284 57.1	43.7	138 13.1	45.1	Suhail	223 03.6 S43	24.7					
	17	125 28.5	115 49.0	03.4	355 19.6	09.2	299 59.7	43.7	153 15.5	45.1								
	18	140 31.0	130 49.9 N 4	03.6	10 20.8 N20	08.9	315 02.3 S 0	43.6	168 17.8 S12	45.1	Vega	80 48.8 N38	46.5					
	19	155 33.5	145 50.8	03.9	25 21.9	08.5	330 04.9	43.6	183 20.2	45.0	Zuben'ubi	137 21.7 S16	01.0					
	20	170 35.9	160 51.8	04.2	40 23.1	08.1	345 07.5	43.5	198 22.5	45.0								
	21	185 38.4	175 52.7	04.4	55 24.3	07.8	0 10.1	43.5	213 24.9	45.0		S.H.A.	Mer. Pass.					
	22	200 40.8	190 53.6	04.7	70 25.4	07.4	15 12.7	43.4	228 27.2	44.9	Venus	351 21.7 h	9 19					
	23	215 43.3	205 54.5	05.0	85 26.6	07.0	30 15.3	43.4	243 29.6	44.9	Mars	230 44.4	17 21					
Mer. Pass. 8 43.4		v 1.0 d 0.2		v 1.2 d 0.4		v 2.6 d 0.1		v 2.3 d 0.0		Jupiter	174 25.4	21 03						
										Saturn	27 51.7	6 52						

UT (GMT)	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise				
	G.H.A. Dec.		G.H.A. <i>v</i> Dec. <i>d</i> H.P.						Naut.	Civil		10	11	12	13	
	<i>d</i> <i>h</i>	<i>m</i>	<i>d</i> <i>h</i>	<i>m</i>	<i>s</i>	<i>m</i>	<i>s</i>					<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	
MONDAY	10 00	180 54.4	N17 34.0	308 18.6	8.8	S20 47.6	4.8 56.9	N 72					04 14	02 47	02 19	
	01	195 54.4	34.6	322 46.4	9.0	20 42.8	5.0 56.9	N 70	///	///	01 23	02 09	02 10	02 00	01 53	01 47
	02	210 54.5	35.3	337 14.4	9.0	20 37.8	5.1 56.9	66	///	00 25	02 38	01 24	01 32	01 35	01 36	
	03	225 54.5	35.9	351 42.4	9.1	20 32.7	5.2 56.8	64	///	01 34	03 00	00 54	01 11	01 20	01 26	
	04	240 54.5	36.6	6 10.5	9.3	20 27.5	5.3 56.8	62	///	02 08	03 18	00 31	00 53	01 07	01 17	
	05	255 54.5	37.3	20 38.8	9.2	20 22.2	5.4 56.8	60	00 22	02 32	03 32	00 13	00 39	00 57	01 10	
	06	270 54.5	N17 37.9	35 07.0	9.4	S20 16.8	5.5 56.7	N 58	01 24	02 51	03 44	24 27	00 27	00 48	01 04	
	07	285 54.6	38.6	49 35.4	9.5	20 11.3	5.6 56.7	56	01 55	03 07	03 55	24 16	00 16	00 39	00 58	
	08	300 54.6	39.2	64 03.9	9.5	20 05.7	5.7 56.7	54	02 18	03 20	04 04	24 07	00 07	00 32	00 53	
	09	315 54.6	39.9	78 32.4	9.6	20 00.0	5.8 56.6	52	02 36	03 31	04 13	23 58	24 26	00 26	00 48	
	10	330 54.6	40.5	93 01.0	9.8	19 54.2	5.9 56.6	50	02 51	03 41	04 20	23 51	24 20	00 20	00 44	
	11	345 54.7	41.2	107 29.8	9.8	19 48.3	6.0 56.6	45	03 20	04 02	04 36	23 34	24 07	00 07	00 35	
	12	0 54.7	N17 41.8	121 58.6	9.8	S19 42.3	6.1 56.5	N 40	03 41	04 19	04 49	23 21	23 56	24 27	00 27	
	13	15 54.7	42.5	136 27.4	10.0	19 36.2	6.2 56.5	35	03 58	04 32	05 00	23 10	23 47	24 20	00 20	
	14	30 54.7	43.1	150 56.4	10.1	19 30.0	6.3 56.5	30	04 12	04 43	05 09	23 00	23 39	24 15	00 15	
	15	45 54.8	43.8	165 25.5	10.1	19 23.7	6.4 56.4	20	04 34	05 02	05 26	22 43	23 25	24 04	00 04	
	16	60 54.8	44.4	179 54.6	10.2	19 17.3	6.5 56.4	N 10	04 52	05 18	05 40	22 28	23 13	23 56	24 35	
	17	75 54.8	45.1	194 23.8	10.3	19 10.8	6.5 56.4	0	05 06	05 31	05 53	22 14	23 02	23 47	24 30	
	18	90 54.8	N17 45.7	208 53.1	10.4	S19 04.3	6.7 56.3	S 10	05 18	05 44	06 06	21 59	22 50	23 39	24 25	
	19	105 54.8	46.4	223 22.5	10.5	18 57.6	6.7 56.3	20	05 30	05 56	06 20	21 44	22 38	23 30	24 19	
	20	120 54.9	47.0	237 52.0	10.6	18 50.9	6.9 56.3	30	05 41	06 10	06 35	21 27	22 24	23 19	24 13	
	21	135 54.9	47.7	252 21.6	10.6	18 44.0	6.9 56.2	35	05 47	06 17	06 44	21 17	22 16	23 13	24 09	
	22	150 54.9	48.3	266 51.2	10.7	18 37.1	7.0 56.2	40	05 53	06 26	06 54	21 05	22 07	23 07	24 05	
	23	165 54.9	48.9	281 20.9	10.9	18 30.1	7.1 56.2	45	06 00	06 35	07 07	20 52	21 56	22 59	24 00	
TUESDAY	11 00	180 54.9	N17 49.6	295 50.8	10.9	S18 23.0	7.2 56.1	S 50	06 07	06 46	07 21	20 35	21 42	22 49	23 55	
	01	195 55.0	50.2	310 20.7	10.9	18 15.8	7.2 56.1	52	06 10	06 51	07 28	20 27	21 36	22 45	23 52	
	02	210 55.0	50.9	324 50.6	11.1	18 08.6	7.4 56.1	54	06 13	06 56	07 35	20 18	21 29	22 40	23 49	
	03	225 55.0	51.5	339 20.7	11.2	18 01.2	7.4 56.0	56	06 17	07 02	07 44	20 08	21 22	22 34	23 46	
	04	240 55.0	52.2	353 50.9	11.2	17 53.8	7.5 56.0	58	06 20	07 08	07 53	19 57	21 13	22 28	23 42	
	05	255 55.0	52.8	8 21.1	11.3	17 46.3	7.6 56.0	S 60	06 24	07 16	08 04	19 44	21 03	22 21	23 38	
	06	270 55.1	N17 53.4	22 51.4	11.4	S17 38.7	7.7 55.9									
	07	285 55.1	54.1	37 21.8	11.5	17 31.0	7.7 55.9									
	08	300 55.1	54.7	51 52.3	11.6	17 23.3	7.8 55.9									
	09	315 55.1	55.4	66 22.9	11.6	17 15.5	7.9 55.9									
	10	330 55.1	56.0	80 53.5	11.7	17 07.6	8.0 55.8									
	11	345 55.1	56.6	95 24.2	11.8	16 59.6	8.0 55.8									
	12	0 55.2	N17 57.3	109 55.0	11.9	S16 51.6	8.1 55.8	N 72					04 51	07 56	09 57	
	13	15 55.2	57.9	124 25.9	12.0	16 43.5	8.2 55.7	N 70	22 37	///	///	05 07	06 24	08 26	10 13	
	14	30 55.2	58.6	138 56.9	12.1	16 35.3	8.2 55.7	68	21 48	///	///	05 52	07 30	09 05	10 36	
	15	45 55.2	59.2	153 28.0	12.1	16 27.1	8.3 55.7	66	21 18	///	///	06 22	07 51	09 19	10 45	
	16	60 55.2	59.8	167 59.1	12.2	16 18.8	8.4 55.6	64	20 55	22 24	///	06 44	08 07	09 31	10 52	
	17	75 55.2	60.5	182 30.3	12.3	16 10.4	8.5 55.6	62	20 37	21 48	///	07 02	08 21	09 41	10 58	
	18	90 55.2	N18 01.1	197 01.6	12.3	S16 01.9	8.5 55.6	60	20 22	21 23	///	07 17	08 33	09 49	11 04	
	19	105 55.3	01.7	211 32.9	12.5	15 53.4	8.6 55.6	N 58	20 10	21 04	22 33	07 30	08 43	09 57	11 09	
	20	120 55.3	02.4	226 04.4	12.5	15 44.8	8.6 55.5	56	19 59	20 48	22 00	07 30	08 52	10 03	11 13	
	21	135 55.3	03.0	240 35.9	12.6	15 36.2	8.7 55.5	54	19 50	20 34	21 37	07 41	09 00	10 09	11 17	
	22	150 55.3	03.6	255 07.5	12.6	15 27.5	8.8 55.5	52	19 41	20 23	21 19	07 51	09 00	10 09	11 17	
	23	165 55.3	04.3	269 39.1	12.8	15 18.7	8.8 55.5	50	19 34	20 12	21 03	07 59	09 07	10 15	11 21	
WEDNESDAY	12 00	180 55.3	N18 04.9	284 10.9	12.8	S15 09.9	8.9 55.4	45	19 18	19 51	20 34	08 18	09 22	10 26	11 29	
	01	195 55.3	05.5	298 42.7	12.9	15 01.0	9.0 55.4	N 40	19 04	19 35	20 12	08 33	09 35	10 36	11 35	
	02	210 55.4	06.2	313 14.6	12.9	14 52.0	9.0 55.4	35	18 53	19 21	19 55	08 46	09 45	10 44	11 41	
	03	225 55.4	06.8	327 46.5	13.1	14 43.0	9.1 55.3	30	18 44	19 10	19 41	08 57	09 55	10 51	11 45	
	04	240 55.4	07.4	342 18.6	13.1	14 33.9	9.1 55.3	20	18 27	18 51	19 19	09 15	10 11	11 03	11 54	
	05	255 55.4	08.1	356 50.7	13.1	14 24.8	9.2 55.3	N 10	18 13	18 35	19 01	09 32	10 24	11 14	12 01	
	06	270 55.4	N18 08.7	11 22.8	13.3	S14 15.6	9.2 55.3	0	18 00	18 22	18 47	09 47	10 37	11 24	12 08	
	07	285 55.4	09.3	25 55.1	13.3	14 06.4	9.3 55.2	S 10	17 47	18 09	18 34	10 02	10 50	11 34	12 15	
	08	300 55.4	09.9	40 27.4	13.4	13 57.1	9.3 55.2	20	17 33	17 56	18 23	10 18	11 04	11 44	12 22	
	09	315 55.4	10.6	54 59.8	13.4	13 47.8	9.4 55.2	30	17 17	17 42	18 11	10 37	11 19	11 56	12 30	
	10	330 55.5	11.2	69 32.2	13.5	13 38.4	9.5 55.2	40	17 08	17 35	18 05	10 47	11 28	12 03	12 35	
	11	345 55.5	11.8	84 04.7	13.6	13 28.9	9.5 55.1	50	16 58	17 27	17 59	11 00	11 38	12 11	12 40	
	12	0 55.5	N18 12.4	98 37.3	13.7	S13 19.4	9.5 55.1	60	16 46	17 17	17 53	11 14	11 50	12 20	12 46	
	13	15 55.5	13.1	113 10.0	13.7	13 09.9	9.6 55.1	S 50	16 31	17 06	17 45	11 32	12 04	12 31	12 53	
	14	30 55.5	13.7	127 42.7	13.7	13 00.3	9.7 55.1	52	16 24	17 01	17 42	11 40	12 11	12 36	12 57	
	15	45 55.5	14.3	142 15.4	13.9	12 50.6	9.6 55.1	54	16 17	16 56	17 39	11 49	12 18	12 41	13 00	
	16	60 55.5	14.9	156 48.3	13.9	12 41.0	9.8 55.0	56	16 08	16 50	17 35	11 59	12 27	12 48	13 04	
	17	75 55.5	15.6	171 21.2	14.0	12 31.2	9.8 55.0	58	15 59	16 43	17 32	12 11	12 36	12 54	13 09	
	18	90 55.5	N18 16.2	185 54.2	14.0	S12 21.4	9.8 55.0	S 60	15 48	16 36	17 27	12 25	12 46	13 02	13 14	
	19	105 55.5	16.8	200 27.2	14.1	12 11.6	9.9 55.0									
	20	120 55.5	17.4	215 00.3	14.1	12 01.7	9.9 54.9									
	21	135 55.6	18.1	229 33.4	14.2	11 51.8	9.9 54.9									
	22	150 55.6	18.7	244 06.6	14.3	11 41.9	10.0 54.9									
	23	165 55.6	19.3	258 39.9	14.3	11 31.9	10.1 54.9									
		S.D. 15.9	<i>d</i> 0.6	S.D.	15.4	15.2	15.0									
		Day		Eqn. of Time		Mer. Pass.		MOON		Mer. Pass.		Age		Phase		
		00 <i>h</i>		12 <i>h</i>		Pass.		Upper		Lower		<i>d</i>				
		<i>m</i> <i>s</i>		<i>m</i>												

UT (GMT)	ARIES	VENUS -4.5	MARS +1.2	JUPITER -2.3	SATURN +0.9	STARS
d h	G.H.A.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	Name S.H.A. Dec.
13 00 01 02 03 04 05 06 07 08 09	230 45.8	220 55.5 N 4 05.3	100 27.8 N20 06.7	45 17.9 S 0 43.3	258 31.9 S12 44.9	Acamar 315 30.1 S40 19.8
	245 48.2	235 56.4 05.5	115 28.9 06.3	60 20.5 43.3	273 34.3 44.8	Achernar 335 38.4 S57 16.0
	260 50.7	250 57.3 05.8	130 30.1 05.9	75 23.1 43.2	288 36.6 44.8	Acrux 173 25.7 S63 04.1
	275 53.2	265 58.2 06.1	145 31.2 05.6	90 25.6 43.2	303 39.0 44.8	Adhara 255 24.6 S28 58.0
	290 55.6	280 59.1 06.4	160 32.4 05.2	105 28.2 43.1	318 41.4 44.7	Aldebaran 291 07.0 N16 29.7
	305 58.1	296 00.0 06.6	175 33.6 04.8	120 30.8 43.1	333 43.7 44.7	
	321 00.6	311 00.9 N 4 06.9	190 34.7 N20 04.5	135 33.4 S 0 43.0	348 46.1 S12 44.7	Alioth 166 33.3 N55 59.8
	336 03.0	326 01.8 07.2	205 35.9 04.1	150 36.0 43.0	3 48.4 44.6	Alkaid 153 10.2 N49 20.8
	351 05.5	341 02.8 07.5	220 37.0 03.7	165 38.6 43.0	18 50.8 44.6	Al Na'ir 28 02.5 S46 59.7
	6 08.0	356 03.7 07.8	235 38.2 03.4	180 41.2 42.9	33 53.1 44.6	Alnilam 276 01.9 S 1 12.5
T H U R S D A Y	21 10.4	11 04.6 08.1	250 39.4 03.0	195 43.8 42.9	48 55.5 44.5	Alphard 218 10.9 S 8 38.0
	36 12.9	26 05.5 08.3	265 40.5 02.6	210 46.4 42.8	63 57.8 44.5	
	51 15.3	41 06.4 N 4 08.6	280 41.7 N20 02.2	225 49.0 S 0 42.8	79 00.2 S12 44.5	Alphecca 126 23.3 N26 44.1
	66 17.8	56 07.3 08.9	295 42.8 01.9	240 51.6 42.7	94 02.5 44.5	Alpheratz 357 59.3 N29 03.1
	81 20.3	71 08.2 09.2	310 44.0 01.5	255 54.2 42.7	109 04.9 44.4	Altair 62 22.7 N 8 51.0
	96 22.7	86 09.1 09.5	325 45.1 01.1	270 56.8 42.6	124 07.2 44.4	Ankaa 353 30.7 S42 20.3
	111 25.2	101 09.9 09.8	340 46.3 00.8	285 59.4 42.6	139 09.6 44.4	Antares 112 44.3 S26 25.1
	126 27.7	116 10.8 10.1	355 47.5 00.4	301 02.0 42.5	154 12.0 44.3	
	141 30.1	131 11.7 N 4 10.4	10 48.6 N20 00.0	316 04.6 S 0 42.5	169 14.3 S12 44.3	Arcturus 146 09.1 N19 12.9
	156 32.6	146 12.6 10.7	25 49.8 19 59.7	331 07.2 42.4	184 16.7 44.3	Atria 107 59.2 S69 00.9
F R I D A Y	171 35.1	161 13.5 11.0	40 50.9 59.3	346 09.8 42.4	199 19.0 44.2	Avior 234 24.4 S59 29.7
	186 37.5	176 14.4 11.3	55 52.1 58.9	1 12.3 42.4	214 21.4 44.2	Bellatrix 278 48.4 N 6 20.6
	201 40.0	191 15.3 11.6	70 53.3 58.5	16 14.9 42.3	229 23.7 44.2	Betelgeuse 271 17.8 N 7 24.3
	216 42.4	206 16.1 11.9	85 54.4 58.2	31 17.5 42.3	244 26.1 44.1	
	231 44.9	221 17.0 N 4 12.2	100 55.6 N19 57.8	46 20.1 S 0 42.2	259 28.5 S12 44.1	Canopus 264 03.2 S52 41.8
	246 47.4	236 17.9 12.5	115 56.7 57.4	61 22.7 42.2	274 30.8 44.1	Capella 280 57.1 N45 59.5
	261 49.8	251 18.8 12.8	130 57.9 57.1	76 25.3 42.1	289 33.2 44.0	Deneb 49 41.6 N45 15.2
	276 52.3	266 19.6 13.1	145 59.0 56.7	91 27.9 42.1	304 35.5 44.0	Denobola 182 48.8 N14 36.4
	291 54.8	281 20.5 13.4	161 00.2 56.3	106 30.5 42.0	319 37.9 44.0	Diphda 349 11.2 S18 01.3
	306 57.2	296 21.4 13.7	176 01.4 55.9	121 33.1 42.0	334 40.2 44.0	
S A T U R D A Y	321 59.7	311 22.3 N 4 14.0	191 02.5 N19 55.6	136 35.7 S 0 42.0	349 42.6 S12 43.9	Dubhe 194 09.7 N61 47.3
	337 02.2	326 23.1 14.3	206 03.7 55.2	151 38.3 41.9	4 44.9 43.9	Elnath 278 32.0 N28 36.1
	352 04.6	341 24.0 14.6	221 04.8 54.8	166 40.8 41.9	19 47.3 43.9	Eltanin 90 52.7 N51 29.2
	7 07.1	356 24.9 14.9	236 06.0 54.4	181 43.4 41.8	34 49.7 43.8	Enif 34 01.9 N 9 50.6
	22 09.6	11 25.7 15.2	251 07.1 54.1	196 46.0 41.8	49 52.0 43.8	Fomalhaut 15 40.6 S29 39.3
	37 12.0	26 26.6 15.6	266 08.3 53.7	211 48.6 41.7	64 54.4 43.8	
	52 14.5	41 27.4 N 4 15.9	281 09.5 N19 53.3	226 51.2 S 0 41.7	79 56.7 S12 43.7	Gacrux 172 17.3 S57 04.9
	67 16.9	56 28.3 16.2	296 10.6 53.0	241 53.8 41.7	94 59.1 43.7	Gienah 176 07.6 S17 30.6
	82 19.4	71 29.1 16.5	311 11.8 52.6	256 56.4 41.6	110 01.5 43.7	Hadar 149 08.7 S60 20.7
	97 21.9	86 30.0 16.8	326 12.9 52.2	271 59.0 41.6	125 03.8 43.7	Hamal 328 18.1 N23 25.8
M E R C U R Y	112 24.3	101 30.8 17.1	341 14.1 51.8	287 01.6 41.5	140 06.2 43.6	Kaus Aust. 84 03.4 S34 23.2
	127 26.8	116 31.7 17.5	356 15.2 51.5	302 04.1 41.5	155 08.5 43.6	
	142 29.3	131 32.5 N 4 17.8	11 16.4 N19 51.1	317 06.7 S 0 41.4	170 10.9 S12 43.6	Kochab 137 18.2 N74 11.0
	157 31.7	146 33.4 18.1	26 17.6 50.7	332 09.3 41.4	185 13.2 43.5	Markab 13 53.4 N15 10.1
	172 34.2	161 34.2 18.4	41 18.7 50.3	347 11.9 41.4	200 15.6 43.5	Menkar 314 31.1 N 4 03.8
	187 36.7	176 35.1 18.8	56 19.9 50.0	2 14.5 41.3	215 18.0 43.5	Menkent 148 25.0 S36 20.5
	202 39.1	191 35.9 19.1	71 21.0 49.6	17 17.1 41.3	230 20.3 43.4	Micoplacidus 221 43.0 S69 41.8
	217 41.6	206 36.8 19.4	86 22.2 49.2	32 19.7 41.2	245 22.7 43.4	
	232 44.1	221 37.6 N 4 19.7	101 23.3 N19 48.8	47 22.2 S 0 41.2	260 25.0 S12 43.4	Mirfak 309 02.4 N49 50.2
	247 46.5	236 38.4 20.1	116 24.5 48.4	62 24.8 41.1	275 27.4 43.4	Nunki 76 16.7 S26 18.2
M E R C U R Y	262 49.0	251 39.3 20.4	131 25.6 48.1	77 27.4 41.1	290 29.8 43.3	Peacock 53 42.6 S56 45.1
	277 51.4	266 40.1 20.7	146 26.8 47.7	92 30.0 41.1	305 32.1 43.3	Pollux 243 46.2 N28 02.5
	292 53.9	281 40.9 21.1	161 27.9 47.3	107 32.6 41.0	320 34.5 43.3	Procyon 245 15.6 N 5 14.4
	307 56.4	296 41.8 21.4	176 29.1 46.9	122 35.2 41.0	335 36.8 43.2	
	322 58.8	311 42.6 N 4 21.7	191 30.3 N19 46.6	137 37.7 S 0 40.9	350 39.2 S12 43.2	Rasalhague 96 20.1 N12 33.8
	338 01.3	326 43.4 22.1	206 31.4 46.2	152 40.3 40.9	5 41.6 43.2	Regulus 207 59.4 N11 59.9
	353 03.8	341 44.2 22.4	221 32.6 45.8	167 42.9 40.9	20 43.9 43.2	Rigel 281 26.8 S 8 12.7
	8 06.2	356 45.1 22.7	236 33.7 45.4	182 45.5 40.8	35 46.3 43.1	Rigel Kent. 140 11.6 S60 48.6
	23 08.7	11 45.9 23.1	251 34.9 45.1	197 48.1 40.8	50 48.7 43.1	Sabik 102 29.5 S15 43.0
	38 11.2	26 46.7 23.4	266 36.0 44.7	212 50.7 40.7	65 51.0 43.1	
M E R C U R Y	53 13.6	41 47.5 N 4 23.8	281 37.2 N19 44.3	227 53.2 S 0 40.7	80 53.4 S12 43.0	Schedar 349 58.2 N56 29.9
	68 16.1	56 48.3 24.1	296 38.3 43.9	242 55.8 40.7	95 55.7 43.0	Shaula 96 41.9 S37 05.9
	83 18.5	71 49.2 24.5	311 39.5 43.5	257 58.4 40.6	110 58.1 43.0	Sirius 258 47.2 S16 42.6
	98 21.0	86 50.0 24.8	326 40.6 43.2	273 01.0 40.6	126 00.5 42.9	Spica 158 46.8 S11 07.8
	113 23.5	101 50.8 25.1	341 41.8 42.8	288 03.6 40.5	141 02.8 42.9	Suhail 223 03.6 S43 24.7
	128 25.9	116 51.6 25.5	356 42.9 42.4	303 06.1 40.5	156 05.2 42.9	
	143 28.4	131 52.4 N 4 25.8	11 44.1 N19 42.0	318 08.7 S 0 40.5	171 07.6 S12 42.9	Vega 80 48.8 N38 46.5
	158 30.9	146 53.2 26.2	26 45.2 41.6	333 11.3 40.4	186 09.9 42.8	Zuben'ubi 137 21.7 S16 01.0
	173 33.3	161 54.0 26.5	41 46.4 41.3	348 13.9 40.4	201 12.3 42.8	
	188 35.8	176 54.8 26.9	56 47.6 40.9	3 16.5 40.3	216 14.6 42.8	
M E R C U R Y	203 38.3	191 55.6 27.2	71 48.7 40.5	18 19.0 40.3	231 17.0 42.8	Venus 349 32.1 9 14
	218 40.7	206 56.4 27.6	86 49.9 40.1	33 21.6 40.3	246 19.4 42.7	Mars 229 10.7 17 15
						Jupiter 174 35.2 20 51
						Saturn 27 43.5 6 41
Mer. Pass. 8	31.6	u 0.9 d 0.3	u 1.2 d 0.4	u 2.6 d 0.0	u 2.4 d 0.0	

UT (GMT)	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise				
	G.H.A. Dec.		G.H.A. <i>v</i> Dec. <i>d</i> H.P.						Naut. Civil			13	14	15	16	
	<i>d</i> <i>h</i>	<i>°</i> <i>'</i>	<i>°</i> <i>'</i>	<i>°</i> <i>'</i>	<i>°</i> <i>'</i>	<i>°</i> <i>'</i>	<i>°</i> <i>'</i>		<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	<i>h</i> <i>m</i>	
13 T H U R S D A Y	00	180 55.6	N18 19.9	273 13.2	14.4	S11 21.8	10.1	54.9	N 72	□	□	□	02 19	02 00	01 43	01 28
	01	195 55.6	20.5	287 46.6	14.4	11 11.7	10.1	54.8	N 70	///	///	00 54	02 02	01 50	01 40	01 30
	02	210 55.6	21.1	302 20.0	14.5	11 01.6	10.1	54.8	68	///	///	01 53	01 47	01 42	01 37	01 32
	03	225 55.6	21.8	316 53.5	14.5	10 51.5	10.2	54.8	66	///	///	02 26	01 36	01 35	01 35	01 34
	04	240 55.6	22.4	331 27.0	14.6	10 41.3	10.3	54.8	64	///	01 15	02 50	01 26	01 30	01 33	01 36
	05	255 55.6	23.0	346 00.6	14.7	10 31.0	10.2	54.8	62	///	01 56	03 09	01 17	01 25	01 31	01 37
	06	270 55.6	23.6	360 00.6	14.7	10 20.8	10.3	54.8	60	///	02 22	03 25	01 10	01 21	01 30	01 38
	07	285 55.6	24.2	15 08.0	14.7	10 10.5	10.4	54.7	N 58	01 07	02 43	03 38	01 04	01 17	01 28	01 39
	08	300 55.6	24.8	29 41.7	14.8	10 00.1	10.3	54.7	56	01 44	03 00	03 49	00 58	01 13	01 27	01 40
	09	315 55.6	25.5	44 15.5	14.9	9 49.8	10.4	54.7	54	02 09	03 14	03 59	00 53	01 10	01 26	01 41
	10	330 55.6	26.1	58 49.4	14.9	9 39.4	10.5	54.7	52	02 29	03 26	04 08	00 48	01 07	01 25	01 42
	11	345 55.6	26.7	73 23.3	14.9	9 28.9	10.4	54.7	50	02 45	03 36	04 16	00 44	01 05	01 24	01 43
	12	0 55.6	N18 27.3	87 57.2	15.0	S 9 18.5	10.5	54.6	45	03 15	03 58	04 32	00 35	00 59	01 22	01 44
	13	15 55.6	27.9	102 31.2	15.0	9 08.0	10.6	54.6	N 40	03 38	04 15	04 46	00 27	00 55	01 20	01 45
	14	30 55.7	28.5	117 05.2	15.1	8 57.4	10.5	54.6	35	03 55	04 29	04 57	00 20	00 51	01 19	01 47
	15	45 55.7	29.1	131 39.3	15.1	8 46.9	10.6	54.6	30	04 10	04 41	05 07	00 15	00 47	01 18	01 48
	16	60 55.7	29.7	146 13.4	15.2	8 36.3	10.6	54.6	20	04 33	05 01	05 24	00 04	00 41	01 15	01 49
	17	75 55.7	30.4	160 47.6	15.2	8 25.7	10.7	54.6	N 10	04 51	05 17	05 39	24 35	00 35	01 13	01 51
	18	90 55.7	N18 31.0	175 21.8	15.2	S 8 15.0	10.7	54.5	0	05 06	05 31	05 53	24 30	00 30	01 11	01 52
	19	105 55.7	31.6	189 56.0	15.3	8 04.3	10.7	54.5	S 10	05 19	05 44	06 06	24 25	00 25	01 10	01 54
	20	120 55.7	32.2	204 30.3	15.3	7 53.6	10.7	54.5	20	05 31	05 58	06 21	24 19	00 19	01 08	01 56
	21	135 55.7	32.8	219 04.6	15.4	7 42.9	10.7	54.5	30	05 43	06 12	06 37	24 13	00 13	01 05	01 57
	22	150 55.7	33.4	233 39.0	15.4	7 32.2	10.8	54.5	35	05 49	06 20	06 47	24 09	00 09	01 04	01 59
	23	165 55.7	34.0	248 13.4	15.4	7 21.4	10.8	54.5	40	05 55	06 28	06 57	24 05	00 05	01 03	02 00
14 F R I D A Y	00	180 55.7	N18 34.6	262 47.8	15.5	S 7 10.6	10.8	54.5	45	06 02	06 38	07 10	24 00	00 01	01 01	02 01
	01	195 55.7	35.2	277 22.3	15.5	6 59.8	10.9	54.4	S 50	06 10	06 50	07 25	23 55	24 59	00 59	02 03
	02	210 55.7	35.8	291 56.8	15.5	6 48.9	10.9	54.4	52	06 14	06 55	07 32	23 52	24 58	00 58	02 04
	03	225 55.7	36.4	306 31.3	15.6	6 38.0	10.8	54.4	54	06 17	07 01	07 40	23 49	24 57	00 57	02 05
	04	240 55.7	37.0	321 05.9	15.6	6 27.2	11.0	54.4	56	06 21	07 07	07 49	23 46	24 56	00 56	02 06
	05	255 55.7	37.6	335 40.5	15.7	6 16.2	10.9	54.4	58	06 25	07 14	07 59	23 42	24 55	00 55	02 07
	06	270 55.7	N18 38.2	350 15.2	15.6	S 6 05.3	10.9	54.4	S 60	06 30	07 22	08 11	23 38	24 53	00 53	02 08
	07	285 55.7	38.8	4 49.8	15.7	5 54.4	11.0	54.4								
	08	300 55.7	39.4	19 24.5	15.7	5 43.4	11.0	54.4								
	09	315 55.7	40.0	33 59.2	15.8	5 32.4	11.0	54.3								
	10	330 55.7	40.6	48 34.0	15.8	5 21.4	11.0	54.3								
	11	345 55.7	41.2	63 08.8	15.8	5 10.4	11.0	54.3								
	12	0 55.7	N18 41.8	77 43.6	15.8	S 4 59.4	11.1	54.3	N 72	23 11	09 57	11 44	13 27	15 10		
	13	15 55.7	42.4	92 18.4	15.8	4 48.3	11.1	54.3	N 70	22 05	10 13	11 52	13 28	15 03		
	14	30 55.7	43.0	106 53.2	15.9	4 37.2	11.0	54.3	68	21 30	10 26	11 58	13 28	14 58		
	15	45 55.7	43.6	121 28.1	15.9	4 26.2	11.1	54.3	66	21 05	10 36	12 03	13 28	14 54		
	16	60 55.7	44.2	136 03.0	15.9	4 15.1	11.1	54.3	64	21 05	10 45	12 07	13 29	14 50		
	17	75 55.7	44.8	150 37.9	16.0	4 04.0	11.2	54.3	62	20 45	10 52	12 11	13 29	14 47		
	18	90 55.7	N18 45.4	165 12.9	15.9	S 3 52.8	11.1	54.3	60	20 29	11 08	12 14	13 29	14 44		
	19	105 55.6	46.0	179 47.8	16.0	3 41.7	11.1	54.3	N 58	20 16	11 12	12 17	13 29	14 41		
	20	120 55.6	46.6	194 22.8	16.0	3 30.6	11.2	54.2	56	20 05	11 09	12 20	13 29	14 39		
	21	135 55.6	47.2	208 57.8	16.0	3 19.4	11.1	54.2	54	19 55	11 13	12 22	13 30	14 37		
	22	150 55.6	47.8	223 32.8	16.0	3 08.3	11.2	54.2	52	19 46	11 17	12 24	13 30	14 35		
	23	165 55.6	48.4	238 07.8	16.0	2 57.1	11.2	54.2	50	19 38	11 21	12 26	13 30	14 34		
15 S A T U R D A Y	00	180 55.6	N18 49.0	252 42.8	16.1	S 2 45.9	11.2	54.2	45	19 21	11 29	12 30	13 30	14 30		
	01	195 55.6	49.6	267 17.9	16.0	2 34.7	11.2	54.2	N 40	19 07	11 35	12 33	13 30	14 27		
	02	210 55.6	50.2	281 52.9	16.1	2 23.5	11.2	54.2	35	18 56	11 41	12 36	13 30	14 25		
	03	225 55.6	50.8	296 28.0	16.1	2 12.3	11.2	54.2	30	18 46	11 45	12 38	13 31	14 23		
	04	240 55.6	51.4	311 03.1	16.1	2 01.1	11.2	54.2	20	18 28	11 54	12 43	13 31	14 19		
	05	255 55.6	52.0	325 38.2	16.1	1 49.9	11.3	54.2	N 10	18 14	12 01	12 47	13 31	14 15		
	06	270 55.6	N18 52.5	340 13.3	16.1	S 1 38.6	11.2	54.2	0	18 00	12 08	12 50	13 31	14 12		
	07	285 55.6	53.1	354 48.4	16.1	1 27.4	11.2	54.2	S 10	17 46	12 15	12 54	13 31	14 09		
	08	300 55.6	53.7	9 23.5	16.2	1 16.2	11.3	54.2	20	17 32	12 22	12 57	13 32	14 06		
	09	315 55.6	54.3	23 58.7	16.1	1 04.9	11.2	54.2	30	17 15	12 30	13 02	13 32	14 02		
	10	330 55.6	54.9	38 33.8	16.1	0 53.7	11.2	54.2	35	17 06	12 33	13 03	13 32	14 00		
	11	345 55.6	55.5	53 08.9	16.2	0 42.5	11.3	54.2	40	16 55	12 34	13 07	13 32	13 57		
	12	0 55.5	N18 56.1	67 44.1	16.1	S 0 31.2	11.2	54.2	45	16 42	12 46	13 10	13 32	13 54		
	13	15 55.5	56.7	82 19.2	16.2	0 20.0	11.3	54.2	S 50	16 27	12 53	13 13	13 32	13 51		
	14	30 55.5	57.2	96 54.4	16.1	S 0 08.7	11.2	54.2	52	16 20	12 57	13 15	13 32	13 49		
	15	45 55.5	57.8	111 29.5	16.1	N 0 02.5	11.3	54.2	54	16 12	13 00	13 17	13 32	13 48		
	16	60 55.5	58.4	126 04.6	16.2	0 13.8	11.2	54.2	56	16 03	13 04	13 19	13 32	13 46		
	17	75 55.5	59.0	140 39.8	16.1	0 25.0	11.3	54.2	58	15 53	13 08	13 21	13 32	13 44		
	18	90 55.5	N18 59.6	155 14.9	16.2	N 0 36.3	11.2	54.2	S 60	15 41	13 14	13 24	13 32	13 41		
	19	105 55.5	19 00.2	169 50.1	16.1	0 47.5	11.3	54.2								
	20	120 55.5	00.7	184 25.2	16.1	0 58.8	11.2	54.2								
	21	135 55.5	01.3	199 00.3	16.2	1 10.0	11.2	54.2								
	22	150 55.5	01.9	213 35.5	16.1	1 21.2	11.3	54.2								
	23	165 55.4	02.5	228 10.6	16.1	1 32.5	11.2	54.2								

UT (GMT)	ARIES	VENUS -4.5	MARS +1.2	JUPITER -2.3	SATURN +0.9	STARS
d h	G.H.A.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	Name S.H.A. Dec.
16 00	233 43.2	221 57.2 N 4 28.0	101 51.0 N19 39.7	48 24.2 S 0 40.2	261 21.7 S12 42.7	Acamar 315 30.1 S40 19.8
01	248 45.7	236 58.0 28.3	116 52.2 39.4	63 26.8 40.2	276 24.1 42.7	Achernar 335 38.4 S57 16.0
02	263 48.1	251 58.8 28.7	131 53.3 39.0	78 29.3 40.1	291 26.5 42.6	Acrux 173 25.7 S63 04.1
03	278 50.6	266 59.6 29.0	146 54.5 38.6	93 31.9 40.1	306 28.8 42.6	Adhara 255 24.6 S28 58.0
04	293 53.0	282 00.4 29.4	161 55.6 38.2	108 34.5 40.1	321 31.2 42.6	Aldebaran 291 07.0 N16 29.7
05	308 55.5	297 01.2 29.7	176 56.8 37.8	123 37.1 40.0	336 33.6 42.6	
06	323 58.0	312 02.0 N 4 30.1	191 57.9 N19 37.5	138 39.7 S 0 40.0	351 35.9 S12 42.5	Alioth 166 33.4 N55 59.8
07	339 00.4	327 02.8 30.5	206 59.1 37.1	153 42.2 40.0	6 38.3 42.5	Alkaid 153 10.2 N49 20.8
08	354 02.9	342 03.6 30.8	222 00.2 36.7	168 44.8 39.9	21 40.6 42.5	Al Na'ir 28 02.5 S46 59.3
S 09	9 05.4	357 04.4 31.2	237 01.4 36.3	183 47.4 39.9	36 43.0 42.4	Alnilam 276 01.9 S 1 12.5
U 10	24 07.8	12 05.1 31.6	252 02.5 35.9	198 50.0 39.8	51 45.4 42.4	Alphard 218 10.9 S 8 38.0
N 11	39 10.3	27 05.9 31.9	267 03.7 35.5	213 52.5 39.8	66 47.7 42.4	
D 12	54 12.8	42 06.7 N 4 32.3	282 04.8 N19 35.2	228 55.1 S 0 39.8	81 50.1 S12 42.4	Alphecca 126 23.3 N26 44.1
A 13	69 15.2	57 07.5 32.7	297 06.0 34.8	243 57.7 39.7	96 52.5 42.3	Alpheratz 357 59.3 N29 03.1
Y 14	84 17.7	72 08.3 33.0	312 07.1 34.4	259 00.3 39.7	111 54.8 42.3	Altair 62 22.7 N 8 51.0
15	99 20.2	87 09.0 33.4	327 08.3 34.0	274 02.8 39.7	126 57.2 42.3	Ankaa 353 30.7 S42 20.3
16	114 22.6	102 09.8 33.8	342 09.4 33.6	289 05.4 39.6	141 59.6 42.3	Antares 112 44.3 S26 25.1
17	129 25.1	117 10.6 34.2	357 10.6 33.2	304 08.0 39.6	157 01.9 42.2	
18	144 27.5	132 11.3 N 4 34.5	12 11.7 N19 32.9	319 10.6 S 0 39.5	172 04.3 S12 42.2	Arcturus 146 09.1 N19 12.9
19	159 30.0	147 12.1 34.9	27 12.9 32.5	334 13.1 39.5	187 06.7 42.2	Atria 107 59.2 S69 00.9
20	174 32.5	162 12.9 35.3	42 14.0 32.1	349 15.7 39.5	202 09.0 42.1	Avior 234 24.4 S59 29.7
21	189 34.9	177 13.7 35.7	57 15.2 31.7	4 18.3 39.4	217 11.4 42.1	Bellatrix 278 48.4 N 6 20.6
22	204 37.4	192 14.4 36.0	72 16.3 31.3	19 20.8 39.4	232 13.8 42.1	Betelgeuse 271 17.8 N 7 24.3
23	219 39.9	207 15.2 36.4	87 17.5 30.9	34 23.4 39.4	247 16.1 42.1	
17 00	234 42.3	222 15.9 N 4 36.8	102 18.6 N19 30.5	49 26.0 S 0 39.3	262 18.5 S12 42.0	Canopus 264 03.2 S52 41.8
01	249 44.8	237 16.7 37.2	117 19.8 30.2	64 28.6 39.3	277 20.9 42.0	Capella 280 57.1 N45 59.5
02	264 47.3	252 17.5 37.6	132 20.9 29.8	79 31.1 39.3	292 23.2 42.0	Deneb 49 41.6 N45 15.2
03	279 49.7	267 18.2 37.9	147 22.1 29.4	94 33.7 39.2	307 25.6 42.0	Denebola 182 48.8 N14 36.4
04	294 52.2	282 19.0 38.3	162 23.2 29.0	109 36.3 39.2	322 28.0 41.9	Diphda 349 11.2 S18 01.3
05	309 54.6	297 19.7 38.7	177 24.4 28.6	124 38.8 39.1	337 30.3 41.9	
06	324 57.1	312 20.5 N 4 39.1	192 25.5 N19 28.2	139 41.4 S 0 39.1	352 32.7 S12 41.9	Dubhe 194 09.7 N61 47.3
07	339 59.6	327 21.2 39.5	207 26.7 27.8	154 44.0 39.1	7 35.1 41.9	Elnath 278 32.0 N28 36.1
08	355 02.0	342 22.0 39.9	222 27.8 27.5	169 46.5 39.0	22 37.4 41.8	Eltanin 90 52.7 N51 29.2
M 09	10 04.5	357 22.7 40.3	237 29.0 27.1	184 49.1 39.0	37 39.8 41.8	Enif 34 01.8 N 9 50.6
U 10	25 07.0	12 23.5 40.6	252 30.1 26.7	199 51.7 39.0	52 42.2 41.8	Fomalhaut 15 40.6 S29 39.2
N 11	40 09.4	27 24.2 41.0	267 31.3 26.3	214 54.3 38.9	67 44.6 41.7	
D 12	55 11.9	42 25.0 N 4 41.4	282 32.4 N19 25.9	229 56.8 S 0 38.9	82 46.9 S12 41.7	Gacrux 172 17.4 S57 04.9
A 13	70 14.4	57 25.7 41.8	297 33.6 25.5	244 59.4 38.9	97 49.3 41.7	Gienah 176 07.6 S17 30.6
Y 14	85 16.8	72 26.5 42.2	312 34.7 25.1	260 02.0 38.8	112 51.7 41.7	Hadar 149 08.7 S60 20.7
15	100 19.3	87 27.2 42.6	327 35.8 24.7	275 04.5 38.8	127 54.0 41.6	Hamal 328 18.1 N23 25.8
16	115 21.8	102 27.9 43.0	342 37.0 24.4	290 07.1 38.8	142 56.4 41.6	Kaus Aust. 84 03.4 S34 23.2
17	130 24.2	117 28.7 43.4	357 38.1 24.0	305 09.7 38.7	157 58.8 41.6	
18	145 26.7	132 29.4 N 4 43.8	12 39.3 N19 23.6	320 12.2 S 0 38.7	173 01.1 S12 41.6	Kochab 137 18.2 N74 11.0
19	160 29.1	147 30.1 44.2	27 40.4 23.2	335 14.8 38.7	188 03.5 41.5	Markab 13 53.4 N15 10.1
20	175 31.6	162 30.9 44.6	42 41.6 22.8	350 17.4 38.6	203 05.9 41.5	Menkar 314 31.1 N 4 03.8
21	190 34.1	177 31.6 45.0	57 42.7 22.4	5 19.9 38.6	218 08.3 41.5	Menkent 148 25.0 S36 20.5
22	205 36.5	192 32.3 45.4	72 43.9 22.0	20 22.5 38.6	233 10.6 41.5	Miaplacidus 221 43.0 S69 41.8
23	220 39.0	207 33.1 45.8	87 45.0 21.6	35 25.1 38.5	248 13.0 41.4	
18 00	235 41.5	222 33.8 N 4 46.2	102 46.2 N19 21.2	50 27.6 S 0 38.5	263 15.4 S12 41.4	Mirfak 309 02.4 N49 50.2
01	250 43.9	237 34.5 46.6	117 47.3 20.8	65 30.2 38.5	278 17.7 41.4	Nunki 76 16.6 S26 18.2
02	265 46.4	252 35.2 47.0	132 48.5 20.5	80 32.8 38.4	293 20.1 41.4	Peacock 53 42.5 S56 45.1
03	280 48.9	267 36.0 47.4	147 49.6 20.1	95 35.3 38.4	308 22.5 41.3	Pollux 243 46.3 N28 02.5
04	295 51.3	282 36.7 47.8	162 50.8 19.7	110 37.9 38.4	323 24.8 41.3	Procyon 245 15.6 N 5 14.4
05	310 53.8	297 37.4 48.3	177 51.9 19.3	125 40.4 38.3	338 27.2 41.3	
06	325 56.3	312 38.1 N 4 48.7	192 53.0 N19 18.9	140 43.0 S 0 38.3	353 29.6 S12 41.3	Rasalhague 96 20.1 N12 33.8
07	340 58.7	327 38.8 49.1	207 54.2 18.5	155 45.6 38.3	8 32.0 41.2	Regulus 207 59.4 N11 59.9
08	356 01.2	342 39.5 49.5	222 55.3 18.1	170 48.1 38.2	23 34.3 41.2	Rigel 281 26.8 S 8 12.7
U 09	11 03.6	357 40.3 49.9	237 56.5 17.7	185 50.7 38.2	38 36.7 41.2	Rigel Kent. 140 11.6 S60 48.6
S 10	26 06.1	12 41.0 50.3	252 57.6 17.3	200 53.3 38.2	53 39.1 41.2	Sabik 102 29.4 S15 43.0
D 11	41 08.6	27 41.7 50.7	267 58.8 16.9	215 55.8 38.1	68 41.5 41.1	
12	56 11.0	42 42.4 N 4 51.1	282 59.9 N19 16.5	230 58.4 S 0 38.1	83 43.8 S12 41.1	Schedar 349 58.1 N56 29.9
13	71 13.5	57 43.1 51.6	298 01.1 16.2	246 00.9 38.1	98 46.2 41.1	Shaula 96 41.9 S37 05.9
14	86 16.0	72 43.8 52.0	313 02.2 15.8	261 03.5 38.1	113 48.6 41.1	Sirius 258 47.2 S16 42.6
15	101 18.4	87 44.5 52.4	328 03.4 15.4	276 06.1 38.0	128 50.9 41.0	Spica 158 46.8 S11 07.8
16	116 20.9	102 45.2 52.8	343 04.5 15.0	291 08.6 38.0	143 53.3 41.0	Suhail 223 03.6 S43 24.7
17	131 23.4	117 45.9 53.2	358 05.6 14.6	306 11.2 38.0	158 55.7 41.0	
18	146 25.8	132 46.6 N 4 53.7	13 06.8 N19 14.2	321 13.7 S 0 37.9	173 58.1 S12 41.0	Vega 80 48.8 N38 46.5
19	161 28.3	147 47.3 54.1	28 07.9 13.8	336 16.3 37.9	189 00.4 40.9	Zuben'ubi 137 21.7 S16 01.0
20	176 30.7	162 48.0 54.5	43 09.1 13.4	351 18.9 37.9	204 02.8 40.9	
21	191 33.2	177 48.7 54.9	58 10.2 13.0	6 21.4 37.8	219 05.2 40.9	S.H.A. Mer. Pass.
22	206 35.7	192 49.4 55.4	73 11.4 12.6	21 24.0 37.8	234 07.6 40.9	Venus 347 33.6 9 10
23	221 38.1	207 50.1 55.8	88 12.5 12.2	36 26.5 37.8	249 09.9 40.8	Mars 227 36.3 17 09
						Jupiter 174 43.7 20 39
						Saturn 27 36.2 6 30
Mer. Pass. 8 19.8	U 0.7 d 0.4	U 1.1 d 0.4	U 2.6 d 0.0	U 2.4 d 0.0		

UT (GMT)		SUN		MOON				Lat.	Twilight		Sunrise	Moonrise									
		G.H.A.	Dec.	G.H.A.	<i>v</i>	Dec.	<i>d</i>		H.P.	Naut.		Civil	16	17	18	19					
<i>d</i>	<i>h</i>	[°]	[']	[°]	[']	[°]	[']	[°]	[']	^h	^m	^h	^m	^h	^m	^h	^m	^h	^m		
SUNDAY	16 00	180	55.4	N19	03.1	242	45.7	16.1	N	1	43.7	11.2	54.2	N 72	□	□	□	01 28	01 12	00 53	(⁰⁰ ₂₃) 28
	01	195	55.4		03.6	257	20.8	16.1		1	54.9	11.2	54.2	N 70	□	□	□	01 30	01 21	01 10	00 57
	02	210	55.4		04.2	271	55.9	16.1		2	06.1	11.2	54.2	68	///	///	01 36	01 32	01 28	01 23	01 18
	03	225	55.4		04.8	286	31.0	16.1		2	17.3	11.2	54.2	66	///	///	02 14	01 34	01 34	01 34	01 35
	04	240	55.4		05.4	301	06.1	16.0		2	28.5	11.2	54.2	64	///	00 52	02 41	01 36	01 39	01 43	01 49
	05	255	55.4		06.0	315	41.1	16.1		2	39.7	11.2	54.2	62	///	01 43	03 01	01 37	01 43	01 51	02 01
	06	270	55.4	N19	06.5	330	16.2	16.0	N	2	50.9	11.2	54.2	60	///	02 13	03 18	01 38	01 47	01 58	02 11
	07	285	55.3		07.1	344	51.2	16.0		3	02.1	11.1	54.2	N 58	00 47	02 35	03 32	01 39	01 51	02 04	02 20
	08	300	55.3		07.7	359	26.2	16.1		3	13.2	11.2	54.2	56	01 33	02 53	03 44	01 40	01 54	02 09	02 27
	09	315	55.3		08.3	374	01.3	16.0		3	24.4	11.1	54.2	54	02 01	03 08	03 54	01 41	01 57	02 14	02 34
	10	330	55.3		08.8	388	36.3	15.9		3	35.5	11.2	54.2	52	02 21	03 21	04 03	01 42	01 59	02 18	02 40
	11	345	55.3		09.4	403	11.2	16.0		3	46.7	11.1	54.2	50	02 38	03 32	04 11	01 43	02 02	02 22	02 46
	12	0	55.3	N19	10.0	57	46.2	15.9	N	3	57.8	11.1	54.2	45	03 11	03 54	04 29	01 44	02 07	02 31	02 58
	13	15	55.3		10.6	72	21.1	16.0		4	08.9	11.1	54.2	N 40	03 34	04 12	04 43	01 45	02 11	02 38	03 08
	14	30	55.2		11.1	86	56.1	15.9		4	20.0	11.1	54.2	35	03 53	04 27	04 55	01 47	02 15	02 45	03 17
	15	45	55.2		11.7	101	31.0	15.8		4	31.1	11.0	54.2	30	04 08	04 39	05 05	01 48	02 18	02 50	03 25
	16	60	55.2		12.3	116	05.8	15.9		4	42.1	11.1	54.2	20	04 31	04 59	05 23	01 49	02 24	03 00	03 38
	17	75	55.2		12.8	130	40.7	15.8		4	53.2	11.0	54.2	N 10	04 50	05 16	05 39	01 51	02 29	03 08	03 50
	18	90	55.2	N19	13.4	145	15.5	15.8	N	5	04.2	11.0	54.2	0	05 05	05 31	05 53	01 52	02 34	03 16	04 01
	19	105	55.2		14.0	159	50.3	15.8		5	15.2	11.0	54.2	S 10	05 19	05 45	06 07	01 54	02 39	03 24	04 12
	20	120	55.2		14.5	174	25.1	15.8		5	26.2	11.0	54.2	20	05 32	05 59	06 22	01 56	02 44	03 33	04 24
	21	135	55.1		15.1	188	59.9	15.7		5	37.2	11.0	54.2	30	05 44	06 13	06 39	01 57	02 50	03 43	04 38
	22	150	55.1		15.7	203	34.6	15.8		5	48.2	10.9	54.2	35	05 51	06 22	06 49	01 59	02 53	03 49	04 46
	23	165	55.1		16.2	218	09.4	15.6		5	59.1	10.9	54.2	40	05 58	06 31	07 00	02 00	02 57	03 55	04 55
MONDAY	00	180	55.1	N19	16.8	232	44.0	15.7	N	6	10.0	10.9	54.2	45	06 05	06 41	07 13	02 01	03 02	04 03	05 06
	01	195	55.1		17.4	247	18.7	15.6		6	20.9	10.9	54.3	S 50	06 14	06 53	07 29	02 03	03 07	04 12	05 19
	02	210	55.1		17.9	261	53.3	15.6		6	31.8	10.9	54.3	52	06 17	06 59	07 37	02 04	03 10	04 17	05 25
	03	225	55.0		18.5	276	27.9	15.6		6	42.7	10.8	54.3	54	06 21	07 05	07 45	02 05	03 13	04 22	05 31
	04	240	55.0		19.1	291	02.5	15.5		6	53.5	10.8	54.3	56	06 25	07 12	07 55	02 06	03 16	04 27	05 39
	05	255	55.0		19.6	305	37.0	15.5		7	04.3	10.8	54.3	58	06 30	07 19	08 05	02 07	03 19	04 33	05 48
	06	270	55.0	N19	20.2	320	11.5	15.5	N	7	15.1	10.8	54.3	S 60	06 35	07 27	08 17	02 08	03 23	04 39	05 57
	07	285	55.0		20.8	334	46.0	15.4		7	25.9	10.7	54.3								
	08	300	54.9		21.3	349	20.4	15.4		7	36.6	10.7	54.3	Lat.	Sunset	Twilight		Moonset			
	09	315	54.9		21.9	3	54.8	15.4		7	47.3	10.7	54.3			Civil	Naut.	16	17	18	19
	10	330	54.9		22.4	18	29.2	15.3		7	58.0	10.7	54.3								
	11	345	54.9		23.0	33	03.5	15.3		8	08.7	10.6	54.3								
	12	0	54.9	N19	23.6	47	37.8	15.2	N	8	19.3	10.6	54.3	N 72	□	□	□	15 10	16 56	18 53	21 22
	13	15	54.8		24.1	62	12.0	15.3		8	29.9	10.6	54.4	N 70	□	□	□	15 03	16 41	18 26	20 21
	14	30	54.8		24.7	76	46.3	15.1		8	40.5	10.6	54.4	68	22 22	///	///	14 58	16 30	18 05	19 47
	15	45	54.8		25.2	91	20.4	15.2		8	51.1	10.5	54.4	66	21 42	///	///	14 54	16 20	17 49	19 22
	16	60	54.8		25.8	105	54.6	15.1		9	01.6	10.5	54.4	64	21 14	23 09	///	14 50	16 12	17 37	19 03
	17	75	54.8		26.4	120	28.7	15.0		9	12.1	10.4	54.4	62	20 53	22 14	///	14 47	16 05	17 26	18 47
	18	90	54.7	N19	26.9	135	02.7	15.0	N	9	22.5	10.4	54.4	60	20 36	21 43	///	14 44	15 59	17 16	18 34
	19	105	54.7		27.5	149	36.7	15.0		9	32.9	10.4	54.4	N 58	20 22	21 20	23 14	14 41	15 54	17 08	18 23
	20	120	54.7		28.0	164	10.7	14.9		9	43.3	10.4	54.4	56	20 10	21 01	22 24	14 39	15 50	17 01	18 13
	21	135	54.7		28.6	178	44.6	14.9		9	53.7	10.3	54.4	54	20 00	20 46	21 55	14 37	15 46	16 55	18 05
	22	150	54.7		29.1	193	18.5	14.8		10	04.0	10.3	54.5	52	19 50	20 33	21 33	14 35	15 42	16 49	17 57
	23	165	54.6		29.7	207	52.3	14.8		10	14.3	10.2	54.5	50	19 42	20 22	21 16	14 34	15 38	16 44	17 50
TUESDAY	00	180	54.6	N19	30.2	222	26.1	14.8	N	10	24.5	10.2	54.5	45	19 24	19 59	20 43	14 30	15 31	16 33	17 36
	01	195	54.6		30.8	236	59.9	14.6		10	34.7	10.2	54.5	N 40	19 10	19 41	20 19	14 27	15 25	16 24	17 24
	02	210	54.6		31.3	251	33.5	14.7		10	44.9	10.1	54.5	35	18 58	19 26	20 01	14 25	15 20	16 16	17 14
	03	225	54.5		31.9	266	07.2	14.6		10	55.0	10.1	54.5	30	18 48	19 14	19 46	14 23	15 15	16 09	17 05
	04	240	54.5		32.4	280	40.8	14.5		11	05.1	10.1	54.5	20	18 30	18 53	19 22	14 19	15 07	15 58	16 49
	05	255	54.5		33.0	295	14.3	14.5		11	15.2	10.0	54.5	N 10	18 14	18 37	19 03	14 15	15 01	15 47	16 36
	06	270	54.5	N19	33.5	309	47.8	14.5	N	11	25.2	9.9	54.6	0	18 00	18 22	18 47	14 12	14 54	15 38	16 23
	07	285	54.4		34.1	324	21.3	14.4		11	35.1	10.0	54.6	S 10	17 46	18 08	18 34	14 09	14 48	15 28	16 11
	08	300	54.4		34.6	338	54.7	14.3		11	45.1	9.8	54.6	20	17 31	17 54	18 21	14 06	14 41	15 18	15 58
	09	315	54.4		35.2	353	28.0	14.3		11	54.9	9.9	54.6	30	17 13	17 39	18 08	14 02	14 33	15 06	15 43
	10	330	54.4		35.7	8	01.3	14.2		12	04.8	9.8	54.6	35	17 04	17 31	18 01	14 00	14 28	14 59	15 34
	11	345	54.3		36.3	22	34.5	14.2		12	14.6	9.7	54.6	40	16 52	17 21	17 54	13 57	14 23	14 52	15 24
	12	0	54.3	N19	36.8	37	07.7	14.2	N	12											

UT (GMT)	ARIES	VENUS -4.1	MARS +1.6	JUPITER -2.0	SATURN +0.6	STARS
d h	G.H.A.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	Name S.H.A. Dec.
3 00	281 01.8	225 53.5 N16 43.7	123 12.5 N10 25.0	94 47.8 S 1 16.9	308 31.1 S12 49.6	Acomar 315 29.9 S40 19.6
01	296 04.3	240 53.3 44.4	138 13.6 24.5	109 50.1 17.0	323 33.6 49.6	Achernar 335 37.9 S57 15.8
02	311 06.8	255 53.0 45.0	153 14.7 23.9	124 52.3 17.1	338 36.2 49.6	Acruz 173 26.1 S63 04.2
03	326 09.2	270 52.8 45.7	168 15.8 23.3	139 54.6 17.2	353 38.7 49.7	Adhara 255 24.6 S28 57.8
04	341 11.7	285 52.5 46.3	183 16.9 22.8	154 56.8 17.3	8 41.3 49.7	Aldebaran 291 06.8 N16 29.8
05	356 14.2	300 52.3 46.9	198 17.9 22.2	169 59.1 17.4	23 43.8 49.8	
06	11 16.6	315 52.1 N16 47.6	213 19.0 N10 21.6	185 01.4 S 1 17.5	38 46.4 S12 49.8	Alioth 166 33.7 N55 59.9
07	26 19.1	330 51.8 48.2	228 20.1 21.0	200 03.6 17.6	53 48.9 49.8	Alkaid 153 10.4 N49 20.9
S 08	41 21.6	345 51.6 48.9	243 21.2 20.5	215 05.9 17.7	68 51.5 49.9	Altair 62 22.4 N 8 51.2
A 09	56 24.0	0 51.3 49.5	258 22.3 19.9	230 08.2 17.8	83 54.0 49.9	Alnilam 276 01.8 S 1 12.4
T 10	71 26.5	15 51.1 50.1	273 23.4 19.3	245 10.4 17.9	98 56.6 49.9	Alphard 218 11.0 S 8 37.9
U 11	86 28.9	30 50.8 50.8	288 24.5 18.8	260 12.7 18.0	113 59.1 50.0	
R 12	101 31.4	45 50.6 N16 51.4	303 25.6 N10 18.2	275 14.9 S 1 18.1	129 01.7 S12 50.0	Alphecca 126 23.4 N26 44.3
D 13	116 33.9	60 50.4 52.0	318 26.6 17.6	290 17.2 18.2	144 04.2 50.1	Alpheratz 357 58.9 N29 03.3
A 14	131 36.3	75 50.1 52.7	333 27.7 17.1	305 19.5 18.3	159 06.8 50.1	Altair 62 22.4 N 8 51.2
Y 15	146 38.8	90 49.9 53.3	348 28.8 16.5	320 21.7 18.4	174 09.3 50.1	Ankaa 353 30.3 S42 20.1
16	161 41.3	105 49.6 54.0	3 29.9 15.9	335 24.0 18.5	189 11.9 50.2	Antares 112 44.2 S26 25.1
17	176 43.7	120 49.4 54.6	18 31.0 15.3	350 26.2 18.6	204 14.4 50.2	
18	191 46.2	135 49.1 N16 55.2	33 32.1 N10 14.8	5 28.5 S 1 18.7	219 17.0 S12 50.3	Arcturus 146 09.2 N19 13.0
19	206 48.7	150 48.9 55.9	48 33.2 14.2	20 30.8 18.8	234 19.5 50.3	Atria 107 59.0 S69 01.1
20	221 51.1	165 48.6 56.5	63 34.3 13.6	35 33.0 18.9	249 22.1 50.3	Avior 234 24.7 S59 29.5
21	236 53.6	180 48.4 57.1	78 35.3 13.1	50 35.3 19.0	264 24.6 50.4	Bellatrix 278 48.3 N 6 20.6
22	251 56.1	195 48.1 57.8	93 36.4 12.5	65 37.5 19.1	279 27.2 50.4	Betelgeuse 271 17.8 N 7 24.3
23	266 58.5	210 47.9 58.4	108 37.5 11.9	80 39.8 19.2	294 29.7 50.5	
4 00	282 01.0	225 47.6 N16 59.0	123 38.6 N10 11.3	95 42.0 S 1 19.3	309 32.3 S12 50.5	Canopus 264 03.3 S52 41.5
01	297 03.4	240 47.4 16 59.7	138 39.7 10.8	110 44.3 19.4	324 34.8 50.5	Capella 280 56.9 N45 59.4
02	312 05.9	255 47.1 17 00.3	153 40.8 10.2	125 46.6 19.5	339 37.4 50.6	Deneb 49 41.2 N45 15.4
03	327 08.4	270 46.9 17 00.9	168 41.9 9.9	140 48.8 19.6	354 39.9 50.6	Denebola 182 48.9 N14 36.5
04	342 10.8	285 46.6 01.6	183 43.0 09.0	155 51.1 19.7	9 42.5 50.7	Diphda 349 10.8 S18 01.1
05	357 13.3	300 46.3 02.2	198 44.0 08.5	170 53.3 19.8	24 45.0 50.7	
06	12 15.8	315 46.1 N17 02.8	213 45.1 N10 07.9	185 55.6 S 1 19.9	39 47.6 S12 50.8	Dubhe 194 10.1 N61 47.3
07	27 18.2	330 45.8 03.4	228 46.2 07.3	200 57.8 20.0	54 50.1 50.8	Elnath 278 31.8 N28 36.1
08	42 20.7	345 45.6 04.1	243 47.3 06.7	216 00.1 20.1	69 52.7 50.8	Eltanin 90 52.5 N51 29.5
S 09	57 23.2	0 45.3 04.7	258 48.4 06.2	231 02.4 20.2	84 55.2 50.9	Enif 34 01.5 N 9 50.8
U 10	72 25.6	15 45.1 05.3	273 49.5 05.6	246 04.6 20.3	99 57.8 50.9	Fomalhaut 15 40.2 S29 39.1
N 11	87 28.1	30 44.8 06.0	288 50.6 05.0	261 06.9 20.4	115 00.3 51.0	
D 12	102 30.6	45 44.5 N17 06.6	303 51.7 N10 04.5	276 09.1 S 1 20.5	130 02.9 S12 51.0	Gacrux 172 17.6 S57 05.0
A 13	117 33.0	60 44.3 07.2	318 52.7 03.9	291 11.4 20.6	145 05.4 51.0	Gienah 176 07.7 S17 30.5
Y 14	132 35.5	75 44.0 07.8	333 53.8 03.3	306 13.6 20.7	160 08.0 51.1	Hadar 149 08.9 S60 20.8
15	147 37.9	90 43.7 08.5	348 54.9 02.7	321 15.9 20.8	175 10.5 51.1	Hamal 328 17.7 N23 25.9
16	162 40.4	105 43.5 09.1	3 56.0 02.2	336 18.1 20.9	190 13.1 51.2	Kaus Aust. 84 03.1 S34 23.2
17	177 42.9	120 43.2 09.7	18 57.1 01.6	351 20.4 21.0	205 15.7 51.2	
18	192 45.3	135 43.0 N17 10.3	33 58.2 N10 01.0	6 22.6 S 1 21.1	220 18.2 S12 51.2	Kochab 137 18.7 N74 11.2
19	207 47.8	150 42.7 11.0	48 59.3 10 00.4	21 24.9 21.2	235 20.8 51.3	Markab 13 53.0 N15 10.3
20	222 50.3	165 42.4 11.6	64 00.4 9 59.9	36 27.1 21.3	250 23.3 51.3	Menkar 314 30.8 N 4 03.9
21	237 52.7	180 42.2 12.2	79 01.4 9 59.3	51 29.4 21.4	265 25.9 51.4	Menkent 148 25.0 S36 20.5
22	252 55.2	195 41.9 12.8	94 02.5 9 58.7	66 31.7 21.5	280 28.4 51.4	Miaplacidus 221 43.6 S69 41.7
23	267 57.7	210 41.6 13.4	109 03.6 58.1	81 33.9 21.6	295 31.0 51.4	
5 00	283 00.1	225 41.4 N17 14.1	124 04.7 N 9 57.6	96 36.2 S 1 21.7	310 33.5 S12 51.5	Mirfak 309 02.1 N49 50.2
01	298 02.6	240 41.1 14.7	139 05.8 57.0	111 38.4 21.8	325 36.1 51.5	Nunki 76 16.4 S26 18.2
02	313 05.0	255 40.8 15.3	154 06.9 56.4	126 40.7 21.9	340 38.6 51.6	Peacock 53 42.0 S56 45.1
03	328 07.5	270 40.5 15.9	169 08.0 55.8	141 42.9 22.0	355 41.2 51.6	Pollux 243 46.3 N28 02.5
04	343 10.0	285 40.3 16.6	184 09.1 55.3	156 45.2 22.1	10 43.8 51.7	Procyon 245 15.6 N 5 14.5
05	358 12.4	300 40.0 17.2	199 10.1 54.7	171 47.4 22.2	25 46.3 51.7	
06	13 14.9	315 39.7 N17 17.8	214 11.2 N 9 54.1	186 49.7 S 1 22.3	40 48.9 S12 51.7	Rasalhague 96 19.9 N12 34.0
07	28 17.4	330 39.5 18.4	229 12.3 53.5	201 51.9 22.4	55 51.4 51.8	Regulus 207 59.6 N11 59.9
08	43 19.8	345 39.2 19.0	244 13.4 52.9	216 54.2 22.5	70 54.0 51.8	Rigel 281 26.7 S 8 12.5
M 09	58 22.3	0 38.9 19.6	259 14.5 52.4	231 56.4 22.6	85 56.5 51.9	Rigel Kent. 140 11.8 S60 48.8
U 10	73 24.8	15 38.6 20.3	274 15.6 51.8	246 58.7 22.7	100 59.1 51.9	Sabik 102 29.3 S15 43.0
N 11	88 27.2	30 38.4 20.9	289 16.7 51.2	262 00.9 22.8	116 01.6 51.9	
D 12	103 29.7	45 38.1 N17 21.5	304 17.7 N 9 50.6	277 03.2 S 1 22.9	131 04.2 S12 52.0	Schedar 349 57.6 N56 29.9
A 13	118 32.2	60 37.8 22.1	319 18.8 50.1	292 05.4 23.0	146 06.8 52.0	Shaula 96 41.7 S37 06.0
Y 14	133 34.6	75 37.5 22.7	334 19.9 49.5	307 07.7 23.1	161 09.3 52.1	Sirius 258 47.2 S16 42.5
15	148 37.1	90 37.3 23.3	349 21.0 48.9	322 09.9 23.2	176 11.9 52.1	Spica 158 46.9 S11 07.8
16	163 39.5	105 37.0 23.9	4 22.1 48.3	337 12.2 23.3	191 14.4 52.2	Suhail 223 03.8 S43 24.6
17	178 42.0	120 36.7 24.6	19 23.2 47.8	352 14.4 23.4	206 17.0 52.2	
18	193 44.5	135 36.4 N17 25.2	34 24.3 N 9 47.2	7 16.6 S 1 23.5	221 19.5 S12 52.2	Vega 80 48.6 N38 46.8
19	208 46.9	150 36.1 25.8	49 25.4 46.6	22 18.9 23.6	236 22.1 52.3	Zuben'ubi 137 21.7 S16 01.0
20	223 49.4	165 35.9 26.4	64 26.4 46.0	37 21.1 23.7	251 24.6 52.3	
21	238 51.9	180 35.6 27.0	79 27.5 45.4	52 23.4 23.8	266 27.2 52.4	
22	253 54.3	195 35.3 27.6	94 28.6 44.9	67 25.6 23.9	281 29.8 52.4	
23	268 56.8	210 35.0 28.2	109 29.7 44.3	82 27.9 24.0	296 32.3 52.5	
Mer. Pass. 5 11.1	h m	u -0.3 d 0.6	u 1.1 d 0.6	u 2.3 d 0.1	u 2.6 d 0.0	S.H.A. Mer. Pass. Venus 303 46.6 8 57 Mars 201 37.6 15 44 Jupiter 173 41.1 17 35 Saturn 27 31.3 3 21

UT (GMT)	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
	G.H.A. Dec.		G.H.A. ν		Dec. d		H.P.		Naut.	Civil		3	4	5	6
	d	h	d	h	d	h									
SATURDAY	300	178 58.4	N22 58.6	12 06.5	7.7	S21 54.7	2.7 57.3	N 72	□	□	□	■	■	{ ∞ $\frac{11}{12}$ }	22 41
	01	193 58.3	58.4	26 33.2	7.8	21 52.0	2.9 57.3	N 70	□	□	□	■	■	23 00	22 25
	02	208 58.2	58.2	41 00.0	7.7	21 49.1	2.9 57.2	68	□	□	□	■	■	22 32	22 11
	03	223 58.1	58.0	55 26.7	7.9	21 46.2	3.1 57.2	66	///	///	00 41	21 49	21 57	22 00	22 00
	04	238 58.0	57.8	69 53.6	7.9	21 43.1	3.2 57.2	64	///	///	01 47	21 20	21 36	21 45	21 51
	05	253 57.8	57.6	84 20.5	7.9	21 39.9	3.4 57.2	62	///	///	02 21	20 58	21 20	21 34	21 43
	06	268 57.7	N22 57.4	98 47.4	8.1	S21 36.5	3.4 57.1	60	///	01 11	02 46	20 40	21 06	21 23	21 36
	07	283 57.6	57.2	113 14.5	8.0	21 33.1	3.6 57.1	N 58	///	01 53	03 05	20 25	20 54	21 14	21 30
	08	298 57.5	57.0	127 41.5	8.1	21 29.5	3.7 57.1	56	///	02 20	03 21	20 12	20 43	21 07	21 25
	09	313 57.4	56.8	142 08.6	8.2	21 25.8	3.8 57.1	54	01 05	02 41	03 35	20 01	20 34	21 00	21 20
	10	328 57.3	56.6	156 35.8	8.3	21 22.0	4.0 57.0	52	01 44	02 59	03 46	19 51	20 26	20 53	21 16
	11	343 57.2	56.4	171 03.1	8.3	21 18.0	4.0 57.0	50	02 10	03 13	03 57	19 42	20 18	20 48	21 12
	12	358 57.0	N22 56.2	185 30.4	8.3	S21 14.0	4.2 57.0	45	02 53	03 42	04 19	19 23	20 03	20 35	21 03
	13	13 56.9	55.9	199 57.7	8.4	21 09.8	4.3 57.0	N 40	03 23	04 04	04 36	19 08	19 49	20 25	20 56
	14	28 56.8	55.7	214 25.1	8.5	21 05.5	4.4 57.0	35	03 45	04 21	04 51	18 55	19 38	20 16	20 50
	15	43 56.7	55.5	228 52.6	8.6	21 01.1	4.5 56.9	30	04 03	04 36	05 04	18 44	19 29	20 08	20 44
	16	58 56.6	55.3	243 20.2	8.6	20 56.6	4.7 56.9	20	04 32	05 01	05 25	18 24	19 12	19 55	20 35
	17	73 56.5	55.1	257 47.8	8.7	20 51.9	4.7 56.9	N 10	04 54	05 21	05 44	18 07	18 57	19 43	20 26
	18	88 56.4	N22 54.9	272 15.5	8.7	S20 47.2	4.9 56.9	0	05 12	05 38	06 01	17 51	18 43	19 32	20 18
	19	103 56.3	54.7	286 43.2	8.8	20 42.3	4.9 56.8	S 10	05 29	05 55	06 18	17 35	18 29	19 21	20 10
	20	118 56.1	54.5	301 11.0	8.9	20 37.4	5.1 56.8	20	05 44	06 12	06 36	17 18	18 15	19 09	20 02
	21	133 56.0	54.3	315 38.9	8.9	20 32.3	5.2 56.8	30	06 00	06 30	06 56	16 59	17 58	18 56	19 52
	22	148 55.9	54.1	330 06.8	9.0	20 27.1	5.3 56.8	35	06 09	06 40	07 08	16 47	17 48	18 48	19 46
	23	163 55.8	53.8	344 34.8	9.1	20 21.8	5.4 56.7	40	06 18	06 52	07 22	16 34	17 36	18 39	19 40
SUNDAY	400	178 55.7	N22 53.6	359 02.9	9.2	S20 16.4	5.6 56.7	45	06 28	07 05	07 39	16 18	17 23	18 28	19 32
	01	193 55.6	53.4	13 31.1	9.2	20 10.8	5.6 56.7	S 50	06 39	07 20	07 59	15 59	17 06	18 15	19 23
	02	208 55.5	53.2	27 59.3	9.3	20 05.2	5.7 56.7	52	06 44	07 28	08 08	15 50	16 59	18 09	19 19
	03	223 55.4	53.0	42 27.6	9.3	19 59.5	5.9 56.7	54	06 50	07 36	08 19	15 40	16 50	18 03	19 15
	04	238 55.2	52.8	56 55.9	9.4	19 53.6	5.9 56.6	56	06 56	07 44	08 31	15 28	16 41	17 55	19 09
	05	253 55.1	52.6	71 24.3	9.5	19 47.7	6.0 56.6	58	07 02	07 54	08 45	15 15	16 29	17 47	19 04
	06	268 55.0	N22 52.3	85 52.8	9.6	S19 41.7	6.2 56.6	S 60	07 09	08 05	09 02	14 59	16 17	17 37	18 57
	07	283 54.9	52.1	100 21.4	9.6	19 35.5	6.2 56.6								
	08	298 54.8	51.9	114 50.0	9.8	19 29.3	6.3 56.5								
	09	313 54.7	51.7	129 18.8	9.7	19 23.0	6.5 56.5								
	10	328 54.6	51.5	143 47.5	9.9	19 16.5	6.5 56.5								
	11	343 54.5	51.2	158 16.4	9.9	19 10.0	6.6 56.5								
	12	358 54.4	N22 51.0	172 45.3	10.1	S19 03.4	6.8 56.4								
	13	13 54.3	50.8	187 14.4	10.0	18 56.6	6.8 56.4	N 70	□	□	□	■	■	01 54	04 38
	14	28 54.1	50.6	201 43.4	10.2	18 49.8	6.9 56.4	N 72	□	□	□	■	■	03 04	05 05
	15	43 54.0	50.3	216 12.6	10.2	18 42.9	7.0 56.4	68	□	□	□	■	■	03 40	05 26
	16	58 53.9	50.1	230 41.8	10.3	18 35.9	7.1 56.3	66	23 22	///	///	00 53	02 27	04 06	05 42
	17	73 53.8	49.9	245 11.1	10.4	18 28.8	7.2 56.3	64	22 20	///	///	01 32	02 55	04 25	05 55
	18	88 53.7	N22 49.7	259 40.5	10.5	S18 21.6	7.2 56.3	62	21 47	///	///	01 59	03 17	04 41	06 06
	19	103 53.6	49.4	274 10.0	10.5	18 14.4	7.4 56.3	60	21 22	22 56	///	02 20	03 34	04 55	06 15
	20	118 53.5	49.2	288 39.5	10.6	18 07.0	7.4 56.2	N 58	21 03	22 14	///	02 37	03 49	05 06	06 24
	21	133 53.4	49.0	303 09.1	10.7	17 59.6	7.6 56.2	56	20 47	21 47	///	02 51	04 01	05 16	06 31
	22	148 53.3	48.7	317 38.8	10.7	17 52.0	7.6 56.2	54	20 34	21 27	23 02	03 04	04 12	05 25	06 37
	23	163 53.2	48.5	332 08.5	10.9	17 44.4	7.7 56.2	52	20 22	21 10	22 24	03 15	04 22	05 32	06 43
MONDAY	500	178 53.1	N22 48.3	346 38.4	10.9	S17 36.7	7.7 56.2	50	20 11	20 55	21 58	03 25	04 31	05 39	06 48
	01	193 52.9	48.1	1 08.3	10.9	17 29.0	7.9 56.1	45	19 50	20 27	21 15	03 45	04 49	05 54	06 59
	02	208 52.8	47.8	15 38.2	11.1	17 21.1	7.9 56.1	N 40	19 32	20 05	20 46	04 02	05 04	06 06	07 08
	03	223 52.7	47.6	30 08.3	11.1	17 13.2	8.1 56.1	35	19 18	19 47	20 23	04 16	05 16	06 17	07 16
	04	238 52.6	47.4	44 38.4	11.2	17 05.1	8.1 56.1	30	19 05	19 32	20 05	04 28	05 27	06 26	07 23
	05	253 52.5	47.1	59 08.6	11.3	16 57.0	8.1 56.0	20	18 44	19 08	19 37	04 48	05 45	06 41	07 35
	06	268 52.4	N22 46.9	73 38.9	11.3	S16 48.9	8.3 56.0	N 10	18 25	18 48	19 15	05 06	06 02	06 55	07 45
	07	283 52.3	46.7	88 09.2	11.5	16 40.6	8.3 56.0	0	18 08	18 30	18 57	05 23	06 17	07 07	07 55
	08	298 52.2	46.4	102 39.7	11.5	16 32.3	8.4 56.0	S 10	17 51	18 14	18 40	05 40	06 31	07 20	08 04
	09	313 52.1	46.2	117 10.2	11.6	16 23.9	8.5 55.9	20	17 33	17 57	18 24	05 57	06 47	07 33	08 14
	10	328 52.0	45.9	131 40.8	11.6	16 15.4	8.5 55.9	30	17 12	17 39	18 08	06 18	07 06	07 48	08 26
	11	343 51.9	45.7	146 11.4	11.7	16 06.9	8.6 55.9	35	17 00	17 28	18 00	06 30	07 16	07 57	08 32
	12	358 51.8	N22 45.5	160 42.1	11.8	S15 58.3	8.7 55.9	40	16 47	17 17	17 51	06 43	07 28	08 07	08 40
	13	13 51.7	45.2	175 12.9	11.9	15 49.6	8.8 55.8	45	16 30	17 04	17 41	06 59	07 42	08 18	08 48
	14	28 51.5	45.0	189 43.8	11.9	15 40.8	8.8 55.8	S 50	16 10	16 48	17 30	07 19	08 00	08 32	08 59
	15	43 51.4	44.7	204 14.7	12.0	15 32.0	8.9 55.8	52	16 01	16 41	17 25	07 28	08 08	08 39	09 04
	16	58 51.3	44.5	218 45.7	12.1	15 23.1	8.9 55.8	54	15 50	16 33	17 19	07 39	08 17	08 46	09 09
	17	73 51.2	44.3	233 16.8	12.2	15 14.2	9.0 55.8	56	15 38	16 25	17 13	07 51	08 27	08 54	09 15
	18	88 51.1	N22 44.0	247 48.0	12.2	S15 05.2	9.1 55.7	58	15 24	16 15	17 07	08 04	08 38	09 03	09 21
	19	103 51.0	43.8	262 19.2	12.3	14 56.1	9.1 55.7	S 60	15 07	16 04	17 00	08 20	08 52	09 13	09 28
	20	118 50.9	43.5	276 50.5	12.4	14 47.0	9.2 55.7								
	21	133 50.8	43.3	291 21.9	12.4	14 37.8	9.3 55.7								
	22	148 50.7	43.0	305 53.3	12.5	14 28.5	9.3 55.6								
	23	163 50.6	42.8	320 24.8	12.6	14 19.2	9.4 55.6								
	S.D. 15.8	d 0.2	S.D. 15.5	15.4	15.2										

UT (GMT)	ARIES	VENUS -4.1	MARS +1.6	JUPITER -2.0	SATURN +0.6	STARS
d h	G.H.A.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	Name S.H.A. Dec.
6 00	283 59.3	225 34.7 N17 28.8	124 30.8 N 9 43.7	97 30.1 S 1 24.1	311 34.9 S12 52.5	Acamar 315 29.8 S40 19.6
01	299 01.7	240 34.4 29.5	139 31.9 43.1	112 32.4 24.2	326 37.4 52.5	Achernar 335 37.9 S57 15.8
02	314 04.2	255 34.2 30.1	154 33.0 42.5	127 34.6 24.4	341 40.0 52.6	Acrux 173 26.1 S63 04.2
03	329 06.7	270 33.9 30.7	169 34.0 42.0	142 36.9 24.5	356 42.6 52.6	Adhara 255 24.6 S28 57.8
04	344 09.1	285 33.6 31.3	184 35.1 41.4	157 39.1 24.6	11 45.1 52.7	Aldebaran 291 06.8 N16 29.8
05	359 11.6	300 33.3 31.9	199 36.2 40.8	172 41.4 24.7	26 47.7 52.7	
06	14 14.0	315 33.0 N17 32.5	214 37.3 N 9 40.2	187 43.6 S 1 24.8	41 50.2 S12 52.8	Alioth 166 33.7 N55 59.9
07	29 16.5	330 32.7 33.1	229 38.4 39.6	202 45.8 24.9	56 52.8 52.8	Alkaid 153 10.5 N49 20.9
08	44 19.0	345 32.4 33.7	244 39.5 39.1	217 48.1 25.0	71 55.3 52.8	Al Na'ir 28 02.0 S46 59.2
09	59 21.4	0 32.1 34.3	259 40.6 38.5	232 50.3 25.1	86 57.9 52.9	Alnilam 276 01.8 S 1 12.4
10	74 23.9	15 31.9 34.9	274 41.6 37.9	247 52.6 25.2	102 00.5 52.9	Alphard 218 11.0 S 8 37.9
11	89 26.4	30 31.6 35.5	289 42.7 37.3	262 54.8 25.3	117 03.0 53.0	
12	104 28.8	45 31.3 N17 36.1	304 43.8 N 9 36.8	277 57.1 S 1 25.4	132 05.6 S12 53.0	Alphecca 126 23.4 N26 44.3
13	119 31.3	60 31.0 36.7	319 44.9 36.2	292 59.3 25.5	147 08.1 53.1	Alpheratz 357 58.8 N29 03.3
14	134 33.8	75 30.7 37.3	334 46.0 35.6	308 01.6 25.6	162 10.7 53.1	Altair 62 22.4 N 8 51.2
15	149 36.2	90 30.4 37.9	349 47.1 35.0	323 03.8 25.7	177 13.3 53.1	Ankaa 353 30.3 S42 20.1
16	164 38.7	105 30.1 38.5	4 48.2 34.4	338 06.0 25.8	192 15.8 53.2	Antares 112 44.2 S26 25.1
17	179 41.2	120 29.8 39.1	19 49.3 33.8	353 08.3 25.9	207 18.4 53.2	
18	194 43.6	135 29.5 N17 39.7	34 50.3 N 9 33.3	8 10.5 S 1 26.0	222 20.9 S12 53.3	Arcturus 146 09.2 N19 13.0
19	209 46.1	150 29.2 40.3	49 51.4 32.7	23 12.8 26.1	237 23.5 53.3	Atria 107 59.0 S69 01.1
20	224 48.5	165 28.9 40.9	64 52.5 32.1	38 15.0 26.2	252 26.1 53.4	Avior 234 24.7 S59 29.5
21	239 51.0	180 28.6 41.5	79 53.6 31.5	53 17.2 26.4	267 28.6 53.4	Bellatrix 278 48.3 N 6 20.6
22	254 53.5	195 28.3 42.1	94 54.7 30.9	68 19.5 26.5	282 31.2 53.4	Betelgeuse 271 17.7 N 7 24.3
23	269 55.9	210 28.0 42.7	109 55.8 30.4	83 21.7 26.6	297 33.7 53.5	
7 00	284 58.4	225 27.7 N17 43.3	124 56.9 N 9 29.8	98 24.0 S 1 26.7	312 36.3 S12 53.5	Canopus 264 03.3 S52 41.5
01	300 00.9	240 27.4 43.9	139 57.9 29.2	113 26.2 26.8	327 38.9 53.6	Capella 280 56.9 N45 59.4
02	315 03.3	255 27.1 44.5	154 59.0 28.6	128 28.5 26.9	342 41.4 53.6	Deneb 49 41.2 N45 15.5
03	330 05.8	270 26.8 45.1	170 00.1 28.0	143 30.7 27.0	357 44.0 53.7	Denebola 182 48.9 N14 36.5
04	345 08.3	285 26.5 45.7	185 01.2 27.5	158 32.9 27.1	12 46.5 53.7	Diphda 349 10.8 S18 01.1
05	0 10.7	300 26.2 46.3	200 02.3 26.9	173 35.2 27.2	27 49.1 53.8	
06	15 13.2	315 25.9 N17 46.9	215 03.4 N 9 26.3	188 37.4 S 1 27.3	42 51.7 S12 53.8	Dubhe 194 10.1 N61 47.3
07	30 15.6	330 25.6 47.5	230 04.4 25.7	203 39.7 27.4	57 54.2 53.8	Elnath 278 31.8 N28 36.1
08	45 18.1	345 25.3 48.1	245 05.5 25.1	218 41.9 27.5	72 56.8 53.9	Eltanin 90 52.5 N51 29.5
09	60 20.6	0 25.0 48.7	260 06.6 24.5	233 44.1 27.6	87 59.4 53.9	Enif 34 01.5 N 9 50.8
10	75 23.0	15 24.7 49.3	275 07.7 24.0	248 46.4 27.7	103 01.9 54.0	Fomalhaut 15 40.1 S29 39.1
11	90 25.5	30 24.4 49.9	290 08.8 23.4	263 48.6 27.8	118 04.5 54.0	
12	105 28.0	45 24.1 N17 50.5	305 09.9 N 9 22.8	278 50.8 S 1 28.0	133 07.0 S12 54.1	Gacrux 172 17.6 S57 05.0
13	120 30.4	60 23.8 51.1	320 11.0 22.2	293 53.1 28.1	148 09.6 54.1	Gienah 176 07.7 S17 30.5
14	135 32.9	75 23.5 51.7	335 12.0 21.6	308 55.3 28.2	163 12.2 54.2	Hadar 149 08.9 S60 20.8
15	150 35.4	90 23.2 52.2	350 13.1 21.0	323 57.6 28.3	178 14.7 54.2	Hamal 328 17.7 N23 25.9
16	165 37.8	105 22.9 52.8	5 14.2 20.5	338 59.8 28.4	193 17.3 54.2	Kaus Aust. 84 03.1 S34 23.2
17	180 40.3	120 22.5 53.4	20 15.3 19.9	354 02.0 28.5	208 19.9 54.3	
18	195 42.8	135 22.2 N17 54.0	35 16.4 N 9 19.3	9 04.3 S 1 28.6	223 22.4 S12 54.3	Kochab 137 18.8 N74 11.2
19	210 45.2	150 21.9 54.6	50 17.5 18.7	24 06.5 28.7	238 25.0 54.4	Markab 13 53.0 N15 10.3
20	225 47.7	165 21.6 55.2	65 18.6 18.1	39 08.7 28.8	253 27.6 54.4	Menkar 314 30.8 N 4 03.9
21	240 50.1	180 21.3 55.8	80 19.6 17.5	54 11.0 28.9	268 30.1 54.5	Menkent 148 25.0 S36 20.5
22	255 52.6	195 21.0 56.4	95 20.7 17.0	69 13.2 29.0	283 32.7 54.5	Miaplacidus 221 43.6 S69 41.7
23	270 55.1	210 20.7 57.0	110 21.8 16.4	84 15.4 29.1	298 35.2 54.6	
8 00	285 57.5	225 20.4 N17 57.5	125 22.9 N 9 15.8	99 17.7 S 1 29.3	313 37.8 S12 54.6	Mirfak 309 02.0 N49 50.2
01	301 00.0	240 20.0 58.1	140 24.0 15.2	114 19.9 29.4	328 40.4 54.6	Nunki 76 16.4 S26 18.2
02	316 02.5	255 19.7 58.7	155 25.1 14.6	129 22.2 29.5	343 42.9 54.7	Peacock 53 42.0 S56 45.1
03	331 04.9	270 19.4 59.3	170 26.1 14.0	144 24.4 29.6	358 45.5 54.7	Pollux 243 46.3 N28 02.5
04	346 07.4	285 19.1 59.9	185 27.2 13.5	159 26.6 29.7	13 48.1 54.8	Procyon 245 15.6 N 5 14.5
05	1 09.9	300 18.8 18 00.5	200 28.3 12.9	174 28.9 29.8	28 50.6 54.8	
06	16 12.3	315 18.5 N18 01.0	215 29.4 N 9 12.3	189 31.1 S 1 29.9	43 53.2 S12 54.9	Rasalhague 96 19.9 N12 34.0
07	31 14.8	330 18.1 01.6	230 30.5 11.7	204 33.3 30.0	58 55.8 54.9	Regulus 207 59.6 N11 59.9
08	46 17.3	345 17.8 02.2	245 31.6 11.1	219 35.6 30.1	73 58.3 55.0	Rigel 281 26.7 S 8 12.5
09	61 19.7	0 17.5 02.8	260 32.7 10.5	234 37.8 30.2	89 00.9 55.0	Rigel Kent. 140 11.8 S60 48.8
10	76 22.2	15 17.2 03.4	275 33.7 09.9	249 40.0 30.3	104 03.5 55.1	Sabik 102 29.3 S15 43.0
11	91 24.6	30 16.8 03.9	290 34.8 09.4	264 42.3 30.5	119 06.0 55.1	
12	106 27.1	45 16.5 N18 04.5	305 35.9 N 9 08.8	279 44.5 S 1 30.6	134 08.6 S12 55.1	Schedar 349 57.5 N56 30.0
13	121 29.6	60 16.2 05.1	320 37.0 08.2	294 46.7 30.7	149 11.2 55.2	Shaula 96 41.7 S37 06.0
14	136 32.0	75 15.9 05.7	335 38.1 07.6	309 49.0 30.8	164 13.7 55.2	Sirius 258 47.2 S16 42.5
15	151 34.5	90 15.6 06.3	350 39.2 07.0	324 51.2 30.9	179 16.3 55.3	Spica 158 46.9 S11 07.8
16	166 37.0	105 15.2 06.8	5 40.2 06.4	339 53.4 31.0	194 18.9 55.3	Suhail 223 03.8 S43 24.6
17	181 39.4	120 14.9 07.4	20 41.3 05.8	354 55.6 31.1	209 21.4 55.4	
18	196 41.9	135 14.6 N18 08.0	35 42.4 N 9 05.3	9 57.9 S 1 31.2	224 24.0 S12 55.4	Vega 80 48.6 N38 46.8
19	211 44.4	150 14.3 08.6	50 43.5 04.7	25 00.1 31.3	239 26.6 55.5	Zuben'ubi 137 21.8 S16 01.0
20	226 46.8	165 13.9 09.1	65 44.6 04.1	40 02.3 31.4	254 29.1 55.5	
21	241 49.3	180 13.6 09.7	80 45.7 03.5	55 04.6 31.6	269 31.7 55.6	
22	256 51.7	195 13.3 10.3	95 46.8 02.9	70 06.8 31.7	284 34.3 55.6	Venus 300 29.3 8 58
23	271 54.2	210 12.9 10.9	110 47.8 02.3	85 09.0 31.8	299 36.8 55.6	Mars 199 58.5 15 39
						Jupiter 173 25.6 17 24
						Saturn 27 37.9 3 09
Mer. Pass. 4 59.3	u -0.3 d 0.6		u 1.1 d 0.6	u 2.2 d 0.1	u 2.6 d 0.0	

UT (GMT)	SUN		MOON				Lat.	Twilight		Sunrise	Moonrise					
	G.H.A.		G.H.A.					Naut.	Civil		6	7	8	9		
	Dec.		Dec.													
d	h	m	d	h	m	s	h	m	s	h	m	s	h	m	s	
TUESDAY	00	178 50.5	N22 42.5	334 56.4	12.7	S14 09.8	9.4	55.6	N 72	□	□	□	22 41	22 22	22 06	21 50
	01	193 50.4	42.3	349 28.1	12.7	14 00.4	9.5	55.6	N 70	□	□	□	22 25	22 13	22 04	21 54
	02	208 50.3	42.0	3 59.8	12.8	13 50.9	9.6	55.6	66	///	///	00 57	22 00	22 00	22 00	21 59
	03	223 50.2	41.8	18 31.6	12.8	13 41.3	9.6	55.5	64	///	///	01 54	21 51	21 55	21 59	22 02
	04	238 50.1	41.5	33 03.4	12.9	13 31.7	9.6	55.5	62	///	///	02 26	21 43	21 51	21 57	22 04
	05	253 50.0	41.3	47 35.3	13.0	13 22.1	9.8	55.5	60	///	01 19	02 50	21 36	21 47	21 56	22 05
	06	268 49.9	N22 41.0	62 07.3	13.1	S13 12.3	9.7	55.5	N 58	///	01 58	03 08	21 30	21 44	21 55	22 07
	07	283 49.8	40.8	76 39.4	13.1	13 02.6	9.8	55.4	56	///	02 25	03 24	21 25	21 41	21 54	22 08
	08	298 49.7	40.5	91 11.5	13.2	12 52.8	9.9	55.4	54	01 13	02 45	03 37	21 20	21 38	21 54	22 09
	09	313 49.6	40.3	105 43.7	13.2	12 42.9	9.9	55.4	52	01 49	03 02	03 49	21 16	21 35	21 53	22 10
	10	328 49.5	40.0	120 15.9	13.4	12 33.0	10.0	55.4	50	02 14	03 16	03 59	21 12	21 33	21 52	22 11
	11	343 49.4	39.8	134 48.3	13.3	12 23.0	10.0	55.4	45	02 56	03 44	04 21	21 03	21 28	21 51	22 13
	12	358 49.3	N22 39.5	149 20.6	13.5	S12 13.0	10.0	55.3	N 40	03 25	04 06	04 38	20 56	21 24	21 50	22 15
	13	13 49.1	39.3	163 53.1	13.5	12 03.0	10.1	55.3	35	03 47	04 23	04 52	20 50	21 20	21 49	22 17
	14	28 49.0	39.0	178 25.6	13.5	11 52.9	10.1	55.3	30	04 05	04 38	05 05	20 44	21 17	21 48	22 18
	15	43 48.9	38.8	192 58.1	13.7	11 42.8	10.2	55.3	20	04 33	05 02	05 26	20 35	21 11	21 46	22 21
	16	58 48.8	38.5	207 30.8	13.6	11 32.6	10.3	55.3	N 10	04 55	05 21	05 44	20 26	21 06	21 45	22 23
	17	73 48.7	38.2	222 03.4	13.8	11 22.3	10.2	55.2	0	05 13	05 39	06 01	20 18	21 02	21 44	22 25
	18	88 48.6	N22 38.0	236 36.2	13.8	S11 12.1	10.3	55.2	S 10	05 29	05 55	06 18	20 10	20 57	21 42	22 27
	19	103 48.5	37.7	251 09.0	13.8	11 01.8	10.4	55.2	20	05 45	06 12	06 36	20 02	20 52	21 41	22 29
	20	118 48.4	37.5	265 41.8	14.0	10 51.4	10.4	55.2	30	06 00	06 30	06 56	19 52	20 46	21 40	22 32
	21	133 48.3	37.2	280 14.8	13.9	10 41.0	10.4	55.2	35	06 09	06 40	07 08	19 46	20 43	21 39	22 33
	22	148 48.2	36.9	294 47.7	14.1	10 30.6	10.4	55.1	40	06 17	06 51	07 22	19 40	20 40	21 38	22 35
	23	163 48.1	36.7	309 20.8	14.1	10 20.2	10.5	55.1	45	06 27	07 04	07 38	19 32	20 35	21 37	22 37
WEDNESDAY	00	178 48.0	N22 36.4	323 53.9	14.1	S10 09.7	10.6	55.1	S 50	06 38	07 19	07 57	19 23	20 30	21 35	22 40
	01	193 47.9	36.1	338 27.0	14.2	9 59.1	10.5	55.1	52	06 43	07 26	08 07	19 19	20 28	21 35	22 41
	02	208 47.8	35.9	353 00.2	14.2	9 48.6	10.6	55.1	54	06 48	07 34	08 17	19 15	20 25	21 34	22 42
	03	223 47.7	35.6	7 33.4	14.3	9 38.0	10.7	55.0	56	06 54	07 43	08 29	19 09	20 22	21 33	22 43
	04	238 47.6	35.3	22 06.7	14.4	9 27.3	10.6	55.0	58	07 00	07 52	08 43	19 04	20 19	21 32	22 45
	05	253 47.5	35.1	36 40.1	14.4	9 16.7	10.7	55.0	S 60	07 07	08 03	08 59	18 57	20 15	21 31	22 46
	06	268 47.4	N22 34.8	51 13.5	14.5	S 9 06.0	10.7	55.0								
	07	283 47.3	34.5	65 47.0	14.5	8 55.3	10.8	55.0								
	08	298 47.2	34.3	80 20.5	14.5	8 44.5	10.8	54.9								
	09	313 47.1	34.0	94 54.0	14.6	8 33.7	10.8	54.9								
	10	328 47.0	33.7	109 27.6	14.7	8 22.9	10.8	54.9								
	11	343 46.9	33.5	124 01.3	14.7	8 12.1	10.9	54.9								
	12	358 46.8	N22 33.2	138 35.0	14.7	S 8 01.2	10.9	54.9								
	13	13 46.7	32.9	153 08.7	14.8	7 50.3	10.9	54.9								
	14	28 46.6	32.6	167 42.5	14.8	7 39.4	10.9	54.8								
	15	43 46.5	32.4	182 16.3	14.9	7 28.5	11.0	54.8								
	16	58 46.4	32.1	196 50.2	14.9	7 17.5	10.9	54.8								
	17	73 46.3	31.8	211 24.1	15.0	7 06.6	11.0	54.8								
	18	88 46.2	N22 31.5	225 58.1	15.0	S 6 55.6	11.1	54.8								
	19	103 46.1	31.3	240 32.1	15.0	6 44.5	11.0	54.8								
	20	118 46.0	31.0	255 06.1	15.1	6 33.5	11.1	54.7								
	21	133 45.9	30.7	269 40.2	15.1	6 22.4	11.1	54.7								
	22	148 45.8	30.4	284 14.3	15.2	6 11.3	11.1	54.7								
	23	163 45.8	30.2	298 48.5	15.2	6 00.2	11.1	54.7								
THURSDAY	00	178 45.7	N22 29.9	313 22.7	15.2	S 5 49.1	11.1	54.7	N 40	19 31	20 04	20 45	07 08	08 09	09 08	10 06
	01	193 45.6	29.6	327 56.9	15.3	5 38.0	11.1	54.7	35	19 17	19 46	20 23	07 16	08 14	09 10	10 05
	02	208 45.5	29.3	342 31.2	15.3	5 26.9	11.2	54.7	30	19 05	19 32	20 05	07 23	08 18	09 12	10 05
	03	223 45.4	29.0	357 05.5	15.3	5 15.7	11.2	54.6	20	18 44	19 08	19 37	07 35	08 26	09 16	10 04
	04	238 45.3	28.7	11 39.8	15.4	5 04.5	11.2	54.6	N 10	18 25	18 48	19 15	07 45	08 33	09 19	10 04
	05	253 45.2	28.5	26 14.2	15.4	4 53.3	11.2	54.6	0	18 09	18 31	18 57	07 55	08 39	09 22	10 04
	06	268 45.1	N22 28.2	40 48.6	15.4	S 4 42.1	11.2	54.6	S 10	17 52	18 14	18 41	08 04	08 46	09 25	10 03
	07	283 45.0	27.9	55 23.0	15.5	4 30.9	11.2	54.6	20	17 34	17 58	18 25	08 14	08 52	09 28	10 03
	08	298 44.9	27.6	69 57.5	15.5	4 19.7	11.2	54.6	30	17 14	17 40	18 10	08 26	09 00	09 32	10 02
	09	313 44.8	27.3	84 32.0	15.5	4 08.5	11.3	54.6	35	17 02	17 30	18 01	08 32	09 04	09 34	10 02
	10	328 44.7	27.0	99 06.5	15.6	3 57.2	11.3	54.5	40	16 48	17 19	17 52	08 40	09 09	09 36	10 02
	11	343 44.6	26.8	113 41.1	15.6	3 45.9	11.2	54.5	45	16 32	17 06	17 43	08 48	09 15	09 39	10 01
	12	358 44.5	N22 26.5	128 15.7	15.6	S 3 34.7	11.3	54.5	S 50	16 13	16 51	17 32	08 59	09 21	09 42	10 01
	13	13 44.4	26.2	142 50.3	15.6	3 23.4	11.3	54.5	52	16 03	16 44	17 27	09 04	09 25	09 43	10 00
	14	28 44.3	25.9	157 24.9	15.6	3 12.1	11.2	54.5	54	15 53	16 36	17 22	09 09	09 28	09 45	10 00
	15	43 44.2	25.6	171 59.5	15.7	3 00.9	11.3	54.5	56	15 41	16 27	17 16	09 15	09 32	09 46	10 00
	16	58 44.1	25.3	186 34.2	15.7	2 49.6	11.3	54.5	58	15 27	16 18	17 10	09 21	09 36	09 48	10 00
	17	73 44.0	25.0	201 08.9	15.7	2 38.3	11.3	54.5	S 60	15 11	16 07	17 03	09 28	09 40	09 50	09 59
	18	88 43.9	N22 24.7	215 43.6	15.8	S 2 27.0	11.3	54.5								
	19	103 43.8	24.4	230 18.4	15.8	2 15.7	11.4	54.4								
	20	118 43.7	24.1	244 53.2	15.7	2 04.3	11.3	54.4								
	21	133 43.7	23.8	259 27.9	15.8	1 53.0	11.3	54.4								
	22	148 43.6	23.5	274 02.7	15.9	1 41.7	11.3	54.4								
	23	163 43.5	23.2	288 37.6	15.8	1 30.4	11.3	54.4								
								Day	SUN			MOON				
									Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase	
									00 h	12 h		Upper	Lower			
								6	m s	m s	h m	h m	h m	d		
								7	04 38	04 43	12 05	01 43	14 06	16	☉	
								8	04 48	04 52	12 05	02 29	14 51	17		
									04 57	05 02	12 05	03 12	15 33	18		
									S.D. 15.8	d 0.3	S.D. 15.1	15.0	14.9			

UT (GMT)	ARIES	VENUS -4.0	MARS +1.6	JUPITER -1.7	SATURN +0.4	STARS
d h	G.H.A.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	Name S.H.A. Dec.
10 00	349 02.4	210 30.5 N16 25.9	151 46.1 S 7 04.0	153 01.7 S 5 37.4	20 48.6 S14 29.7	Acamar 315 29.3 S40 19.5
01	4 04.9	225 29.9 25.1	166 47.1 04.6	168 03.7 37.6	35 51.2 29.7	Achernar 335 37.2 S57 15.8
02	19 07.3	240 29.3 24.3	181 48.0 05.3	183 05.7 37.8	50 53.9 29.8	Acrux 173 26.5 S63 04.0
03	34 09.8	255 28.8 23.6	196 48.9 05.9	198 07.7 38.0	65 56.5 29.8	Adhara 255 24.3 S28 57.6
04	49 12.3	270 28.2 22.8	211 49.9 06.6	213 09.7 38.2	80 59.1 29.9	Aldebaran 291 06.3 N16 29.9
05	64 14.7	285 27.6 22.0	226 50.8 07.2	228 11.7 38.4	96 01.7 30.0	
06	79 17.2	300 27.0 N16 21.2	241 51.8 S 7 07.9	243 13.7 S 5 38.6	111 04.4 S14 30.0	Alioth 166 34.1 N55 59.7
07	94 19.7	315 26.5 20.4	256 52.7 08.5	258 15.7 38.8	126 07.0 30.1	Alkaid 153 10.8 N49 20.8
08	109 22.1	330 25.9 19.6	271 53.6 09.2	273 17.7 39.0	141 09.6 30.1	Al Na'ir 28 01.7 S46 59.4
09	124 24.6	345 25.3 18.8	286 54.6 09.8	288 19.7 39.2	156 12.2 30.2	Alnilam 276 01.4 S 1 12.2
10	139 27.1	0 24.8 18.0	301 55.5 10.5	303 21.7 39.4	171 14.9 30.2	Alphard 218 10.9 S 8 37.8
11	154 29.5	15 24.2 17.2	316 56.5 11.1	318 23.7 39.6	186 17.5 30.3	
12	169 32.0	30 23.6 N16 16.5	331 57.4 S 7 11.8	333 25.7 S 5 39.8	201 20.1 S14 30.4	Alphecca 126 23.6 N26 44.4
13	184 34.4	45 23.1 15.7	346 58.4 12.4	348 27.7 40.0	216 22.7 30.4	Alpheratz 357 58.5 N29 03.5
14	199 36.9	60 22.5 14.9	1 59.3 13.0	3 29.7 40.2	231 25.4 30.5	Altair 62 22.4 N 8 51.3
15	214 39.4	75 21.9 14.1	17 00.2 13.7	18 31.6 40.4	246 28.0 30.5	Ankaa 353 29.8 S42 20.1
16	229 41.8	90 21.4 13.3	32 01.2 14.3	33 33.6 40.6	261 30.6 30.6	Antares 112 44.5 S26 25.1
17	244 44.3	105 20.8 12.5	47 02.1 15.0	48 35.6 40.8	276 33.2 30.6	
18	259 46.8	120 20.3 N16 11.7	62 03.1 S 7 15.6	63 37.6 S 5 41.0	291 35.9 S14 30.7	Arcturus 146 09.4 N19 13.0
19	274 49.2	135 19.7 10.9	77 04.0 16.3	78 39.6 41.2	306 38.5 30.8	Atria 107 59.6 S69 01.2
20	289 51.7	150 19.1 10.1	92 04.9 16.9	93 41.6 41.4	321 41.1 30.8	Avior 234 24.5 S59 29.2
21	304 54.2	165 18.6 09.3	107 05.9 17.6	108 43.6 41.6	336 43.7 30.9	Bellatrix 278 47.9 N 6 20.7
22	319 56.6	180 18.0 08.5	122 06.8 18.2	123 45.6 41.8	351 46.4 30.9	Betelgeuse 271 17.3 N 7 24.4
23	334 59.1	195 17.4 07.7	137 07.8 18.9	138 47.6 42.0	6 49.0 31.0	
11 00	350 01.6	210 16.9 N16 06.9	152 08.7 S 7 19.5	153 49.6 S 5 42.2	21 51.6 S14 31.0	Canopus 264 02.8 S52 41.3
01	5 04.0	225 16.3 06.1	167 09.6 20.2	168 51.6 42.3	36 54.2 31.1	Capella 280 56.3 N45 59.4
02	20 06.5	240 15.7 05.3	182 10.6 20.8	183 53.6 42.5	51 56.9 31.1	Deneb 49 41.2 N45 15.8
03	35 08.9	255 15.2 04.5	197 11.5 21.5	198 55.6 42.7	66 59.5 31.2	Denebola 182 49.0 N14 36.5
04	50 11.4	270 14.6 03.7	212 12.4 22.1	213 57.6 42.9	82 02.1 31.3	Diphda 349 10.4 S18 01.0
05	65 13.9	285 14.1 02.9	227 13.4 22.8	228 59.6 43.1	97 04.7 31.3	
06	80 16.3	300 13.5 N16 02.1	242 14.3 S 7 23.4	244 01.6 S 5 43.3	112 07.4 S14 31.4	Dubhe 194 10.3 N61 47.0
07	95 18.8	315 12.9 01.2	257 15.3 24.1	259 03.6 43.5	127 10.0 31.4	Elnath 278 31.3 N28 36.1
08	110 21.3	330 12.4 16 00.4	272 16.2 24.7	274 05.6 43.7	142 12.6 31.5	Eltanin 90 52.9 N51 29.7
09	125 23.7	345 11.8 15 59.6	287 17.1 25.4	289 07.6 43.9	157 15.2 31.5	Enif 34 01.3 N 9 51.0
10	140 26.2	0 11.3 58.8	302 18.1 26.0	304 09.6 44.1	172 17.9 31.6	Fomalhaut 15 39.8 S29 39.1
11	155 28.7	15 10.7 58.0	317 19.0 26.7	319 11.6 44.3	187 20.5 31.7	
12	170 31.1	30 10.1 N15 57.2	332 19.9 S 7 27.3	334 13.6 S 5 44.5	202 23.1 S14 31.7	Gacrux 172 18.0 S57 04.8
13	185 33.6	45 09.6 56.4	347 20.9 28.0	349 15.6 44.7	217 25.7 31.8	Gienah 176 07.8 S17 30.4
14	200 36.0	60 09.0 55.6	2 21.8 28.6	4 17.6 44.9	232 28.4 31.8	Hadar 149 09.4 S60 20.8
15	215 38.5	75 08.5 54.8	17 22.8 29.2	19 19.6 45.1	247 31.0 31.9	Hamal 328 17.2 N23 26.1
16	230 41.0	90 07.9 53.9	32 23.7 29.9	34 21.6 45.3	262 33.6 31.9	Kaus Aust. 84 03.3 S34 23.3
17	245 43.4	105 07.4 53.1	47 24.6 30.5	49 23.6 45.5	277 36.2 32.0	
18	260 45.9	120 06.8 N15 52.3	62 25.6 S 7 31.2	64 25.6 S 5 45.7	292 38.9 S14 32.0	Kochab 137 20.0 N74 11.1
19	275 48.4	135 06.2 51.5	77 26.5 31.8	79 27.5 45.9	307 41.5 32.1	Markab 13 52.7 N15 10.5
20	290 50.8	150 05.7 50.7	92 27.4 32.5	94 29.5 46.1	322 44.1 32.2	Menkar 314 30.3 N 4 04.1
21	305 53.3	165 05.1 49.9	107 28.4 33.1	109 31.5 46.3	337 46.7 32.2	Menkent 148 25.3 S36 20.4
22	320 55.8	180 04.6 49.0	122 29.3 33.8	124 33.5 46.5	352 49.3 32.3	Miaplacidus 221 43.6 S69 41.4
23	335 58.2	195 04.0 48.2	137 30.2 34.4	139 35.5 46.7	7 52.0 32.3	
12 00	351 00.7	210 03.5 N15 47.4	152 31.2 S 7 35.1	154 37.5 S 5 46.9	22 54.6 S14 32.4	Mirfak 309 01.3 N49 50.3
01	6 03.2	225 02.9 46.6	167 32.1 35.7	169 39.5 47.1	37 57.2 32.4	Nunki 76 16.4 S26 18.2
02	21 05.6	240 02.3 45.8	182 33.0 36.4	184 41.5 47.3	52 59.8 32.5	Peacock 53 41.9 S56 45.3
03	36 08.1	255 01.8 44.9	197 34.0 37.0	199 43.5 47.5	68 02.5 32.5	Pollux 243 46.0 N28 02.4
04	51 10.5	270 01.2 44.1	212 34.9 37.7	214 45.5 47.7	83 05.1 32.6	Procyon 245 15.3 N 5 14.5
05	66 13.0	285 00.7 43.3	227 35.8 38.3	229 47.5 47.9	98 07.7 32.7	
06	81 15.5	300 00.1 N15 42.5	242 36.8 S 7 38.9	244 49.5 S 5 48.1	113 10.3 S14 32.7	Rasalhague 96 20.1 N12 34.1
07	96 17.9	314 59.6 41.6	257 37.7 39.6	259 51.5 48.3	128 13.0 32.8	Regulus 207 59.5 N11 59.9
08	111 20.4	329 59.0 40.8	272 38.6 40.2	274 53.5 48.5	143 15.6 32.8	Rigel 281 26.2 S 8 12.4
09	126 22.9	344 58.5 40.0	287 39.6 40.9	289 55.5 48.7	158 18.2 32.9	Rigel Kent. 140 12.3 S60 48.7
10	141 25.3	359 57.9 39.1	302 40.5 41.5	304 57.5 48.8	173 20.8 32.9	Sabik 102 29.5 S15 43.0
11	156 27.8	14 57.4 38.3	317 41.4 42.2	319 59.5 49.0	188 23.4 33.0	
12	171 30.3	29 56.8 N15 37.5	332 42.4 S 7 42.8	335 01.5 S 5 49.2	203 26.1 S14 33.0	Schedar 349 56.9 N56 30.2
13	186 32.7	44 56.3 36.7	347 43.3 43.5	350 03.4 49.4	218 28.7 33.1	Shaula 96 41.9 S37 06.0
14	201 35.2	59 55.7 35.8	2 44.2 44.1	5 05.4 49.6	233 31.3 33.1	Sirius 258 46.8 S16 42.3
15	216 37.7	74 55.2 35.0	17 45.2 44.8	20 07.4 49.8	248 33.9 33.2	Spica 158 47.1 S11 07.7
16	231 40.1	89 54.6 34.2	32 46.1 45.4	35 09.4 50.0	263 36.5 33.3	Suhail 223 03.7 S43 24.3
17	246 42.6	104 54.1 33.3	47 47.0 46.1	50 11.4 50.2	278 39.2 33.3	
18	261 45.0	119 53.5 N15 32.5	62 48.0 S 7 46.7	65 13.4 S 5 50.4	293 41.8 S14 33.4	Vega 80 48.8 N38 47.0
19	276 47.5	134 53.0 31.7	77 48.9 47.3	80 15.4 50.6	308 44.4 33.4	Zuben'ubi 137 22.0 S16 00.9
20	291 50.0	149 52.4 30.8	92 49.8 48.0	95 17.4 50.8	323 47.0 33.5	
21	306 52.4	164 51.9 30.0	107 50.8 48.6	110 19.4 51.0	338 49.7 33.5	
22	321 54.9	179 51.3 29.1	122 51.7 49.3	125 21.4 51.2	353 52.3 33.6	
23	336 57.4	194 50.8 28.3	137 52.6 49.9	140 23.4 51.4	8 54.9 33.6	
Mer. Pass. 0 39.8	u -0.6 d 0.8		u 0.9 d 0.6	u 2.0 d 0.2	u 2.6 d 0.1	
						S.H.A. Mer. Pass.
						Venus 220 15.3 9 59
						Mars 162 07.1 13 51
						Jupiter 163 48.1 13 43
						Saturn 31 50.1 22 29

UT (GMT)	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
	G.H.A.	Dec.	G.H.A.	v	Dec.	d	H.P.		Naut.	Civil		10	11	12	13
												h m	h m	h m	h m
F R I D A Y	10 00	180 43.3	N 5 01.0	263 27.2	8.8	N21 42.3	1.8 56.6	N 72	01 27	03 33	04 49	□	□	23 36	26 00
	01	195 43.6	5 00.0	277 55.0	8.7	21 40.5	1.8 56.7	N 70	02 12	03 50	04 56	□	21 50	24 07	00 07
	02	210 43.8	4 59.1	292 22.7	8.7	21 38.7	2.0 56.7	68	02 40	04 03	05 02	20 38	22 33	24 30	00 30
	03	225 44.0	.. 58.1	306 50.4	8.7	21 36.7	2.2 56.7	66	03 01	04 13	05 07	21 24	23 02	24 48	00 48
	04	240 44.2	57.2	321 18.1	8.7	21 34.5	2.2 56.8	64	03 17	04 22	05 11	21 54	23 24	25 02	01 02
	05	255 44.4	56.2	335 45.8	8.6	21 32.3	2.4 56.8	62	03 31	04 29	05 15	22 17	23 41	25 14	01 14
	06	270 44.7	N 4 55.3	350 13.4	8.6	N21 29.9	2.5 56.9	60	03 42	04 35	05 18	22 35	23 55	25 24	01 24
	07	285 44.9	54.3	4 41.0	8.6	21 27.4	2.6 56.9	N 58	03 51	04 41	05 21	22 50	24 07	00 07	01 33
	08	300 45.1	53.4	19 08.6	8.5	21 24.8	2.8 56.9	56	03 59	04 45	05 24	23 03	24 18	00 18	01 41
	09	315 45.3	.. 52.4	33 36.1	8.6	21 22.0	2.8 57.0	54	04 06	04 50	05 26	23 14	24 27	00 27	01 48
	10	330 45.5	51.5	48 03.7	8.5	21 19.2	3.0 57.0	52	04 12	04 53	05 28	23 24	24 35	00 35	01 54
	11	345 45.7	50.5	62 31.2	8.5	21 16.2	3.1 57.0	50	04 17	04 57	05 30	23 33	24 43	00 43	01 59
	12	0 46.0	N 4 49.6	76 58.7	8.4	N21 13.1	3.3 57.1	45	04 29	05 04	05 34	23 51	24 59	00 59	02 11
	13	15 46.2	48.6	91 26.1	8.4	21 09.8	3.3 57.1	N 40	04 37	05 10	05 37	24 06	00 06	01 12	02 21
	14	30 46.4	47.7	105 53.5	8.5	21 06.5	3.5 57.2	35	04 44	05 14	05 40	24 19	00 19	01 23	02 30
	15	45 46.6	.. 46.7	120 21.0	8.4	21 03.0	3.6 57.2	30	04 50	05 18	05 42	24 30	00 30	01 32	02 37
	16	60 46.8	45.8	134 48.4	8.3	20 59.4	3.8 57.2	20	04 59	05 24	05 46	24 50	00 50	01 49	02 50
	17	75 47.1	44.8	149 15.7	8.4	20 55.6	3.8 57.3	N 10	05 04	05 29	05 50	00 11	01 06	02 03	03 01
	18	90 47.3	N 4 43.9	163 43.1	8.3	N20 51.8	4.0 57.3	0	05 09	05 33	05 53	00 28	01 22	02 16	03 11
	19	105 47.5	42.9	178 10.4	8.3	20 47.8	4.1 57.3	S 10	05 11	05 35	05 56	00 44	01 37	02 30	03 21
	20	120 47.7	42.0	192 37.7	8.3	20 43.7	4.3 57.4	20	05 12	05 38	06 00	01 02	01 54	02 44	03 32
	21	135 47.9	.. 41.0	207 05.0	8.3	20 39.4	4.3 57.4	30	05 12	05 39	06 03	01 23	02 13	03 00	03 45
	22	150 48.1	40.1	221 32.3	8.3	20 35.1	4.5 57.5	35	05 11	05 40	06 05	01 35	02 24	03 10	03 52
	23	165 48.4	39.1	235 59.6	8.3	20 30.6	4.6 57.5	40	05 09	05 41	06 08	01 49	02 37	03 20	04 00
S A T U R D A Y	11 00	180 48.6	N 4 38.2	250 26.9	8.2	N20 26.0	4.8 57.5	45	05 07	05 41	06 10	02 05	02 52	03 33	04 10
	01	195 48.8	37.2	264 54.1	8.2	20 21.2	4.8 57.6	S 50	05 04	05 41	06 13	02 25	03 10	03 48	04 21
	02	210 49.0	36.3	279 21.3	8.3	20 16.4	5.0 57.6	52	05 02	05 41	06 15	02 35	03 19	03 55	04 26
	03	225 49.2	.. 35.3	293 48.6	8.2	20 11.4	5.1 57.7	54	05 00	05 41	06 16	02 45	03 28	04 03	04 32
	04	240 49.5	34.4	308 15.8	8.1	20 06.3	5.2 57.7	56	04 58	05 41	06 18	02 58	03 39	04 12	04 39
	05	255 49.7	33.4	322 42.9	8.2	20 01.1	5.4 57.7	58	04 55	05 40	06 20	03 12	03 52	04 22	04 46
	06	270 49.9	N 4 32.5	337 10.1	8.2	N19 55.7	5.5 57.8	S 60	04 52	05 40	06 22	03 28	04 06	04 34	04 54
	07	285 50.1	31.5	351 37.3	8.2	19 50.2	5.6 57.8	Lat.		Sunset		Twilight		Moonset	
	08	300 50.3	30.6	6 04.5	8.1	19 44.6	5.7 57.9			Civil		Naut.		10	11
	09	315 50.6	.. 29.6	20 31.6	8.2	19 38.9	5.9 57.9							12	13
	10	330 50.8	28.7	34 58.8	8.1	19 33.0	5.9 57.9								
	11	345 51.0	27.7	49 25.9	8.1	19 27.1	6.1 58.0								
	12	0 51.2	N 4 26.8	63 53.0	8.1	N19 21.0	6.2 58.0	N 72	19 02	20 16	22 16	□	□	18 37	18 08
	13	15 51.4	25.8	78 20.1	8.2	19 14.8	6.4 58.1	N 70	18 55	20 00	21 35	□	18 26	18 04	17 51
	14	30 51.6	24.9	92 47.3	8.1	19 08.4	6.4 58.1	68	18 49	19 48	21 08	17 43	17 42	17 40	17 37
	15	45 51.9	.. 23.9	107 14.4	8.1	19 02.0	6.6 58.1	66	18 44	19 38	20 48	16 57	17 13	17 21	17 25
	16	60 52.1	23.0	121 41.5	8.1	18 55.4	6.7 58.2	64	18 40	19 29	20 33	16 27	16 51	17 05	17 15
	17	75 52.3	22.0	136 08.6	8.1	18 48.7	6.8 58.2	62	18 37	19 22	20 20	16 04	16 33	16 53	17 07
	18	90 52.5	N 4 21.1	150 35.7	8.1	N18 41.9	7.0 58.3	60	18 33	19 16	20 09	15 46	16 18	16 42	17 00
	19	105 52.7	20.1	165 02.8	8.1	18 34.9	7.0 58.3	N 58	18 31	19 11	20 00	15 30	16 05	16 32	16 53
	20	120 53.0	19.2	179 29.9	8.1	18 27.9	7.2 58.3	56	18 28	19 06	19 53	15 17	15 54	16 24	16 48
	21	135 53.2	.. 18.2	193 57.0	8.0	18 20.7	7.3 58.4	54	18 26	19 02	19 46	15 06	15 44	16 16	16 43
	22	150 53.4	17.3	208 24.0	8.1	18 13.4	7.5 58.4	52	18 24	18 59	19 40	14 56	15 36	16 09	16 38
	23	165 53.6	16.3	222 51.1	8.1	18 05.9	7.5 58.5	50	18 23	18 55	19 34	14 46	15 28	16 03	16 34
S U N D A Y	12 00	180 53.8	N 4 15.4	237 18.2	8.1	N17 58.4	7.6 58.5	45	18 19	18 48	19 23	14 27	15 11	15 50	16 25
	01	195 54.1	14.4	251 45.3	8.1	17 50.8	7.8 58.5	N 40	18 16	18 43	19 15	14 12	14 57	15 39	16 17
	02	210 54.3	13.5	266 12.4	8.1	17 43.0	7.9 58.6	35	18 13	18 38	19 08	13 58	14 46	15 30	16 10
	03	225 54.5	.. 12.5	280 39.5	8.1	17 35.1	8.0 58.6	30	18 10	18 34	19 03	13 47	14 36	15 21	16 05
	04	240 54.7	11.5	295 06.6	8.1	17 27.1	8.1 58.7	20	18 06	18 29	18 54	13 27	14 18	15 07	15 54
	05	255 54.9	10.6	309 33.7	8.0	17 19.0	8.3 58.7	N 10	18 03	18 24	18 49	13 10	14 02	14 54	15 45
	06	270 55.2	N 4 09.6	324 00.7	8.1	N17 10.7	8.3 58.7	0	18 00	18 21	18 45	12 53	13 48	14 42	15 37
	07	285 55.4	08.7	338 27.8	8.1	17 02.4	8.5 58.8	S 10	17 57	18 18	18 42	12 37	13 33	14 30	15 28
	08	300 55.6	07.7	352 54.9	8.1	16 53.9	8.6 58.8	20	17 54	18 16	18 41	12 20	13 18	14 18	15 19
	09	315 55.8	.. 06.8	7 22.0	8.1	16 45.3	8.7 58.9	30	17 50	18 14	18 42	12 00	12 59	13 03	15 08
	10	330 56.0	05.8	21 49.1	8.1	16 36.6	8.8 58.9	35	17 48	18 14	18 43	11 48	12 49	13 54	15 02
	11	345 56.3	04.9	36 16.2	8.1	16 27.8	8.9 58.9	40	17 46	18 13	18 45	11 34	12 37	13 44	14 55
	12	0 56.5	N 4 03.9	50 43.3	8.1	N16 18.9	9.0 59.0	45	17 44	18 13	18 47	11 18	12 22	13 33	14 47
	13	15 56.7	03.0	65 10.4	8.2	16 09.9	9.1 59.0	S 50	17 41	18 13	18 51	10 58	12 05	13 18	14 37
	14	30 56.9	02.0	79 37.6	8.1	16 00.8	9.3 59.1	52	17 40	18 13	18 52	10 49	11 56	13 12	14 32
	15	45 57.1	.. 01.0	94 04.7	8.1	15 51.5	9.3 59.1	54	17 38	18 13	18 54	10 38	11 47	13 04	14 27
	16	60 57.4	4 00.1	108 31.8	8.1	15 42.2	9.5 59.1	56	17 37	18 14	18 57	10 26	11 37	12 56	14 22
	17	75 57.6	3 59.1	122 58.9	8.2	15 32.7	9.5 59.2	58	17 35	18 14	19 00	10 12	11 25	12 47	14 15
	18	90 57.8	N 3 58.2	137 26.1	8.1	N15 23.2	9.7 59.2	S 60	17 33	18 14	19 03	09 56	11 11	12 36	14 08
	19	105 58.0	57.2	151 53.2	8.2	15 13.5	9.8 59.3	Day		SUN		MOON			
	20	120 58.2	56.3	166 20.4	8.1	15 03.7	9.9 59.3			Eqn. of Time		Mer. Pass.			
	21	135 58.5	.. 55.3	180 47.5	8.2	14 53.8	9.9 59.3			00 h 12 h		Upper Lower		Age	Phase
	22	150 58.7	54.4	195 14.7	8.1	14 43.9	10.1 59.4			m s m s h m		h m h m		d	
	23	165 58.9	53.4	209 41.8	8.2	14 33.8	10.2 59.4			02 53 03 03 11 57		06 41 19 08		24	
	S.D. 15.9	d 1.0	S.D. 15.6	15.8	16.1										

UT (GMT)	ARIES	VENUS -3.9	MARS +1.2	JUPITER -1.8	SATURN +0.8	STARS
d h	G.H.A.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	G.H.A. Dec.	Name S.H.A. Dec.
18 00	86 37.2	188 41.9 S22 46.9	178 17.2 S24 08.9	231 09.7 S12 56.6	118 05.7 S14 16.8	Acamar 315 29.1 S40 19.9
01	101 39.6	203 41.0 47.3	193 17.7 09.0	246 11.7 56.8	133 07.9 16.8	Achernar 335 37.3 S57 16.2
02	116 42.1	218 40.1 47.6	208 18.1 09.0	261 13.8 56.9	148 10.2 16.7	Acrux 173 25.7 S63 03.7
03	131 44.5	233 39.1 48.0	223 18.5 09.0	276 15.8 57.0	163 12.5 16.6	Adhara 255 23.6 S28 57.9
04	146 47.0	248 38.2 48.3	238 18.9 09.1	291 17.8 57.2	178 14.8 16.6	Aldebaran 291 05.8 N16 29.8
05	161 49.5	263 37.3 48.7	253 19.3 09.1	306 19.9 57.3	193 17.0 16.5	
06	176 51.9	278 36.3 S22 49.1	268 19.7 S24 09.2	321 21.9 S12 57.5	208 19.3 S14 16.4	Alioth 166 33.6 N55 59.2
07	191 54.4	293 35.4 49.4	283 20.1 09.2	336 24.0 57.6	223 21.6 16.4	Alkaid 153 10.6 N49 20.3
S 08	206 56.9	308 34.5 49.8	298 20.5 09.2	351 26.0 57.7	238 23.8 16.3	Al Na'ir 28 02.2 S46 59.5
A 09	221 59.3	323 33.6 50.1	313 20.9 09.3	6 28.0 57.9	253 26.1 16.2	Alnilam 276 00.8 S 1 12.4
T 10	237 01.8	338 32.6 50.5	328 21.3 09.3	21 30.1 58.0	268 28.4 16.1	Alphard 218 10.2 S 8 38.0
U 11	252 04.3	353 31.7 50.8	343 21.7 09.3	36 32.1 58.2	283 30.7 16.1	
R 12	267 06.7	8 30.8 S22 51.2	358 22.1 S24 09.4	51 34.1 S12 58.3	298 32.9 S14 16.0	Alphecca 126 23.7 N26 44.0
D 13	282 09.2	23 29.8 51.5	13 22.5 09.4	66 36.2 58.4	313 35.2 15.9	Alpheratz 357 58.6 N29 03.7
A 14	297 11.7	38 28.9 51.9	28 22.9 09.5	81 38.2 58.6	328 37.5 15.9	Altair 62 22.7 N 8 51.3
Y 15	312 14.1	53 28.0 52.2	43 23.3 09.5	96 40.2 58.7	343 39.7 15.8	Ankaa 353 30.0 S42 20.5
16	327 16.6	68 27.0 52.5	58 23.7 09.5	111 42.3 58.8	358 42.0 15.7	Antares 112 44.5 S26 25.0
17	342 19.0	83 26.1 52.9	73 24.1 09.6	126 44.3 59.0	13 44.3 15.6	
18	357 21.5	98 25.2 S22 53.2	88 24.5 S24 09.6	141 46.3 S12 59.1	28 46.5 S14 15.6	Arcturus 146 09.2 N19 12.7
19	12 24.0	113 24.2 53.6	103 24.9 09.6	156 48.4 59.3	43 48.8 15.5	Atria 108 00.0 S69 00.9
20	27 26.4	128 23.3 53.9	118 25.4 09.7	171 50.4 59.4	58 51.1 15.4	Avior 234 23.4 S59 29.3
21	42 28.9	143 22.4 54.2	133 25.8 09.7	186 52.5 59.5	73 53.3 15.4	Bellatrix 278 47.3 N 6 20.6
22	57 31.4	158 21.4 54.6	148 26.2 09.7	201 54.5 59.7	88 55.6 15.3	Betelgeuse 271 16.7 N 7 24.3
23	72 33.8	173 20.5 54.9	163 26.6 09.8	216 56.5 59.8	103 57.9 15.2	
19 00	87 36.3	188 19.6 S22 55.2	178 27.0 S24 09.8	231 58.6 S12 59.9	119 00.2 S14 15.1	Canopus 264 02.0 S52 41.6
01	102 38.8	203 18.6 55.6	193 27.4 09.8	247 00.6 13 00.1	134 02.4 15.1	Capella 280 55.5 N45 59.5
02	117 41.2	218 17.7 55.9	208 27.8 09.9	262 02.6 00.2	149 04.7 15.0	Deneb 49 41.8 N45 15.8
03	132 43.7	233 16.8 56.2	223 28.2 09.9	277 04.7 00.4	164 07.0 14.9	Denebola 182 48.5 N14 36.2
04	147 46.2	248 15.8 56.6	238 28.6 09.9	292 06.7 00.5	179 09.2 14.9	Diphda 349 10.4 S18 01.2
05	162 48.6	263 14.9 56.9	253 29.0 09.9	307 08.8 00.6	194 11.5 14.8	
06	177 51.1	278 14.0 S22 57.2	268 29.4 S24 10.0	322 10.8 S13 00.8	209 13.8 S14 14.7	Dubhe 194 09.3 N61 46.6
07	192 53.5	293 13.0 57.5	283 29.8 10.0	337 12.8 00.9	224 16.0 14.6	Elnath 278 30.7 N28 36.1
08	207 56.0	308 12.1 57.9	298 30.2 10.0	352 14.9 01.0	239 18.3 14.6	Eltanin 90 53.5 N51 29.5
S 09	222 58.5	323 11.1 58.2	313 30.6 10.1	7 16.9 01.2	254 20.6 14.5	Enif 34 01.6 N 9 51.0
U 10	238 00.9	338 10.2 58.5	328 31.0 10.1	22 18.9 01.3	269 22.8 14.4	Fomalhaut 15 40.1 S29 39.3
D 11	253 03.4	353 09.3 58.8	343 31.4 10.1	37 21.0 01.5	284 25.1 14.4	
A 12	268 05.9	8 08.3 S22 59.2	358 31.8 S24 10.1	52 23.0 S13 01.6	299 27.4 S14 14.3	Gacrux 172 17.3 S57 04.6
Y 13	283 08.3	23 07.4 59.5	13 32.2 10.2	67 25.1 01.7	314 29.6 14.2	Gienah 176 07.4 S17 30.5
14	298 10.8	38 06.5 22 59.8	28 32.6 10.2	82 27.1 01.9	329 31.9 14.1	Hadar 149 09.0 S60 20.4
15	313 13.3	53 05.5 23 00.1	43 33.0 10.2	97 29.1 02.0	344 34.2 14.1	Hamal 328 17.0 N23 26.2
16	328 15.7	68 04.6 00.4	58 33.4 10.2	112 31.2 02.1	359 36.4 14.0	Kaus Aust. 84 03.5 S34 23.2
17	343 18.2	83 03.6 00.7	73 33.8 10.3	127 33.2 02.3	14 38.7 13.9	
18	358 20.7	98 02.7 S23 01.1	88 34.2 S24 10.3	142 35.3 S13 02.4	29 41.0 S14 13.9	Kochab 137 20.3 N74 10.6
19	13 23.1	113 01.8 01.4	103 34.6 10.3	157 37.3 02.5	44 43.2 13.8	Markab 13 52.9 N15 10.6
20	28 25.6	128 00.8 01.7	118 35.0 10.3	172 39.3 02.7	59 45.5 13.7	Menkar 314 30.0 N 4 04.0
21	43 28.0	142 59.9 02.0	133 35.4 10.3	187 41.4 02.8	74 47.8 13.6	Menkent 148 25.0 S36 20.3
22	58 30.5	157 58.9 02.3	148 35.8 10.4	202 43.4 03.0	89 50.0 13.6	Miaplacidus 221 42.1 S69 41.4
23	73 33.0	172 58.0 02.6	163 36.2 10.4	217 45.5 03.1	104 52.3 13.5	
20 00	88 35.4	187 57.1 S23 02.9	178 36.6 S24 10.4	232 47.5 S13 03.2	119 54.6 S14 13.4	Mirfak 309 00.8 N49 50.6
01	103 37.9	202 56.1 03.2	193 37.0 10.4	247 49.5 03.4	134 56.8 13.4	Nunki 76 16.7 S26 18.2
02	118 40.4	217 55.2 03.5	208 37.4 10.4	262 51.6 03.5	149 59.1 13.3	Peacock 53 42.6 S56 45.3
03	133 42.8	232 54.2 03.8	223 37.8 10.5	277 53.6 03.6	165 01.4 13.2	Pollux 243 45.2 N28 02.3
04	148 45.3	247 53.3 04.1	238 38.2 10.5	292 55.7 03.8	180 03.6 13.1	Procyon 245 14.7 N 5 14.3
05	163 47.8	262 52.4 04.4	253 38.6 10.5	307 57.7 03.9	195 05.9 13.1	
06	178 50.2	277 51.4 S23 04.7	268 39.0 S24 10.5	322 59.7 S13 04.0	210 08.1 S14 13.0	Rasalhague 96 20.3 N12 33.9
07	193 52.7	292 50.5 05.0	283 39.4 10.5	338 01.8 04.2	225 10.4 12.9	Regulus 207 58.8 N11 59.6
08	208 55.1	307 49.5 05.3	298 39.8 10.6	353 03.8 04.3	240 12.7 12.8	Rigel 281 25.7 S 8 12.6
M 09	223 57.6	322 48.6 05.6	313 40.2 10.6	8 05.9 04.4	255 14.9 12.8	Rigel Kent. 140 12.1 S60 48.4
O 10	239 00.1	337 47.6 05.9	328 40.6 10.6	23 07.9 04.6	270 17.2 12.7	Sabik 102 29.6 S15 43.0
N 11	254 02.5	352 46.7 06.2	343 41.0 10.6	38 10.0 04.7	285 19.5 12.6	
D 12	269 05.0	7 45.8 S23 06.5	358 41.4 S24 10.6	53 12.0 S13 04.9	300 21.7 S14 12.6	Schedar 349 57.1 N56 30.6
A 13	284 07.5	22 44.8 06.7	13 41.8 10.6	68 14.0 05.0	315 24.0 12.5	Shaula 96 42.1 S37 05.9
Y 14	299 09.9	37 43.9 07.0	28 42.2 10.6	83 16.1 05.1	330 26.3 12.4	Sirius 258 46.2 S16 42.5
15	314 12.4	52 42.9 07.3	43 42.6 10.7	98 18.1 05.3	345 28.5 12.3	Spica 158 46.8 S11 07.8
16	329 14.9	67 42.0 07.6	58 43.0 10.7	113 20.2 05.4	0 30.8 12.3	Suhail 223 02.8 S43 24.4
17	344 17.3	82 41.0 07.9	73 43.4 10.7	128 22.2 05.5	15 33.1 12.2	
18	359 19.8	97 40.1 S23 08.2	88 43.8 S24 10.7	143 24.2 S13 05.7	30 35.3 S14 12.1	Vega 80 49.3 N38 46.8
19	14 22.3	112 39.1 08.5	103 44.2 10.7	158 26.3 05.8	45 37.6 12.0	Zuben'ubi 137 21.8 S16 01.0
20	29 24.7	127 38.2 08.7	118 44.6 10.7	173 28.3 05.9	60 39.8 12.0	
21	44 27.2	142 37.2 09.0	133 45.0 10.7	188 30.4 06.1	75 42.1 11.9	
22	59 29.6	157 36.3 09.3	148 45.4 10.7	203 32.4 06.2	90 44.4 11.8	
23	74 32.1	172 35.4 09.6	163 45.8 10.7	218 34.5 06.3	105 46.6 11.8	
h m						S.H.A. Mer. Pass.
Mer. Pass. 18 06.6	v -0.9 d 0.3	v 0.4 d 0.0	v 2.0 d 0.1	v 2.3 d 0.1		
						Venus 100 43.3 11 27
						Mars 90 50.7 12 06
						Jupiter 144 22.3 8 31
						Saturn 31 23.9 16 02

UT (GMT)	SUN		MOON				Lat.	Twilight		Sunrise	Moonrise					
	G.H.A.		G.H.A.		Dec.			H.P.	Naut.		Civil	18	19	20	21	
	°	'	°	'	°	'										
SATURDAY	18 00	180 53.4	S23 22.8	122 46.2	13.6	S	8 53.1	10.6	55.8	N 72	08 24	10 56	11 38	11 23	11 10	10 56
	01	195 53.1	22.9	137 18.8	13.6	8	42.5	10.6	55.8	N 70	08 04	09 53	11 28	11 20	11 12	11 04
	02	210 52.8	23.0	151 51.4	13.7	8	31.9	10.7	55.7	68	07 48	09 18	11 20	11 17	11 14	11 11
	03	225 52.5	23.0	166 24.1	13.8	8	21.2	10.7	55.7	66	07 35	08 52	11 13	11 15	11 16	11 17
	04	240 52.2	23.1	180 56.9	13.8	8	10.5	10.6	55.7	64	07 24	08 33	09 51	11 07	11 13	11 17
	05	255 51.8	23.2	195 29.7	13.9	7	59.9	10.8	55.7	62	07 15	08 17	09 22	11 03	11 11	11 18
	06	270 51.5	S23 23.3	210 02.6	13.9	S	7 49.1	10.7	55.6	60	07 06	08 03	09 01	10 58	11 09	11 20
	07	285 51.2	23.3	224 35.5	14.0	7	38.4	10.8	55.6	N 58	06 59	07 51	08 43	10 54	11 08	11 21
	08	300 50.9	23.4	239 08.5	14.1	7	27.6	10.7	55.6	56	06 52	07 41	08 29	10 51	11 07	11 21
	09	315 50.6	23.5	253 41.6	14.1	7	16.9	10.8	55.5	54	06 46	07 32	08 16	10 48	11 06	11 22
	10	330 50.3	23.5	268 14.7	14.1	7	06.1	10.9	55.5	52	06 40	07 24	08 05	10 45	11 05	11 23
	11	345 50.0	23.6	282 47.8	14.2	6	55.2	10.8	55.5	50	06 35	07 16	07 55	10 42	11 04	11 24
SUNDAY	12	0 49.7	S23 23.7	297 21.0	14.3	S	6 44.4	10.8	55.5	45	06 23	07 00	07 34	10 37	11 02	11 25
	13	15 49.4	23.7	311 54.3	14.3	6	33.6	10.9	55.4	N 40	06 13	06 47	07 17	10 32	11 00	11 26
	14	30 49.1	23.8	326 27.6	14.3	6	22.7	10.9	55.4	35	06 03	06 35	07 03	10 28	10 58	11 27
	15	45 48.8	23.9	341 00.9	14.4	6	11.8	10.9	55.4	30	05 54	06 24	06 51	10 25	10 57	11 28
	16	60 48.5	23.9	355 34.3	14.5	6	00.9	10.9	55.4	20	05 38	06 05	06 29	10 18	10 55	11 30
	17	75 48.1	24.0	10 07.8	14.5	5	50.0	11.0	55.3	N 10	05 22	05 48	06 11	10 13	10 53	11 32
	18	90 47.8	S23 24.0	24 41.3	14.5	S	39.0	10.9	55.3	0	05 05	05 31	05 53	10 08	10 51	11 33
	19	105 47.5	24.1	39 14.8	14.6	5	28.1	11.0	55.3	S 10	04 46	05 13	05 36	10 03	10 49	11 34
	20	120 47.2	24.2	53 48.4	14.7	5	17.1	10.9	55.3	20	04 23	04 52	05 17	09 57	10 47	11 36
	21	135 46.9	24.2	68 22.1	14.7	5	06.2	11.0	55.2	30	03 54	04 27	04 55	09 51	10 45	11 38
	22	150 46.6	24.3	82 55.8	14.7	4	55.2	11.0	55.2	35	03 35	04 12	04 42	09 47	10 44	11 39
	23	165 46.3	24.3	97 29.5	14.7	4	44.2	11.0	55.2	40	03 12	03 54	04 27	09 43	10 42	11 40
MONDAY	00	180 46.0	S23 24.4	112 03.2	14.8	S	4 33.2	11.0	55.2	45	02 41	03 31	04 09	09 38	10 40	11 41
	01	195 45.7	24.5	126 37.0	14.9	4	22.2	11.1	55.1	S 50	01 56	03 01	03 46	09 32	10 38	11 43
	02	210 45.4	24.5	141 10.9	14.9	4	11.1	11.0	55.1	52	01 28	02 46	03 35	09 30	10 38	11 44
	03	225 45.1	24.6	155 44.8	14.9	4	00.1	11.0	55.1	54	00 41	02 28	03 23	09 27	10 37	11 45
	04	240 44.8	24.6	170 18.7	14.9	3	49.1	11.0	55.1	56	///	02 06	03 09	09 23	10 35	11 46
	05	255 44.4	24.7	184 52.6	15.0	3	38.1	11.1	55.1	58	///	01 36	02 52	09 20	10 34	11 47
	06	270 44.1	S23 24.7	199 26.6	15.1	S	3 27.0	11.0	55.0	S 60	///	00 46	02 31	09 16	10 33	11 48
	07	285 43.8	24.8	214 00.7	15.0	3	16.0	11.1	55.0	Twilight		Moonset				
	08	300 43.5	24.8	228 34.7	15.1	3	04.9	11.1	55.0	Lat.	Sunset	Civil	Naut.	18	19	20
	09	315 43.2	24.9	243 08.8	15.2	2	53.8	11.0	55.0							
	10	330 42.9	24.9	257 43.0	15.1	2	42.8	11.1	54.9	Twilight		Moonset				
	11	345 42.6	25.0	272 17.1	15.2	2	31.7	11.0	54.9	h m	h m	h m	h m	h m	h m	h m
12	0 42.3	S23 25.0	286 51.3	15.2	S	2 20.7	11.1	54.9								
13	15 42.0	25.1	301 25.5	15.3	2	09.6	11.1	54.9	N 72	12 59	15 30	21 23	23 07	24 48	00 48	
14	30 41.7	25.1	315 59.8	15.3	1	58.5	11.0	54.9	N 70	14 01	15 50	21 30	23 07	24 42	00 42	
15	45 41.3	25.1	330 34.1	15.3	1	47.5	11.1	54.8	68	14 37	16 06	21 37	23 08	24 37	00 37	
16	60 41.0	25.2	345 08.4	15.3	1	36.4	11.0	54.8	66	13 21	15 02	16 19	21 42	23 08	24 33	
17	75 40.7	25.2	359 42.7	15.4	1	25.4	11.1	54.8	64	14 04	15 22	16 30	21 46	23 08	24 29	
18	90 40.4	S23 25.3	14 17.1	15.3	S	1 14.3	11.1	54.8	62	14 32	15 38	16 40	21 50	23 09	24 26	
19	105 40.1	25.3	28 51.4	15.4	1	03.2	11.0	54.8	60	14 54	15 51	16 48	21 53	23 09	24 23	
20	120 39.8	25.4	43 25.8	15.5	0	52.2	11.1	54.8	N 58	15 11	16 03	16 56	21 56	23 09	24 21	
21	135 39.5	25.4	58 00.3	15.4	0	41.1	11.0	54.7	56	15 26	16 13	17 02	21 58	23 09	24 19	
22	150 39.2	25.4	72 34.7	15.5	0	30.1	11.0	54.7	54	15 38	16 22	17 09	22 00	23 09	24 17	
23	165 38.9	25.5	87 09.2	15.5	0	19.1	11.1	54.7	52	15 50	16 31	17 14	22 02	23 10	24 15	
TUESDAY	00	180 38.6	S23 25.5	101 43.7	15.5	S	0 08.0	11.0	54.7	50	15 59	16 38	17 20	22 04	23 10	24 14
	01	195 38.2	25.5	116 18.2	15.5	N	0 03.0	11.0	54.7	45	16 20	16 54	17 31	22 08	23 10	24 11
	02	210 37.9	25.6	130 52.7	15.5	0	14.0	11.0	54.6	N 40	16 37	17 08	17 42	22 12	23 10	24 08
	03	225 37.6	25.6	145 27.2	15.6	0	25.0	11.0	54.6	35	16 51	17 19	17 51	22 15	23 10	24 05
	04	240 37.3	25.6	160 01.8	15.6	0	36.0	11.0	54.6	30	17 04	17 30	18 00	22 17	23 11	24 03
	05	255 37.0	25.7	174 36.4	15.5	0	47.0	11.0	54.6	20	17 25	17 49	18 16	22 21	23 11	23 59
	06	270 36.7	S23 25.7	189 10.9	15.6	N	0 58.0	11.0	54.6	N 10	17 43	18 06	18 33	22 25	23 11	23 56
	07	285 36.4	25.7	203 45.5	15.6	1	09.0	10.9	54.6	0	18 01	18 23	18 50	22 29	23 11	23 53
	08	300 36.1	25.8	218 20.1	15.7	1	19.9	11.0	54.6	S 10	18 19	18 42	19 09	22 32	23 12	23 50
	09	315 35.8	25.8	232 54.8	15.6	1	30.9	10.9	54.5	20	18 38	19 02	19 31	22 36	23 12	23 47
	10	330 35.5	25.8	247 29.4	15.6	1	41.8	10.9	54.5	30	19 00	19 27	20 00	22 40	23 12	23 43
	11	345 35.1	25.9	262 04.0	15.7	1	52.7	10.9	54.5	35	19 13	19 42	20 19	22 42	23 12	23 41
WEDNESDAY	12	0 34.8	S23 25.9	276 38.7	15.6	N	2 03.6	10.9	54.5	40	19 28	20 01	20 42	22 45	23 12	23 39
	13	15 34.5	25.9	291 13.3	15.7	2	14.5	10.9	54.5	45	19 46	20 23	21 13	22 48	23 12	23 36
	14	30 34.2	25.9	305 48.0	15.7	2	25.4	10.9	54.5	S 50	20 08	20 53	21 59	22 52	23 12	23 33
	15	45 33.9	26.0	320 22.7	15.7	2	36.3	10.8	54.5	52	20 19	21 08	22 27	22 54	23 13	23 31
	16	60 33.6	26.0	334 57.4	15.6	2	47.1	10.9	54.4	54	20 32	21 26	23 14	22 55	23 13	23 29
	17	75 33.3	26.0	349 32.0	15.7	2	58.0	10.8	54.4	56	20 46	21 48	///	22 57	23 13	23 28
	18	90 33.0	S23 26.0	4 06.7	15.7	N	3 08.8	10.8	54.4	58	21 03	22 18	///	23 00	23 13	23 26
	19	105 32.7	26.1	18 41.4	15.7	3	19.6	10.8	54.4	S 60	21 23	23 10	///	23 02	23 13	23 23
	20	120 32.4	26.1	33 16.1	15.7	3	30.4	10.8	54.4	SUN		MOON				
	21	135 32.0	26.1	47 50.8	15.7	3	41.2	10.7	54.4	Day	Eqn. of Time 00 h	Mer. Pass.	Mer. Pass.		Age	Phase
	22	150 31.7	26.1	62 25.5	15.6	3	51.9	10.7	54.4				Upper	Lower		
	23	165 31.4	26.1	77 00.1	15.7	4	02.6	10.8	54.4				h m	h m		
		S.D. 16.3	d 0.0	S.D. 15.1	15.0	14.8			18	03 34	03 19	11 57	16 18	03 56	05 05	
									19	03 05	02 50	11 57	17 01	04 40	06 06	
									20	02 35	02 20	11 58	17 43	05 22	07 07	

Mag.	Name and Number	SHA							Declination						
			JULY	AUG.	SEPT.	OCT.	NOV.	DEC.		JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
3.4	γ Cephei	5	12.7	12.1	11.8	12.0	12.4	13.0	N 77	35.6	35.8	36.0	36.1	36.3	36.4
2.6	Markab	57	13	53.0	52.8	52.7	52.7	52.8	N 15	10.3	10.4	10.5	10.6	10.6	10.6
2.6	Scheat	14	07.6	07.4	07.4	07.4	07.5	07.6	N 28	02.9	03.0	03.2	03.3	03.3	03.3
1.3	Fomalhaut	56	15	40.1	39.9	39.8	39.9	40.0	S 29	39.1	39.1	39.1	39.2	39.3	39.3
2.2	β Gruis	19	25.2	25.0	24.9	25.0	25.1	25.3	S 46	54.8	54.8	54.9	55.0	55.1	55.1
2.9	α Tucanæ	25	28.3	28.0	28.0	28.1	28.4	28.6	S 60	17.2	17.2	17.4	17.5	17.6	17.5
2.2	Al Na'ir	55	28	01.9	01.8	01.7	01.8	02.0	S 46	59.2	59.3	59.4	59.5	59.5	59.5
3.0	δ Capricorni	33	19.2	19.1	19.0	19.1	19.2	19.3	S 16	09.2	09.1	09.2	09.2	09.2	09.2
2.5	Enif	54	34	01.4	01.3	01.3	01.4	01.5	N 9	50.9	51.0	51.0	51.1	51.1	51.0
3.1	β Aquarii	37	11.2	11.1	11.1	11.1	11.3	11.3	S 5	35.8	35.7	35.7	35.7	35.7	35.8
2.6	Alderamin	40	22.8	22.7	22.8	23.0	23.4	23.7	N 62	33.5	33.7	33.9	34.0	34.0	34.0
2.6	ϵ Cygni	48	30.2	30.1	30.2	30.3	30.5	30.6	N 33	56.8	57.0	57.1	57.2	57.2	57.1
1.3	Deneb	53	49	41.2	41.1	41.2	41.4	41.7	N 45	15.5	15.7	15.8	15.9	15.9	15.8
3.2	α Indi	50	50	42.5	42.4	42.5	42.6	42.9	S 47	18.6	18.7	18.8	18.8	18.9	18.8
2.1	Peacock	52	53	42.0	41.9	42.0	42.2	42.4	S 56	45.2	45.3	45.4	45.4	45.4	45.4
2.3	γ Cygni	54	29.4	29.4	29.5	29.7	29.8	30.0	N 40	14.2	14.4	14.5	14.6	14.6	14.5
0.9	Altair	51	62	22.4	22.4	22.4	22.6	22.7	N 8	51.2	51.3	51.4	51.4	51.3	51.3
2.8	γ Aquilæ	63	30.1	30.1	30.2	30.3	30.4	30.5	N 10	36.0	36.1	36.1	36.1	36.1	36.1
3.0	δ Cygni	63	47.7	47.8	47.9	48.1	48.3	48.4	N 45	07.0	07.2	07.3	07.3	07.3	07.2
3.2	Albireo	67	22.5	22.5	22.6	22.8	22.9	23.0	N 27	56.9	57.0	57.1	57.1	57.1	57.0
3.0	π Sagittarii	72	38.7	38.6	38.7	38.9	39.0	39.0	S 21	01.9	01.9	01.9	01.9	01.9	01.9
3.0	ζ Aquilæ	73	42.7	42.7	42.8	43.0	43.1	43.1	N 13	51.4	51.4	51.5	51.5	51.5	51.4
2.7	ζ Sagittarii	74	26.3	26.3	26.4	26.5	26.7	26.7	S 29	53.3	53.3	53.3	53.3	53.3	53.3
2.1	Nunki	50	76	16.4	16.3	16.4	16.6	16.7	S 26	18.2	18.2	18.2	18.2	18.2	18.2
0.1	Vega	49	80	48.6	48.7	48.8	49.0	49.2	N 38	46.8	46.9	47.0	47.0	47.0	46.8
2.9	λ Sagittarii	83	05.8	05.8	05.9	06.0	06.1	06.1	S 25	25.5	25.5	25.5	25.5	25.5	25.5
2.0	Kaus Australis	48	84	03.1	03.1	03.3	03.4	03.5	S 34	23.2	23.3	23.3	23.3	23.3	23.2
2.8	δ Sagittarii	84	50.6	50.6	50.7	50.9	51.0	51.0	S 29	49.8	49.8	49.9	49.9	49.8	49.8
3.1	γ Sagittarii	88	38.4	38.5	38.6	38.7	38.8	38.8	S 30	25.4	25.5	25.5	25.5	25.4	25.4
2.4	Eltanin	47	90	52.6	52.7	52.9	53.2	53.4	N 51	29.6	29.7	29.7	29.7	29.6	29.5
2.9	β Ophiuchi	94	12.2	12.2	12.3	12.5	12.5	12.5	N 4	34.3	34.3	34.4	34.4	34.3	34.3
2.5	κ Scorpii	94	28.7	28.7	28.9	29.0	29.1	29.1	S 39	01.6	01.7	01.7	01.7	01.6	01.6
2.0	θ Scorpii	95	46.4	46.5	46.6	46.8	46.9	46.9	S 42	59.7	59.7	59.7	59.7	59.7	59.6
2.1	Rasalhague	46	96	19.9	20.0	20.1	20.3	20.3	N 12	34.0	34.1	34.1	34.1	34.0	33.9
1.7	Shaula	45	96	41.7	41.8	41.9	42.1	42.2	S 37	06.0	06.0	06.0	06.0	06.0	05.9
3.0	α Aræ	97	09.0	09.1	09.3	09.5	09.6	09.6	S 49	52.3	52.4	52.4	52.4	52.3	52.2
2.8	ν Scorpii	97	24.4	24.5	24.6	24.8	24.9	24.8	S 37	17.5	17.5	17.5	17.5	17.5	17.4
3.0	β Draconis	97	25.1	25.3	25.5	25.8	26.0	26.0	N 52	18.6	18.7	18.7	18.7	18.6	18.4
2.8	β Aræ	98	47.6	47.7	48.0	48.2	48.3	48.3	S 55	31.5	31.6	31.6	31.6	31.5	31.4
Var.†	α Herculis	101	24.2	24.3	24.4	24.5	24.6	24.6	N 14	24.0	24.0	24.1	24.0	24.0	23.9
2.6	Sabik	44	102	29.3	29.4	29.5	29.6	29.7	S 15	43.0	43.0	43.0	43.0	43.0	43.0
3.1	ζ Aræ	105	27.8	28.0	28.2	28.4	28.5	28.4	S 55	58.9	59.0	59.0	59.0	58.9	58.8
2.4	ϵ Scorpii	107	33.2	33.3	33.4	33.6	33.6	33.5	S 34	17.0	17.0	17.0	17.0	16.9	16.9
1.9	Atria	43	107	59.0	59.3	59.7	60.0	60.2	S 69	01.1	01.2	01.2	01.2	01.0	00.9
3.0	ζ Herculis	109	43.9	44.0	44.2	44.3	44.4	44.4	N 31	37.0	37.1	37.1	37.1	37.0	36.8
2.7	ζ Ophiuchi	110	47.4	47.5	47.6	47.7	47.8	47.7	S 10	33.2	33.2	33.2	33.2	33.2	33.2
2.9	τ Scorpii	111	07.2	07.3	07.4	07.6	07.6	07.5	S 28	12.2	12.2	12.2	12.2	12.2	12.1
2.8	β Herculis	112	30.4	30.5	30.6	30.8	30.8	30.8	N 21	30.3	30.4	30.4	30.4	30.3	30.2
1.2	Antares	42	112	44.3	44.3	44.5	44.6	44.5	S 26	25.1	25.1	25.1	25.1	25.1	25.0
2.9	η Draconis	114	00.9	01.2	01.6	01.9	02.1	02.1	N 61	32.0	32.0	32.0	31.9	31.8	31.6
3.0	δ Ophiuchi	116	29.4	29.5	29.6	29.7	29.8	29.7	S 3	40.6	40.6	40.6	40.6	40.6	40.7
2.8	β Scorpii	118	43.6	43.6	43.8	43.9	43.9	43.8	S 19	47.3	47.3	47.3	47.3	47.3	47.3
2.5	Dschubba	120	00.2	00.3	00.4	00.5	00.5	00.4	S 22	36.3	36.3	36.2	36.2	36.2	36.2
3.0	π Scorpii	120	22.5	22.6	22.8	22.9	22.9	22.8	S 26	05.8	05.8	05.8	05.8	05.7	05.7
3.0	β Trianguli Aust.	121	20.5	20.7	21.0	21.3	21.3	21.1	S 63	24.9	24.9	24.9	24.8	24.7	24.6
2.8	α Serpentis	124	00.3	00.4	00.5	00.6	00.6	00.5	N 6	26.8	26.8	26.9	26.8	26.8	26.7
3.0	γ Lupi	126	18.8	18.9	19.1	19.2	19.2	19.0	S 41	08.9	08.9	08.9	08.8	08.7	08.7
2.3	Alphecca	41	126	23.4	23.5	23.7	23.8	23.7	N 26	44.3	44.4	44.4	44.3	44.2	44.0

† 3.0 — 3.7

CONVERSION OF ARC TO TIME

0°-59°			60°-119°			120°-179°			180°-239°			240°-299°			300°-359°				0°00	0°25	0°50	0°75				
°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	/	m	s	m	s	m	s	m	s
0	0	00	60	4	00	120	8	00	180	12	00	240	16	00	300	20	00	0	0	00	0	01	0	02	0	03
1	0	04	61	4	04	121	8	04	181	12	04	241	16	04	301	20	04	1	0	04	0	05	0	06	0	07
2	0	08	62	4	08	122	8	08	182	12	08	242	16	08	302	20	08	2	0	08	0	09	0	10	0	11
3	0	12	63	4	12	123	8	12	183	12	12	243	16	12	303	20	12	3	0	12	0	13	0	14	0	15
4	0	16	64	4	16	124	8	16	184	12	16	244	16	16	304	20	16	4	0	16	0	17	0	18	0	19
5	0	20	65	4	20	125	8	20	185	12	20	245	16	20	305	20	20	5	0	20	0	21	0	22	0	23
6	0	24	66	4	24	126	8	24	186	12	24	246	16	24	306	20	24	6	0	24	0	25	0	26	0	27
7	0	28	67	4	28	127	8	28	187	12	28	247	16	28	307	20	28	7	0	28	0	29	0	30	0	31
8	0	32	68	4	32	128	8	32	188	12	32	248	16	32	308	20	32	8	0	32	0	33	0	34	0	35
9	0	36	69	4	36	129	8	36	189	12	36	249	16	36	309	20	36	9	0	36	0	37	0	38	0	39
10	0	40	70	4	40	130	8	40	190	12	40	250	16	40	310	20	40	10	0	40	0	41	0	42	0	43
11	0	44	71	4	44	131	8	44	191	12	44	251	16	44	311	20	44	11	0	44	0	45	0	46	0	47
12	0	48	72	4	48	132	8	48	192	12	48	252	16	48	312	20	48	12	0	48	0	49	0	50	0	51
13	0	52	73	4	52	133	8	52	193	12	52	253	16	52	313	20	52	13	0	52	0	53	0	54	0	55
14	0	56	74	4	56	134	8	56	194	12	56	254	16	56	314	20	56	14	0	56	0	57	0	58	0	59
15	1	00	75	5	00	135	9	00	195	13	00	255	17	00	315	21	00	15	1	00	1	01	1	02	1	03
16	1	04	76	5	04	136	9	04	196	13	04	256	17	04	316	21	04	16	1	04	1	05	1	06	1	07
17	1	08	77	5	08	137	9	08	197	13	08	257	17	08	317	21	08	17	1	08	1	09	1	10	1	11
18	1	12	78	5	12	138	9	12	198	13	12	258	17	12	318	21	12	18	1	12	1	13	1	14	1	15
19	1	16	79	5	16	139	9	16	199	13	16	259	17	16	319	21	16	19	1	16	1	17	1	18	1	19
20	1	20	80	5	20	140	9	20	200	13	20	260	17	20	320	21	20	20	1	20	1	21	1	22	1	23
21	1	24	81	5	24	141	9	24	201	13	24	261	17	24	321	21	24	21	1	24	1	25	1	26	1	27
22	1	28	82	5	28	142	9	28	202	13	28	262	17	28	322	21	28	22	1	28	1	29	1	30	1	31
23	1	32	83	5	32	143	9	32	203	13	32	263	17	32	323	21	32	23	1	32	1	33	1	34	1	35
24	1	36	84	5	36	144	9	36	204	13	36	264	17	36	324	21	36	24	1	36	1	37	1	38	1	39
25	1	40	85	5	40	145	9	40	205	13	40	265	17	40	325	21	40	25	1	40	1	41	1	42	1	43
26	1	44	86	5	44	146	9	44	206	13	44	266	17	44	326	21	44	26	1	44	1	45	1	46	1	47
27	1	48	87	5	48	147	9	48	207	13	48	267	17	48	327	21	48	27	1	48	1	49	1	50	1	51
28	1	52	88	5	52	148	9	52	208	13	52	268	17	52	328	21	52	28	1	52	1	53	1	54	1	55
29	1	56	89	5	56	149	9	56	209	13	56	269	17	56	329	21	56	29	1	56	1	57	1	58	1	59
30	2	00	90	6	00	150	10	00	210	14	00	270	18	00	330	22	00	30	2	00	2	01	2	02	2	03
31	2	04	91	6	04	151	10	04	211	14	04	271	18	04	331	22	04	31	2	04	2	05	2	06	2	07
32	2	08	92	6	08	152	10	08	212	14	08	272	18	08	332	22	08	32	2	08	2	09	2	10	2	11
33	2	12	93	6	12	153	10	12	213	14	12	273	18	12	333	22	12	33	2	12	2	13	2	14	2	15
34	2	16	94	6	16	154	10	16	214	14	16	274	18	16	334	22	16	34	2	16	2	17	2	18	2	19
35	2	20	95	6	20	155	10	20	215	14	20	275	18	20	335	22	20	35	2	20	2	21	2	22	2	23
36	2	24	96	6	24	156	10	24	216	14	24	276	18	24	336	22	24	36	2	24	2	25	2	26	2	27
37	2	28	97	6	28	157	10	28	217	14	28	277	18	28	337	22	28	37	2	28	2	29	2	30	2	31
38	2	32	98	6	32	158	10	32	218	14	32	278	18	32	338	22	32	38	2	32	2	33	2	34	2	35
39	2	36	99	6	36	159	10	36	219	14	36	279	18	36	339	22	36	39	2	36	2	37	2	38	2	39
40	2	40	100	6	40	160	10	40	220	14	40	280	18	40	340	22	40	40	2	40	2	41	2	42	2	43
41	2	44	101	6	44	161	10	44	221	14	44	281	18	44	341	22	44	41	2	44	2	45	2	46	2	47
42	2	48	102	6	48	162	10	48	222	14	48	282	18	48	342	22	48	42	2	48	2	49	2	50	2	51
43	2	52	103	6	52	163	10	52	223	14	52	283	18	52	343	22	52	43	2	52	2	53	2	54	2	55
44	2	56	104	6	56	164	10	56	224	14	56	284	18	56	344	22	56	44	2	56	2	57	2	58	2	59
45	3	00	105	7	00	165	11	00	225	15	00	285	19	00	345	23	00	45	3	00	3	01	3	02	3	03
46	3	04	106	7	04	166	11	04	226	15	04	286	19	04	346	23	04	46	3	04	3	05	3	06	3	07
47	3	08	107	7	08	167	11	08	227	15	08	287	19	08	347	23	08	47	3	08	3	09	3	10	3	11
48	3	12	108	7	12	168	11	12	228	15	12	288	19	12	348	23	12	48	3	12	3	13	3	14	3	15
49	3	16	109	7	16	169	11	16	229	15	16	289	19	16	349	23	16	49	3	16	3	17	3	18	3	19
50	3	20	110	7	20	170	11	20	230	15	20	290	19	20	350	23	20	50	3	20	3	21	3	22	3	23
51	3	24	111	7	24	171	11	24	231	15	24	291	19	24	351	23	24	51	3	24	3	25	3	26	3	27
52	3	28	112	7	28	172	11	28	232	15	28	292	19	28	352	23	28	52	3	28	3	29	3	30	3	31
53	3	32	113	7	32	173	11	32	233	15	32	293	19	32	353	23	32	53	3	32	3	33	3	34	3	35
54	3	36	114	7	36	174	11	36	234	15	36	294	19	36	354	23	36	54	3	36	3	37	3	38	3	39
55	3	40	115	7	40	175	11	40	235	15	40	295	19	40												

The above table is for converting expressions in arc to their equivalent in time; its main use in this Almanac is for the conversion of longitude for application to LMT (*added if west, subtracted if east*) to give UT or vice versa, particularly in the case of sunrise, sunset, etc.

m 0	SUN PLANETS		ARIES	MOON	v or Corr ⁿ		v or Corr ⁿ		v or Corr ⁿ		m 1	SUN PLANETS		ARIES	MOON	v or Corr ⁿ		v or Corr ⁿ		v or Corr ⁿ				
s	o	/	o	/	o	/	/	/	/	/	s	o	/	o	/	o	/	/	/	/	/			
00	0	00.0	0	00.0	0	00.0	0.0	0.0	6.0	0.1	12.0	0.1	0	15.0	0	15.0	0	14.3	0.0	0.0	6.0	0.2	12.0	0.3
01	0	00.3	0	00.3	0	00.2	0.1	0.0	6.1	0.1	12.1	0.1	0	15.3	0	15.3	0	14.6	0.1	0.0	6.1	0.2	12.1	0.3
02	0	00.5	0	00.5	0	00.5	0.2	0.0	6.2	0.1	12.2	0.1	0	15.5	0	15.5	0	14.8	0.2	0.0	6.2	0.2	12.2	0.3
03	0	00.8	0	00.8	0	00.7	0.3	0.0	6.3	0.1	12.3	0.1	0	15.8	0	15.8	0	15.0	0.3	0.0	6.3	0.2	12.3	0.3
04	0	01.0	0	01.0	0	01.0	0.4	0.0	6.4	0.1	12.4	0.1	0	16.0	0	16.0	0	15.3	0.4	0.0	6.4	0.2	12.4	0.3
05	0	01.3	0	01.3	0	01.2	0.5	0.0	6.5	0.1	12.5	0.1	0	16.3	0	16.3	0	15.5	0.5	0.0	6.5	0.2	12.5	0.3
06	0	01.5	0	01.5	0	01.4	0.6	0.0	6.6	0.1	12.6	0.1	0	16.5	0	16.5	0	15.7	0.6	0.0	6.6	0.2	12.6	0.3
07	0	01.8	0	01.8	0	01.7	0.7	0.0	6.7	0.1	12.7	0.1	0	16.8	0	16.8	0	16.0	0.7	0.0	6.7	0.2	12.7	0.3
08	0	02.0	0	02.0	0	01.9	0.8	0.0	6.8	0.1	12.8	0.1	0	17.0	0	17.0	0	16.2	0.8	0.0	6.8	0.2	12.8	0.3
09	0	02.3	0	02.3	0	02.1	0.9	0.0	6.9	0.1	12.9	0.1	0	17.3	0	17.3	0	16.5	0.9	0.0	6.9	0.2	12.9	0.3
10	0	02.5	0	02.5	0	02.4	1.0	0.0	7.0	0.1	13.0	0.1	0	17.5	0	17.5	0	16.7	1.0	0.0	7.0	0.2	13.0	0.3
11	0	02.8	0	02.8	0	02.6	1.1	0.0	7.1	0.1	13.1	0.1	0	17.8	0	17.8	0	16.9	1.1	0.0	7.1	0.2	13.1	0.3
12	0	03.0	0	03.0	0	02.9	1.2	0.0	7.2	0.1	13.2	0.1	0	18.0	0	18.0	0	17.2	1.2	0.0	7.2	0.2	13.2	0.3
13	0	03.3	0	03.3	0	03.1	1.3	0.0	7.3	0.1	13.3	0.1	0	18.3	0	18.3	0	17.4	1.3	0.0	7.3	0.2	13.3	0.3
14	0	03.5	0	03.5	0	03.3	1.4	0.0	7.4	0.1	13.4	0.1	0	18.5	0	18.6	0	17.7	1.4	0.0	7.4	0.2	13.4	0.3
15	0	03.8	0	03.8	0	03.6	1.5	0.0	7.5	0.1	13.5	0.1	0	18.8	0	18.8	0	17.9	1.5	0.0	7.5	0.2	13.5	0.3
16	0	04.0	0	04.0	0	03.8	1.6	0.0	7.6	0.1	13.6	0.1	0	19.0	0	19.1	0	18.1	1.6	0.0	7.6	0.2	13.6	0.3
17	0	04.3	0	04.3	0	04.1	1.7	0.0	7.7	0.1	13.7	0.1	0	19.3	0	19.3	0	18.4	1.7	0.0	7.7	0.2	13.7	0.3
18	0	04.5	0	04.5	0	04.3	1.8	0.0	7.8	0.1	13.8	0.1	0	19.5	0	19.6	0	18.6	1.8	0.0	7.8	0.2	13.8	0.3
19	0	04.8	0	04.8	0	04.5	1.9	0.0	7.9	0.1	13.9	0.1	0	19.8	0	19.8	0	18.9	1.9	0.0	7.9	0.2	13.9	0.3
20	0	05.0	0	05.0	0	04.8	2.0	0.0	8.0	0.1	14.0	0.1	0	20.0	0	20.1	0	19.1	2.0	0.1	8.0	0.2	14.0	0.4
21	0	05.3	0	05.3	0	05.0	2.1	0.0	8.1	0.1	14.1	0.1	0	20.3	0	20.3	0	19.3	2.1	0.1	8.1	0.2	14.1	0.4
22	0	05.5	0	05.5	0	05.2	2.2	0.0	8.2	0.1	14.2	0.1	0	20.5	0	20.6	0	19.6	2.2	0.1	8.2	0.2	14.2	0.4
23	0	05.8	0	05.8	0	05.5	2.3	0.0	8.3	0.1	14.3	0.1	0	20.8	0	20.8	0	19.8	2.3	0.1	8.3	0.2	14.3	0.4
24	0	06.0	0	06.0	0	05.7	2.4	0.0	8.4	0.1	14.4	0.1	0	21.0	0	21.1	0	20.0	2.4	0.1	8.4	0.2	14.4	0.4
25	0	06.3	0	06.3	0	06.0	2.5	0.0	8.5	0.1	14.5	0.1	0	21.3	0	21.3	0	20.3	2.5	0.1	8.5	0.2	14.5	0.4
26	0	06.5	0	06.5	0	06.2	2.6	0.0	8.6	0.1	14.6	0.1	0	21.5	0	21.6	0	20.5	2.6	0.1	8.6	0.2	14.6	0.4
27	0	06.8	0	06.8	0	06.4	2.7	0.0	8.7	0.1	14.7	0.1	0	21.8	0	21.8	0	20.8	2.7	0.1	8.7	0.2	14.7	0.4
28	0	07.0	0	07.0	0	06.7	2.8	0.0	8.8	0.1	14.8	0.1	0	22.0	0	22.1	0	21.0	2.8	0.1	8.8	0.2	14.8	0.4
29	0	07.3	0	07.3	0	06.9	2.9	0.0	8.9	0.1	14.9	0.1	0	22.3	0	22.3	0	21.2	2.9	0.1	8.9	0.2	14.9	0.4
30	0	07.5	0	07.5	0	07.2	3.0	0.0	9.0	0.1	15.0	0.1	0	22.5	0	22.6	0	21.5	3.0	0.1	9.0	0.2	15.0	0.4
31	0	07.8	0	07.8	0	07.4	3.1	0.0	9.1	0.1	15.1	0.1	0	22.8	0	22.8	0	21.7	3.1	0.1	9.1	0.2	15.1	0.4
32	0	08.0	0	08.0	0	07.6	3.2	0.0	9.2	0.1	15.2	0.1	0	23.0	0	23.1	0	22.0	3.2	0.1	9.2	0.2	15.2	0.4
33	0	08.3	0	08.3	0	07.9	3.3	0.0	9.3	0.1	15.3	0.1	0	23.3	0	23.3	0	22.2	3.3	0.1	9.3	0.2	15.3	0.4
34	0	08.5	0	08.5	0	08.1	3.4	0.0	9.4	0.1	15.4	0.1	0	23.5	0	23.6	0	22.4	3.4	0.1	9.4	0.2	15.4	0.4
35	0	08.8	0	08.8	0	08.4	3.5	0.0	9.5	0.1	15.5	0.1	0	23.8	0	23.8	0	22.7	3.5	0.1	9.5	0.2	15.5	0.4
36	0	09.0	0	09.0	0	08.6	3.6	0.0	9.6	0.1	15.6	0.1	0	24.0	0	24.1	0	22.9	3.6	0.1	9.6	0.2	15.6	0.4
37	0	09.3	0	09.3	0	08.8	3.7	0.0	9.7	0.1	15.7	0.1	0	24.3	0	24.3	0	23.1	3.7	0.1	9.7	0.2	15.7	0.4
38	0	09.5	0	09.5	0	09.1	3.8	0.0	9.8	0.1	15.8	0.1	0	24.5	0	24.6	0	23.4	3.8	0.1	9.8	0.2	15.8	0.4
39	0	09.8	0	09.8	0	09.3	3.9	0.0	9.9	0.1	15.9	0.1	0	24.8	0	24.8	0	23.6	3.9	0.1	9.9	0.2	15.9	0.4
40	0	10.0	0	10.0	0	09.5	4.0	0.0	10.0	0.1	16.0	0.1	0	25.0	0	25.1	0	23.9	4.0	0.1	10.0	0.3	16.0	0.4
41	0	10.3	0	10.3	0	09.8	4.1	0.0	10.1	0.1	16.1	0.1	0	25.3	0	25.3	0	24.1	4.1	0.1	10.1	0.3	16.1	0.4
42	0	10.5	0	10.5	0	10.0	4.2	0.0	10.2	0.1	16.2	0.1	0	25.5	0	25.6	0	24.3	4.2	0.1	10.2	0.3	16.2	0.4
43	0	10.8	0	10.8	0	10.3	4.3	0.0	10.3	0.1	16.3	0.1	0	25.8	0	25.8	0	24.6	4.3	0.1	10.3	0.3	16.3	0.4
44	0	11.0	0	11.0	0	10.5	4.4	0.0	10.4	0.1	16.4	0.1	0	26.0	0	26.1	0	24.8	4.4	0.1	10.4	0.3	16.4	0.4
45	0	11.3	0	11.3	0	10.7	4.5	0.0	10.5	0.1	16.5	0.1	0	26.3	0	26.3	0	25.1	4.5	0.1	10.5	0.3	16.5	0.4
46	0	11.5	0	11.5	0	11.0	4.6	0.0	10.6	0.1	16.6	0.1	0	26.5	0	26.6	0	25.3	4.6	0.1	10.6	0.3	16.6	0.4
47	0	11.8	0	11.8	0	11.2	4.7	0.0	10.7	0.1	16.7	0.1	0	26.8	0	26.8	0	25.5	4.7	0.1	10.7	0.3	16.7	0.4
48	0	12.0	0	12.0	0	11.5	4.8	0.0	10.8	0.1	16.8	0.1	0	27.0	0	27.1	0	25.8	4.8	0.1	10.8	0.3	16.8	0.4
49	0	12.3	0	12.3	0	11.7	4.9	0.0	10.9	0.1	16.9	0.1	0	27.3	0	27.3	0	26.0	4.9	0.1	10.9	0.3	16.9	0.4
50	0	12.5	0	12.5	0	11.9	5.0	0.0	11.0	0.1	17.0	0.1	0	27.5	0	27.6	0	26.2	5.0	0.1	11.0	0.3	17.0	0.4
51	0	12.8	0	12.8	0	12.2	5.1	0.0	11.1	0.1	17.1	0.1	0	27.8	0	27.8	0	26.5	5.1	0.1	11.1	0.3	17.1	0.4
52	0	13.0	0	13.0	0	12.4	5.2	0.0	11.2	0.1	17.2	0.1	0	28.0	0	28.1	0	26.7	5.2	0.1	11.2	0.3	17.2	0.4
53	0	13.3	0	13.3	0	12.6	5.3	0.0	11.3	0.1	17.3	0.1	0	28.3	0	28.3	0	27.0	5.3	0.1	11.3	0.3	17.3	0.4
54	0	13.5	0	13.5	0	12.9	5.4	0.0	11.4	0.1	17.4	0.1	0	28.5	0	28.6	0	27.2	5.4	0.1	11.4	0.3	17.4	0.4
55	0	13.8	0	13.8	0	13.1	5.5	0.0	11.5	0.1	17.5	0.1	0	28.8	0	28.8	0	27.4	5.5	0.1	11.5	0.3	17.5	0.4
56	0	14.0	0	14.0	0	13.4	5.6	0.0	11.6	0.1	17.6	0.1	0	29.0	0	29.1	0	27.7	5.6	0.1	11.6	0.3	17.6	0.4
57	0	14.3	0	14.3	0	13.6	5.7	0.0	11.7	0.1	17.7	0.1	0	29.3	0	29.3	0	27.9	5.7	0.1	11.7	0.3	17.7	0.4
58	0	14.5	0	14.5	0	13.8	5.8	0.0	11.8	0.1	17.8	0.1	0	29.5	0	29.6	0	28.2	5.8	0.1	11.8	0.3	17.8	0.4
59	0	14.8	0	14.8	0	14.1	5.9	0.0	11.9	0.1	17.9	0.1	0	29.8	0	29.8	0	28.4	5.9	0.1	11.9	0.3	17.9	0.4
60	0	15.0	0	15.0	0	14.3	6.0	0.1	12.0	0.1	18.0													

^m 2	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	^m 3	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	0 30.0	0 30.1	0 28.6	0.0 0.0	6.0 0.3	12.0 0.5	00	0 45.0	0 45.1	0 43.0	0.0 0.0	6.0 0.4	12.0 0.7
01	0 30.3	0 30.3	0 28.9	0.1 0.0	6.1 0.3	12.1 0.5	01	0 45.3	0 45.4	0 43.2	0.1 0.0	6.1 0.4	12.1 0.7
02	0 30.5	0 30.6	0 29.1	0.2 0.0	6.2 0.3	12.2 0.5	02	0 45.5	0 45.6	0 43.4	0.2 0.0	6.2 0.4	12.2 0.7
03	0 30.8	0 30.8	0 29.3	0.3 0.0	6.3 0.3	12.3 0.5	03	0 45.8	0 45.9	0 43.7	0.3 0.0	6.3 0.4	12.3 0.7
04	0 31.0	0 31.1	0 29.6	0.4 0.0	6.4 0.3	12.4 0.5	04	0 46.0	0 46.1	0 43.9	0.4 0.0	6.4 0.4	12.4 0.7
05	0 31.3	0 31.3	0 29.8	0.5 0.0	6.5 0.3	12.5 0.5	05	0 46.3	0 46.4	0 44.1	0.5 0.0	6.5 0.4	12.5 0.7
06	0 31.5	0 31.6	0 30.1	0.6 0.0	6.6 0.3	12.6 0.5	06	0 46.5	0 46.6	0 44.4	0.6 0.0	6.6 0.4	12.6 0.7
07	0 31.8	0 31.8	0 30.3	0.7 0.0	6.7 0.3	12.7 0.5	07	0 46.8	0 46.9	0 44.6	0.7 0.0	6.7 0.4	12.7 0.7
08	0 32.0	0 32.1	0 30.5	0.8 0.0	6.8 0.3	12.8 0.5	08	0 47.0	0 47.1	0 44.9	0.8 0.0	6.8 0.4	12.8 0.7
09	0 32.3	0 32.3	0 30.8	0.9 0.0	6.9 0.3	12.9 0.5	09	0 47.3	0 47.4	0 45.1	0.9 0.1	6.9 0.4	12.9 0.8
10	0 32.5	0 32.6	0 31.0	1.0 0.0	7.0 0.3	13.0 0.5	10	0 47.5	0 47.6	0 45.3	1.0 0.1	7.0 0.4	13.0 0.8
11	0 32.8	0 32.8	0 31.3	1.1 0.0	7.1 0.3	13.1 0.5	11	0 47.8	0 47.9	0 45.6	1.1 0.1	7.1 0.4	13.1 0.8
12	0 33.0	0 33.1	0 31.5	1.2 0.1	7.2 0.3	13.2 0.6	12	0 48.0	0 48.1	0 45.8	1.2 0.1	7.2 0.4	13.2 0.8
13	0 33.3	0 33.3	0 31.7	1.3 0.1	7.3 0.3	13.3 0.6	13	0 48.3	0 48.4	0 46.1	1.3 0.1	7.3 0.4	13.3 0.8
14	0 33.5	0 33.6	0 32.0	1.4 0.1	7.4 0.3	13.4 0.6	14	0 48.5	0 48.6	0 46.3	1.4 0.1	7.4 0.4	13.4 0.8
15	0 33.8	0 33.8	0 32.2	1.5 0.1	7.5 0.3	13.5 0.6	15	0 48.8	0 48.9	0 46.5	1.5 0.1	7.5 0.4	13.5 0.8
16	0 34.0	0 34.1	0 32.5	1.6 0.1	7.6 0.3	13.6 0.6	16	0 49.0	0 49.1	0 46.8	1.6 0.1	7.6 0.4	13.6 0.8
17	0 34.3	0 34.3	0 32.7	1.7 0.1	7.7 0.3	13.7 0.6	17	0 49.3	0 49.4	0 47.0	1.7 0.1	7.7 0.4	13.7 0.8
18	0 34.5	0 34.6	0 32.9	1.8 0.1	7.8 0.3	13.8 0.6	18	0 49.5	0 49.6	0 47.2	1.8 0.1	7.8 0.5	13.8 0.8
19	0 34.8	0 34.8	0 33.2	1.9 0.1	7.9 0.3	13.9 0.6	19	0 49.8	0 49.9	0 47.5	1.9 0.1	7.9 0.5	13.9 0.8
20	0 35.0	0 35.1	0 33.4	2.0 0.1	8.0 0.3	14.0 0.6	20	0 50.0	0 50.1	0 47.7	2.0 0.1	8.0 0.5	14.0 0.8
21	0 35.3	0 35.3	0 33.6	2.1 0.1	8.1 0.3	14.1 0.6	21	0 50.3	0 50.4	0 48.0	2.1 0.1	8.1 0.5	14.1 0.8
22	0 35.5	0 35.6	0 33.9	2.2 0.1	8.2 0.3	14.2 0.6	22	0 50.5	0 50.6	0 48.2	2.2 0.1	8.2 0.5	14.2 0.8
23	0 35.8	0 35.8	0 34.1	2.3 0.1	8.3 0.3	14.3 0.6	23	0 50.8	0 50.9	0 48.4	2.3 0.1	8.3 0.5	14.3 0.8
24	0 36.0	0 36.1	0 34.4	2.4 0.1	8.4 0.4	14.4 0.6	24	0 51.0	0 51.1	0 48.7	2.4 0.1	8.4 0.5	14.4 0.8
25	0 36.3	0 36.3	0 34.6	2.5 0.1	8.5 0.4	14.5 0.6	25	0 51.3	0 51.4	0 48.9	2.5 0.1	8.5 0.5	14.5 0.8
26	0 36.5	0 36.6	0 34.8	2.6 0.1	8.6 0.4	14.6 0.6	26	0 51.5	0 51.6	0 49.2	2.6 0.2	8.6 0.5	14.6 0.9
27	0 36.8	0 36.9	0 35.1	2.7 0.1	8.7 0.4	14.7 0.6	27	0 51.8	0 51.9	0 49.4	2.7 0.2	8.7 0.5	14.7 0.9
28	0 37.0	0 37.1	0 35.3	2.8 0.1	8.8 0.4	14.8 0.6	28	0 52.0	0 52.1	0 49.6	2.8 0.2	8.8 0.5	14.8 0.9
29	0 37.3	0 37.4	0 35.6	2.9 0.1	8.9 0.4	14.9 0.6	29	0 52.3	0 52.4	0 49.9	2.9 0.2	8.9 0.5	14.9 0.9
30	0 37.5	0 37.6	0 35.8	3.0 0.1	9.0 0.4	15.0 0.6	30	0 52.5	0 52.6	0 50.1	3.0 0.2	9.0 0.5	15.0 0.9
31	0 37.8	0 37.9	0 36.0	3.1 0.1	9.1 0.4	15.1 0.6	31	0 52.8	0 52.9	0 50.3	3.1 0.2	9.1 0.5	15.1 0.9
32	0 38.0	0 38.1	0 36.3	3.2 0.1	9.2 0.4	15.2 0.6	32	0 53.0	0 53.1	0 50.6	3.2 0.2	9.2 0.5	15.2 0.9
33	0 38.3	0 38.4	0 36.5	3.3 0.1	9.3 0.4	15.3 0.6	33	0 53.3	0 53.4	0 50.8	3.3 0.2	9.3 0.5	15.3 0.9
34	0 38.5	0 38.6	0 36.7	3.4 0.1	9.4 0.4	15.4 0.6	34	0 53.5	0 53.6	0 51.1	3.4 0.2	9.4 0.5	15.4 0.9
35	0 38.8	0 38.9	0 37.0	3.5 0.1	9.5 0.4	15.5 0.6	35	0 53.8	0 53.9	0 51.3	3.5 0.2	9.5 0.6	15.5 0.9
36	0 39.0	0 39.1	0 37.2	3.6 0.2	9.6 0.4	15.6 0.7	36	0 54.0	0 54.1	0 51.5	3.6 0.2	9.6 0.6	15.6 0.9
37	0 39.3	0 39.4	0 37.5	3.7 0.2	9.7 0.4	15.7 0.7	37	0 54.3	0 54.4	0 51.8	3.7 0.2	9.7 0.6	15.7 0.9
38	0 39.5	0 39.6	0 37.7	3.8 0.2	9.8 0.4	15.8 0.7	38	0 54.5	0 54.6	0 52.0	3.8 0.2	9.8 0.6	15.8 0.9
39	0 39.8	0 39.9	0 37.9	3.9 0.2	9.9 0.4	15.9 0.7	39	0 54.8	0 54.9	0 52.3	3.9 0.2	9.9 0.6	15.9 0.9
40	0 40.0	0 40.1	0 38.2	4.0 0.2	10.0 0.4	16.0 0.7	40	0 55.0	0 55.2	0 52.5	4.0 0.2	10.0 0.6	16.0 0.9
41	0 40.3	0 40.4	0 38.4	4.1 0.2	10.1 0.4	16.1 0.7	41	0 55.3	0 55.4	0 52.7	4.1 0.2	10.1 0.6	16.1 0.9
42	0 40.5	0 40.6	0 38.7	4.2 0.2	10.2 0.4	16.2 0.7	42	0 55.5	0 55.7	0 53.0	4.2 0.2	10.2 0.6	16.2 0.9
43	0 40.8	0 40.9	0 38.9	4.3 0.2	10.3 0.4	16.3 0.7	43	0 55.8	0 55.9	0 53.2	4.3 0.3	10.3 0.6	16.3 1.0
44	0 41.0	0 41.1	0 39.1	4.4 0.2	10.4 0.4	16.4 0.7	44	0 56.0	0 56.2	0 53.4	4.4 0.3	10.4 0.6	16.4 1.0
45	0 41.3	0 41.4	0 39.4	4.5 0.2	10.5 0.4	16.5 0.7	45	0 56.3	0 56.4	0 53.7	4.5 0.3	10.5 0.6	16.5 1.0
46	0 41.5	0 41.6	0 39.6	4.6 0.2	10.6 0.4	16.6 0.7	46	0 56.5	0 56.7	0 53.9	4.6 0.3	10.6 0.6	16.6 1.0
47	0 41.8	0 41.9	0 39.8	4.7 0.2	10.7 0.4	16.7 0.7	47	0 56.8	0 56.9	0 54.2	4.7 0.3	10.7 0.6	16.7 1.0
48	0 42.0	0 42.1	0 40.1	4.8 0.2	10.8 0.5	16.8 0.7	48	0 57.0	0 57.2	0 54.4	4.8 0.3	10.8 0.6	16.8 1.0
49	0 42.3	0 42.4	0 40.3	4.9 0.2	10.9 0.5	16.9 0.7	49	0 57.3	0 57.4	0 54.6	4.9 0.3	10.9 0.6	16.9 1.0
50	0 42.5	0 42.6	0 40.6	5.0 0.2	11.0 0.5	17.0 0.7	50	0 57.5	0 57.7	0 54.9	5.0 0.3	11.0 0.6	17.0 1.0
51	0 42.8	0 42.9	0 40.8	5.1 0.2	11.1 0.5	17.1 0.7	51	0 57.8	0 57.9	0 55.1	5.1 0.3	11.1 0.6	17.1 1.0
52	0 43.0	0 43.1	0 41.0	5.2 0.2	11.2 0.5	17.2 0.7	52	0 58.0	0 58.2	0 55.4	5.2 0.3	11.2 0.7	17.2 1.0
53	0 43.3	0 43.4	0 41.3	5.3 0.2	11.3 0.5	17.3 0.7	53	0 58.3	0 58.4	0 55.6	5.3 0.3	11.3 0.7	17.3 1.0
54	0 43.5	0 43.6	0 41.5	5.4 0.2	11.4 0.5	17.4 0.7	54	0 58.5	0 58.7	0 55.8	5.4 0.3	11.4 0.7	17.4 1.0
55	0 43.8	0 43.9	0 41.8	5.5 0.2	11.5 0.5	17.5 0.7	55	0 58.8	0 58.9	0 56.1	5.5 0.3	11.5 0.7	17.5 1.0
56	0 44.0	0 44.1	0 42.0	5.6 0.2	11.6 0.5	17.6 0.7	56	0 59.0	0 59.2	0 56.3	5.6 0.3	11.6 0.7	17.6 1.0
57	0 44.3	0 44.4	0 42.2	5.7 0.2	11.7 0.5	17.7 0.7	57	0 59.3	0 59.4	0 56.6	5.7 0.3	11.7 0.7	17.7 1.0
58	0 44.5	0 44.6	0 42.5	5.8 0.2	11.8 0.5	17.8 0.7	58	0 59.5	0 59.7	0 56.8	5.8 0.3	11.8 0.7	17.8 1.0
59	0 44.8	0 44.9	0 42.7	5.9 0.2	11.9 0.5	17.9 0.7	59	0 59.8	0 59.9	0 57.0	5.9 0.3	11.9 0.7	17.9 1.0
60	0 45.0	0 45.1	0 43.0	6.0 0.3	12.0 0.5	18.0 0.8	60	1 00.0	1 00.2	0 57.3	6.0 0.4	12.0 0.7	18.0 1.1

4 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	5 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	1 00.0	1 00.2	0 57.3	0.0 0.0	6.0 0.5	12.0 0.9	00	1 15.0	1 15.2	1 11.6	0.0 0.0	6.0 0.6	12.0 1.1
01	1 00.3	1 00.4	0 57.5	0.1 0.0	6.1 0.5	12.1 0.9	01	1 15.3	1 15.5	1 11.8	0.1 0.0	6.1 0.6	12.1 1.1
02	1 00.5	1 00.7	0 57.7	0.2 0.0	6.2 0.5	12.2 0.9	02	1 15.5	1 15.7	1 12.1	0.2 0.0	6.2 0.6	12.2 1.1
03	1 00.8	1 00.9	0 58.0	0.3 0.0	6.3 0.5	12.3 0.9	03	1 15.8	1 16.0	1 12.3	0.3 0.0	6.3 0.6	12.3 1.1
04	1 01.0	1 01.2	0 58.2	0.4 0.0	6.4 0.5	12.4 0.9	04	1 16.0	1 16.2	1 12.5	0.4 0.0	6.4 0.6	12.4 1.1
05	1 01.3	1 01.4	0 58.5	0.5 0.0	6.5 0.5	12.5 0.9	05	1 16.3	1 16.5	1 12.8	0.5 0.0	6.5 0.6	12.5 1.1
06	1 01.5	1 01.7	0 58.7	0.6 0.0	6.6 0.5	12.6 0.9	06	1 16.5	1 16.7	1 13.0	0.6 0.1	6.6 0.6	12.6 1.2
07	1 01.8	1 01.9	0 58.9	0.7 0.1	6.7 0.5	12.7 1.0	07	1 16.8	1 17.0	1 13.3	0.7 0.1	6.7 0.6	12.7 1.2
08	1 02.0	1 02.2	0 59.2	0.8 0.1	6.8 0.5	12.8 1.0	08	1 17.0	1 17.2	1 13.5	0.8 0.1	6.8 0.6	12.8 1.2
09	1 02.3	1 02.4	0 59.4	0.9 0.1	6.9 0.5	12.9 1.0	09	1 17.3	1 17.5	1 13.7	0.9 0.1	6.9 0.6	12.9 1.2
10	1 02.5	1 02.7	0 59.7	1.0 0.1	7.0 0.5	13.0 1.0	10	1 17.5	1 17.7	1 14.0	1.0 0.1	7.0 0.6	13.0 1.2
11	1 02.8	1 02.9	0 59.9	1.1 0.1	7.1 0.5	13.1 1.0	11	1 17.8	1 18.0	1 14.2	1.1 0.1	7.1 0.7	13.1 1.2
12	1 03.0	1 03.2	1 00.1	1.2 0.1	7.2 0.5	13.2 1.0	12	1 18.0	1 18.2	1 14.4	1.2 0.1	7.2 0.7	13.2 1.2
13	1 03.3	1 03.4	1 00.4	1.3 0.1	7.3 0.5	13.3 1.0	13	1 18.3	1 18.5	1 14.7	1.3 0.1	7.3 0.7	13.3 1.2
14	1 03.5	1 03.7	1 00.6	1.4 0.1	7.4 0.6	13.4 1.0	14	1 18.5	1 18.7	1 14.9	1.4 0.1	7.4 0.7	13.4 1.2
15	1 03.8	1 03.9	1 00.8	1.5 0.1	7.5 0.6	13.5 1.0	15	1 18.8	1 19.0	1 15.2	1.5 0.1	7.5 0.7	13.5 1.2
16	1 04.0	1 04.2	1 01.1	1.6 0.1	7.6 0.6	13.6 1.0	16	1 19.0	1 19.2	1 15.4	1.6 0.1	7.6 0.7	13.6 1.2
17	1 04.3	1 04.4	1 01.3	1.7 0.1	7.7 0.6	13.7 1.0	17	1 19.3	1 19.5	1 15.6	1.7 0.2	7.7 0.7	13.7 1.3
18	1 04.5	1 04.7	1 01.6	1.8 0.1	7.8 0.6	13.8 1.0	18	1 19.5	1 19.7	1 15.9	1.8 0.2	7.8 0.7	13.8 1.3
19	1 04.8	1 04.9	1 01.8	1.9 0.1	7.9 0.6	13.9 1.0	19	1 19.8	1 20.0	1 16.1	1.9 0.2	7.9 0.7	13.9 1.3
20	1 05.0	1 05.2	1 02.0	2.0 0.2	8.0 0.6	14.0 1.1	20	1 20.0	1 20.2	1 16.4	2.0 0.2	8.0 0.7	14.0 1.3
21	1 05.3	1 05.4	1 02.3	2.1 0.2	8.1 0.6	14.1 1.1	21	1 20.3	1 20.5	1 16.6	2.1 0.2	8.1 0.7	14.1 1.3
22	1 05.5	1 05.7	1 02.5	2.2 0.2	8.2 0.6	14.2 1.1	22	1 20.5	1 20.7	1 16.8	2.2 0.2	8.2 0.8	14.2 1.3
23	1 05.8	1 05.9	1 02.8	2.3 0.2	8.3 0.6	14.3 1.1	23	1 20.8	1 21.0	1 17.1	2.3 0.2	8.3 0.8	14.3 1.3
24	1 06.0	1 06.2	1 03.0	2.4 0.2	8.4 0.6	14.4 1.1	24	1 21.0	1 21.2	1 17.3	2.4 0.2	8.4 0.8	14.4 1.3
25	1 06.3	1 06.4	1 03.2	2.5 0.2	8.5 0.6	14.5 1.1	25	1 21.3	1 21.5	1 17.5	2.5 0.2	8.5 0.8	14.5 1.3
26	1 06.5	1 06.7	1 03.5	2.6 0.2	8.6 0.6	14.6 1.1	26	1 21.5	1 21.7	1 17.8	2.6 0.2	8.6 0.8	14.6 1.3
27	1 06.8	1 06.9	1 03.7	2.7 0.2	8.7 0.7	14.7 1.1	27	1 21.8	1 22.0	1 18.0	2.7 0.2	8.7 0.8	14.7 1.3
28	1 07.0	1 07.2	1 03.9	2.8 0.2	8.8 0.7	14.8 1.1	28	1 22.0	1 22.2	1 18.3	2.8 0.3	8.8 0.8	14.8 1.4
29	1 07.3	1 07.4	1 04.2	2.9 0.2	8.9 0.7	14.9 1.1	29	1 22.3	1 22.5	1 18.5	2.9 0.3	8.9 0.8	14.9 1.4
30	1 07.5	1 07.7	1 04.4	3.0 0.2	9.0 0.7	15.0 1.1	30	1 22.5	1 22.7	1 18.7	3.0 0.3	9.0 0.8	15.0 1.4
31	1 07.8	1 07.9	1 04.7	3.1 0.2	9.1 0.7	15.1 1.1	31	1 22.8	1 23.0	1 19.0	3.1 0.3	9.1 0.8	15.1 1.4
32	1 08.0	1 08.2	1 04.9	3.2 0.2	9.2 0.7	15.2 1.1	32	1 23.0	1 23.2	1 19.2	3.2 0.3	9.2 0.8	15.2 1.4
33	1 08.3	1 08.4	1 05.1	3.3 0.2	9.3 0.7	15.3 1.1	33	1 23.3	1 23.5	1 19.5	3.3 0.3	9.3 0.9	15.3 1.4
34	1 08.5	1 08.7	1 05.4	3.4 0.3	9.4 0.7	15.4 1.2	34	1 23.5	1 23.7	1 19.7	3.4 0.3	9.4 0.9	15.4 1.4
35	1 08.8	1 08.9	1 05.6	3.5 0.3	9.5 0.7	15.5 1.2	35	1 23.8	1 24.0	1 19.9	3.5 0.3	9.5 0.9	15.5 1.4
36	1 09.0	1 09.2	1 05.9	3.6 0.3	9.6 0.7	15.6 1.2	36	1 24.0	1 24.2	1 20.2	3.6 0.3	9.6 0.9	15.6 1.4
37	1 09.3	1 09.4	1 06.1	3.7 0.3	9.7 0.7	15.7 1.2	37	1 24.3	1 24.5	1 20.4	3.7 0.3	9.7 0.9	15.7 1.4
38	1 09.5	1 09.7	1 06.3	3.8 0.3	9.8 0.7	15.8 1.2	38	1 24.5	1 24.7	1 20.7	3.8 0.3	9.8 0.9	15.8 1.4
39	1 09.8	1 09.9	1 06.6	3.9 0.3	9.9 0.7	15.9 1.2	39	1 24.8	1 25.0	1 20.9	3.9 0.4	9.9 0.9	15.9 1.5
40	1 10.0	1 10.2	1 06.8	4.0 0.3	10.0 0.8	16.0 1.2	40	1 25.0	1 25.2	1 21.1	4.0 0.4	10.0 0.9	16.0 1.5
41	1 10.3	1 10.4	1 07.0	4.1 0.3	10.1 0.8	16.1 1.2	41	1 25.3	1 25.5	1 21.4	4.1 0.4	10.1 0.9	16.1 1.5
42	1 10.5	1 10.7	1 07.3	4.2 0.3	10.2 0.8	16.2 1.2	42	1 25.5	1 25.7	1 21.6	4.2 0.4	10.2 0.9	16.2 1.5
43	1 10.8	1 10.9	1 07.5	4.3 0.3	10.3 0.8	16.3 1.2	43	1 25.8	1 26.0	1 21.8	4.3 0.4	10.3 0.9	16.3 1.5
44	1 11.0	1 11.2	1 07.8	4.4 0.3	10.4 0.8	16.4 1.2	44	1 26.0	1 26.2	1 22.1	4.4 0.4	10.4 1.0	16.4 1.5
45	1 11.3	1 11.4	1 08.0	4.5 0.3	10.5 0.8	16.5 1.2	45	1 26.3	1 26.5	1 22.3	4.5 0.4	10.5 1.0	16.5 1.5
46	1 11.5	1 11.7	1 08.2	4.6 0.3	10.6 0.8	16.6 1.2	46	1 26.5	1 26.7	1 22.6	4.6 0.4	10.6 1.0	16.6 1.5
47	1 11.8	1 11.9	1 08.5	4.7 0.4	10.7 0.8	16.7 1.3	47	1 26.8	1 27.0	1 22.8	4.7 0.4	10.7 1.0	16.7 1.5
48	1 12.0	1 12.2	1 08.7	4.8 0.4	10.8 0.8	16.8 1.3	48	1 27.0	1 27.2	1 23.0	4.8 0.4	10.8 1.0	16.8 1.5
49	1 12.3	1 12.4	1 09.0	4.9 0.4	10.9 0.8	16.9 1.3	49	1 27.3	1 27.5	1 23.3	4.9 0.4	10.9 1.0	16.9 1.5
50	1 12.5	1 12.7	1 09.2	5.0 0.4	11.0 0.8	17.0 1.3	50	1 27.5	1 27.7	1 23.5	5.0 0.5	11.0 1.0	17.0 1.6
51	1 12.8	1 12.9	1 09.4	5.1 0.4	11.1 0.8	17.1 1.3	51	1 27.8	1 28.0	1 23.8	5.1 0.5	11.1 1.0	17.1 1.6
52	1 13.0	1 13.2	1 09.7	5.2 0.4	11.2 0.8	17.2 1.3	52	1 28.0	1 28.2	1 24.0	5.2 0.5	11.2 1.0	17.2 1.6
53	1 13.3	1 13.5	1 09.9	5.3 0.4	11.3 0.8	17.3 1.3	53	1 28.3	1 28.5	1 24.2	5.3 0.5	11.3 1.0	17.3 1.6
54	1 13.5	1 13.7	1 10.2	5.4 0.4	11.4 0.9	17.4 1.3	54	1 28.5	1 28.7	1 24.5	5.4 0.5	11.4 1.0	17.4 1.6
55	1 13.8	1 14.0	1 10.4	5.5 0.4	11.5 0.9	17.5 1.3	55	1 28.8	1 29.0	1 24.7	5.5 0.5	11.5 1.1	17.5 1.6
56	1 14.0	1 14.2	1 10.6	5.6 0.4	11.6 0.9	17.6 1.3	56	1 29.0	1 29.2	1 24.9	5.6 0.5	11.6 1.1	17.6 1.6
57	1 14.3	1 14.5	1 10.9	5.7 0.4	11.7 0.9	17.7 1.3	57	1 29.3	1 29.5	1 25.2	5.7 0.5	11.7 1.1	17.7 1.6
58	1 14.5	1 14.7	1 11.1	5.8 0.4	11.8 0.9	17.8 1.3	58	1 29.5	1 29.7	1 25.4	5.8 0.5	11.8 1.1	17.8 1.6
59	1 14.8	1 15.0	1 11.3	5.9 0.4	11.9 0.9	17.9 1.3	59	1 29.8	1 30.0	1 25.7	5.9 0.5	11.9 1.1	17.9 1.6
60	1 15.0	1 15.2	1 11.6	6.0 0.5	12.0 0.9	18.0 1.4	60	1 30.0	1 30.2	1 25.9	6.0 0.6	12.0 1.1	18.0 1.7

^m 6	SUN PLANETS	ARIES	MOON	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^m 7	SUN PLANETS	ARIES	MOON	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^v or d	Corr ⁿ
s	° /	° /	° /	/	/	/	/	/	/	s	° /	° /	° /	/	/	/	/	/	/
00	1 30.0	1 30.2	1 25.9	0.0	0.0	6.0	0.7	12.0	1.3	00	1 45.0	1 45.3	1 40.2	0.0	0.0	6.0	0.8	12.0	1.5
01	1 30.3	1 30.5	1 26.1	0.1	0.0	6.1	0.7	12.1	1.3	01	1 45.3	1 45.5	1 40.5	0.1	0.0	6.1	0.8	12.1	1.5
02	1 30.5	1 30.7	1 26.4	0.2	0.0	6.2	0.7	12.2	1.3	02	1 45.5	1 45.8	1 40.7	0.2	0.0	6.2	0.8	12.2	1.5
03	1 30.8	1 31.0	1 26.6	0.3	0.0	6.3	0.7	12.3	1.3	03	1 45.8	1 46.0	1 40.9	0.3	0.0	6.3	0.8	12.3	1.5
04	1 31.0	1 31.2	1 26.9	0.4	0.0	6.4	0.7	12.4	1.3	04	1 46.0	1 46.3	1 41.2	0.4	0.1	6.4	0.8	12.4	1.6
05	1 31.3	1 31.5	1 27.1	0.5	0.1	6.5	0.7	12.5	1.4	05	1 46.3	1 46.5	1 41.4	0.5	0.1	6.5	0.8	12.5	1.6
06	1 31.5	1 31.8	1 27.3	0.6	0.1	6.6	0.7	12.6	1.4	06	1 46.5	1 46.8	1 41.6	0.6	0.1	6.6	0.8	12.6	1.6
07	1 31.8	1 32.0	1 27.6	0.7	0.1	6.7	0.7	12.7	1.4	07	1 46.8	1 47.0	1 41.9	0.7	0.1	6.7	0.8	12.7	1.6
08	1 32.0	1 32.3	1 27.8	0.8	0.1	6.8	0.7	12.8	1.4	08	1 47.0	1 47.3	1 42.1	0.8	0.1	6.8	0.9	12.8	1.6
09	1 32.3	1 32.5	1 28.0	0.9	0.1	6.9	0.7	12.9	1.4	09	1 47.3	1 47.5	1 42.4	0.9	0.1	6.9	0.9	12.9	1.6
10	1 32.5	1 32.8	1 28.3	1.0	0.1	7.0	0.8	13.0	1.4	10	1 47.5	1 47.8	1 42.6	1.0	0.1	7.0	0.9	13.0	1.6
11	1 32.8	1 33.0	1 28.5	1.1	0.1	7.1	0.8	13.1	1.4	11	1 47.8	1 48.0	1 42.8	1.1	0.1	7.1	0.9	13.1	1.6
12	1 33.0	1 33.3	1 28.8	1.2	0.1	7.2	0.8	13.2	1.4	12	1 48.0	1 48.3	1 43.1	1.2	0.2	7.2	0.9	13.2	1.7
13	1 33.3	1 33.5	1 29.0	1.3	0.1	7.3	0.8	13.3	1.4	13	1 48.3	1 48.5	1 43.3	1.3	0.2	7.3	0.9	13.3	1.7
14	1 33.5	1 33.8	1 29.2	1.4	0.2	7.4	0.8	13.4	1.5	14	1 48.5	1 48.8	1 43.6	1.4	0.2	7.4	0.9	13.4	1.7
15	1 33.8	1 34.0	1 29.5	1.5	0.2	7.5	0.8	13.5	1.5	15	1 48.8	1 49.0	1 43.8	1.5	0.2	7.5	0.9	13.5	1.7
16	1 34.0	1 34.3	1 29.7	1.6	0.2	7.6	0.8	13.6	1.5	16	1 49.0	1 49.3	1 44.0	1.6	0.2	7.6	1.0	13.6	1.7
17	1 34.3	1 34.5	1 30.0	1.7	0.2	7.7	0.8	13.7	1.5	17	1 49.3	1 49.5	1 44.3	1.7	0.2	7.7	1.0	13.7	1.7
18	1 34.5	1 34.8	1 30.2	1.8	0.2	7.8	0.8	13.8	1.5	18	1 49.5	1 49.8	1 44.5	1.8	0.2	7.8	1.0	13.8	1.7
19	1 34.8	1 35.0	1 30.4	1.9	0.2	7.9	0.9	13.9	1.5	19	1 49.8	1 50.1	1 44.8	1.9	0.2	7.9	1.0	13.9	1.7
20	1 35.0	1 35.3	1 30.7	2.0	0.2	8.0	0.9	14.0	1.5	20	1 50.0	1 50.3	1 45.0	2.0	0.3	8.0	1.0	14.0	1.8
21	1 35.3	1 35.5	1 30.9	2.1	0.2	8.1	0.9	14.1	1.5	21	1 50.3	1 50.6	1 45.2	2.1	0.3	8.1	1.0	14.1	1.8
22	1 35.5	1 35.8	1 31.1	2.2	0.2	8.2	0.9	14.2	1.5	22	1 50.5	1 50.8	1 45.5	2.2	0.3	8.2	1.0	14.2	1.8
23	1 35.8	1 36.0	1 31.4	2.3	0.2	8.3	0.9	14.3	1.5	23	1 50.8	1 51.1	1 45.7	2.3	0.3	8.3	1.0	14.3	1.8
24	1 36.0	1 36.3	1 31.6	2.4	0.3	8.4	0.9	14.4	1.6	24	1 51.0	1 51.3	1 45.9	2.4	0.3	8.4	1.1	14.4	1.8
25	1 36.3	1 36.5	1 31.9	2.5	0.3	8.5	0.9	14.5	1.6	25	1 51.3	1 51.6	1 46.2	2.5	0.3	8.5	1.1	14.5	1.8
26	1 36.5	1 36.8	1 32.1	2.6	0.3	8.6	0.9	14.6	1.6	26	1 51.5	1 51.8	1 46.4	2.6	0.3	8.6	1.1	14.6	1.8
27	1 36.8	1 37.0	1 32.3	2.7	0.3	8.7	0.9	14.7	1.6	27	1 51.8	1 52.1	1 46.7	2.7	0.3	8.7	1.1	14.7	1.8
28	1 37.0	1 37.3	1 32.6	2.8	0.3	8.8	1.0	14.8	1.6	28	1 52.0	1 52.3	1 46.9	2.8	0.4	8.8	1.1	14.8	1.9
29	1 37.3	1 37.5	1 32.8	2.9	0.3	8.9	1.0	14.9	1.6	29	1 52.3	1 52.6	1 47.1	2.9	0.4	8.9	1.1	14.9	1.9
30	1 37.5	1 37.8	1 33.1	3.0	0.3	9.0	1.0	15.0	1.6	30	1 52.5	1 52.8	1 47.4	3.0	0.4	9.0	1.1	15.0	1.9
31	1 37.8	1 38.0	1 33.3	3.1	0.3	9.1	1.0	15.1	1.6	31	1 52.8	1 53.1	1 47.6	3.1	0.4	9.1	1.1	15.1	1.9
32	1 38.0	1 38.3	1 33.5	3.2	0.3	9.2	1.0	15.2	1.6	32	1 53.0	1 53.3	1 47.9	3.2	0.4	9.2	1.2	15.2	1.9
33	1 38.3	1 38.5	1 33.8	3.3	0.4	9.3	1.0	15.3	1.7	33	1 53.3	1 53.6	1 48.1	3.3	0.4	9.3	1.2	15.3	1.9
34	1 38.5	1 38.8	1 34.0	3.4	0.4	9.4	1.0	15.4	1.7	34	1 53.5	1 53.8	1 48.3	3.4	0.4	9.4	1.2	15.4	1.9
35	1 38.8	1 39.0	1 34.3	3.5	0.4	9.5	1.0	15.5	1.7	35	1 53.8	1 54.1	1 48.6	3.5	0.4	9.5	1.2	15.5	1.9
36	1 39.0	1 39.3	1 34.5	3.6	0.4	9.6	1.0	15.6	1.7	36	1 54.0	1 54.3	1 48.8	3.6	0.5	9.6	1.2	15.6	2.0
37	1 39.3	1 39.5	1 34.7	3.7	0.4	9.7	1.1	15.7	1.7	37	1 54.3	1 54.6	1 49.0	3.7	0.5	9.7	1.2	15.7	2.0
38	1 39.5	1 39.8	1 35.0	3.8	0.4	9.8	1.1	15.8	1.7	38	1 54.5	1 54.8	1 49.3	3.8	0.5	9.8	1.2	15.8	2.0
39	1 39.8	1 40.0	1 35.2	3.9	0.4	9.9	1.1	15.9	1.7	39	1 54.8	1 55.1	1 49.5	3.9	0.5	9.9	1.2	15.9	2.0
40	1 40.0	1 40.3	1 35.4	4.0	0.4	10.0	1.1	16.0	1.7	40	1 55.0	1 55.3	1 49.8	4.0	0.5	10.0	1.3	16.0	2.0
41	1 40.3	1 40.5	1 35.7	4.1	0.4	10.1	1.1	16.1	1.7	41	1 55.3	1 55.6	1 50.0	4.1	0.5	10.1	1.3	16.1	2.0
42	1 40.5	1 40.8	1 35.9	4.2	0.5	10.2	1.1	16.2	1.8	42	1 55.5	1 55.8	1 50.2	4.2	0.5	10.2	1.3	16.2	2.0
43	1 40.8	1 41.0	1 36.2	4.3	0.5	10.3	1.1	16.3	1.8	43	1 55.8	1 56.1	1 50.5	4.3	0.5	10.3	1.3	16.3	2.0
44	1 41.0	1 41.3	1 36.4	4.4	0.5	10.4	1.1	16.4	1.8	44	1 56.0	1 56.3	1 50.7	4.4	0.6	10.4	1.3	16.4	2.1
45	1 41.3	1 41.5	1 36.6	4.5	0.5	10.5	1.1	16.5	1.8	45	1 56.3	1 56.6	1 51.0	4.5	0.6	10.5	1.3	16.5	2.1
46	1 41.5	1 41.8	1 36.9	4.6	0.5	10.6	1.1	16.6	1.8	46	1 56.5	1 56.8	1 51.2	4.6	0.6	10.6	1.3	16.6	2.1
47	1 41.8	1 42.0	1 37.1	4.7	0.5	10.7	1.2	16.7	1.8	47	1 56.8	1 57.1	1 51.4	4.7	0.6	10.7	1.3	16.7	2.1
48	1 42.0	1 42.3	1 37.4	4.8	0.5	10.8	1.2	16.8	1.8	48	1 57.0	1 57.3	1 51.7	4.8	0.6	10.8	1.4	16.8	2.1
49	1 42.3	1 42.5	1 37.6	4.9	0.5	10.9	1.2	16.9	1.8	49	1 57.3	1 57.6	1 51.9	4.9	0.6	10.9	1.4	16.9	2.1
50	1 42.5	1 42.8	1 37.8	5.0	0.5	11.0	1.2	17.0	1.8	50	1 57.5	1 57.8	1 52.1	5.0	0.6	11.0	1.4	17.0	2.1
51	1 42.8	1 43.0	1 38.1	5.1	0.6	11.1	1.2	17.1	1.9	51	1 57.8	1 58.1	1 52.4	5.1	0.6	11.1	1.4	17.1	2.1
52	1 43.0	1 43.3	1 38.3	5.2	0.6	11.2	1.2	17.2	1.9	52	1 58.0	1 58.3	1 52.6	5.2	0.7	11.2	1.4	17.2	2.2
53	1 43.3	1 43.5	1 38.5	5.3	0.6	11.3	1.2	17.3	1.9	53	1 58.3	1 58.6	1 52.9	5.3	0.7	11.3	1.4	17.3	2.2
54	1 43.5	1 43.8	1 38.8	5.4	0.6	11.4	1.2	17.4	1.9	54	1 58.5	1 58.8	1 53.1	5.4	0.7	11.4	1.4	17.4	2.2
55	1 43.8	1 44.0	1 39.0	5.5	0.6	11.5	1.2	17.5	1.9	55	1 58.8	1 59.1	1 53.3	5.5	0.7	11.5	1.4	17.5	2.2
56	1 44.0	1 44.3	1 39.3	5.6	0.6	11.6	1.3	17.6	1.9	56	1 59.0	1 59.3	1 53.6	5.6	0.7	11.6	1.5	17.6	2.2
57	1 44.3	1 44.5	1 39.5	5.7	0.6	11.7	1.3	17.7	1.9	57	1 59.3	1 59.6	1 53.8	5.7	0.7	11.7	1.5	17.7	2.2
58	1 44.5	1 44.8	1 39.7	5.8	0.6	11.8	1.3	17.8	1.9	58	1 59.5	1 59.8	1 54.1	5.8	0.7	11.8	1.5	17.8	2.2
59	1 44.8	1 45.0	1 40.0	5.9	0.6	11.9	1.3	17.9	1.9	59	1 59.8	2 00.1	1 54.3	5.9	0.7	11.9	1.5	17.9	2.2
60	1 45.0	1 45.3	1 40.2	6.0	0.7	12.0	1.3	18.0	2.0	60	2 00.0	2 00.3	1 54.5	6.0	0.8	12.0	1.5	18.0	2.3

8 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	9 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	2 00.0	2 00.3	1 54.5	0.0 0.0	6.0 0.9	12.0 1.7	00	2 15.0	2 15.4	2 08.9	0.0 0.0	6.0 1.0	12.0 1.9
01	2 00.3	2 00.6	1 54.8	0.1 0.0	6.1 0.9	12.1 1.7	01	2 15.3	2 15.6	2 09.1	0.1 0.0	6.1 1.0	12.1 1.9
02	2 00.5	2 00.8	1 55.0	0.2 0.0	6.2 0.9	12.2 1.7	02	2 15.5	2 15.9	2 09.3	0.2 0.0	6.2 1.0	12.2 1.9
03	2 00.8	2 01.1	1 55.2	0.3 0.0	6.3 0.9	12.3 1.7	03	2 15.8	2 16.1	2 09.6	0.3 0.0	6.3 1.0	12.3 1.9
04	2 01.0	2 01.3	1 55.5	0.4 0.1	6.4 0.9	12.4 1.8	04	2 16.0	2 16.4	2 09.8	0.4 0.1	6.4 1.0	12.4 2.0
05	2 01.3	2 01.6	1 55.7	0.5 0.1	6.5 0.9	12.5 1.8	05	2 16.3	2 16.6	2 10.0	0.5 0.1	6.5 1.0	12.5 2.0
06	2 01.5	2 01.8	1 56.0	0.6 0.1	6.6 0.9	12.6 1.8	06	2 16.5	2 16.9	2 10.3	0.6 0.1	6.6 1.0	12.6 2.0
07	2 01.8	2 02.1	1 56.2	0.7 0.1	6.7 0.9	12.7 1.8	07	2 16.8	2 17.1	2 10.5	0.7 0.1	6.7 1.1	12.7 2.0
08	2 02.0	2 02.3	1 56.4	0.8 0.1	6.8 1.0	12.8 1.8	08	2 17.0	2 17.4	2 10.8	0.8 0.1	6.8 1.1	12.8 2.0
09	2 02.3	2 02.6	1 56.7	0.9 0.1	6.9 1.0	12.9 1.8	09	2 17.3	2 17.6	2 11.0	0.9 0.1	6.9 1.1	12.9 2.0
10	2 02.5	2 02.8	1 56.9	1.0 0.1	7.0 1.0	13.0 1.8	10	2 17.5	2 17.9	2 11.2	1.0 0.2	7.0 1.1	13.0 2.1
11	2 02.8	2 03.1	1 57.2	1.1 0.2	7.1 1.0	13.1 1.9	11	2 17.8	2 18.1	2 11.5	1.1 0.2	7.1 1.1	13.1 2.1
12	2 03.0	2 03.3	1 57.4	1.2 0.2	7.2 1.0	13.2 1.9	12	2 18.0	2 18.4	2 11.7	1.2 0.2	7.2 1.1	13.2 2.1
13	2 03.3	2 03.6	1 57.6	1.3 0.2	7.3 1.0	13.3 1.9	13	2 18.3	2 18.6	2 12.0	1.3 0.2	7.3 1.2	13.3 2.1
14	2 03.5	2 03.8	1 57.9	1.4 0.2	7.4 1.0	13.4 1.9	14	2 18.5	2 18.9	2 12.2	1.4 0.2	7.4 1.2	13.4 2.1
15	2 03.8	2 04.1	1 58.1	1.5 0.2	7.5 1.1	13.5 1.9	15	2 18.8	2 19.1	2 12.4	1.5 0.2	7.5 1.2	13.5 2.1
16	2 04.0	2 04.3	1 58.4	1.6 0.2	7.6 1.1	13.6 1.9	16	2 19.0	2 19.4	2 12.7	1.6 0.3	7.6 1.2	13.6 2.2
17	2 04.3	2 04.6	1 58.6	1.7 0.2	7.7 1.1	13.7 1.9	17	2 19.3	2 19.6	2 12.9	1.7 0.3	7.7 1.2	13.7 2.2
18	2 04.5	2 04.8	1 58.8	1.8 0.3	7.8 1.1	13.8 2.0	18	2 19.5	2 19.9	2 13.1	1.8 0.3	7.8 1.2	13.8 2.2
19	2 04.8	2 05.1	1 59.1	1.9 0.3	7.9 1.1	13.9 2.0	19	2 19.8	2 20.1	2 13.4	1.9 0.3	7.9 1.3	13.9 2.2
20	2 05.0	2 05.3	1 59.3	2.0 0.3	8.0 1.1	14.0 2.0	20	2 20.0	2 20.4	2 13.6	2.0 0.3	8.0 1.3	14.0 2.2
21	2 05.3	2 05.6	1 59.5	2.1 0.3	8.1 1.1	14.1 2.0	21	2 20.3	2 20.6	2 13.9	2.1 0.3	8.1 1.3	14.1 2.2
22	2 05.5	2 05.8	1 59.8	2.2 0.3	8.2 1.2	14.2 2.0	22	2 20.5	2 20.9	2 14.1	2.2 0.3	8.2 1.3	14.2 2.2
23	2 05.8	2 06.1	2 00.0	2.3 0.3	8.3 1.2	14.3 2.0	23	2 20.8	2 21.1	2 14.3	2.3 0.4	8.3 1.3	14.3 2.3
24	2 06.0	2 06.3	2 00.3	2.4 0.3	8.4 1.2	14.4 2.0	24	2 21.0	2 21.4	2 14.6	2.4 0.4	8.4 1.3	14.4 2.3
25	2 06.3	2 06.6	2 00.5	2.5 0.4	8.5 1.2	14.5 2.1	25	2 21.3	2 21.6	2 14.8	2.5 0.4	8.5 1.3	14.5 2.3
26	2 06.5	2 06.8	2 00.7	2.6 0.4	8.6 1.2	14.6 2.1	26	2 21.5	2 21.9	2 15.1	2.6 0.4	8.6 1.4	14.6 2.3
27	2 06.8	2 07.1	2 01.0	2.7 0.4	8.7 1.2	14.7 2.1	27	2 21.8	2 22.1	2 15.3	2.7 0.4	8.7 1.4	14.7 2.3
28	2 07.0	2 07.3	2 01.2	2.8 0.4	8.8 1.2	14.8 2.1	28	2 22.0	2 22.4	2 15.5	2.8 0.4	8.8 1.4	14.8 2.3
29	2 07.3	2 07.6	2 01.5	2.9 0.4	8.9 1.3	14.9 2.1	29	2 22.3	2 22.6	2 15.8	2.9 0.5	8.9 1.4	14.9 2.4
30	2 07.5	2 07.8	2 01.7	3.0 0.4	9.0 1.3	15.0 2.1	30	2 22.5	2 22.9	2 16.0	3.0 0.5	9.0 1.4	15.0 2.4
31	2 07.8	2 08.1	2 01.9	3.1 0.4	9.1 1.3	15.1 2.1	31	2 22.8	2 23.1	2 16.2	3.1 0.5	9.1 1.4	15.1 2.4
32	2 08.0	2 08.4	2 02.2	3.2 0.5	9.2 1.3	15.2 2.2	32	2 23.0	2 23.4	2 16.5	3.2 0.5	9.2 1.5	15.2 2.4
33	2 08.3	2 08.6	2 02.4	3.3 0.5	9.3 1.3	15.3 2.2	33	2 23.3	2 23.6	2 16.7	3.3 0.5	9.3 1.5	15.3 2.4
34	2 08.5	2 08.9	2 02.6	3.4 0.5	9.4 1.3	15.4 2.2	34	2 23.5	2 23.9	2 17.0	3.4 0.5	9.4 1.5	15.4 2.4
35	2 08.8	2 09.1	2 02.9	3.5 0.5	9.5 1.3	15.5 2.2	35	2 23.8	2 24.1	2 17.2	3.5 0.6	9.5 1.5	15.5 2.5
36	2 09.0	2 09.4	2 03.1	3.6 0.5	9.6 1.4	15.6 2.2	36	2 24.0	2 24.4	2 17.4	3.6 0.6	9.6 1.5	15.6 2.5
37	2 09.3	2 09.6	2 03.4	3.7 0.5	9.7 1.4	15.7 2.2	37	2 24.3	2 24.6	2 17.7	3.7 0.6	9.7 1.5	15.7 2.5
38	2 09.5	2 09.9	2 03.6	3.8 0.5	9.8 1.4	15.8 2.2	38	2 24.5	2 24.9	2 17.9	3.8 0.6	9.8 1.6	15.8 2.5
39	2 09.8	2 10.1	2 03.8	3.9 0.6	9.9 1.4	15.9 2.3	39	2 24.8	2 25.1	2 18.2	3.9 0.6	9.9 1.6	15.9 2.5
40	2 10.0	2 10.4	2 04.1	4.0 0.6	10.0 1.4	16.0 2.3	40	2 25.0	2 25.4	2 18.4	4.0 0.6	10.0 1.6	16.0 2.5
41	2 10.3	2 10.6	2 04.3	4.1 0.6	10.1 1.4	16.1 2.3	41	2 25.3	2 25.6	2 18.6	4.1 0.6	10.1 1.6	16.1 2.5
42	2 10.5	2 10.9	2 04.6	4.2 0.6	10.2 1.4	16.2 2.3	42	2 25.5	2 25.9	2 18.9	4.2 0.7	10.2 1.6	16.2 2.6
43	2 10.8	2 11.1	2 04.8	4.3 0.6	10.3 1.5	16.3 2.3	43	2 25.8	2 26.1	2 19.1	4.3 0.7	10.3 1.6	16.3 2.6
44	2 11.0	2 11.4	2 05.0	4.4 0.6	10.4 1.5	16.4 2.3	44	2 26.0	2 26.4	2 19.3	4.4 0.7	10.4 1.6	16.4 2.6
45	2 11.3	2 11.6	2 05.3	4.5 0.6	10.5 1.5	16.5 2.3	45	2 26.3	2 26.7	2 19.6	4.5 0.7	10.5 1.7	16.5 2.6
46	2 11.5	2 11.9	2 05.5	4.6 0.7	10.6 1.5	16.6 2.4	46	2 26.5	2 26.9	2 19.8	4.6 0.7	10.6 1.7	16.6 2.6
47	2 11.8	2 12.1	2 05.7	4.7 0.7	10.7 1.5	16.7 2.4	47	2 26.8	2 27.2	2 20.1	4.7 0.7	10.7 1.7	16.7 2.6
48	2 12.0	2 12.4	2 06.0	4.8 0.7	10.8 1.5	16.8 2.4	48	2 27.0	2 27.4	2 20.3	4.8 0.8	10.8 1.7	16.8 2.7
49	2 12.3	2 12.6	2 06.2	4.9 0.7	10.9 1.5	16.9 2.4	49	2 27.3	2 27.7	2 20.5	4.9 0.8	10.9 1.7	16.9 2.7
50	2 12.5	2 12.9	2 06.5	5.0 0.7	11.0 1.6	17.0 2.4	50	2 27.5	2 27.9	2 20.8	5.0 0.8	11.0 1.7	17.0 2.7
51	2 12.8	2 13.1	2 06.7	5.1 0.7	11.1 1.6	17.1 2.4	51	2 27.8	2 28.2	2 21.0	5.1 0.8	11.1 1.8	17.1 2.7
52	2 13.0	2 13.4	2 06.9	5.2 0.7	11.2 1.6	17.2 2.4	52	2 28.0	2 28.4	2 21.3	5.2 0.8	11.2 1.8	17.2 2.7
53	2 13.3	2 13.6	2 07.2	5.3 0.8	11.3 1.6	17.3 2.5	53	2 28.3	2 28.7	2 21.5	5.3 0.8	11.3 1.8	17.3 2.7
54	2 13.5	2 13.9	2 07.4	5.4 0.8	11.4 1.6	17.4 2.5	54	2 28.5	2 28.9	2 21.7	5.4 0.9	11.4 1.8	17.4 2.8
55	2 13.8	2 14.1	2 07.7	5.5 0.8	11.5 1.6	17.5 2.5	55	2 28.8	2 29.2	2 22.0	5.5 0.9	11.5 1.8	17.5 2.8
56	2 14.0	2 14.4	2 07.9	5.6 0.8	11.6 1.6	17.6 2.5	56	2 29.0	2 29.4	2 22.2	5.6 0.9	11.6 1.8	17.6 2.8
57	2 14.3	2 14.6	2 08.1	5.7 0.8	11.7 1.7	17.7 2.5	57	2 29.3	2 29.7	2 22.5	5.7 0.9	11.7 1.9	17.7 2.8
58	2 14.5	2 14.9	2 08.4	5.8 0.8	11.8 1.7	17.8 2.5	58	2 29.5	2 29.9	2 22.7	5.8 0.9	11.8 1.9	17.8 2.8
59	2 14.8	2 15.1	2 08.6	5.9 0.8	11.9 1.7	17.9 2.5	59	2 29.8	2 30.2	2 22.9	5.9 0.9	11.9 1.9	17.9 2.8
60	2 15.0	2 15.4	2 08.9	6.0 0.9	12.0 1.7	18.0 2.6	60	2 30.0	2 30.4	2 23.2	6.0 1.0	12.0 1.9	18.0 2.9

10 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	11 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	2 30:0	2 30:4	2 23:2	0:0 0:0	6:0 1:1	12:0 2:1	00	2 45:0	2 45:5	2 37:5	0:0 0:0	6:0 1:2	12:0 2:3
01	2 30:3	2 30:7	2 23:4	0:1 0:0	6:1 1:1	12:1 2:1	01	2 45:3	2 45:7	2 37:7	0:1 0:0	6:1 1:2	12:1 2:3
02	2 30:5	2 30:9	2 23:6	0:2 0:0	6:2 1:1	12:2 2:1	02	2 45:5	2 46:0	2 38:0	0:2 0:0	6:2 1:2	12:2 2:3
03	2 30:8	2 31:2	2 23:9	0:3 0:1	6:3 1:1	12:3 2:2	03	2 45:8	2 46:2	2 38:2	0:3 0:1	6:3 1:2	12:3 2:4
04	2 31:0	2 31:4	2 24:1	0:4 0:1	6:4 1:1	12:4 2:2	04	2 46:0	2 46:5	2 38:4	0:4 0:1	6:4 1:2	12:4 2:4
05	2 31:3	2 31:7	2 24:4	0:5 0:1	6:5 1:1	12:5 2:2	05	2 46:3	2 46:7	2 38:7	0:5 0:1	6:5 1:2	12:5 2:4
06	2 31:5	2 31:9	2 24:6	0:6 0:1	6:6 1:2	12:6 2:2	06	2 46:5	2 47:0	2 38:9	0:6 0:1	6:6 1:3	12:6 2:4
07	2 31:8	2 32:2	2 24:8	0:7 0:1	6:7 1:2	12:7 2:2	07	2 46:8	2 47:2	2 39:2	0:7 0:1	6:7 1:3	12:7 2:4
08	2 32:0	2 32:4	2 25:1	0:8 0:1	6:8 1:2	12:8 2:2	08	2 47:0	2 47:5	2 39:4	0:8 0:2	6:8 1:3	12:8 2:5
09	2 32:3	2 32:7	2 25:3	0:9 0:2	6:9 1:2	12:9 2:3	09	2 47:3	2 47:7	2 39:6	0:9 0:2	6:9 1:3	12:9 2:5
10	2 32:5	2 32:9	2 25:6	1:0 0:2	7:0 1:2	13:0 2:3	10	2 47:5	2 48:0	2 39:9	1:0 0:2	7:0 1:3	13:0 2:5
11	2 32:8	2 33:2	2 25:8	1:1 0:2	7:1 1:2	13:1 2:3	11	2 47:8	2 48:2	2 40:1	1:1 0:2	7:1 1:4	13:1 2:5
12	2 33:0	2 33:4	2 26:0	1:2 0:2	7:2 1:3	13:2 2:3	12	2 48:0	2 48:5	2 40:3	1:2 0:2	7:2 1:4	13:2 2:5
13	2 33:3	2 33:7	2 26:3	1:3 0:2	7:3 1:3	13:3 2:3	13	2 48:3	2 48:7	2 40:6	1:3 0:2	7:3 1:4	13:3 2:5
14	2 33:5	2 33:9	2 26:5	1:4 0:2	7:4 1:3	13:4 2:3	14	2 48:5	2 49:0	2 40:8	1:4 0:3	7:4 1:4	13:4 2:6
15	2 33:8	2 34:2	2 26:7	1:5 0:3	7:5 1:3	13:5 2:4	15	2 48:8	2 49:2	2 41:1	1:5 0:3	7:5 1:4	13:5 2:6
16	2 34:0	2 34:4	2 27:0	1:6 0:3	7:6 1:3	13:6 2:4	16	2 49:0	2 49:5	2 41:3	1:6 0:3	7:6 1:5	13:6 2:6
17	2 34:3	2 34:7	2 27:2	1:7 0:3	7:7 1:3	13:7 2:4	17	2 49:3	2 49:7	2 41:5	1:7 0:3	7:7 1:5	13:7 2:6
18	2 34:5	2 34:9	2 27:5	1:8 0:3	7:8 1:4	13:8 2:4	18	2 49:5	2 50:0	2 41:8	1:8 0:3	7:8 1:5	13:8 2:6
19	2 34:8	2 35:2	2 27:7	1:9 0:3	7:9 1:4	13:9 2:4	19	2 49:8	2 50:2	2 42:0	1:9 0:4	7:9 1:5	13:9 2:7
20	2 35:0	2 35:4	2 27:9	2:0 0:4	8:0 1:4	14:0 2:5	20	2 50:0	2 50:5	2 42:3	2:0 0:4	8:0 1:5	14:0 2:7
21	2 35:3	2 35:7	2 28:2	2:1 0:4	8:1 1:4	14:1 2:5	21	2 50:3	2 50:7	2 42:5	2:1 0:4	8:1 1:6	14:1 2:7
22	2 35:5	2 35:9	2 28:4	2:2 0:4	8:2 1:4	14:2 2:5	22	2 50:5	2 51:0	2 42:7	2:2 0:4	8:2 1:6	14:2 2:7
23	2 35:8	2 36:2	2 28:7	2:3 0:4	8:3 1:5	14:3 2:5	23	2 50:8	2 51:2	2 43:0	2:3 0:4	8:3 1:6	14:3 2:7
24	2 36:0	2 36:4	2 28:9	2:4 0:4	8:4 1:5	14:4 2:5	24	2 51:0	2 51:5	2 43:2	2:4 0:5	8:4 1:6	14:4 2:8
25	2 36:3	2 36:7	2 29:1	2:5 0:4	8:5 1:5	14:5 2:5	25	2 51:3	2 51:7	2 43:4	2:5 0:5	8:5 1:6	14:5 2:8
26	2 36:5	2 36:9	2 29:4	2:6 0:5	8:6 1:5	14:6 2:6	26	2 51:5	2 52:0	2 43:7	2:6 0:5	8:6 1:6	14:6 2:8
27	2 36:8	2 37:2	2 29:6	2:7 0:5	8:7 1:5	14:7 2:6	27	2 51:8	2 52:2	2 43:9	2:7 0:5	8:7 1:7	14:7 2:8
28	2 37:0	2 37:4	2 29:8	2:8 0:5	8:8 1:5	14:8 2:6	28	2 52:0	2 52:5	2 44:2	2:8 0:5	8:8 1:7	14:8 2:8
29	2 37:3	2 37:7	2 30:1	2:9 0:5	8:9 1:6	14:9 2:6	29	2 52:3	2 52:7	2 44:4	2:9 0:6	8:9 1:7	14:9 2:9
30	2 37:5	2 37:9	2 30:3	3:0 0:5	9:0 1:6	15:0 2:6	30	2 52:5	2 53:0	2 44:6	3:0 0:6	9:0 1:7	15:0 2:9
31	2 37:8	2 38:2	2 30:6	3:1 0:5	9:1 1:6	15:1 2:6	31	2 52:8	2 53:2	2 44:9	3:1 0:6	9:1 1:7	15:1 2:9
32	2 38:0	2 38:4	2 30:8	3:2 0:6	9:2 1:6	15:2 2:7	32	2 53:0	2 53:5	2 45:1	3:2 0:6	9:2 1:8	15:2 2:9
33	2 38:3	2 38:7	2 31:0	3:3 0:6	9:3 1:6	15:3 2:7	33	2 53:3	2 53:7	2 45:4	3:3 0:6	9:3 1:8	15:3 2:9
34	2 38:5	2 38:9	2 31:3	3:4 0:6	9:4 1:6	15:4 2:7	34	2 53:5	2 54:0	2 45:6	3:4 0:7	9:4 1:8	15:4 3:0
35	2 38:8	2 39:2	2 31:5	3:5 0:6	9:5 1:7	15:5 2:7	35	2 53:8	2 54:2	2 45:8	3:5 0:7	9:5 1:8	15:5 3:0
36	2 39:0	2 39:4	2 31:8	3:6 0:6	9:6 1:7	15:6 2:7	36	2 54:0	2 54:5	2 46:1	3:6 0:7	9:6 1:8	15:6 3:0
37	2 39:3	2 39:7	2 32:0	3:7 0:6	9:7 1:7	15:7 2:7	37	2 54:3	2 54:7	2 46:3	3:7 0:7	9:7 1:9	15:7 3:0
38	2 39:5	2 39:9	2 32:2	3:8 0:7	9:8 1:7	15:8 2:8	38	2 54:5	2 55:0	2 46:6	3:8 0:7	9:8 1:9	15:8 3:0
39	2 39:8	2 40:2	2 32:5	3:9 0:7	9:9 1:7	15:9 2:8	39	2 54:8	2 55:2	2 46:8	3:9 0:7	9:9 1:9	15:9 3:0
40	2 40:0	2 40:4	2 32:7	4:0 0:7	10:0 1:8	16:0 2:8	40	2 55:0	2 55:5	2 47:0	4:0 0:8	10:0 1:9	16:0 3:1
41	2 40:3	2 40:7	2 32:9	4:1 0:7	10:1 1:8	16:1 2:8	41	2 55:3	2 55:7	2 47:3	4:1 0:8	10:1 1:9	16:1 3:1
42	2 40:5	2 40:9	2 33:2	4:2 0:7	10:2 1:8	16:2 2:8	42	2 55:5	2 56:0	2 47:5	4:2 0:8	10:2 2:0	16:2 3:1
43	2 40:8	2 41:2	2 33:4	4:3 0:8	10:3 1:8	16:3 2:9	43	2 55:8	2 56:2	2 47:7	4:3 0:8	10:3 2:0	16:3 3:1
44	2 41:0	2 41:4	2 33:7	4:4 0:8	10:4 1:8	16:4 2:9	44	2 56:0	2 56:5	2 48:0	4:4 0:8	10:4 2:0	16:4 3:1
45	2 41:3	2 41:7	2 33:9	4:5 0:8	10:5 1:8	16:5 2:9	45	2 56:3	2 56:7	2 48:2	4:5 0:9	10:5 2:0	16:5 3:2
46	2 41:5	2 41:9	2 34:1	4:6 0:8	10:6 1:9	16:6 2:9	46	2 56:5	2 57:0	2 48:5	4:6 0:9	10:6 2:0	16:6 3:2
47	2 41:8	2 42:2	2 34:4	4:7 0:8	10:7 1:9	16:7 2:9	47	2 56:8	2 57:2	2 48:7	4:7 0:9	10:7 2:1	16:7 3:2
48	2 42:0	2 42:4	2 34:6	4:8 0:8	10:8 1:9	16:8 2:9	48	2 57:0	2 57:5	2 48:9	4:8 0:9	10:8 2:1	16:8 3:2
49	2 42:3	2 42:7	2 34:9	4:9 0:9	10:9 1:9	16:9 3:0	49	2 57:3	2 57:7	2 49:2	4:9 0:9	10:9 2:1	16:9 3:2
50	2 42:5	2 42:9	2 35:1	5:0 0:9	11:0 1:9	17:0 3:0	50	2 57:5	2 58:0	2 49:4	5:0 1:0	11:0 2:1	17:0 3:3
51	2 42:8	2 43:2	2 35:3	5:1 0:9	11:1 1:9	17:1 3:0	51	2 57:8	2 58:2	2 49:7	5:1 1:0	11:1 2:1	17:1 3:3
52	2 43:0	2 43:4	2 35:6	5:2 0:9	11:2 2:0	17:2 3:0	52	2 58:0	2 58:5	2 49:9	5:2 1:0	11:2 2:1	17:2 3:3
53	2 43:3	2 43:7	2 35:8	5:3 0:9	11:3 2:0	17:3 3:0	53	2 58:3	2 58:7	2 50:1	5:3 1:0	11:3 2:2	17:3 3:3
54	2 43:5	2 43:9	2 36:1	5:4 0:9	11:4 2:0	17:4 3:0	54	2 58:5	2 59:0	2 50:4	5:4 1:0	11:4 2:2	17:4 3:3
55	2 43:8	2 44:2	2 36:3	5:5 1:0	11:5 2:0	17:5 3:1	55	2 58:8	2 59:2	2 50:6	5:5 1:1	11:5 2:2	17:5 3:4
56	2 44:0	2 44:4	2 36:5	5:6 1:0	11:6 2:0	17:6 3:1	56	2 59:0	2 59:5	2 50:8	5:6 1:1	11:6 2:2	17:6 3:4
57	2 44:3	2 44:7	2 36:8	5:7 1:0	11:7 2:0	17:7 3:1	57	2 59:3	2 59:7	2 51:1	5:7 1:1	11:7 2:2	17:7 3:4
58	2 44:5	2 45:0	2 37:0	5:8 1:0	11:8 2:1	17:8 3:1	58	2 59:5	3 00:0	2 51:3	5:8 1:1	11:8 2:3	17:8 3:4
59	2 44:8	2 45:2	2 37:2	5:9 1:0	11:9 2:1	17:9 3:1	59	2 59:8	3 00:2	2 51:6	5:9 1:1	11:9 2:3	17:9 3:4
60	2 45:0	2 45:5	2 37:5	6:0 1:1	12:0 2:1	18:0 3:2	60	3 00:0	3 00:5	2 51:8	6:0 1:2	12:0 2:3	18:0 3:5

12 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	13 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	3 00.0	3 00.5	2 51.8	0.0 0.0	6.0 1.3	12.0 2.5	00	3 15.0	3 15.5	3 06.1	0.0 0.0	6.0 1.4	12.0 2.7
01	3 00.3	3 00.7	2 52.0	0.1 0.0	6.1 1.3	12.1 2.5	01	3 15.3	3 15.8	3 06.4	0.1 0.0	6.1 1.4	12.1 2.7
02	3 00.5	3 01.0	2 52.3	0.2 0.0	6.2 1.3	12.2 2.5	02	3 15.5	3 16.0	3 06.6	0.2 0.0	6.2 1.4	12.2 2.7
03	3 00.8	3 01.2	2 52.5	0.3 0.1	6.3 1.3	12.3 2.6	03	3 15.8	3 16.3	3 06.8	0.3 0.1	6.3 1.4	12.3 2.8
04	3 01.0	3 01.5	2 52.8	0.4 0.1	6.4 1.3	12.4 2.6	04	3 16.0	3 16.5	3 07.1	0.4 0.1	6.4 1.4	12.4 2.8
05	3 01.3	3 01.7	2 53.0	0.5 0.1	6.5 1.4	12.5 2.6	05	3 16.3	3 16.8	3 07.3	0.5 0.1	6.5 1.5	12.5 2.8
06	3 01.5	3 02.0	2 53.2	0.6 0.1	6.6 1.4	12.6 2.6	06	3 16.5	3 17.0	3 07.5	0.6 0.1	6.6 1.5	12.6 2.8
07	3 01.8	3 02.2	2 53.5	0.7 0.1	6.7 1.4	12.7 2.6	07	3 16.8	3 17.3	3 07.8	0.7 0.2	6.7 1.5	12.7 2.9
08	3 02.0	3 02.5	2 53.7	0.8 0.2	6.8 1.4	12.8 2.7	08	3 17.0	3 17.5	3 08.0	0.8 0.2	6.8 1.5	12.8 2.9
09	3 02.3	3 02.7	2 53.9	0.9 0.2	6.9 1.4	12.9 2.7	09	3 17.3	3 17.8	3 08.3	0.9 0.2	6.9 1.6	12.9 2.9
10	3 02.5	3 03.0	2 54.2	1.0 0.2	7.0 1.5	13.0 2.7	10	3 17.5	3 18.0	3 08.5	1.0 0.2	7.0 1.6	13.0 2.9
11	3 02.8	3 03.3	2 54.4	1.1 0.2	7.1 1.5	13.1 2.7	11	3 17.8	3 18.3	3 08.7	1.1 0.2	7.1 1.6	13.1 2.9
12	3 03.0	3 03.5	2 54.7	1.2 0.3	7.2 1.5	13.2 2.8	12	3 18.0	3 18.5	3 09.0	1.2 0.3	7.2 1.6	13.2 3.0
13	3 03.3	3 03.8	2 54.9	1.3 0.3	7.3 1.5	13.3 2.8	13	3 18.3	3 18.8	3 09.2	1.3 0.3	7.3 1.6	13.3 3.0
14	3 03.5	3 04.0	2 55.1	1.4 0.3	7.4 1.5	13.4 2.8	14	3 18.5	3 19.0	3 09.5	1.4 0.3	7.4 1.7	13.4 3.0
15	3 03.8	3 04.3	2 55.4	1.5 0.3	7.5 1.6	13.5 2.8	15	3 18.8	3 19.3	3 09.7	1.5 0.3	7.5 1.7	13.5 3.0
16	3 04.0	3 04.5	2 55.6	1.6 0.3	7.6 1.6	13.6 2.8	16	3 19.0	3 19.5	3 09.9	1.6 0.4	7.6 1.7	13.6 3.1
17	3 04.3	3 04.8	2 55.9	1.7 0.4	7.7 1.6	13.7 2.9	17	3 19.3	3 19.8	3 10.2	1.7 0.4	7.7 1.7	13.7 3.1
18	3 04.5	3 05.0	2 56.1	1.8 0.4	7.8 1.6	13.8 2.9	18	3 19.5	3 20.0	3 10.4	1.8 0.4	7.8 1.8	13.8 3.1
19	3 04.8	3 05.3	2 56.3	1.9 0.4	7.9 1.6	13.9 2.9	19	3 19.8	3 20.3	3 10.7	1.9 0.4	7.9 1.8	13.9 3.1
20	3 05.0	3 05.5	2 56.6	2.0 0.4	8.0 1.7	14.0 2.9	20	3 20.0	3 20.5	3 10.9	2.0 0.5	8.0 1.8	14.0 3.2
21	3 05.3	3 05.8	2 56.8	2.1 0.4	8.1 1.7	14.1 2.9	21	3 20.3	3 20.8	3 11.1	2.1 0.5	8.1 1.8	14.1 3.2
22	3 05.5	3 06.0	2 57.0	2.2 0.5	8.2 1.7	14.2 3.0	22	3 20.5	3 21.0	3 11.4	2.2 0.5	8.2 1.8	14.2 3.2
23	3 05.8	3 06.3	2 57.3	2.3 0.5	8.3 1.7	14.3 3.0	23	3 20.8	3 21.3	3 11.6	2.3 0.5	8.3 1.9	14.3 3.2
24	3 06.0	3 06.5	2 57.5	2.4 0.5	8.4 1.8	14.4 3.0	24	3 21.0	3 21.6	3 11.8	2.4 0.5	8.4 1.9	14.4 3.2
25	3 06.3	3 06.8	2 57.8	2.5 0.5	8.5 1.8	14.5 3.0	25	3 21.3	3 21.8	3 12.1	2.5 0.6	8.5 1.9	14.5 3.3
26	3 06.5	3 07.0	2 58.0	2.6 0.5	8.6 1.8	14.6 3.0	26	3 21.5	3 22.1	3 12.3	2.6 0.6	8.6 1.9	14.6 3.3
27	3 06.8	3 07.3	2 58.2	2.7 0.6	8.7 1.8	14.7 3.1	27	3 21.8	3 22.3	3 12.6	2.7 0.6	8.7 2.0	14.7 3.3
28	3 07.0	3 07.5	2 58.5	2.8 0.6	8.8 1.8	14.8 3.1	28	3 22.0	3 22.6	3 12.8	2.8 0.6	8.8 2.0	14.8 3.3
29	3 07.3	3 07.8	2 58.7	2.9 0.6	8.9 1.9	14.9 3.1	29	3 22.3	3 22.8	3 13.0	2.9 0.7	8.9 2.0	14.9 3.4
30	3 07.5	3 08.0	2 59.0	3.0 0.6	9.0 1.9	15.0 3.1	30	3 22.5	3 23.1	3 13.3	3.0 0.7	9.0 2.0	15.0 3.4
31	3 07.8	3 08.3	2 59.2	3.1 0.6	9.1 1.9	15.1 3.1	31	3 22.8	3 23.3	3 13.5	3.1 0.7	9.1 2.0	15.1 3.4
32	3 08.0	3 08.5	2 59.4	3.2 0.7	9.2 1.9	15.2 3.2	32	3 23.0	3 23.6	3 13.8	3.2 0.7	9.2 2.1	15.2 3.4
33	3 08.3	3 08.8	2 59.7	3.3 0.7	9.3 1.9	15.3 3.2	33	3 23.3	3 23.8	3 14.0	3.3 0.7	9.3 2.1	15.3 3.4
34	3 08.5	3 09.0	2 59.9	3.4 0.7	9.4 2.0	15.4 3.2	34	3 23.5	3 24.1	3 14.2	3.4 0.8	9.4 2.1	15.4 3.5
35	3 08.8	3 09.3	3 00.2	3.5 0.7	9.5 2.0	15.5 3.2	35	3 23.8	3 24.3	3 14.5	3.5 0.8	9.5 2.1	15.5 3.5
36	3 09.0	3 09.5	3 00.4	3.6 0.8	9.6 2.0	15.6 3.3	36	3 24.0	3 24.6	3 14.7	3.6 0.8	9.6 2.2	15.6 3.5
37	3 09.3	3 09.8	3 00.6	3.7 0.8	9.7 2.0	15.7 3.3	37	3 24.3	3 24.8	3 14.9	3.7 0.8	9.7 2.2	15.7 3.5
38	3 09.5	3 10.0	3 00.9	3.8 0.8	9.8 2.0	15.8 3.3	38	3 24.5	3 25.1	3 15.2	3.8 0.9	9.8 2.2	15.8 3.6
39	3 09.8	3 10.3	3 01.1	3.9 0.8	9.9 2.1	15.9 3.3	39	3 24.8	3 25.3	3 15.4	3.9 0.9	9.9 2.2	15.9 3.6
40	3 10.0	3 10.5	3 01.3	4.0 0.8	10.0 2.1	16.0 3.3	40	3 25.0	3 25.6	3 15.7	4.0 0.9	10.0 2.3	16.0 3.6
41	3 10.3	3 10.8	3 01.6	4.1 0.9	10.1 2.1	16.1 3.4	41	3 25.3	3 25.8	3 15.9	4.1 0.9	10.1 2.3	16.1 3.6
42	3 10.5	3 11.0	3 01.8	4.2 0.9	10.2 2.1	16.2 3.4	42	3 25.5	3 26.1	3 16.1	4.2 0.9	10.2 2.3	16.2 3.6
43	3 10.8	3 11.3	3 02.1	4.3 0.9	10.3 2.1	16.3 3.4	43	3 25.8	3 26.3	3 16.4	4.3 1.0	10.3 2.3	16.3 3.7
44	3 11.0	3 11.5	3 02.3	4.4 0.9	10.4 2.2	16.4 3.4	44	3 26.0	3 26.6	3 16.6	4.4 1.0	10.4 2.3	16.4 3.7
45	3 11.3	3 11.8	3 02.5	4.5 0.9	10.5 2.2	16.5 3.4	45	3 26.3	3 26.8	3 16.9	4.5 1.0	10.5 2.4	16.5 3.7
46	3 11.5	3 12.0	3 02.8	4.6 1.0	10.6 2.2	16.6 3.5	46	3 26.5	3 27.1	3 17.1	4.6 1.0	10.6 2.4	16.6 3.7
47	3 11.8	3 12.3	3 03.0	4.7 1.0	10.7 2.2	16.7 3.5	47	3 26.8	3 27.3	3 17.3	4.7 1.1	10.7 2.4	16.7 3.8
48	3 12.0	3 12.5	3 03.3	4.8 1.0	10.8 2.3	16.8 3.5	48	3 27.0	3 27.6	3 17.6	4.8 1.1	10.8 2.4	16.8 3.8
49	3 12.3	3 12.8	3 03.5	4.9 1.0	10.9 2.3	16.9 3.5	49	3 27.3	3 27.8	3 17.8	4.9 1.1	10.9 2.5	16.9 3.8
50	3 12.5	3 13.0	3 03.7	5.0 1.0	11.0 2.3	17.0 3.5	50	3 27.5	3 28.1	3 18.0	5.0 1.1	11.0 2.5	17.0 3.8
51	3 12.8	3 13.3	3 04.0	5.1 1.1	11.1 2.3	17.1 3.6	51	3 27.8	3 28.3	3 18.3	5.1 1.1	11.1 2.5	17.1 3.8
52	3 13.0	3 13.5	3 04.2	5.2 1.1	11.2 2.3	17.2 3.6	52	3 28.0	3 28.6	3 18.5	5.2 1.2	11.2 2.5	17.2 3.9
53	3 13.3	3 13.8	3 04.4	5.3 1.1	11.3 2.4	17.3 3.6	53	3 28.3	3 28.8	3 18.8	5.3 1.2	11.3 2.5	17.3 3.9
54	3 13.5	3 14.0	3 04.7	5.4 1.1	11.4 2.4	17.4 3.6	54	3 28.5	3 29.1	3 19.0	5.4 1.2	11.4 2.6	17.4 3.9
55	3 13.8	3 14.3	3 04.9	5.5 1.1	11.5 2.4	17.5 3.6	55	3 28.8	3 29.3	3 19.2	5.5 1.2	11.5 2.6	17.5 3.9
56	3 14.0	3 14.5	3 05.2	5.6 1.2	11.6 2.4	17.6 3.7	56	3 29.0	3 29.6	3 19.5	5.6 1.3	11.6 2.6	17.6 4.0
57	3 14.3	3 14.8	3 05.4	5.7 1.2	11.7 2.4	17.7 3.7	57	3 29.3	3 29.8	3 19.7	5.7 1.3	11.7 2.6	17.7 4.0
58	3 14.5	3 15.0	3 05.6	5.8 1.2	11.8 2.5	17.8 3.7	58	3 29.5	3 30.1	3 20.0	5.8 1.3	11.8 2.7	17.8 4.0
59	3 14.8	3 15.3	3 05.9	5.9 1.2	11.9 2.5	17.9 3.7	59	3 29.8	3 30.3	3 20.2	5.9 1.3	11.9 2.7	17.9 4.0
60	3 15.0	3 15.5	3 06.1	6.0 1.3	12.0 2.5	18.0 3.8	60	3 30.0	3 30.6	3 20.4	6.0 1.4	12.0 2.7	18.0 4.1

^m 14	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	3 30-0	3 30-6	3 20-4	0-0 0-0	6-0 1-5	12-0 2-9
01	3 30-3	3 30-8	3 20-7	0-1 0-0	6-1 1-5	12-1 2-9
02	3 30-5	3 31-1	3 20-9	0-2 0-0	6-2 1-5	12-2 2-9
03	3 30-8	3 31-3	3 21-1	0-3 0-1	6-3 1-5	12-3 3-0
04	3 31-0	3 31-6	3 21-4	0-4 0-1	6-4 1-5	12-4 3-0
05	3 31-3	3 31-8	3 21-6	0-5 0-1	6-5 1-6	12-5 3-0
06	3 31-5	3 32-1	3 21-9	0-6 0-1	6-6 1-6	12-6 3-0
07	3 31-8	3 32-3	3 22-1	0-7 0-2	6-7 1-6	12-7 3-1
08	3 32-0	3 32-6	3 22-3	0-8 0-2	6-8 1-6	12-8 3-1
09	3 32-3	3 32-8	3 22-6	0-9 0-2	6-9 1-7	12-9 3-1
10	3 32-5	3 33-1	3 22-8	1-0 0-2	7-0 1-7	13-0 3-1
11	3 32-8	3 33-3	3 23-1	1-1 0-3	7-1 1-7	13-1 3-2
12	3 33-0	3 33-6	3 23-3	1-2 0-3	7-2 1-7	13-2 3-2
13	3 33-3	3 33-8	3 23-5	1-3 0-3	7-3 1-8	13-3 3-2
14	3 33-5	3 34-1	3 23-8	1-4 0-3	7-4 1-8	13-4 3-2
15	3 33-8	3 34-3	3 24-0	1-5 0-4	7-5 1-8	13-5 3-3
16	3 34-0	3 34-6	3 24-3	1-6 0-4	7-6 1-8	13-6 3-3
17	3 34-3	3 34-8	3 24-5	1-7 0-4	7-7 1-9	13-7 3-3
18	3 34-5	3 35-1	3 24-7	1-8 0-4	7-8 1-9	13-8 3-3
19	3 34-8	3 35-3	3 25-0	1-9 0-5	7-9 1-9	13-9 3-4
20	3 35-0	3 35-6	3 25-2	2-0 0-5	8-0 1-9	14-0 3-4
21	3 35-3	3 35-8	3 25-4	2-1 0-5	8-1 2-0	14-1 3-4
22	3 35-5	3 36-1	3 25-7	2-2 0-5	8-2 2-0	14-2 3-4
23	3 35-8	3 36-3	3 25-9	2-3 0-6	8-3 2-0	14-3 3-5
24	3 36-0	3 36-6	3 26-2	2-4 0-6	8-4 2-0	14-4 3-5
25	3 36-3	3 36-8	3 26-4	2-5 0-6	8-5 2-1	14-5 3-5
26	3 36-5	3 37-1	3 26-6	2-6 0-6	8-6 2-1	14-6 3-5
27	3 36-8	3 37-3	3 26-9	2-7 0-7	8-7 2-1	14-7 3-6
28	3 37-0	3 37-6	3 27-1	2-8 0-7	8-8 2-1	14-8 3-6
29	3 37-3	3 37-8	3 27-4	2-9 0-7	8-9 2-2	14-9 3-6
30	3 37-5	3 38-1	3 27-6	3-0 0-7	9-0 2-2	15-0 3-6
31	3 37-8	3 38-3	3 27-8	3-1 0-7	9-1 2-2	15-1 3-6
32	3 38-0	3 38-6	3 28-1	3-2 0-8	9-2 2-2	15-2 3-7
33	3 38-3	3 38-8	3 28-3	3-3 0-8	9-3 2-2	15-3 3-7
34	3 38-5	3 39-1	3 28-5	3-4 0-8	9-4 2-3	15-4 3-7
35	3 38-8	3 39-3	3 28-8	3-5 0-8	9-5 2-3	15-5 3-7
36	3 39-0	3 39-6	3 29-0	3-6 0-9	9-6 2-3	15-6 3-8
37	3 39-3	3 39-9	3 29-3	3-7 0-9	9-7 2-3	15-7 3-8
38	3 39-5	3 40-1	3 29-5	3-8 0-9	9-8 2-4	15-8 3-8
39	3 39-8	3 40-4	3 29-7	3-9 0-9	9-9 2-4	15-9 3-8
40	3 40-0	3 40-6	3 30-0	4-0 1-0	10-0 2-4	16-0 3-9
41	3 40-3	3 40-9	3 30-2	4-1 1-0	10-1 2-4	16-1 3-9
42	3 40-5	3 41-1	3 30-5	4-2 1-0	10-2 2-5	16-2 3-9
43	3 40-8	3 41-4	3 30-7	4-3 1-0	10-3 2-5	16-3 3-9
44	3 41-0	3 41-6	3 30-9	4-4 1-1	10-4 2-5	16-4 4-0
45	3 41-3	3 41-9	3 31-2	4-5 1-1	10-5 2-5	16-5 4-0
46	3 41-5	3 42-1	3 31-4	4-6 1-1	10-6 2-6	16-6 4-0
47	3 41-8	3 42-4	3 31-6	4-7 1-1	10-7 2-6	16-7 4-0
48	3 42-0	3 42-6	3 31-9	4-8 1-2	10-8 2-6	16-8 4-1
49	3 42-3	3 42-9	3 32-1	4-9 1-2	10-9 2-6	16-9 4-1
50	3 42-5	3 43-1	3 32-4	5-0 1-2	11-0 2-7	17-0 4-1
51	3 42-8	3 43-4	3 32-6	5-1 1-2	11-1 2-7	17-1 4-1
52	3 43-0	3 43-6	3 32-8	5-2 1-3	11-2 2-7	17-2 4-2
53	3 43-3	3 43-9	3 33-1	5-3 1-3	11-3 2-7	17-3 4-2
54	3 43-5	3 44-1	3 33-3	5-4 1-3	11-4 2-8	17-4 4-2
55	3 43-8	3 44-4	3 33-6	5-5 1-3	11-5 2-8	17-5 4-2
56	3 44-0	3 44-6	3 33-8	5-6 1-4	11-6 2-8	17-6 4-3
57	3 44-3	3 44-9	3 34-0	5-7 1-4	11-7 2-8	17-7 4-3
58	3 44-5	3 45-1	3 34-3	5-8 1-4	11-8 2-9	17-8 4-3
59	3 44-8	3 45-4	3 34-5	5-9 1-4	11-9 2-9	17-9 4-3
60	3 45-0	3 45-6	3 34-8	6-0 1-5	12-0 2-9	18-0 4-4

^m 15	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	3 45-0	3 45-6	3 34-8	0-0 0-0	6-0 1-6	12-0 3-1
01	3 45-3	3 45-9	3 35-0	0-1 0-0	6-1 1-6	12-1 3-1
02	3 45-5	3 46-1	3 35-2	0-2 0-1	6-2 1-6	12-2 3-2
03	3 45-8	3 46-4	3 35-5	0-3 0-1	6-3 1-6	12-3 3-2
04	3 46-0	3 46-6	3 35-7	0-4 0-1	6-4 1-7	12-4 3-2
05	3 46-3	3 46-9	3 35-9	0-5 0-1	6-5 1-7	12-5 3-2
06	3 46-5	3 47-1	3 36-2	0-6 0-2	6-6 1-7	12-6 3-3
07	3 46-8	3 47-4	3 36-4	0-7 0-2	6-7 1-7	12-7 3-3
08	3 47-0	3 47-6	3 36-7	0-8 0-2	6-8 1-8	12-8 3-3
09	3 47-3	3 47-9	3 36-9	0-9 0-2	6-9 1-8	12-9 3-3
10	3 47-5	3 48-1	3 37-1	1-0 0-3	7-0 1-8	13-0 3-4
11	3 47-8	3 48-4	3 37-4	1-1 0-3	7-1 1-8	13-1 3-4
12	3 48-0	3 48-6	3 37-6	1-2 0-3	7-2 1-9	13-2 3-4
13	3 48-3	3 48-9	3 37-9	1-3 0-3	7-3 1-9	13-3 3-4
14	3 48-5	3 49-1	3 38-1	1-4 0-4	7-4 1-9	13-4 3-5
15	3 48-8	3 49-4	3 38-3	1-5 0-4	7-5 1-9	13-5 3-5
16	3 49-0	3 49-6	3 38-6	1-6 0-4	7-6 2-0	13-6 3-5
17	3 49-3	3 49-9	3 38-8	1-7 0-4	7-7 2-0	13-7 3-5
18	3 49-5	3 50-1	3 39-0	1-8 0-5	7-8 2-0	13-8 3-6
19	3 49-8	3 50-4	3 39-3	1-9 0-5	7-9 2-0	13-9 3-6
20	3 50-0	3 50-6	3 39-5	2-0 0-5	8-0 2-1	14-0 3-6
21	3 50-3	3 50-9	3 39-8	2-1 0-5	8-1 2-1	14-1 3-6
22	3 50-5	3 51-1	3 40-0	2-2 0-6	8-2 2-1	14-2 3-7
23	3 50-8	3 51-4	3 40-2	2-3 0-6	8-3 2-1	14-3 3-7
24	3 51-0	3 51-6	3 40-5	2-4 0-6	8-4 2-2	14-4 3-7
25	3 51-3	3 51-9	3 40-7	2-5 0-6	8-5 2-2	14-5 3-7
26	3 51-5	3 52-1	3 41-0	2-6 0-7	8-6 2-2	14-6 3-8
27	3 51-8	3 52-4	3 41-2	2-7 0-7	8-7 2-2	14-7 3-8
28	3 52-0	3 52-6	3 41-4	2-8 0-7	8-8 2-3	14-8 3-8
29	3 52-3	3 52-9	3 41-7	2-9 0-7	8-9 2-3	14-9 3-8
30	3 52-5	3 53-1	3 41-9	3-0 0-8	9-0 2-3	15-0 3-9
31	3 52-8	3 53-4	3 42-1	3-1 0-8	9-1 2-4	15-1 3-9
32	3 53-0	3 53-6	3 42-4	3-2 0-8	9-2 2-4	15-2 3-9
33	3 53-3	3 53-9	3 42-6	3-3 0-9	9-3 2-4	15-3 4-0
34	3 53-5	3 54-1	3 42-9	3-4 0-9	9-4 2-4	15-4 4-0
35	3 53-8	3 54-4	3 43-1	3-5 0-9	9-5 2-5	15-5 4-0
36	3 54-0	3 54-6	3 43-3	3-6 0-9	9-6 2-5	15-6 4-0
37	3 54-3	3 54-9	3 43-6	3-7 1-0	9-7 2-5	15-7 4-1
38	3 54-5	3 55-1	3 43-8	3-8 1-0	9-8 2-5	15-8 4-1
39	3 54-8	3 55-4	3 44-1	3-9 1-0	9-9 2-6	15-9 4-1
40	3 55-0	3 55-6	3 44-3	4-0 1-0	10-0 2-6	16-0 4-1
41	3 55-3	3 55-9	3 44-5	4-1 1-1	10-1 2-6	16-1 4-2
42	3 55-5	3 56-1	3 44-8	4-2 1-1	10-2 2-6	16-2 4-2
43	3 55-8	3 56-4	3 45-0	4-3 1-1	10-3 2-7	16-3 4-2
44	3 56-0	3 56-6	3 45-2	4-4 1-1	10-4 2-7	16-4 4-2
45	3 56-3	3 56-9	3 45-5	4-5 1-2	10-5 2-7	16-5 4-3
46	3 56-5	3 57-1	3 45-7	4-6 1-2	10-6 2-7	16-6 4-3
47	3 56-8	3 57-4	3 46-0	4-7 1-2	10-7 2-8	16-7 4-3
48	3 57-0	3 57-6	3 46-2	4-8 1-2	10-8 2-8	16-8 4-3
49	3 57-3	3 57-9	3 46-4	4-9 1-3	10-9 2-8	16-9 4-4
50	3 57-5	3 58-2	3 46-7	5-0 1-3	11-0 2-8	17-0 4-4
51	3 57-8	3 58-4	3 46-9	5-1 1-3	11-1 2-9	17-1 4-4
52	3 58-0	3 58-7	3 47-2	5-2 1-3	11-2 2-9	17-2 4-4
53	3 58-3	3 58-9	3 47-4	5-3 1-4	11-3 2-9	17-3 4-5
54	3 58-5	3 59-2	3 47-6	5-4 1-4	11-4 2-9	17-4 4-5
55	3 58-8	3 59-4	3 47-9	5-5 1-4	11-5 3-0	17-5 4-5
56	3 59-0	3 59-7	3 48-1	5-6 1-4	11-6 3-0	17-6 4-5
57	3 59-3	3 59-9	3 48-4	5-7 1-5	11-7 3-0	17-7 4-6
58	3 59-5	4 00-2	3 48-6	5-8 1-5	11-8 3-0	17-8 4-6
59	3 59-8	4 00-4	3 48-8	5-9 1-5	11-9 3-1	17-9 4-6
60	4 00-0	4 00-7	3 49-1	6-0 1-6	12-0 3-1	18-0 4-7

16 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	17 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	4 00:0	4 00:7	3 49:1	0:0 0:0	6:0 1:7	12:0 3:3	00	4 15:0	4 15:7	4 03:4	0:0 0:0	6:0 1:8	12:0 3:5
01	4 00:3	4 00:9	3 49:3	0:1 0:0	6:1 1:7	12:1 3:3	01	4 15:3	4 15:9	4 03:6	0:1 0:0	6:1 1:8	12:1 3:5
02	4 00:5	4 01:2	3 49:5	0:2 0:1	6:2 1:7	12:2 3:4	02	4 15:5	4 16:2	4 03:9	0:2 0:1	6:2 1:8	12:2 3:6
03	4 00:8	4 01:4	3 49:8	0:3 0:1	6:3 1:7	12:3 3:4	03	4 15:8	4 16:5	4 04:1	0:3 0:1	6:3 1:8	12:3 3:6
04	4 01:0	4 01:7	3 50:0	0:4 0:1	6:4 1:8	12:4 3:4	04	4 16:0	4 16:7	4 04:3	0:4 0:1	6:4 1:9	12:4 3:6
05	4 01:3	4 01:9	3 50:3	0:5 0:1	6:5 1:8	12:5 3:4	05	4 16:3	4 17:0	4 04:6	0:5 0:1	6:5 1:9	12:5 3:6
06	4 01:5	4 02:2	3 50:5	0:6 0:2	6:6 1:8	12:6 3:5	06	4 16:5	4 17:2	4 04:8	0:6 0:2	6:6 1:9	12:6 3:7
07	4 01:8	4 02:4	3 50:7	0:7 0:2	6:7 1:8	12:7 3:5	07	4 16:8	4 17:5	4 05:1	0:7 0:2	6:7 2:0	12:7 3:7
08	4 02:0	4 02:7	3 51:0	0:8 0:2	6:8 1:9	12:8 3:5	08	4 17:0	4 17:7	4 05:3	0:8 0:2	6:8 2:0	12:8 3:7
09	4 02:3	4 02:9	3 51:2	0:9 0:2	6:9 1:9	12:9 3:5	09	4 17:3	4 18:0	4 05:5	0:9 0:3	6:9 2:0	12:9 3:8
10	4 02:5	4 03:2	3 51:5	1:0 0:3	7:0 1:9	13:0 3:6	10	4 17:5	4 18:2	4 05:8	1:0 0:3	7:0 2:0	13:0 3:8
11	4 02:8	4 03:4	3 51:7	1:1 0:3	7:1 2:0	13:1 3:6	11	4 17:8	4 18:5	4 06:0	1:1 0:3	7:1 2:1	13:1 3:8
12	4 03:0	4 03:7	3 51:9	1:2 0:3	7:2 2:0	13:2 3:6	12	4 18:0	4 18:7	4 06:2	1:2 0:4	7:2 2:1	13:2 3:9
13	4 03:3	4 03:9	3 52:2	1:3 0:4	7:3 2:0	13:3 3:7	13	4 18:3	4 19:0	4 06:5	1:3 0:4	7:3 2:1	13:3 3:9
14	4 03:5	4 04:2	3 52:4	1:4 0:4	7:4 2:0	13:4 3:7	14	4 18:5	4 19:2	4 06:7	1:4 0:4	7:4 2:2	13:4 3:9
15	4 03:8	4 04:4	3 52:6	1:5 0:4	7:5 2:1	13:5 3:7	15	4 18:8	4 19:5	4 07:0	1:5 0:4	7:5 2:2	13:5 3:9
16	4 04:0	4 04:7	3 52:9	1:6 0:4	7:6 2:1	13:6 3:7	16	4 19:0	4 19:7	4 07:2	1:6 0:5	7:6 2:2	13:6 4:0
17	4 04:3	4 04:9	3 53:1	1:7 0:5	7:7 2:1	13:7 3:8	17	4 19:3	4 20:0	4 07:4	1:7 0:5	7:7 2:2	13:7 4:0
18	4 04:5	4 05:2	3 53:4	1:8 0:5	7:8 2:1	13:8 3:8	18	4 19:5	4 20:2	4 07:7	1:8 0:5	7:8 2:3	13:8 4:0
19	4 04:8	4 05:4	3 53:6	1:9 0:5	7:9 2:2	13:9 3:8	19	4 19:8	4 20:5	4 07:9	1:9 0:6	7:9 2:3	13:9 4:1
20	4 05:0	4 05:7	3 53:8	2:0 0:6	8:0 2:2	14:0 3:9	20	4 20:0	4 20:7	4 08:2	2:0 0:6	8:0 2:3	14:0 4:1
21	4 05:3	4 05:9	3 54:1	2:1 0:6	8:1 2:2	14:1 3:9	21	4 20:3	4 21:0	4 08:4	2:1 0:6	8:1 2:4	14:1 4:1
22	4 05:5	4 06:2	3 54:3	2:2 0:6	8:2 2:3	14:2 3:9	22	4 20:5	4 21:2	4 08:6	2:2 0:6	8:2 2:4	14:2 4:1
23	4 05:8	4 06:4	3 54:6	2:3 0:6	8:3 2:3	14:3 3:9	23	4 20:8	4 21:5	4 08:9	2:3 0:7	8:3 2:4	14:3 4:2
24	4 06:0	4 06:7	3 54:8	2:4 0:7	8:4 2:3	14:4 4:0	24	4 21:0	4 21:7	4 09:1	2:4 0:7	8:4 2:5	14:4 4:2
25	4 06:3	4 06:9	3 55:0	2:5 0:7	8:5 2:3	14:5 4:0	25	4 21:3	4 22:0	4 09:3	2:5 0:7	8:5 2:5	14:5 4:2
26	4 06:5	4 07:2	3 55:3	2:6 0:7	8:6 2:4	14:6 4:0	26	4 21:5	4 22:2	4 09:6	2:6 0:8	8:6 2:5	14:6 4:3
27	4 06:8	4 07:4	3 55:5	2:7 0:7	8:7 2:4	14:7 4:0	27	4 21:8	4 22:5	4 09:8	2:7 0:8	8:7 2:5	14:7 4:3
28	4 07:0	4 07:7	3 55:7	2:8 0:8	8:8 2:4	14:8 4:1	28	4 22:0	4 22:7	4 10:1	2:8 0:8	8:8 2:6	14:8 4:3
29	4 07:3	4 07:9	3 56:0	2:9 0:8	8:9 2:4	14:9 4:1	29	4 22:3	4 23:0	4 10:3	2:9 0:8	8:9 2:6	14:9 4:3
30	4 07:5	4 08:2	3 56:2	3:0 0:8	9:0 2:5	15:0 4:1	30	4 22:5	4 23:2	4 10:5	3:0 0:9	9:0 2:6	15:0 4:4
31	4 07:8	4 08:4	3 56:5	3:1 0:9	9:1 2:5	15:1 4:2	31	4 22:8	4 23:5	4 10:8	3:1 0:9	9:1 2:7	15:1 4:4
32	4 08:0	4 08:7	3 56:7	3:2 0:9	9:2 2:5	15:2 4:2	32	4 23:0	4 23:7	4 11:0	3:2 0:9	9:2 2:7	15:2 4:4
33	4 08:3	4 08:9	3 56:9	3:3 0:9	9:3 2:6	15:3 4:2	33	4 23:3	4 24:0	4 11:3	3:3 1:0	9:3 2:7	15:3 4:5
34	4 08:5	4 09:2	3 57:2	3:4 0:9	9:4 2:6	15:4 4:2	34	4 23:5	4 24:2	4 11:5	3:4 1:0	9:4 2:7	15:4 4:5
35	4 08:8	4 09:4	3 57:4	3:5 1:0	9:5 2:6	15:5 4:3	35	4 23:8	4 24:5	4 11:7	3:5 1:0	9:5 2:8	15:5 4:5
36	4 09:0	4 09:7	3 57:7	3:6 1:0	9:6 2:6	15:6 4:3	36	4 24:0	4 24:7	4 12:0	3:6 1:1	9:6 2:8	15:6 4:6
37	4 09:3	4 09:9	3 57:9	3:7 1:0	9:7 2:7	15:7 4:3	37	4 24:3	4 25:0	4 12:2	3:7 1:1	9:7 2:8	15:7 4:6
38	4 09:5	4 10:2	3 58:1	3:8 1:0	9:8 2:7	15:8 4:3	38	4 24:5	4 25:2	4 12:5	3:8 1:1	9:8 2:9	15:8 4:6
39	4 09:8	4 10:4	3 58:4	3:9 1:1	9:9 2:7	15:9 4:4	39	4 24:8	4 25:5	4 12:7	3:9 1:1	9:9 2:9	15:9 4:6
40	4 10:0	4 10:7	3 58:6	4:0 1:1	10:0 2:8	16:0 4:4	40	4 25:0	4 25:7	4 12:9	4:0 1:2	10:0 2:9	16:0 4:7
41	4 10:3	4 10:9	3 58:8	4:1 1:1	10:1 2:8	16:1 4:4	41	4 25:3	4 26:0	4 13:2	4:1 1:2	10:1 2:9	16:1 4:7
42	4 10:5	4 11:2	3 59:1	4:2 1:2	10:2 2:8	16:2 4:5	42	4 25:5	4 26:2	4 13:4	4:2 1:2	10:2 3:0	16:2 4:7
43	4 10:8	4 11:4	3 59:3	4:3 1:2	10:3 2:8	16:3 4:5	43	4 25:8	4 26:5	4 13:6	4:3 1:3	10:3 3:0	16:3 4:8
44	4 11:0	4 11:7	3 59:6	4:4 1:2	10:4 2:9	16:4 4:5	44	4 26:0	4 26:7	4 13:9	4:4 1:3	10:4 3:0	16:4 4:8
45	4 11:3	4 11:9	3 59:8	4:5 1:2	10:5 2:9	16:5 4:5	45	4 26:3	4 27:0	4 14:1	4:5 1:3	10:5 3:1	16:5 4:8
46	4 11:5	4 12:2	4 00:0	4:6 1:3	10:6 2:9	16:6 4:6	46	4 26:5	4 27:2	4 14:4	4:6 1:3	10:6 3:1	16:6 4:8
47	4 11:8	4 12:4	4 00:3	4:7 1:3	10:7 2:9	16:7 4:6	47	4 26:8	4 27:5	4 14:6	4:7 1:4	10:7 3:1	16:7 4:9
48	4 12:0	4 12:7	4 00:5	4:8 1:3	10:8 3:0	16:8 4:6	48	4 27:0	4 27:7	4 14:8	4:8 1:4	10:8 3:2	16:8 4:9
49	4 12:3	4 12:9	4 00:8	4:9 1:3	10:9 3:0	16:9 4:6	49	4 27:3	4 28:0	4 15:1	4:9 1:4	10:9 3:2	16:9 4:9
50	4 12:5	4 13:2	4 01:0	5:0 1:4	11:0 3:0	17:0 4:7	50	4 27:5	4 28:2	4 15:3	5:0 1:5	11:0 3:2	17:0 5:0
51	4 12:8	4 13:4	4 01:2	5:1 1:4	11:1 3:1	17:1 4:7	51	4 27:8	4 28:5	4 15:6	5:1 1:5	11:1 3:2	17:1 5:0
52	4 13:0	4 13:7	4 01:5	5:2 1:4	11:2 3:1	17:2 4:7	52	4 28:0	4 28:7	4 15:8	5:2 1:5	11:2 3:3	17:2 5:0
53	4 13:3	4 13:9	4 01:7	5:3 1:5	11:3 3:1	17:3 4:8	53	4 28:3	4 29:0	4 16:0	5:3 1:5	11:3 3:3	17:3 5:0
54	4 13:5	4 14:2	4 02:0	5:4 1:5	11:4 3:1	17:4 4:8	54	4 28:5	4 29:2	4 16:3	5:4 1:6	11:4 3:3	17:4 5:1
55	4 13:8	4 14:4	4 02:2	5:5 1:5	11:5 3:2	17:5 4:8	55	4 28:8	4 29:5	4 16:5	5:5 1:6	11:5 3:4	17:5 5:1
56	4 14:0	4 14:7	4 02:4	5:6 1:5	11:6 3:2	17:6 4:8	56	4 29:0	4 29:7	4 16:7	5:6 1:6	11:6 3:4	17:6 5:1
57	4 14:3	4 14:9	4 02:7	5:7 1:6	11:7 3:2	17:7 4:9	57	4 29:3	4 30:0	4 17:0	5:7 1:7	11:7 3:4	17:7 5:2
58	4 14:5	4 15:2	4 02:9	5:8 1:6	11:8 3:2	17:8 4:9	58	4 29:5	4 30:2	4 17:2	5:8 1:7	11:8 3:4	17:8 5:2
59	4 14:8	4 15:4	4 03:1	5:9 1:6	11:9 3:3	17:9 4:9	59	4 29:8	4 30:5	4 17:5	5:9 1:7	11:9 3:5	17:9 5:2
60	4 15:0	4 15:7	4 03:4	6:0 1:7	12:0 3:3	18:0 5:0	60	4 30:0	4 30:7	4 17:7	6:0 1:8	12:0 3:5	18:0 5:3

^m 18	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	^m 19	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	4 30.0	4 30.7	4 17.7	0.0	0.0	6.0 1.9	00	4 45.0	4 45.8	4 32.0	0.0	0.0	6.0 2.0
01	4 30.3	4 31.0	4 17.9	0.1	0.0	6.1 1.9	01	4 45.3	4 46.0	4 32.3	0.1	0.0	6.1 2.0
02	4 30.5	4 31.2	4 18.2	0.2	0.1	6.2 1.9	02	4 45.5	4 46.3	4 32.5	0.2	0.1	6.2 2.0
03	4 30.8	4 31.5	4 18.4	0.3	0.1	6.3 1.9	03	4 45.8	4 46.5	4 32.7	0.3	0.1	6.3 2.0
04	4 31.0	4 31.7	4 18.7	0.4	0.1	6.4 2.0	04	4 46.0	4 46.8	4 33.0	0.4	0.1	6.4 2.1
05	4 31.3	4 32.0	4 18.9	0.5	0.2	6.5 2.0	05	4 46.3	4 47.0	4 33.2	0.5	0.2	6.5 2.1
06	4 31.5	4 32.2	4 19.1	0.6	0.2	6.6 2.0	06	4 46.5	4 47.3	4 33.4	0.6	0.2	6.6 2.1
07	4 31.8	4 32.5	4 19.4	0.7	0.2	6.7 2.1	07	4 46.8	4 47.5	4 33.7	0.7	0.2	6.7 2.2
08	4 32.0	4 32.7	4 19.6	0.8	0.2	6.8 2.1	08	4 47.0	4 47.8	4 33.9	0.8	0.3	6.8 2.2
09	4 32.3	4 33.0	4 19.8	0.9	0.3	6.9 2.1	09	4 47.3	4 48.0	4 34.2	0.9	0.3	6.9 2.2
10	4 32.5	4 33.2	4 20.1	1.0	0.3	7.0 2.2	10	4 47.5	4 48.3	4 34.4	1.0	0.3	7.0 2.3
11	4 32.8	4 33.5	4 20.3	1.1	0.3	7.1 2.2	11	4 47.8	4 48.5	4 34.6	1.1	0.4	7.1 2.3
12	4 33.0	4 33.7	4 20.6	1.2	0.4	7.2 2.2	12	4 48.0	4 48.8	4 34.9	1.2	0.4	7.2 2.3
13	4 33.3	4 34.0	4 20.8	1.3	0.4	7.3 2.3	13	4 48.3	4 49.0	4 35.1	1.3	0.4	7.3 2.4
14	4 33.5	4 34.2	4 21.0	1.4	0.4	7.4 2.3	14	4 48.5	4 49.3	4 35.4	1.4	0.5	7.4 2.4
15	4 33.8	4 34.5	4 21.3	1.5	0.5	7.5 2.3	15	4 48.8	4 49.5	4 35.6	1.5	0.5	7.5 2.4
16	4 34.0	4 34.8	4 21.5	1.6	0.5	7.6 2.3	16	4 49.0	4 49.8	4 35.8	1.6	0.5	7.6 2.5
17	4 34.3	4 35.0	4 21.8	1.7	0.5	7.7 2.4	17	4 49.3	4 50.0	4 36.1	1.7	0.6	7.7 2.5
18	4 34.5	4 35.3	4 22.0	1.8	0.6	7.8 2.4	18	4 49.5	4 50.3	4 36.3	1.8	0.6	7.8 2.5
19	4 34.8	4 35.5	4 22.2	1.9	0.6	7.9 2.4	19	4 49.8	4 50.5	4 36.6	1.9	0.6	7.9 2.6
20	4 35.0	4 35.8	4 22.5	2.0	0.6	8.0 2.5	20	4 50.0	4 50.8	4 36.8	2.0	0.7	8.0 2.6
21	4 35.3	4 36.0	4 22.7	2.1	0.6	8.1 2.5	21	4 50.3	4 51.0	4 37.0	2.1	0.7	8.1 2.6
22	4 35.5	4 36.3	4 22.9	2.2	0.7	8.2 2.5	22	4 50.5	4 51.3	4 37.3	2.2	0.7	8.2 2.7
23	4 35.8	4 36.5	4 23.2	2.3	0.7	8.3 2.6	23	4 50.8	4 51.5	4 37.5	2.3	0.7	8.3 2.7
24	4 36.0	4 36.8	4 23.4	2.4	0.7	8.4 2.6	24	4 51.0	4 51.8	4 37.7	2.4	0.8	8.4 2.7
25	4 36.3	4 37.0	4 23.7	2.5	0.8	8.5 2.6	25	4 51.3	4 52.0	4 38.0	2.5	0.8	8.5 2.8
26	4 36.5	4 37.3	4 23.9	2.6	0.8	8.6 2.7	26	4 51.5	4 52.3	4 38.2	2.6	0.8	8.6 2.8
27	4 36.8	4 37.5	4 24.1	2.7	0.8	8.7 2.7	27	4 51.8	4 52.5	4 38.5	2.7	0.9	8.7 2.8
28	4 37.0	4 37.8	4 24.4	2.8	0.9	8.8 2.7	28	4 52.0	4 52.8	4 38.7	2.8	0.9	8.8 2.9
29	4 37.3	4 38.0	4 24.6	2.9	0.9	8.9 2.7	29	4 52.3	4 53.1	4 38.9	2.9	0.9	8.9 2.9
30	4 37.5	4 38.3	4 24.9	3.0	0.9	9.0 2.8	30	4 52.5	4 53.3	4 39.2	3.0	1.0	9.0 2.9
31	4 37.8	4 38.5	4 25.1	3.1	1.0	9.1 2.8	31	4 52.8	4 53.6	4 39.4	3.1	1.0	9.1 3.0
32	4 38.0	4 38.8	4 25.3	3.2	1.0	9.2 2.8	32	4 53.0	4 53.8	4 39.7	3.2	1.0	9.2 3.0
33	4 38.3	4 39.0	4 25.6	3.3	1.0	9.3 2.9	33	4 53.3	4 54.1	4 39.9	3.3	1.1	9.3 3.0
34	4 38.5	4 39.3	4 25.8	3.4	1.0	9.4 2.9	34	4 53.5	4 54.3	4 40.1	3.4	1.1	9.4 3.1
35	4 38.8	4 39.5	4 26.1	3.5	1.1	9.5 2.9	35	4 53.8	4 54.6	4 40.4	3.5	1.1	9.5 3.1
36	4 39.0	4 39.8	4 26.3	3.6	1.1	9.6 3.0	36	4 54.0	4 54.8	4 40.6	3.6	1.2	9.6 3.1
37	4 39.3	4 40.0	4 26.5	3.7	1.1	9.7 3.0	37	4 54.3	4 55.1	4 40.8	3.7	1.2	9.7 3.2
38	4 39.5	4 40.3	4 26.8	3.8	1.2	9.8 3.0	38	4 54.5	4 55.3	4 41.1	3.8	1.2	9.8 3.2
39	4 39.8	4 40.5	4 27.0	3.9	1.2	9.9 3.1	39	4 54.8	4 55.6	4 41.3	3.9	1.3	9.9 3.2
40	4 40.0	4 40.8	4 27.2	4.0	1.2	10.0 3.1	40	4 55.0	4 55.8	4 41.6	4.0	1.3	10.0 3.3
41	4 40.3	4 41.0	4 27.5	4.1	1.3	10.1 3.1	41	4 55.3	4 56.1	4 41.8	4.1	1.3	10.1 3.3
42	4 40.5	4 41.3	4 27.7	4.2	1.3	10.2 3.1	42	4 55.5	4 56.3	4 42.0	4.2	1.4	10.2 3.3
43	4 40.8	4 41.5	4 28.0	4.3	1.3	10.3 3.2	43	4 55.8	4 56.6	4 42.3	4.3	1.4	10.3 3.3
44	4 41.0	4 41.8	4 28.2	4.4	1.4	10.4 3.2	44	4 56.0	4 56.8	4 42.5	4.4	1.4	10.4 3.4
45	4 41.3	4 42.0	4 28.4	4.5	1.4	10.5 3.2	45	4 56.3	4 57.1	4 42.8	4.5	1.5	10.5 3.4
46	4 41.5	4 42.3	4 28.7	4.6	1.4	10.6 3.3	46	4 56.5	4 57.3	4 43.0	4.6	1.5	10.6 3.4
47	4 41.8	4 42.5	4 28.9	4.7	1.4	10.7 3.3	47	4 56.8	4 57.6	4 43.2	4.7	1.5	10.7 3.5
48	4 42.0	4 42.8	4 29.2	4.8	1.5	10.8 3.3	48	4 57.0	4 57.8	4 43.5	4.8	1.6	10.8 3.5
49	4 42.3	4 43.0	4 29.4	4.9	1.5	10.9 3.4	49	4 57.3	4 58.1	4 43.7	4.9	1.6	10.9 3.5
50	4 42.5	4 43.3	4 29.6	5.0	1.5	11.0 3.4	50	4 57.5	4 58.3	4 43.9	5.0	1.6	11.0 3.6
51	4 42.8	4 43.5	4 29.9	5.1	1.6	11.1 3.4	51	4 57.8	4 58.6	4 44.2	5.1	1.7	11.1 3.6
52	4 43.0	4 43.8	4 30.1	5.2	1.6	11.2 3.5	52	4 58.0	4 58.8	4 44.4	5.2	1.7	11.2 3.6
53	4 43.3	4 44.0	4 30.3	5.3	1.6	11.3 3.5	53	4 58.3	4 59.1	4 44.7	5.3	1.7	11.3 3.7
54	4 43.5	4 44.3	4 30.6	5.4	1.7	11.4 3.5	54	4 58.5	4 59.3	4 44.9	5.4	1.8	11.4 3.7
55	4 43.8	4 44.5	4 30.8	5.5	1.7	11.5 3.5	55	4 58.8	4 59.6	4 45.1	5.5	1.8	11.5 3.7
56	4 44.0	4 44.8	4 31.1	5.6	1.7	11.6 3.6	56	4 59.0	4 59.8	4 45.4	5.6	1.8	11.6 3.8
57	4 44.3	4 45.0	4 31.3	5.7	1.8	11.7 3.6	57	4 59.3	5 00.1	4 45.6	5.7	1.9	11.7 3.8
58	4 44.5	4 45.3	4 31.5	5.8	1.8	11.8 3.6	58	4 59.5	5 00.3	4 45.9	5.8	1.9	11.8 3.8
59	4 44.8	4 45.5	4 31.8	5.9	1.8	11.9 3.7	59	4 59.8	5 00.6	4 46.1	5.9	1.9	11.9 3.9
60	4 45.0	4 45.8	4 32.0	6.0	1.9	12.0 3.7	60	5 00.0	5 00.8	4 46.3	6.0	2.0	12.0 3.9

^m 20	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	5 00.0	5 00.8	4 46.3	0.0 0.0	6.0 2.1	12.0 4.1
01	5 00.3	5 01.1	4 46.6	0.1 0.0	6.1 2.1	12.1 4.1
02	5 00.5	5 01.3	4 46.8	0.2 0.1	6.2 2.1	12.2 4.2
03	5 00.8	5 01.6	4 47.0	0.3 0.1	6.3 2.2	12.3 4.2
04	5 01.0	5 01.8	4 47.3	0.4 0.1	6.4 2.2	12.4 4.2
05	5 01.3	5 02.1	4 47.5	0.5 0.2	6.5 2.2	12.5 4.3
06	5 01.5	5 02.3	4 47.8	0.6 0.2	6.6 2.3	12.6 4.3
07	5 01.8	5 02.6	4 48.0	0.7 0.2	6.7 2.3	12.7 4.3
08	5 02.0	5 02.8	4 48.2	0.8 0.3	6.8 2.3	12.8 4.4
09	5 02.3	5 03.1	4 48.5	0.9 0.3	6.9 2.4	12.9 4.4
10	5 02.5	5 03.3	4 48.7	1.0 0.3	7.0 2.4	13.0 4.4
11	5 02.8	5 03.6	4 49.0	1.1 0.4	7.1 2.4	13.1 4.5
12	5 03.0	5 03.8	4 49.2	1.2 0.4	7.2 2.5	13.2 4.5
13	5 03.3	5 04.1	4 49.4	1.3 0.4	7.3 2.5	13.3 4.5
14	5 03.5	5 04.3	4 49.7	1.4 0.5	7.4 2.5	13.4 4.6
15	5 03.8	5 04.6	4 49.9	1.5 0.5	7.5 2.6	13.5 4.6
16	5 04.0	5 04.8	4 50.2	1.6 0.5	7.6 2.6	13.6 4.6
17	5 04.3	5 05.1	4 50.4	1.7 0.6	7.7 2.6	13.7 4.7
18	5 04.5	5 05.3	4 50.6	1.8 0.6	7.8 2.7	13.8 4.7
19	5 04.8	5 05.6	4 50.9	1.9 0.6	7.9 2.7	13.9 4.7
20	5 05.0	5 05.8	4 51.1	2.0 0.7	8.0 2.7	14.0 4.8
21	5 05.3	5 06.1	4 51.3	2.1 0.7	8.1 2.8	14.1 4.8
22	5 05.5	5 06.3	4 51.6	2.2 0.8	8.2 2.8	14.2 4.9
23	5 05.8	5 06.6	4 51.8	2.3 0.8	8.3 2.8	14.3 4.9
24	5 06.0	5 06.8	4 52.1	2.4 0.8	8.4 2.9	14.4 4.9
25	5 06.3	5 07.1	4 52.3	2.5 0.9	8.5 2.9	14.5 5.0
26	5 06.5	5 07.3	4 52.5	2.6 0.9	8.6 2.9	14.6 5.0
27	5 06.8	5 07.6	4 52.8	2.7 0.9	8.7 3.0	14.7 5.0
28	5 07.0	5 07.8	4 53.0	2.8 1.0	8.8 3.0	14.8 5.1
29	5 07.3	5 08.1	4 53.3	2.9 1.0	8.9 3.0	14.9 5.1
30	5 07.5	5 08.3	4 53.5	3.0 1.0	9.0 3.1	15.0 5.1
31	5 07.8	5 08.6	4 53.7	3.1 1.1	9.1 3.1	15.1 5.2
32	5 08.0	5 08.8	4 54.0	3.2 1.1	9.2 3.1	15.2 5.2
33	5 08.3	5 09.1	4 54.2	3.3 1.1	9.3 3.2	15.3 5.2
34	5 08.5	5 09.3	4 54.4	3.4 1.2	9.4 3.2	15.4 5.3
35	5 08.8	5 09.6	4 54.7	3.5 1.2	9.5 3.2	15.5 5.3
36	5 09.0	5 09.8	4 54.9	3.6 1.2	9.6 3.3	15.6 5.3
37	5 09.3	5 10.1	4 55.2	3.7 1.3	9.7 3.3	15.7 5.4
38	5 09.5	5 10.3	4 55.4	3.8 1.3	9.8 3.3	15.8 5.4
39	5 09.8	5 10.6	4 55.6	3.9 1.3	9.9 3.4	15.9 5.4
40	5 10.0	5 10.8	4 55.9	4.0 1.4	10.0 3.4	16.0 5.5
41	5 10.3	5 11.1	4 56.1	4.1 1.4	10.1 3.5	16.1 5.5
42	5 10.5	5 11.4	4 56.4	4.2 1.4	10.2 3.5	16.2 5.5
43	5 10.8	5 11.6	4 56.6	4.3 1.5	10.3 3.5	16.3 5.6
44	5 11.0	5 11.9	4 56.8	4.4 1.5	10.4 3.6	16.4 5.6
45	5 11.3	5 12.1	4 57.1	4.5 1.5	10.5 3.6	16.5 5.6
46	5 11.5	5 12.4	4 57.3	4.6 1.6	10.6 3.6	16.6 5.7
47	5 11.8	5 12.6	4 57.5	4.7 1.6	10.7 3.7	16.7 5.7
48	5 12.0	5 12.9	4 57.8	4.8 1.6	10.8 3.7	16.8 5.7
49	5 12.3	5 13.1	4 58.0	4.9 1.7	10.9 3.7	16.9 5.8
50	5 12.5	5 13.4	4 58.3	5.0 1.7	11.0 3.8	17.0 5.8
51	5 12.8	5 13.6	4 58.5	5.1 1.7	11.1 3.8	17.1 5.8
52	5 13.0	5 13.9	4 58.7	5.2 1.8	11.2 3.8	17.2 5.9
53	5 13.3	5 14.1	4 59.0	5.3 1.8	11.3 3.9	17.3 5.9
54	5 13.5	5 14.4	4 59.2	5.4 1.8	11.4 3.9	17.4 5.9
55	5 13.8	5 14.6	4 59.5	5.5 1.9	11.5 3.9	17.5 6.0
56	5 14.0	5 14.9	4 59.7	5.6 1.9	11.6 4.0	17.6 6.0
57	5 14.3	5 15.1	4 59.9	5.7 1.9	11.7 4.0	17.7 6.0
58	5 14.5	5 15.4	5 00.2	5.8 2.0	11.8 4.0	17.8 6.1
59	5 14.8	5 15.6	5 00.4	5.9 2.0	11.9 4.1	17.9 6.1
60	5 15.0	5 15.9	5 00.7	6.0 2.1	12.0 4.1	18.0 6.2

^m 21	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	5 15.0	5 15.9	5 00.7	0.0 0.0	6.0 2.2	12.0 4.3
01	5 15.3	5 16.1	5 00.9	0.1 0.0	6.1 2.2	12.1 4.3
02	5 15.5	5 16.4	5 01.1	0.2 0.1	6.2 2.2	12.2 4.4
03	5 15.8	5 16.6	5 01.4	0.3 0.1	6.3 2.3	12.3 4.4
04	5 16.0	5 16.9	5 01.6	0.4 0.1	6.4 2.3	12.4 4.4
05	5 16.3	5 17.1	5 01.8	0.5 0.2	6.5 2.3	12.5 4.5
06	5 16.5	5 17.4	5 02.1	0.6 0.2	6.6 2.4	12.6 4.5
07	5 16.8	5 17.6	5 02.3	0.7 0.3	6.7 2.4	12.7 4.6
08	5 17.0	5 17.9	5 02.6	0.8 0.3	6.8 2.4	12.8 4.6
09	5 17.3	5 18.1	5 02.8	0.9 0.3	6.9 2.5	12.9 4.6
10	5 17.5	5 18.4	5 03.0	1.0 0.4	7.0 2.5	13.0 4.7
11	5 17.8	5 18.6	5 03.3	1.1 0.4	7.1 2.5	13.1 4.7
12	5 18.0	5 18.9	5 03.5	1.2 0.4	7.2 2.6	13.2 4.7
13	5 18.3	5 19.1	5 03.8	1.3 0.5	7.3 2.6	13.3 4.8
14	5 18.5	5 19.4	5 04.0	1.4 0.5	7.4 2.7	13.4 4.8
15	5 18.8	5 19.6	5 04.2	1.5 0.5	7.5 2.7	13.5 4.8
16	5 19.0	5 19.9	5 04.5	1.6 0.6	7.6 2.7	13.6 4.9
17	5 19.3	5 20.1	5 04.7	1.7 0.6	7.7 2.8	13.7 4.9
18	5 19.5	5 20.4	5 04.9	1.8 0.6	7.8 2.8	13.8 4.9
19	5 19.8	5 20.6	5 05.2	1.9 0.7	7.9 2.8	13.9 5.0
20	5 20.0	5 20.9	5 05.4	2.0 0.7	8.0 2.9	14.0 5.0
21	5 20.3	5 21.1	5 05.7	2.1 0.8	8.1 2.9	14.1 5.1
22	5 20.5	5 21.4	5 05.9	2.2 0.8	8.2 2.9	14.2 5.1
23	5 20.8	5 21.6	5 06.1	2.3 0.8	8.3 3.0	14.3 5.1
24	5 21.0	5 21.9	5 06.4	2.4 0.9	8.4 3.0	14.4 5.2
25	5 21.3	5 22.1	5 06.6	2.5 0.9	8.5 3.0	14.5 5.2
26	5 21.5	5 22.4	5 06.9	2.6 0.9	8.6 3.1	14.6 5.2
27	5 21.8	5 22.6	5 07.1	2.7 1.0	8.7 3.1	14.7 5.3
28	5 22.0	5 22.9	5 07.3	2.8 1.0	8.8 3.2	14.8 5.3
29	5 22.3	5 23.1	5 07.6	2.9 1.0	8.9 3.2	14.9 5.3
30	5 22.5	5 23.4	5 07.8	3.0 1.1	9.0 3.2	15.0 5.4
31	5 22.8	5 23.6	5 08.0	3.1 1.1	9.1 3.3	15.1 5.4
32	5 23.0	5 23.9	5 08.3	3.2 1.1	9.2 3.3	15.2 5.4
33	5 23.3	5 24.1	5 08.5	3.3 1.2	9.3 3.3	15.3 5.5
34	5 23.5	5 24.4	5 08.8	3.4 1.2	9.4 3.4	15.4 5.5
35	5 23.8	5 24.6	5 09.0	3.5 1.3	9.5 3.4	15.5 5.6
36	5 24.0	5 24.9	5 09.2	3.6 1.3	9.6 3.4	15.6 5.6
37	5 24.3	5 25.1	5 09.5	3.7 1.3	9.7 3.5	15.7 5.6
38	5 24.5	5 25.4	5 09.7	3.8 1.4	9.8 3.5	15.8 5.7
39	5 24.8	5 25.6	5 10.0	3.9 1.4	9.9 3.5	15.9 5.7
40	5 25.0	5 25.9	5 10.2	4.0 1.4	10.0 3.6	16.0 5.7
41	5 25.3	5 26.1	5 10.4	4.1 1.5	10.1 3.6	16.1 5.8
42	5 25.5	5 26.4	5 10.7	4.2 1.5	10.2 3.7	16.2 5.8
43	5 25.8	5 26.6	5 10.9	4.3 1.5	10.3 3.7	16.3 5.8
44	5 26.0	5 26.9	5 11.1	4.4 1.6	10.4 3.7	16.4 5.9
45	5 26.3	5 27.1	5 11.4	4.5 1.6	10.5 3.8	16.5 5.9
46	5 26.5	5 27.4	5 11.6	4.6 1.6	10.6 3.8	16.6 5.9
47	5 26.8	5 27.6	5 11.9	4.7 1.7	10.7 3.8	16.7 6.0
48	5 27.0	5 27.9	5 12.1	4.8 1.7	10.8 3.9	16.8 6.0
49	5 27.3	5 28.1	5 12.3	4.9 1.8	10.9 3.9	16.9 6.1
50	5 27.5	5 28.4	5 12.6	5.0 1.8	11.0 3.9	17.0 6.1
51	5 27.8	5 28.6	5 12.8	5.1 1.8	11.1 4.0	17.1 6.1
52	5 28.0	5 28.9	5 13.1	5.2 1.9	11.2 4.0	17.2 6.2
53	5 28.3	5 29.1	5 13.3	5.3 1.9	11.3 4.0	17.3 6.2
54	5 28.5	5 29.4	5 13.5	5.4 1.9	11.4 4.1	17.4 6.2
55	5 28.8	5 29.7	5 13.8	5.5 2.0	11.5 4.1	17.5 6.3
56	5 29.0	5 29.9	5 14.0	5.6 2.0	11.6 4.2	17.6 6.3
57	5 29.3	5 30.2	5 14.3	5.7 2.0	11.7 4.2	17.7 6.3
58	5 29.5	5 30.4	5 14.5	5.8 2.1	11.8 4.2	17.8 6.4
59	5 29.8	5 30.7	5 14.7	5.9 2.1	11.9 4.3	17.9 6.4
60	5 30.0	5 30.9	5 15.0	6.0 2.2	12.0 4.3	18.0 6.5

^m 22	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	^m 23	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	5 30.0	5 30.9	5 15.0	0.0 0.0	6.0 2.3	12.0 4.5	00	5 45.0	5 45.9	5 29.3	0.0 0.0	6.0 2.4	12.0 4.7
01	5 30.3	5 31.2	5 15.2	0.1 0.0	6.1 2.3	12.1 4.5	01	5 45.3	5 46.2	5 29.5	0.1 0.0	6.1 2.4	12.1 4.7
02	5 30.5	5 31.4	5 15.4	0.2 0.1	6.2 2.3	12.2 4.6	02	5 45.5	5 46.4	5 29.8	0.2 0.1	6.2 2.4	12.2 4.8
03	5 30.8	5 31.7	5 15.7	0.3 0.1	6.3 2.4	12.3 4.6	03	5 45.8	5 46.7	5 30.0	0.3 0.1	6.3 2.5	12.3 4.8
04	5 31.0	5 31.9	5 15.9	0.4 0.2	6.4 2.4	12.4 4.7	04	5 46.0	5 46.9	5 30.2	0.4 0.2	6.4 2.5	12.4 4.9
05	5 31.3	5 32.2	5 16.2	0.5 0.2	6.5 2.4	12.5 4.7	05	5 46.3	5 47.2	5 30.5	0.5 0.2	6.5 2.5	12.5 4.9
06	5 31.5	5 32.4	5 16.4	0.6 0.2	6.6 2.5	12.6 4.7	06	5 46.5	5 47.4	5 30.7	0.6 0.2	6.6 2.6	12.6 4.9
07	5 31.8	5 32.7	5 16.6	0.7 0.3	6.7 2.5	12.7 4.8	07	5 46.8	5 47.7	5 31.0	0.7 0.3	6.7 2.6	12.7 5.0
08	5 32.0	5 32.9	5 16.9	0.8 0.3	6.8 2.6	12.8 4.8	08	5 47.0	5 48.0	5 31.2	0.8 0.3	6.8 2.7	12.8 5.0
09	5 32.3	5 33.2	5 17.1	0.9 0.3	6.9 2.6	12.9 4.8	09	5 47.3	5 48.2	5 31.4	0.9 0.4	6.9 2.7	12.9 5.1
10	5 32.5	5 33.4	5 17.4	1.0 0.4	7.0 2.6	13.0 4.9	10	5 47.5	5 48.5	5 31.7	1.0 0.4	7.0 2.7	13.0 5.1
11	5 32.8	5 33.7	5 17.6	1.1 0.4	7.1 2.7	13.1 4.9	11	5 47.8	5 48.7	5 31.9	1.1 0.4	7.1 2.8	13.1 5.1
12	5 33.0	5 33.9	5 17.8	1.2 0.5	7.2 2.7	13.2 5.0	12	5 48.0	5 49.0	5 32.1	1.2 0.5	7.2 2.8	13.2 5.2
13	5 33.3	5 34.2	5 18.1	1.3 0.5	7.3 2.7	13.3 5.0	13	5 48.3	5 49.2	5 32.4	1.3 0.5	7.3 2.9	13.3 5.2
14	5 33.5	5 34.4	5 18.3	1.4 0.5	7.4 2.8	13.4 5.0	14	5 48.5	5 49.5	5 32.6	1.4 0.5	7.4 2.9	13.4 5.2
15	5 33.8	5 34.7	5 18.5	1.5 0.6	7.5 2.8	13.5 5.1	15	5 48.8	5 49.7	5 32.9	1.5 0.6	7.5 2.9	13.5 5.3
16	5 34.0	5 34.9	5 18.8	1.6 0.6	7.6 2.9	13.6 5.1	16	5 49.0	5 50.0	5 33.1	1.6 0.6	7.6 3.0	13.6 5.3
17	5 34.3	5 35.2	5 19.0	1.7 0.6	7.7 2.9	13.7 5.1	17	5 49.3	5 50.2	5 33.3	1.7 0.7	7.7 3.0	13.7 5.4
18	5 34.5	5 35.4	5 19.3	1.8 0.7	7.8 2.9	13.8 5.2	18	5 49.5	5 50.5	5 33.6	1.8 0.7	7.8 3.1	13.8 5.4
19	5 34.8	5 35.7	5 19.5	1.9 0.7	7.9 3.0	13.9 5.2	19	5 49.8	5 50.7	5 33.8	1.9 0.7	7.9 3.1	13.9 5.4
20	5 35.0	5 35.9	5 19.7	2.0 0.8	8.0 3.0	14.0 5.3	20	5 50.0	5 51.0	5 34.1	2.0 0.8	8.0 3.1	14.0 5.5
21	5 35.3	5 36.2	5 20.0	2.1 0.8	8.1 3.0	14.1 5.3	21	5 50.3	5 51.2	5 34.3	2.1 0.8	8.1 3.2	14.1 5.5
22	5 35.5	5 36.4	5 20.2	2.2 0.8	8.2 3.1	14.2 5.3	22	5 50.5	5 51.5	5 34.5	2.2 0.9	8.2 3.2	14.2 5.6
23	5 35.8	5 36.7	5 20.5	2.3 0.9	8.3 3.1	14.3 5.4	23	5 50.8	5 51.7	5 34.8	2.3 0.9	8.3 3.3	14.3 5.6
24	5 36.0	5 36.9	5 20.7	2.4 0.9	8.4 3.2	14.4 5.4	24	5 51.0	5 52.0	5 35.0	2.4 0.9	8.4 3.3	14.4 5.6
25	5 36.3	5 37.2	5 20.9	2.5 0.9	8.5 3.2	14.5 5.4	25	5 51.3	5 52.2	5 35.2	2.5 1.0	8.5 3.3	14.5 5.7
26	5 36.5	5 37.4	5 21.2	2.6 1.0	8.6 3.2	14.6 5.5	26	5 51.5	5 52.5	5 35.5	2.6 1.0	8.6 3.4	14.6 5.7
27	5 36.8	5 37.7	5 21.4	2.7 1.0	8.7 3.3	14.7 5.5	27	5 51.8	5 52.7	5 35.7	2.7 1.1	8.7 3.4	14.7 5.8
28	5 37.0	5 37.9	5 21.6	2.8 1.0	8.8 3.3	14.8 5.6	28	5 52.0	5 53.0	5 36.0	2.8 1.1	8.8 3.4	14.8 5.8
29	5 37.3	5 38.2	5 21.9	2.9 1.1	8.9 3.3	14.9 5.6	29	5 52.3	5 53.2	5 36.2	2.9 1.1	8.9 3.5	14.9 5.8
30	5 37.5	5 38.4	5 22.1	3.0 1.1	9.0 3.4	15.0 5.6	30	5 52.5	5 53.5	5 36.4	3.0 1.2	9.0 3.5	15.0 5.9
31	5 37.8	5 38.7	5 22.4	3.1 1.2	9.1 3.4	15.1 5.7	31	5 52.8	5 53.7	5 36.7	3.1 1.2	9.1 3.6	15.1 5.9
32	5 38.0	5 38.9	5 22.6	3.2 1.2	9.2 3.5	15.2 5.7	32	5 53.0	5 54.0	5 36.9	3.2 1.3	9.2 3.6	15.2 6.0
33	5 38.3	5 39.2	5 22.8	3.3 1.2	9.3 3.5	15.3 5.7	33	5 53.3	5 54.2	5 37.2	3.3 1.3	9.3 3.6	15.3 6.0
34	5 38.5	5 39.4	5 23.1	3.4 1.3	9.4 3.5	15.4 5.8	34	5 53.5	5 54.5	5 37.4	3.4 1.3	9.4 3.7	15.4 6.0
35	5 38.8	5 39.7	5 23.3	3.5 1.3	9.5 3.6	15.5 5.8	35	5 53.8	5 54.7	5 37.6	3.5 1.4	9.5 3.7	15.5 6.1
36	5 39.0	5 39.9	5 23.6	3.6 1.4	9.6 3.6	15.6 5.9	36	5 54.0	5 55.0	5 37.9	3.6 1.4	9.6 3.8	15.6 6.1
37	5 39.3	5 40.2	5 23.8	3.7 1.4	9.7 3.6	15.7 5.9	37	5 54.3	5 55.2	5 38.1	3.7 1.4	9.7 3.8	15.7 6.1
38	5 39.5	5 40.4	5 24.0	3.8 1.4	9.8 3.7	15.8 5.9	38	5 54.5	5 55.5	5 38.4	3.8 1.5	9.8 3.8	15.8 6.2
39	5 39.8	5 40.7	5 24.3	3.9 1.5	9.9 3.7	15.9 6.0	39	5 54.8	5 55.7	5 38.6	3.9 1.5	9.9 3.9	15.9 6.2
40	5 40.0	5 40.9	5 24.5	4.0 1.5	10.0 3.8	16.0 6.0	40	5 55.0	5 56.0	5 38.8	4.0 1.6	10.0 3.9	16.0 6.3
41	5 40.3	5 41.2	5 24.7	4.1 1.5	10.1 3.8	16.1 6.0	41	5 55.3	5 56.2	5 39.1	4.1 1.6	10.1 4.0	16.1 6.3
42	5 40.5	5 41.4	5 25.0	4.2 1.6	10.2 3.8	16.2 6.1	42	5 55.5	5 56.5	5 39.3	4.2 1.6	10.2 4.0	16.2 6.3
43	5 40.8	5 41.7	5 25.2	4.3 1.6	10.3 3.9	16.3 6.1	43	5 55.8	5 56.7	5 39.5	4.3 1.7	10.3 4.0	16.3 6.4
44	5 41.0	5 41.9	5 25.5	4.4 1.7	10.4 3.9	16.4 6.1	44	5 56.0	5 57.0	5 39.8	4.4 1.7	10.4 4.1	16.4 6.4
45	5 41.3	5 42.2	5 25.7	4.5 1.7	10.5 3.9	16.5 6.2	45	5 56.3	5 57.2	5 40.0	4.5 1.8	10.5 4.1	16.5 6.5
46	5 41.5	5 42.4	5 25.9	4.6 1.7	10.6 4.0	16.6 6.2	46	5 56.5	5 57.5	5 40.3	4.6 1.8	10.6 4.2	16.6 6.5
47	5 41.8	5 42.7	5 26.2	4.7 1.8	10.7 4.0	16.7 6.3	47	5 56.8	5 57.7	5 40.5	4.7 1.8	10.7 4.2	16.7 6.5
48	5 42.0	5 42.9	5 26.4	4.8 1.8	10.8 4.1	16.8 6.3	48	5 57.0	5 58.0	5 40.7	4.8 1.9	10.8 4.2	16.8 6.6
49	5 42.3	5 43.2	5 26.7	4.9 1.8	10.9 4.1	16.9 6.3	49	5 57.3	5 58.2	5 41.0	4.9 1.9	10.9 4.3	16.9 6.6
50	5 42.5	5 43.4	5 26.9	5.0 1.9	11.0 4.1	17.0 6.4	50	5 57.5	5 58.5	5 41.2	5.0 2.0	11.0 4.3	17.0 6.7
51	5 42.8	5 43.7	5 27.1	5.1 1.9	11.1 4.2	17.1 6.4	51	5 57.8	5 58.7	5 41.5	5.1 2.0	11.1 4.3	17.1 6.7
52	5 43.0	5 43.9	5 27.4	5.2 2.0	11.2 4.2	17.2 6.5	52	5 58.0	5 59.0	5 41.7	5.2 2.0	11.2 4.4	17.2 6.7
53	5 43.3	5 44.2	5 27.6	5.3 2.0	11.3 4.2	17.3 6.5	53	5 58.3	5 59.2	5 41.9	5.3 2.1	11.3 4.4	17.3 6.8
54	5 43.5	5 44.4	5 27.9	5.4 2.0	11.4 4.3	17.4 6.5	54	5 58.5	5 59.5	5 42.2	5.4 2.1	11.4 4.5	17.4 6.8
55	5 43.8	5 44.7	5 28.1	5.5 2.1	11.5 4.3	17.5 6.6	55	5 58.8	5 59.7	5 42.4	5.5 2.2	11.5 4.5	17.5 6.9
56	5 44.0	5 44.9	5 28.3	5.6 2.1	11.6 4.4	17.6 6.6	56	5 59.0	6 00.0	5 42.6	5.6 2.2	11.6 4.5	17.6 6.9
57	5 44.3	5 45.2	5 28.6	5.7 2.1	11.7 4.4	17.7 6.6	57	5 59.3	6 00.2	5 42.9	5.7 2.2	11.7 4.6	17.7 6.9
58	5 44.5	5 45.4	5 28.8	5.8 2.2	11.8 4.4	17.8 6.7	58	5 59.5	6 00.5	5 43.1	5.8 2.3	11.8 4.6	17.8 7.0
59	5 44.8	5 45.7	5 29.0	5.9 2.2	11.9 4.5	17.9 6.7	59	5 59.8	6 00.7	5 43.4	5.9 2.3	11.9 4.7	17.9 7.0
60	5 45.0	5 45.9	5 29.3	6.0 2.3	12.0 4.5	18.0 6.8	60	6 00.0	6 01.0	5 43.6	6.0 2.4	12.0 4.7	18.0 7.1

^m 24	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	^m 25	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ		
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /		
00	6 00.0	6 01.0	5 43.6	0.0	0.0	6.0 2.5	12.0 4.9	00	6 15.0	6 16.0	5 57.9	0.0	0.0	6.0 2.6	12.0 5.1
01	6 00.3	6 01.2	5 43.8	0.1	0.0	6.1 2.5	12.1 4.9	01	6 15.3	6 16.3	5 58.2	0.1	0.0	6.1 2.6	12.1 5.1
02	6 00.5	6 01.5	5 44.1	0.2	0.1	6.2 2.5	12.2 5.0	02	6 15.5	6 16.5	5 58.4	0.2	0.1	6.2 2.6	12.2 5.2
03	6 00.8	6 01.7	5 44.3	0.3	0.1	6.3 2.6	12.3 5.0	03	6 15.8	6 16.8	5 58.6	0.3	0.1	6.3 2.7	12.3 5.2
04	6 01.0	6 02.0	5 44.6	0.4	0.2	6.4 2.6	12.4 5.1	04	6 16.0	6 17.0	5 58.9	0.4	0.2	6.4 2.7	12.4 5.3
05	6 01.3	6 02.2	5 44.8	0.5	0.2	6.5 2.7	12.5 5.1	05	6 16.3	6 17.3	5 59.1	0.5	0.2	6.5 2.8	12.5 5.3
06	6 01.5	6 02.5	5 45.0	0.6	0.2	6.6 2.7	12.6 5.1	06	6 16.5	6 17.5	5 59.3	0.6	0.3	6.6 2.8	12.6 5.4
07	6 01.8	6 02.7	5 45.3	0.7	0.3	6.7 2.7	12.7 5.2	07	6 16.8	6 17.8	5 59.6	0.7	0.3	6.7 2.8	12.7 5.4
08	6 02.0	6 03.0	5 45.5	0.8	0.3	6.8 2.8	12.8 5.2	08	6 17.0	6 18.0	5 59.8	0.8	0.3	6.8 2.9	12.8 5.4
09	6 02.3	6 03.2	5 45.7	0.9	0.4	6.9 2.8	12.9 5.3	09	6 17.3	6 18.3	6 00.1	0.9	0.4	6.9 2.9	12.9 5.5
10	6 02.5	6 03.5	5 46.0	1.0	0.4	7.0 2.9	13.0 5.3	10	6 17.5	6 18.5	6 00.3	1.0	0.4	7.0 3.0	13.0 5.5
11	6 02.8	6 03.7	5 46.2	1.1	0.4	7.1 2.9	13.1 5.3	11	6 17.8	6 18.8	6 00.5	1.1	0.5	7.1 3.0	13.1 5.6
12	6 03.0	6 04.0	5 46.5	1.2	0.5	7.2 2.9	13.2 5.4	12	6 18.0	6 19.0	6 00.8	1.2	0.5	7.2 3.1	13.2 5.6
13	6 03.3	6 04.2	5 46.7	1.3	0.5	7.3 3.0	13.3 5.4	13	6 18.3	6 19.3	6 01.0	1.3	0.6	7.3 3.1	13.3 5.7
14	6 03.5	6 04.5	5 46.9	1.4	0.6	7.4 3.0	13.4 5.5	14	6 18.5	6 19.5	6 01.3	1.4	0.6	7.4 3.1	13.4 5.7
15	6 03.8	6 04.7	5 47.2	1.5	0.6	7.5 3.1	13.5 5.5	15	6 18.8	6 19.8	6 01.5	1.5	0.6	7.5 3.2	13.5 5.7
16	6 04.0	6 05.0	5 47.4	1.6	0.7	7.6 3.1	13.6 5.6	16	6 19.0	6 20.0	6 01.7	1.6	0.7	7.6 3.2	13.6 5.8
17	6 04.3	6 05.2	5 47.7	1.7	0.7	7.7 3.1	13.7 5.6	17	6 19.3	6 20.3	6 02.0	1.7	0.7	7.7 3.3	13.7 5.8
18	6 04.5	6 05.5	5 47.9	1.8	0.7	7.8 3.2	13.8 5.6	18	6 19.5	6 20.5	6 02.2	1.8	0.8	7.8 3.3	13.8 5.9
19	6 04.8	6 05.7	5 48.1	1.9	0.8	7.9 3.2	13.9 5.7	19	6 19.8	6 20.8	6 02.5	1.9	0.8	7.9 3.4	13.9 5.9
20	6 05.0	6 06.0	5 48.4	2.0	0.8	8.0 3.3	14.0 5.7	20	6 20.0	6 21.0	6 02.7	2.0	0.9	8.0 3.4	14.0 6.0
21	6 05.3	6 06.3	5 48.6	2.1	0.9	8.1 3.3	14.1 5.8	21	6 20.3	6 21.3	6 02.9	2.1	0.9	8.1 3.4	14.1 6.0
22	6 05.5	6 06.5	5 48.8	2.2	0.9	8.2 3.3	14.2 5.8	22	6 20.5	6 21.5	6 03.2	2.2	0.9	8.2 3.5	14.2 6.0
23	6 05.8	6 06.8	5 49.1	2.3	0.9	8.3 3.4	14.3 5.8	23	6 20.8	6 21.8	6 03.4	2.3	1.0	8.3 3.5	14.3 6.1
24	6 06.0	6 07.0	5 49.3	2.4	1.0	8.4 3.4	14.4 5.9	24	6 21.0	6 22.0	6 03.6	2.4	1.0	8.4 3.6	14.4 6.1
25	6 06.3	6 07.3	5 49.6	2.5	1.0	8.5 3.5	14.5 5.9	25	6 21.3	6 22.3	6 03.9	2.5	1.1	8.5 3.6	14.5 6.2
26	6 06.5	6 07.5	5 49.8	2.6	1.1	8.6 3.5	14.6 6.0	26	6 21.5	6 22.5	6 04.1	2.6	1.1	8.6 3.7	14.6 6.2
27	6 06.8	6 07.8	5 50.0	2.7	1.1	8.7 3.6	14.7 6.0	27	6 21.8	6 22.8	6 04.4	2.7	1.1	8.7 3.7	14.7 6.2
28	6 07.0	6 08.0	5 50.3	2.8	1.1	8.8 3.6	14.8 6.0	28	6 22.0	6 23.0	6 04.6	2.8	1.2	8.8 3.7	14.8 6.3
29	6 07.3	6 08.3	5 50.5	2.9	1.2	8.9 3.6	14.9 6.1	29	6 22.3	6 23.3	6 04.8	2.9	1.2	8.9 3.8	14.9 6.3
30	6 07.5	6 08.5	5 50.8	3.0	1.2	9.0 3.7	15.0 6.1	30	6 22.5	6 23.5	6 05.1	3.0	1.3	9.0 3.8	15.0 6.4
31	6 07.8	6 08.8	5 51.0	3.1	1.3	9.1 3.7	15.1 6.2	31	6 22.8	6 23.8	6 05.3	3.1	1.3	9.1 3.9	15.1 6.4
32	6 08.0	6 09.0	5 51.2	3.2	1.3	9.2 3.8	15.2 6.2	32	6 23.0	6 24.0	6 05.6	3.2	1.4	9.2 3.9	15.2 6.5
33	6 08.3	6 09.3	5 51.5	3.3	1.3	9.3 3.8	15.3 6.2	33	6 23.3	6 24.3	6 05.8	3.3	1.4	9.3 4.0	15.3 6.5
34	6 08.5	6 09.5	5 51.7	3.4	1.4	9.4 3.8	15.4 6.3	34	6 23.5	6 24.5	6 06.0	3.4	1.4	9.4 4.0	15.4 6.5
35	6 08.8	6 09.8	5 52.0	3.5	1.4	9.5 3.9	15.5 6.3	35	6 23.8	6 24.8	6 06.3	3.5	1.5	9.5 4.0	15.5 6.6
36	6 09.0	6 10.0	5 52.2	3.6	1.5	9.6 3.9	15.6 6.4	36	6 24.0	6 25.1	6 06.5	3.6	1.5	9.6 4.1	15.6 6.6
37	6 09.3	6 10.3	5 52.4	3.7	1.5	9.7 4.0	15.7 6.4	37	6 24.3	6 25.3	6 06.7	3.7	1.6	9.7 4.1	15.7 6.7
38	6 09.5	6 10.5	5 52.7	3.8	1.6	9.8 4.0	15.8 6.5	38	6 24.5	6 25.6	6 07.0	3.8	1.6	9.8 4.2	15.8 6.7
39	6 09.8	6 10.8	5 52.9	3.9	1.6	9.9 4.0	15.9 6.5	39	6 24.8	6 25.8	6 07.2	3.9	1.7	9.9 4.2	15.9 6.8
40	6 10.0	6 11.0	5 53.1	4.0	1.6	10.0 4.1	16.0 6.5	40	6 25.0	6 26.1	6 07.5	4.0	1.7	10.0 4.3	16.0 6.8
41	6 10.3	6 11.3	5 53.4	4.1	1.7	10.1 4.1	16.1 6.6	41	6 25.3	6 26.3	6 07.7	4.1	1.7	10.1 4.3	16.1 6.8
42	6 10.5	6 11.5	5 53.6	4.2	1.7	10.2 4.2	16.2 6.6	42	6 25.5	6 26.6	6 07.9	4.2	1.8	10.2 4.3	16.2 6.9
43	6 10.8	6 11.8	5 53.9	4.3	1.8	10.3 4.2	16.3 6.7	43	6 25.8	6 26.8	6 08.2	4.3	1.8	10.3 4.4	16.3 6.9
44	6 11.0	6 12.0	5 54.1	4.4	1.8	10.4 4.2	16.4 6.7	44	6 26.0	6 27.1	6 08.4	4.4	1.9	10.4 4.4	16.4 7.0
45	6 11.3	6 12.3	5 54.3	4.5	1.8	10.5 4.3	16.5 6.7	45	6 26.3	6 27.3	6 08.7	4.5	1.9	10.5 4.5	16.5 7.0
46	6 11.5	6 12.5	5 54.6	4.6	1.9	10.6 4.3	16.6 6.8	46	6 26.5	6 27.6	6 08.9	4.6	2.0	10.6 4.5	16.6 7.1
47	6 11.8	6 12.8	5 54.8	4.7	1.9	10.7 4.4	16.7 6.8	47	6 26.8	6 27.8	6 09.1	4.7	2.0	10.7 4.5	16.7 7.1
48	6 12.0	6 13.0	5 55.1	4.8	2.0	10.8 4.4	16.8 6.9	48	6 27.0	6 28.1	6 09.4	4.8	2.0	10.8 4.6	16.8 7.1
49	6 12.3	6 13.3	5 55.3	4.9	2.0	10.9 4.5	16.9 6.9	49	6 27.3	6 28.3	6 09.6	4.9	2.1	10.9 4.6	16.9 7.2
50	6 12.5	6 13.5	5 55.5	5.0	2.0	11.0 4.5	17.0 6.9	50	6 27.5	6 28.6	6 09.8	5.0	2.1	11.0 4.7	17.0 7.2
51	6 12.8	6 13.8	5 55.8	5.1	2.1	11.1 4.5	17.1 7.0	51	6 27.8	6 28.8	6 10.1	5.1	2.2	11.1 4.7	17.1 7.3
52	6 13.0	6 14.0	5 56.0	5.2	2.1	11.2 4.6	17.2 7.0	52	6 28.0	6 29.1	6 10.3	5.2	2.2	11.2 4.8	17.2 7.3
53	6 13.3	6 14.3	5 56.2	5.3	2.2	11.3 4.6	17.3 7.1	53	6 28.3	6 29.3	6 10.6	5.3	2.3	11.3 4.8	17.3 7.4
54	6 13.5	6 14.5	5 56.5	5.4	2.2	11.4 4.7	17.4 7.1	54	6 28.5	6 29.6	6 10.8	5.4	2.3	11.4 4.8	17.4 7.4
55	6 13.8	6 14.8	5 56.7	5.5	2.2	11.5 4.7	17.5 7.1	55	6 28.8	6 29.8	6 11.0	5.5	2.3	11.5 4.9	17.5 7.4
56	6 14.0	6 15.0	5 57.0	5.6	2.3	11.6 4.7	17.6 7.2	56	6 29.0	6 30.1	6 11.3	5.6	2.4	11.6 4.9	17.6 7.5
57	6 14.3	6 15.3	5 57.2	5.7	2.3	11.7 4.8	17.7 7.2	57	6 29.3	6 30.3	6 11.5	5.7	2.4	11.7 5.0	17.7 7.5
58	6 14.5	6 15.5	5 57.4	5.8	2.4	11.8 4.8	17.8 7.3	58	6 29.5	6 30.6	6 11.8	5.8	2.5	11.8 5.0	17.8 7.6
59	6 14.8	6 15.8	5 57.7	5.9	2.4	11.9 4.9	17.9 7.3	59	6 29.8	6 30.8	6 12.0	5.9	2.5	11.9 5.1	17.9 7.6
60	6 15.0	6 16.0	5 57.9	6.0	2.5	12.0 4.9	18.0 7.4	60	6 30.0	6 31.1	6 12.2	6.0	2.6	12.0 5.1	18.0 7.7

^m 26	SUN PLANETS	ARIES	MOON	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^m 27	SUN PLANETS	ARIES	MOON	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^v or d	Corr ⁿ
s	° /	° /	° /	/	/	/	/	/	/	s	° /	° /	° /	/	/	/	/	/	/
00	6 30.0	6 31.1	6 12.2	0.0	0.0	6.0	2.7	12.0	5.3	00	6 45.0	6 46.1	6 26.6	0.0	0.0	6.0	2.8	12.0	5.5
01	6 30.3	6 31.3	6 12.5	0.1	0.0	6.1	2.7	12.1	5.3	01	6 45.3	6 46.4	6 26.8	0.1	0.0	6.1	2.8	12.1	5.5
02	6 30.5	6 31.6	6 12.7	0.2	0.1	6.2	2.7	12.2	5.4	02	6 45.5	6 46.6	6 27.0	0.2	0.1	6.2	2.8	12.2	5.6
03	6 30.8	6 31.8	6 12.9	0.3	0.1	6.3	2.8	12.3	5.4	03	6 45.8	6 46.9	6 27.3	0.3	0.1	6.3	2.9	12.3	5.6
04	6 31.0	6 32.1	6 13.2	0.4	0.2	6.4	2.8	12.4	5.5	04	6 46.0	6 47.1	6 27.5	0.4	0.2	6.4	2.9	12.4	5.7
05	6 31.3	6 32.3	6 13.4	0.5	0.2	6.5	2.9	12.5	5.5	05	6 46.3	6 47.4	6 27.7	0.5	0.2	6.5	3.0	12.5	5.7
06	6 31.5	6 32.6	6 13.7	0.6	0.3	6.6	2.9	12.6	5.6	06	6 46.5	6 47.6	6 28.0	0.6	0.3	6.6	3.0	12.6	5.8
07	6 31.8	6 32.8	6 13.9	0.7	0.3	6.7	3.0	12.7	5.6	07	6 46.8	6 47.9	6 28.2	0.7	0.3	6.7	3.1	12.7	5.8
08	6 32.0	6 33.1	6 14.1	0.8	0.4	6.8	3.0	12.8	5.7	08	6 47.0	6 48.1	6 28.5	0.8	0.4	6.8	3.1	12.8	5.9
09	6 32.3	6 33.3	6 14.4	0.9	0.4	6.9	3.0	12.9	5.7	09	6 47.3	6 48.4	6 28.7	0.9	0.4	6.9	3.2	12.9	5.9
10	6 32.5	6 33.6	6 14.6	1.0	0.4	7.0	3.1	13.0	5.7	10	6 47.5	6 48.6	6 28.9	1.0	0.5	7.0	3.2	13.0	6.0
11	6 32.8	6 33.8	6 14.9	1.1	0.5	7.1	3.1	13.1	5.8	11	6 47.8	6 48.9	6 29.2	1.1	0.5	7.1	3.3	13.1	6.0
12	6 33.0	6 34.1	6 15.1	1.2	0.5	7.2	3.2	13.2	5.8	12	6 48.0	6 49.1	6 29.4	1.2	0.6	7.2	3.3	13.2	6.1
13	6 33.3	6 34.3	6 15.3	1.3	0.6	7.3	3.2	13.3	5.9	13	6 48.3	6 49.4	6 29.7	1.3	0.6	7.3	3.3	13.3	6.1
14	6 33.5	6 34.6	6 15.6	1.4	0.6	7.4	3.3	13.4	5.9	14	6 48.5	6 49.6	6 29.9	1.4	0.6	7.4	3.4	13.4	6.1
15	6 33.8	6 34.8	6 15.8	1.5	0.7	7.5	3.3	13.5	6.0	15	6 48.8	6 49.9	6 30.1	1.5	0.7	7.5	3.4	13.5	6.2
16	6 34.0	6 35.1	6 16.1	1.6	0.7	7.6	3.4	13.6	6.0	16	6 49.0	6 50.1	6 30.4	1.6	0.7	7.6	3.5	13.6	6.2
17	6 34.3	6 35.3	6 16.3	1.7	0.8	7.7	3.4	13.7	6.1	17	6 49.3	6 50.4	6 30.6	1.7	0.8	7.7	3.5	13.7	6.3
18	6 34.5	6 35.6	6 16.5	1.8	0.8	7.8	3.4	13.8	6.1	18	6 49.5	6 50.6	6 30.8	1.8	0.8	7.8	3.6	13.8	6.3
19	6 34.8	6 35.8	6 16.8	1.9	0.8	7.9	3.5	13.9	6.1	19	6 49.8	6 50.9	6 31.1	1.9	0.9	7.9	3.6	13.9	6.4
20	6 35.0	6 36.1	6 17.0	2.0	0.9	8.0	3.5	14.0	6.2	20	6 50.0	6 51.1	6 31.3	2.0	0.9	8.0	3.7	14.0	6.4
21	6 35.3	6 36.3	6 17.2	2.1	0.9	8.1	3.6	14.1	6.2	21	6 50.3	6 51.4	6 31.6	2.1	1.0	8.1	3.7	14.1	6.5
22	6 35.5	6 36.6	6 17.5	2.2	1.0	8.2	3.6	14.2	6.3	22	6 50.5	6 51.6	6 31.8	2.2	1.0	8.2	3.8	14.2	6.5
23	6 35.8	6 36.8	6 17.7	2.3	1.0	8.3	3.7	14.3	6.3	23	6 50.8	6 51.9	6 32.0	2.3	1.1	8.3	3.8	14.3	6.6
24	6 36.0	6 37.1	6 18.0	2.4	1.1	8.4	3.7	14.4	6.4	24	6 51.0	6 52.1	6 32.3	2.4	1.1	8.4	3.9	14.4	6.6
25	6 36.3	6 37.3	6 18.2	2.5	1.1	8.5	3.8	14.5	6.4	25	6 51.3	6 52.4	6 32.5	2.5	1.1	8.5	3.9	14.5	6.6
26	6 36.5	6 37.6	6 18.4	2.6	1.1	8.6	3.8	14.6	6.4	26	6 51.5	6 52.6	6 32.8	2.6	1.2	8.6	3.9	14.6	6.7
27	6 36.8	6 37.8	6 18.7	2.7	1.2	8.7	3.8	14.7	6.5	27	6 51.8	6 52.9	6 33.0	2.7	1.2	8.7	4.0	14.7	6.7
28	6 37.0	6 38.1	6 18.9	2.8	1.2	8.8	3.9	14.8	6.5	28	6 52.0	6 53.1	6 33.2	2.8	1.3	8.8	4.0	14.8	6.8
29	6 37.3	6 38.3	6 19.2	2.9	1.3	8.9	3.9	14.9	6.6	29	6 52.3	6 53.4	6 33.5	2.9	1.3	8.9	4.1	14.9	6.8
30	6 37.5	6 38.6	6 19.4	3.0	1.3	9.0	4.0	15.0	6.6	30	6 52.5	6 53.6	6 33.7	3.0	1.4	9.0	4.1	15.0	6.9
31	6 37.8	6 38.8	6 19.6	3.1	1.4	9.1	4.0	15.1	6.7	31	6 52.8	6 53.9	6 33.9	3.1	1.4	9.1	4.2	15.1	6.9
32	6 38.0	6 39.1	6 19.9	3.2	1.4	9.2	4.1	15.2	6.7	32	6 53.0	6 54.1	6 34.2	3.2	1.5	9.2	4.2	15.2	7.0
33	6 38.3	6 39.3	6 20.1	3.3	1.5	9.3	4.1	15.3	6.8	33	6 53.3	6 54.4	6 34.4	3.3	1.5	9.3	4.3	15.3	7.0
34	6 38.5	6 39.6	6 20.3	3.4	1.5	9.4	4.2	15.4	6.8	34	6 53.5	6 54.6	6 34.7	3.4	1.6	9.4	4.3	15.4	7.1
35	6 38.8	6 39.8	6 20.6	3.5	1.5	9.5	4.2	15.5	6.8	35	6 53.8	6 54.9	6 34.9	3.5	1.6	9.5	4.4	15.5	7.1
36	6 39.0	6 40.1	6 20.8	3.6	1.6	9.6	4.2	15.6	6.9	36	6 54.0	6 55.1	6 35.1	3.6	1.7	9.6	4.4	15.6	7.2
37	6 39.3	6 40.3	6 21.1	3.7	1.6	9.7	4.3	15.7	6.9	37	6 54.3	6 55.4	6 35.4	3.7	1.7	9.7	4.4	15.7	7.2
38	6 39.5	6 40.6	6 21.3	3.8	1.7	9.8	4.3	15.8	7.0	38	6 54.5	6 55.6	6 35.6	3.8	1.7	9.8	4.5	15.8	7.2
39	6 39.8	6 40.8	6 21.5	3.9	1.7	9.9	4.4	15.9	7.0	39	6 54.8	6 55.9	6 35.9	3.9	1.8	9.9	4.5	15.9	7.3
40	6 40.0	6 41.1	6 21.8	4.0	1.8	10.0	4.4	16.0	7.1	40	6 55.0	6 56.1	6 36.1	4.0	1.8	10.0	4.6	16.0	7.3
41	6 40.3	6 41.3	6 22.0	4.1	1.8	10.1	4.5	16.1	7.1	41	6 55.3	6 56.4	6 36.3	4.1	1.9	10.1	4.6	16.1	7.4
42	6 40.5	6 41.6	6 22.3	4.2	1.9	10.2	4.5	16.2	7.2	42	6 55.5	6 56.6	6 36.6	4.2	1.9	10.2	4.7	16.2	7.4
43	6 40.8	6 41.8	6 22.5	4.3	1.9	10.3	4.5	16.3	7.2	43	6 55.8	6 56.9	6 36.8	4.3	2.0	10.3	4.7	16.3	7.5
44	6 41.0	6 42.1	6 22.7	4.4	1.9	10.4	4.6	16.4	7.2	44	6 56.0	6 57.1	6 37.0	4.4	2.0	10.4	4.8	16.4	7.5
45	6 41.3	6 42.3	6 23.0	4.5	2.0	10.5	4.6	16.5	7.3	45	6 56.3	6 57.4	6 37.3	4.5	2.1	10.5	4.8	16.5	7.6
46	6 41.5	6 42.6	6 23.2	4.6	2.0	10.6	4.7	16.6	7.3	46	6 56.5	6 57.6	6 37.5	4.6	2.1	10.6	4.9	16.6	7.6
47	6 41.8	6 42.8	6 23.4	4.7	2.1	10.7	4.7	16.7	7.4	47	6 56.8	6 57.9	6 37.8	4.7	2.2	10.7	4.9	16.7	7.7
48	6 42.0	6 43.1	6 23.7	4.8	2.1	10.8	4.8	16.8	7.4	48	6 57.0	6 58.1	6 38.0	4.8	2.2	10.8	5.0	16.8	7.7
49	6 42.3	6 43.4	6 23.9	4.9	2.2	10.9	4.8	16.9	7.5	49	6 57.3	6 58.4	6 38.2	4.9	2.2	10.9	5.0	16.9	7.7
50	6 42.5	6 43.6	6 24.2	5.0	2.2	11.0	4.9	17.0	7.5	50	6 57.5	6 58.6	6 38.5	5.0	2.3	11.0	5.0	17.0	7.8
51	6 42.8	6 43.9	6 24.4	5.1	2.3	11.1	4.9	17.1	7.6	51	6 57.8	6 58.9	6 38.7	5.1	2.3	11.1	5.1	17.1	7.8
52	6 43.0	6 44.1	6 24.6	5.2	2.3	11.2	4.9	17.2	7.6	52	6 58.0	6 59.1	6 39.0	5.2	2.4	11.2	5.1	17.2	7.9
53	6 43.3	6 44.4	6 24.9	5.3	2.3	11.3	5.0	17.3	7.6	53	6 58.3	6 59.4	6 39.2	5.3	2.4	11.3	5.2	17.3	7.9
54	6 43.5	6 44.6	6 25.1	5.4	2.4	11.4	5.0	17.4	7.7	54	6 58.5	6 59.6	6 39.4	5.4	2.5	11.4	5.2	17.4	8.0
55	6 43.8	6 44.9	6 25.4	5.5	2.4	11.5	5.1	17.5	7.7	55	6 58.8	6 59.9	6 39.7	5.5	2.5	11.5	5.3	17.5	8.0
56	6 44.0	6 45.1	6 25.6	5.6	2.5	11.6	5.1	17.6	7.8	56	6 59.0	7 00.1	6 39.9	5.6	2.6	11.6	5.3	17.6	8.1
57	6 44.3	6 45.4	6 25.8	5.7	2.5	11.7	5.2	17.7	7.8	57	6 59.3	7 00.4	6 40.2	5.7	2.6	11.7	5.4	17.7	8.1
58	6 44.5	6 45.6	6 26.1	5.8	2.6	11.8	5.2	17.8	7.9	58	6 59.5	7 00.6	6 40.4	5.8	2.7	11.8	5.4	17.8	8.2
59	6 44.8	6 45.9	6 26.3	5.9	2.6	11.9	5.3	17.9	7.9	59	6 59.8	7 00.9	6 40.6	5.9	2.7	11.9	5.5	17.9	8.2
60	6 45.0	6 46.1	6 26.6	6.0	2.7	12.0	5.3	18.0	8.0	60	7 00.0	7 01.1	6 40.9	6.0	2.8	12.0	5.5	18.0	8.3

28 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	29 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	7 00.0	7 01.1	6 40.9	0.0 0.0	6.0 2.9	12.0 5.7	00	7 15.0	7 16.2	6 55.2	0.0 0.0	6.0 3.0	12.0 5.9
01	7 00.3	7 01.4	6 41.1	0.1 0.0	6.1 2.9	12.1 5.7	01	7 15.3	7 16.4	6 55.4	0.1 0.0	6.1 3.0	12.1 5.9
02	7 00.5	7 01.7	6 41.3	0.2 0.1	6.2 2.9	12.2 5.8	02	7 15.5	7 16.7	6 55.7	0.2 0.1	6.2 3.0	12.2 6.0
03	7 00.8	7 01.9	6 41.6	0.3 0.1	6.3 3.0	12.3 5.8	03	7 15.8	7 16.9	6 55.9	0.3 0.1	6.3 3.1	12.3 6.0
04	7 01.0	7 02.2	6 41.8	0.4 0.2	6.4 3.0	12.4 5.9	04	7 16.0	7 17.2	6 56.1	0.4 0.2	6.4 3.1	12.4 6.1
05	7 01.3	7 02.4	6 42.1	0.5 0.2	6.5 3.1	12.5 5.9	05	7 16.3	7 17.4	6 56.4	0.5 0.2	6.5 3.2	12.5 6.1
06	7 01.5	7 02.7	6 42.3	0.6 0.3	6.6 3.1	12.6 6.0	06	7 16.5	7 17.7	6 56.6	0.6 0.3	6.6 3.2	12.6 6.2
07	7 01.8	7 02.9	6 42.5	0.7 0.3	6.7 3.2	12.7 6.0	07	7 16.8	7 17.9	6 56.9	0.7 0.3	6.7 3.3	12.7 6.2
08	7 02.0	7 03.2	6 42.8	0.8 0.4	6.8 3.2	12.8 6.1	08	7 17.0	7 18.2	6 57.1	0.8 0.4	6.8 3.3	12.8 6.3
09	7 02.3	7 03.4	6 43.0	0.9 0.4	6.9 3.3	12.9 6.1	09	7 17.3	7 18.4	6 57.3	0.9 0.4	6.9 3.4	12.9 6.3
10	7 02.5	7 03.7	6 43.3	1.0 0.5	7.0 3.3	13.0 6.2	10	7 17.5	7 18.7	6 57.6	1.0 0.5	7.0 3.4	13.0 6.4
11	7 02.8	7 03.9	6 43.5	1.1 0.5	7.1 3.4	13.1 6.2	11	7 17.8	7 18.9	6 57.8	1.1 0.5	7.1 3.5	13.1 6.4
12	7 03.0	7 04.2	6 43.7	1.2 0.6	7.2 3.4	13.2 6.3	12	7 18.0	7 19.2	6 58.0	1.2 0.6	7.2 3.5	13.2 6.5
13	7 03.3	7 04.4	6 44.0	1.3 0.6	7.3 3.5	13.3 6.3	13	7 18.3	7 19.4	6 58.3	1.3 0.6	7.3 3.6	13.3 6.5
14	7 03.5	7 04.7	6 44.2	1.4 0.7	7.4 3.5	13.4 6.4	14	7 18.5	7 19.7	6 58.5	1.4 0.7	7.4 3.6	13.4 6.6
15	7 03.8	7 04.9	6 44.4	1.5 0.7	7.5 3.6	13.5 6.4	15	7 18.8	7 20.0	6 58.8	1.5 0.7	7.5 3.7	13.5 6.6
16	7 04.0	7 05.2	6 44.7	1.6 0.8	7.6 3.6	13.6 6.5	16	7 19.0	7 20.2	6 59.0	1.6 0.8	7.6 3.7	13.6 6.7
17	7 04.3	7 05.4	6 44.9	1.7 0.8	7.7 3.7	13.7 6.5	17	7 19.3	7 20.5	6 59.2	1.7 0.8	7.7 3.8	13.7 6.7
18	7 04.5	7 05.7	6 45.2	1.8 0.9	7.8 3.7	13.8 6.6	18	7 19.5	7 20.7	6 59.5	1.8 0.9	7.8 3.8	13.8 6.8
19	7 04.8	7 05.9	6 45.4	1.9 0.9	7.9 3.8	13.9 6.6	19	7 19.8	7 21.0	6 59.7	1.9 0.9	7.9 3.9	13.9 6.8
20	7 05.0	7 06.2	6 45.6	2.0 1.0	8.0 3.8	14.0 6.7	20	7 20.0	7 21.2	7 00.0	2.0 1.0	8.0 3.9	14.0 6.9
21	7 05.3	7 06.4	6 45.9	2.1 1.0	8.1 3.8	14.1 6.7	21	7 20.3	7 21.5	7 00.2	2.1 1.0	8.1 4.0	14.1 6.9
22	7 05.5	7 06.7	6 46.1	2.2 1.0	8.2 3.9	14.2 6.7	22	7 20.5	7 21.7	7 00.4	2.2 1.1	8.2 4.0	14.2 7.0
23	7 05.8	7 06.9	6 46.4	2.3 1.1	8.3 3.9	14.3 6.8	23	7 20.8	7 22.0	7 00.7	2.3 1.1	8.3 4.1	14.3 7.0
24	7 06.0	7 07.2	6 46.6	2.4 1.1	8.4 4.0	14.4 6.8	24	7 21.0	7 22.2	7 00.9	2.4 1.2	8.4 4.1	14.4 7.1
25	7 06.3	7 07.4	6 46.8	2.5 1.2	8.5 4.0	14.5 6.9	25	7 21.3	7 22.5	7 01.1	2.5 1.2	8.5 4.2	14.5 7.1
26	7 06.5	7 07.7	6 47.1	2.6 1.2	8.6 4.1	14.6 6.9	26	7 21.5	7 22.7	7 01.4	2.6 1.3	8.6 4.2	14.6 7.2
27	7 06.8	7 07.9	6 47.3	2.7 1.3	8.7 4.1	14.7 7.0	27	7 21.8	7 23.0	7 01.6	2.7 1.3	8.7 4.3	14.7 7.2
28	7 07.0	7 08.2	6 47.5	2.8 1.3	8.8 4.2	14.8 7.0	28	7 22.0	7 23.2	7 01.9	2.8 1.4	8.8 4.3	14.8 7.3
29	7 07.3	7 08.4	6 47.8	2.9 1.4	8.9 4.2	14.9 7.1	29	7 22.3	7 23.5	7 02.1	2.9 1.4	8.9 4.4	14.9 7.3
30	7 07.5	7 08.7	6 48.0	3.0 1.4	9.0 4.3	15.0 7.1	30	7 22.5	7 23.7	7 02.3	3.0 1.5	9.0 4.4	15.0 7.4
31	7 07.8	7 08.9	6 48.3	3.1 1.5	9.1 4.3	15.1 7.2	31	7 22.8	7 24.0	7 02.6	3.1 1.5	9.1 4.5	15.1 7.4
32	7 08.0	7 09.2	6 48.5	3.2 1.5	9.2 4.4	15.2 7.2	32	7 23.0	7 24.2	7 02.8	3.2 1.6	9.2 4.5	15.2 7.5
33	7 08.3	7 09.4	6 48.7	3.3 1.6	9.3 4.4	15.3 7.3	33	7 23.3	7 24.5	7 03.1	3.3 1.6	9.3 4.6	15.3 7.5
34	7 08.5	7 09.7	6 49.0	3.4 1.6	9.4 4.5	15.4 7.3	34	7 23.5	7 24.7	7 03.3	3.4 1.7	9.4 4.6	15.4 7.6
35	7 08.8	7 09.9	6 49.2	3.5 1.7	9.5 4.5	15.5 7.4	35	7 23.8	7 25.0	7 03.5	3.5 1.7	9.5 4.7	15.5 7.6
36	7 09.0	7 10.2	6 49.5	3.6 1.7	9.6 4.6	15.6 7.4	36	7 24.0	7 25.2	7 03.8	3.6 1.8	9.6 4.7	15.6 7.7
37	7 09.3	7 10.4	6 49.7	3.7 1.8	9.7 4.6	15.7 7.5	37	7 24.3	7 25.5	7 04.0	3.7 1.8	9.7 4.8	15.7 7.7
38	7 09.5	7 10.7	6 49.9	3.8 1.8	9.8 4.7	15.8 7.5	38	7 24.5	7 25.7	7 04.3	3.8 1.9	9.8 4.8	15.8 7.8
39	7 09.8	7 10.9	6 50.2	3.9 1.9	9.9 4.7	15.9 7.6	39	7 24.8	7 26.0	7 04.5	3.9 1.9	9.9 4.9	15.9 7.8
40	7 10.0	7 11.2	6 50.4	4.0 1.9	10.0 4.8	16.0 7.6	40	7 25.0	7 26.2	7 04.7	4.0 2.0	10.0 4.9	16.0 7.9
41	7 10.3	7 11.4	6 50.6	4.1 1.9	10.1 4.8	16.1 7.6	41	7 25.3	7 26.5	7 05.0	4.1 2.0	10.1 5.0	16.1 7.9
42	7 10.5	7 11.7	6 50.9	4.2 2.0	10.2 4.8	16.2 7.7	42	7 25.5	7 26.7	7 05.2	4.2 2.1	10.2 5.0	16.2 8.0
43	7 10.8	7 11.9	6 51.1	4.3 2.0	10.3 4.9	16.3 7.7	43	7 25.8	7 27.0	7 05.4	4.3 2.1	10.3 5.1	16.3 8.0
44	7 11.0	7 12.2	6 51.4	4.4 2.1	10.4 4.9	16.4 7.8	44	7 26.0	7 27.2	7 05.7	4.4 2.2	10.4 5.1	16.4 8.1
45	7 11.3	7 12.4	6 51.6	4.5 2.1	10.5 5.0	16.5 7.8	45	7 26.3	7 27.5	7 05.9	4.5 2.2	10.5 5.2	16.5 8.1
46	7 11.5	7 12.7	6 51.8	4.6 2.2	10.6 5.0	16.6 7.9	46	7 26.5	7 27.7	7 06.2	4.6 2.3	10.6 5.2	16.6 8.2
47	7 11.8	7 12.9	6 52.1	4.7 2.2	10.7 5.1	16.7 7.9	47	7 26.8	7 28.0	7 06.4	4.7 2.3	10.7 5.3	16.7 8.2
48	7 12.0	7 13.2	6 52.3	4.8 2.3	10.8 5.1	16.8 8.0	48	7 27.0	7 28.2	7 06.6	4.8 2.4	10.8 5.3	16.8 8.3
49	7 12.3	7 13.4	6 52.6	4.9 2.3	10.9 5.2	16.9 8.0	49	7 27.3	7 28.5	7 06.9	4.9 2.4	10.9 5.4	16.9 8.3
50	7 12.5	7 13.7	6 52.8	5.0 2.4	11.0 5.2	17.0 8.1	50	7 27.5	7 28.7	7 07.1	5.0 2.5	11.0 5.4	17.0 8.4
51	7 12.8	7 13.9	6 53.0	5.1 2.4	11.1 5.3	17.1 8.1	51	7 27.8	7 29.0	7 07.4	5.1 2.5	11.1 5.5	17.1 8.4
52	7 13.0	7 14.2	6 53.3	5.2 2.5	11.2 5.3	17.2 8.2	52	7 28.0	7 29.2	7 07.6	5.2 2.6	11.2 5.5	17.2 8.5
53	7 13.3	7 14.4	6 53.5	5.3 2.5	11.3 5.4	17.3 8.2	53	7 28.3	7 29.5	7 07.8	5.3 2.6	11.3 5.6	17.3 8.5
54	7 13.5	7 14.7	6 53.8	5.4 2.6	11.4 5.4	17.4 8.3	54	7 28.5	7 29.7	7 08.1	5.4 2.7	11.4 5.6	17.4 8.6
55	7 13.8	7 14.9	6 54.0	5.5 2.6	11.5 5.5	17.5 8.3	55	7 28.8	7 30.0	7 08.3	5.5 2.7	11.5 5.7	17.5 8.6
56	7 14.0	7 15.2	6 54.2	5.6 2.7	11.6 5.5	17.6 8.4	56	7 29.0	7 30.2	7 08.5	5.6 2.8	11.6 5.7	17.6 8.7
57	7 14.3	7 15.4	6 54.5	5.7 2.7	11.7 5.6	17.7 8.4	57	7 29.3	7 30.5	7 08.8	5.7 2.8	11.7 5.8	17.7 8.7
58	7 14.5	7 15.7	6 54.7	5.8 2.8	11.8 5.6	17.8 8.5	58	7 29.5	7 30.7	7 09.0	5.8 2.9	11.8 5.8	17.8 8.8
59	7 14.8	7 15.9	6 54.9	5.9 2.8	11.9 5.7	17.9 8.5	59	7 29.8	7 31.0	7 09.3	5.9 2.9	11.9 5.9	17.9 8.8
60	7 15.0	7 16.2	6 55.2	6.0 2.9	12.0 5.7	18.0 8.6	60	7 30.0	7 31.2	7 09.5	6.0 3.0	12.0 5.9	18.0 8.9

^m 30	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	^m 31	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	° /	° /	° /	/ /	/ /	/ /	s	° /	° /	° /	/ /	/ /	/ /
00	7 30:0	7 31:2	7 09:5	0:0 0:0	6:0 3:1	12:0 6:1	00	7 45:0	7 46:3	7 23:8	0:0 0:0	6:0 3:2	12:0 6:3
01	7 30:3	7 31:5	7 09:7	0:1 0:1	6:1 3:1	12:1 6:2	01	7 45:3	7 46:5	7 24:1	0:1 0:1	6:1 3:2	12:1 6:4
02	7 30:5	7 31:7	7 10:0	0:2 0:1	6:2 3:2	12:2 6:2	02	7 45:5	7 46:8	7 24:3	0:2 0:1	6:2 3:3	12:2 6:4
03	7 30:8	7 32:0	7 10:2	0:3 0:2	6:3 3:2	12:3 6:3	03	7 45:8	7 47:0	7 24:5	0:3 0:2	6:3 3:3	12:3 6:5
04	7 31:0	7 32:2	7 10:5	0:4 0:2	6:4 3:3	12:4 6:3	04	7 46:0	7 47:3	7 24:8	0:4 0:2	6:4 3:4	12:4 6:5
05	7 31:3	7 32:5	7 10:7	0:5 0:3	6:5 3:3	12:5 6:4	05	7 46:3	7 47:5	7 25:0	0:5 0:3	6:5 3:4	12:5 6:6
06	7 31:5	7 32:7	7 10:9	0:6 0:3	6:6 3:4	12:6 6:4	06	7 46:5	7 47:8	7 25:2	0:6 0:3	6:6 3:5	12:6 6:6
07	7 31:8	7 33:0	7 11:2	0:7 0:4	6:7 3:4	12:7 6:5	07	7 46:8	7 48:0	7 25:5	0:7 0:4	6:7 3:5	12:7 6:7
08	7 32:0	7 33:2	7 11:4	0:8 0:4	6:8 3:5	12:8 6:5	08	7 47:0	7 48:3	7 25:7	0:8 0:4	6:8 3:6	12:8 6:7
09	7 32:3	7 33:5	7 11:6	0:9 0:5	6:9 3:5	12:9 6:6	09	7 47:3	7 48:5	7 26:0	0:9 0:5	6:9 3:6	12:9 6:8
10	7 32:5	7 33:7	7 11:9	1:0 0:5	7:0 3:6	13:0 6:6	10	7 47:5	7 48:8	7 26:2	1:0 0:5	7:0 3:7	13:0 6:8
11	7 32:8	7 34:0	7 12:1	1:1 0:6	7:1 3:6	13:1 6:7	11	7 47:8	7 49:0	7 26:4	1:1 0:6	7:1 3:7	13:1 6:9
12	7 33:0	7 34:2	7 12:4	1:2 0:6	7:2 3:7	13:2 6:7	12	7 48:0	7 49:3	7 26:7	1:2 0:6	7:2 3:8	13:2 6:9
13	7 33:3	7 34:5	7 12:6	1:3 0:7	7:3 3:7	13:3 6:8	13	7 48:3	7 49:5	7 26:9	1:3 0:7	7:3 3:8	13:3 7:0
14	7 33:5	7 34:7	7 12:8	1:4 0:7	7:4 3:8	13:4 6:8	14	7 48:5	7 49:8	7 27:2	1:4 0:7	7:4 3:9	13:4 7:0
15	7 33:8	7 35:0	7 13:1	1:5 0:8	7:5 3:8	13:5 6:9	15	7 48:8	7 50:0	7 27:4	1:5 0:8	7:5 3:9	13:5 7:1
16	7 34:0	7 35:2	7 13:3	1:6 0:8	7:6 3:9	13:6 6:9	16	7 49:0	7 50:3	7 27:6	1:6 0:8	7:6 4:0	13:6 7:1
17	7 34:3	7 35:5	7 13:6	1:7 0:9	7:7 3:9	13:7 7:0	17	7 49:3	7 50:5	7 27:9	1:7 0:9	7:7 4:0	13:7 7:2
18	7 34:5	7 35:7	7 13:8	1:8 0:9	7:8 4:0	13:8 7:0	18	7 49:5	7 50:8	7 28:1	1:8 0:9	7:8 4:1	13:8 7:2
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21	7 35:3	7 36:5	7 14:5	2:1 1:1	8:1 4:1	14:1 7:2	21	7 50:3	7 51:5	7 28:8	2:1 1:1	8:1 4:3	14:1 7:4
22	7 35:5	7 36:7	7 14:7	2:2 1:1	8:2 4:2	14:2 7:2	22	7 50:5	7 51:8	7 29:1	2:2 1:2	8:2 4:3	14:2 7:5
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58	7 44:5	7 45:8	7 23:3	5:8 2:9	11:8 6:0	17:8 9:0	58	7 59:5	8 00:8	7 37:7	5:8 3:0	11:8 6:2	17:8 9:3
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60	7 45:0	7 46:3	7 23:8	6:0 3:1	12:0 6:1	18:0 9:2	60	8 00:0	8 01:3	7 38:1	6:0 3:2	12:0 6:3	18:0 9:5

^m 32	SUN PLANETS	ARIES	MOON	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^m 33	SUN PLANETS	ARIES	MOON	^v or d	Corr ⁿ	^v or d	Corr ⁿ	^v or d	Corr ⁿ
s	° /	° /	° /	/	/	/	/	/	/	s	° /	° /	° /	/	/	/	/	/	/
00	8 00.0	8 01.3	7 38.1	0.0	0.0	6.0	3.3	12.0	6.5	00	8 15.0	8 16.4	7 52.5	0.0	0.0	6.0	3.4	12.0	6.7
01	8 00.3	8 01.6	7 38.4	0.1	0.1	6.1	3.3	12.1	6.6	01	8 15.3	8 16.6	7 52.7	0.1	0.1	6.1	3.4	12.1	6.8
02	8 00.5	8 01.8	7 38.6	0.2	0.1	6.2	3.4	12.2	6.6	02	8 15.5	8 16.9	7 52.9	0.2	0.1	6.2	3.5	12.2	6.8
03	8 00.8	8 02.1	7 38.8	0.3	0.2	6.3	3.4	12.3	6.7	03	8 15.8	8 17.1	7 53.2	0.3	0.2	6.3	3.5	12.3	6.9
04	8 01.0	8 02.3	7 39.1	0.4	0.2	6.4	3.5	12.4	6.7	04	8 16.0	8 17.4	7 53.4	0.4	0.2	6.4	3.6	12.4	6.9
05	8 01.3	8 02.6	7 39.3	0.5	0.3	6.5	3.5	12.5	6.8	05	8 16.3	8 17.6	7 53.6	0.5	0.3	6.5	3.6	12.5	7.0
06	8 01.5	8 02.8	7 39.6	0.6	0.3	6.6	3.6	12.6	6.8	06	8 16.5	8 17.9	7 53.9	0.6	0.3	6.6	3.7	12.6	7.0
07	8 01.8	8 03.1	7 39.8	0.7	0.4	6.7	3.6	12.7	6.9	07	8 16.8	8 18.1	7 54.1	0.7	0.4	6.7	3.7	12.7	7.1
08	8 02.0	8 03.3	7 40.0	0.8	0.4	6.8	3.7	12.8	6.9	08	8 17.0	8 18.4	7 54.4	0.8	0.4	6.8	3.8	12.8	7.1
09	8 02.3	8 03.6	7 40.3	0.9	0.5	6.9	3.7	12.9	7.0	09	8 17.3	8 18.6	7 54.6	0.9	0.5	6.9	3.9	12.9	7.2
10	8 02.5	8 03.8	7 40.5	1.0	0.5	7.0	3.8	13.0	7.0	10	8 17.5	8 18.9	7 54.8	1.0	0.6	7.0	3.9	13.0	7.3
11	8 02.8	8 04.1	7 40.8	1.1	0.6	7.1	3.8	13.1	7.1	11	8 17.8	8 19.1	7 55.1	1.1	0.6	7.1	4.0	13.1	7.3
12	8 03.0	8 04.3	7 41.0	1.2	0.7	7.2	3.9	13.2	7.2	12	8 18.0	8 19.4	7 55.3	1.2	0.7	7.2	4.0	13.2	7.4
13	8 03.3	8 04.6	7 41.2	1.3	0.7	7.3	4.0	13.3	7.2	13	8 18.3	8 19.6	7 55.6	1.3	0.7	7.3	4.1	13.3	7.4
14	8 03.5	8 04.8	7 41.5	1.4	0.8	7.4	4.0	13.4	7.3	14	8 18.5	8 19.9	7 55.8	1.4	0.8	7.4	4.1	13.4	7.5
15	8 03.8	8 05.1	7 41.7	1.5	0.8	7.5	4.1	13.5	7.3	15	8 18.8	8 20.1	7 56.0	1.5	0.8	7.5	4.2	13.5	7.5
16	8 04.0	8 05.3	7 42.0	1.6	0.9	7.6	4.1	13.6	7.4	16	8 19.0	8 20.4	7 56.3	1.6	0.9	7.6	4.2	13.6	7.6
17	8 04.3	8 05.6	7 42.2	1.7	0.9	7.7	4.2	13.7	7.4	17	8 19.3	8 20.6	7 56.5	1.7	0.9	7.7	4.3	13.7	7.6
18	8 04.5	8 05.8	7 42.4	1.8	1.0	7.8	4.2	13.8	7.5	18	8 19.5	8 20.9	7 56.7	1.8	1.0	7.8	4.4	13.8	7.7
19	8 04.8	8 06.1	7 42.7	1.9	1.0	7.9	4.3	13.9	7.5	19	8 19.8	8 21.1	7 57.0	1.9	1.1	7.9	4.4	13.9	7.8
20	8 05.0	8 06.3	7 42.9	2.0	1.1	8.0	4.3	14.0	7.6	20	8 20.0	8 21.4	7 57.2	2.0	1.1	8.0	4.5	14.0	7.8
21	8 05.3	8 06.6	7 43.1	2.1	1.1	8.1	4.4	14.1	7.6	21	8 20.3	8 21.6	7 57.5	2.1	1.2	8.1	4.5	14.1	7.9
22	8 05.5	8 06.8	7 43.4	2.2	1.2	8.2	4.4	14.2	7.7	22	8 20.5	8 21.9	7 57.7	2.2	1.2	8.2	4.6	14.2	7.9
23	8 05.8	8 07.1	7 43.6	2.3	1.2	8.3	4.5	14.3	7.7	23	8 20.8	8 22.1	7 57.9	2.3	1.3	8.3	4.6	14.3	8.0
24	8 06.0	8 07.3	7 43.9	2.4	1.3	8.4	4.6	14.4	7.8	24	8 21.0	8 22.4	7 58.2	2.4	1.3	8.4	4.7	14.4	8.0
25	8 06.3	8 07.6	7 44.1	2.5	1.4	8.5	4.6	14.5	7.9	25	8 21.3	8 22.6	7 58.4	2.5	1.4	8.5	4.7	14.5	8.1
26	8 06.5	8 07.8	7 44.3	2.6	1.4	8.6	4.7	14.6	7.9	26	8 21.5	8 22.9	7 58.7	2.6	1.5	8.6	4.8	14.6	8.2
27	8 06.8	8 08.1	7 44.6	2.7	1.5	8.7	4.7	14.7	8.0	27	8 21.8	8 23.1	7 58.9	2.7	1.5	8.7	4.9	14.7	8.2
28	8 07.0	8 08.3	7 44.8	2.8	1.5	8.8	4.8	14.8	8.0	28	8 22.0	8 23.4	7 59.1	2.8	1.6	8.8	4.9	14.8	8.3
29	8 07.3	8 08.6	7 45.1	2.9	1.6	8.9	4.8	14.9	8.1	29	8 22.3	8 23.6	7 59.4	2.9	1.6	8.9	5.0	14.9	8.3
30	8 07.5	8 08.8	7 45.3	3.0	1.6	9.0	4.9	15.0	8.1	30	8 22.5	8 23.9	7 59.6	3.0	1.7	9.0	5.0	15.0	8.4
31	8 07.8	8 09.1	7 45.5	3.1	1.7	9.1	4.9	15.1	8.2	31	8 22.8	8 24.1	7 59.8	3.1	1.7	9.1	5.1	15.1	8.4
32	8 08.0	8 09.3	7 45.8	3.2	1.7	9.2	5.0	15.2	8.2	32	8 23.0	8 24.4	8 00.1	3.2	1.8	9.2	5.1	15.2	8.5
33	8 08.3	8 09.6	7 46.0	3.3	1.8	9.3	5.0	15.3	8.3	33	8 23.3	8 24.6	8 00.3	3.3	1.8	9.3	5.2	15.3	8.5
34	8 08.5	8 09.8	7 46.2	3.4	1.8	9.4	5.1	15.4	8.3	34	8 23.5	8 24.9	8 00.6	3.4	1.9	9.4	5.2	15.4	8.6
35	8 08.8	8 10.1	7 46.5	3.5	1.9	9.5	5.1	15.5	8.4	35	8 23.8	8 25.1	8 00.8	3.5	2.0	9.5	5.3	15.5	8.7
36	8 09.0	8 10.3	7 46.7	3.6	2.0	9.6	5.2	15.6	8.5	36	8 24.0	8 25.4	8 01.0	3.6	2.0	9.6	5.4	15.6	8.7
37	8 09.3	8 10.6	7 47.0	3.7	2.0	9.7	5.3	15.7	8.5	37	8 24.3	8 25.6	8 01.3	3.7	2.1	9.7	5.4	15.7	8.8
38	8 09.5	8 10.8	7 47.2	3.8	2.1	9.8	5.3	15.8	8.6	38	8 24.5	8 25.9	8 01.5	3.8	2.1	9.8	5.5	15.8	8.8
39	8 09.8	8 11.1	7 47.4	3.9	2.1	9.9	5.4	15.9	8.6	39	8 24.8	8 26.1	8 01.8	3.9	2.2	9.9	5.5	15.9	8.9
40	8 10.0	8 11.3	7 47.7	4.0	2.2	10.0	5.4	16.0	8.7	40	8 25.0	8 26.4	8 02.0	4.0	2.2	10.0	5.6	16.0	8.9
41	8 10.3	8 11.6	7 47.9	4.1	2.2	10.1	5.5	16.1	8.7	41	8 25.3	8 26.6	8 02.2	4.1	2.3	10.1	5.6	16.1	9.0
42	8 10.5	8 11.8	7 48.2	4.2	2.3	10.2	5.5	16.2	8.8	42	8 25.5	8 26.9	8 02.5	4.2	2.3	10.2	5.7	16.2	9.0
43	8 10.8	8 12.1	7 48.4	4.3	2.3	10.3	5.6	16.3	8.8	43	8 25.8	8 27.1	8 02.7	4.3	2.4	10.3	5.8	16.3	9.1
44	8 11.0	8 12.3	7 48.6	4.4	2.4	10.4	5.6	16.4	8.9	44	8 26.0	8 27.4	8 02.9	4.4	2.5	10.4	5.8	16.4	9.2
45	8 11.3	8 12.6	7 48.9	4.5	2.4	10.5	5.7	16.5	8.9	45	8 26.3	8 27.6	8 03.2	4.5	2.5	10.5	5.9	16.5	9.2
46	8 11.5	8 12.8	7 49.1	4.6	2.5	10.6	5.7	16.6	9.0	46	8 26.5	8 27.9	8 03.4	4.6	2.6	10.6	5.9	16.6	9.3
47	8 11.8	8 13.1	7 49.3	4.7	2.5	10.7	5.8	16.7	9.0	47	8 26.8	8 28.1	8 03.7	4.7	2.6	10.7	6.0	16.7	9.3
48	8 12.0	8 13.3	7 49.6	4.8	2.6	10.8	5.9	16.8	9.1	48	8 27.0	8 28.4	8 03.9	4.8	2.7	10.8	6.0	16.8	9.4
49	8 12.3	8 13.6	7 49.8	4.9	2.7	10.9	5.9	16.9	9.2	49	8 27.3	8 28.6	8 04.1	4.9	2.7	10.9	6.1	16.9	9.4
50	8 12.5	8 13.8	7 50.1	5.0	2.7	11.0	6.0	17.0	9.2	50	8 27.5	8 28.9	8 04.4	5.0	2.8	11.0	6.1	17.0	9.5
51	8 12.8	8 14.1	7 50.3	5.1	2.8	11.1	6.0	17.1	9.3	51	8 27.8	8 29.1	8 04.6	5.1	2.8	11.1	6.2	17.1	9.5
52	8 13.0	8 14.3	7 50.5	5.2	2.8	11.2	6.1	17.2	9.3	52	8 28.0	8 29.4	8 04.9	5.2	2.9	11.2	6.3	17.2	9.6
53	8 13.3	8 14.6	7 50.8	5.3	2.9	11.3	6.1	17.3	9.4	53	8 28.3	8 29.6	8 05.1	5.3	3.0	11.3	6.3	17.3	9.7
54	8 13.5	8 14.9	7 51.0	5.4	2.9	11.4	6.2	17.4	9.4	54	8 28.5	8 29.9	8 05.3	5.4	3.0	11.4	6.4	17.4	9.7
55	8 13.8	8 15.1	7 51.3	5.5	3.0	11.5	6.2	17.5	9.5	55	8 28.8	8 30.1	8 05.6	5.5	3.1	11.5	6.4	17.5	9.8
56	8 14.0	8 15.4	7 51.5	5.6	3.0	11.6	6.3	17.6	9.5	56	8 29.0	8 30.4	8 05.8	5.6	3.1	11.6	6.5	17.6	9.8
57	8 14.3	8 15.6	7 51.7	5.7	3.1	11.7	6.3	17.7	9.6	57	8 29.3	8 30.6	8 06.1	5.7	3.2	11.7	6.5	17.7	9.9
58	8 14.5	8 15.9	7 52.0	5.8	3.1	11.8	6.4	17.8	9.6	58	8 29.5	8 30.9	8 06.3	5.8	3.2	11.8	6.6	17.8	9.9
59	8 14.8	8 16.1	7 52.2	5.9	3.2	11.9	6.4	17.9	9.7	59	8 29.8	8 31.1	8 06.5	5.9	3.3	11.9	6.6	17.9	10.0
60	8 15.0	8 16.4	7 52.5	6.0	3.3	12.0	6.5	18.0	9.8	60	8 30.0	8 31.4	8 06.8	6.0	3.4	12.0	6.7	18.0	10.1

34 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	35 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	8 30.0	8 31.4	8 06.8	0.0 0.0	6.0 3.5	12.0 6.9	00	8 45.0	8 46.4	8 21.1	0.0 0.0	6.0 3.6	12.0 7.1
01	8 30.3	8 31.6	8 07.0	0.1 0.1	6.1 3.5	12.1 7.0	01	8 45.3	8 46.7	8 21.3	0.1 0.1	6.1 3.6	12.1 7.2
02	8 30.5	8 31.9	8 07.2	0.2 0.1	6.2 3.6	12.2 7.0	02	8 45.5	8 46.9	8 21.6	0.2 0.1	6.2 3.7	12.2 7.2
03	8 30.8	8 32.1	8 07.5	0.3 0.2	6.3 3.6	12.3 7.1	03	8 45.8	8 47.2	8 21.8	0.3 0.2	6.3 3.7	12.3 7.3
04	8 31.0	8 32.4	8 07.7	0.4 0.2	6.4 3.7	12.4 7.1	04	8 46.0	8 47.4	8 22.0	0.4 0.2	6.4 3.8	12.4 7.3
05	8 31.3	8 32.6	8 08.0	0.5 0.3	6.5 3.7	12.5 7.2	05	8 46.3	8 47.7	8 22.3	0.5 0.3	6.5 3.8	12.5 7.4
06	8 31.5	8 32.9	8 08.2	0.6 0.3	6.6 3.8	12.6 7.2	06	8 46.5	8 47.9	8 22.5	0.6 0.4	6.6 3.9	12.6 7.5
07	8 31.8	8 33.2	8 08.4	0.7 0.4	6.7 3.9	12.7 7.3	07	8 46.8	8 48.2	8 22.8	0.7 0.4	6.7 4.0	12.7 7.5
08	8 32.0	8 33.4	8 08.7	0.8 0.5	6.8 3.9	12.8 7.4	08	8 47.0	8 48.4	8 23.0	0.8 0.5	6.8 4.0	12.8 7.6
09	8 32.3	8 33.7	8 08.9	0.9 0.5	6.9 4.0	12.9 7.4	09	8 47.3	8 48.7	8 23.2	0.9 0.5	6.9 4.1	12.9 7.6
10	8 32.5	8 33.9	8 09.2	1.0 0.6	7.0 4.0	13.0 7.5	10	8 47.5	8 48.9	8 23.5	1.0 0.6	7.0 4.1	13.0 7.7
11	8 32.8	8 34.2	8 09.4	1.1 0.6	7.1 4.1	13.1 7.5	11	8 47.8	8 49.2	8 23.7	1.1 0.7	7.1 4.2	13.1 7.8
12	8 33.0	8 34.4	8 09.6	1.2 0.7	7.2 4.1	13.2 7.6	12	8 48.0	8 49.4	8 23.9	1.2 0.7	7.2 4.3	13.2 7.8
13	8 33.3	8 34.7	8 09.9	1.3 0.7	7.3 4.2	13.3 7.6	13	8 48.3	8 49.7	8 24.2	1.3 0.8	7.3 4.3	13.3 7.9
14	8 33.5	8 34.9	8 10.1	1.4 0.8	7.4 4.3	13.4 7.7	14	8 48.5	8 49.9	8 24.4	1.4 0.8	7.4 4.4	13.4 7.9
15	8 33.8	8 35.2	8 10.3	1.5 0.9	7.5 4.3	13.5 7.8	15	8 48.8	8 50.2	8 24.7	1.5 0.9	7.5 4.4	13.5 8.0
16	8 34.0	8 35.4	8 10.6	1.6 0.9	7.6 4.4	13.6 7.8	16	8 49.0	8 50.4	8 24.9	1.6 0.9	7.6 4.5	13.6 8.0
17	8 34.3	8 35.7	8 10.8	1.7 1.0	7.7 4.4	13.7 7.9	17	8 49.3	8 50.7	8 25.1	1.7 1.0	7.7 4.6	13.7 8.1
18	8 34.5	8 35.9	8 11.1	1.8 1.0	7.8 4.5	13.8 7.9	18	8 49.5	8 50.9	8 25.4	1.8 1.1	7.8 4.6	13.8 8.2
19	8 34.8	8 36.2	8 11.3	1.9 1.1	7.9 4.5	13.9 8.0	19	8 49.8	8 51.2	8 25.6	1.9 1.1	7.9 4.7	13.9 8.2
20	8 35.0	8 36.4	8 11.5	2.0 1.2	8.0 4.6	14.0 8.1	20	8 50.0	8 51.5	8 25.9	2.0 1.2	8.0 4.7	14.0 8.3
21	8 35.3	8 36.7	8 11.8	2.1 1.2	8.1 4.7	14.1 8.1	21	8 50.3	8 51.7	8 26.1	2.1 1.2	8.1 4.8	14.1 8.3
22	8 35.5	8 36.9	8 12.0	2.2 1.3	8.2 4.7	14.2 8.2	22	8 50.5	8 52.0	8 26.3	2.2 1.3	8.2 4.9	14.2 8.4
23	8 35.8	8 37.2	8 12.3	2.3 1.3	8.3 4.8	14.3 8.2	23	8 50.8	8 52.2	8 26.6	2.3 1.4	8.3 4.9	14.3 8.5
24	8 36.0	8 37.4	8 12.5	2.4 1.4	8.4 4.8	14.4 8.3	24	8 51.0	8 52.5	8 26.8	2.4 1.4	8.4 5.0	14.4 8.5
25	8 36.3	8 37.7	8 12.7	2.5 1.4	8.5 4.9	14.5 8.3	25	8 51.3	8 52.7	8 27.0	2.5 1.5	8.5 5.0	14.5 8.6
26	8 36.5	8 37.9	8 13.0	2.6 1.5	8.6 4.9	14.6 8.4	26	8 51.5	8 53.0	8 27.3	2.6 1.5	8.6 5.1	14.6 8.6
27	8 36.8	8 38.2	8 13.2	2.7 1.6	8.7 5.0	14.7 8.5	27	8 51.8	8 53.2	8 27.5	2.7 1.6	8.7 5.1	14.7 8.7
28	8 37.0	8 38.4	8 13.4	2.8 1.6	8.8 5.1	14.8 8.5	28	8 52.0	8 53.5	8 27.8	2.8 1.7	8.8 5.2	14.8 8.8
29	8 37.3	8 38.7	8 13.7	2.9 1.7	8.9 5.1	14.9 8.6	29	8 52.3	8 53.7	8 28.0	2.9 1.7	8.9 5.3	14.9 8.8
30	8 37.5	8 38.9	8 13.9	3.0 1.7	9.0 5.2	15.0 8.6	30	8 52.5	8 54.0	8 28.2	3.0 1.8	9.0 5.3	15.0 8.9
31	8 37.8	8 39.2	8 14.2	3.1 1.8	9.1 5.2	15.1 8.7	31	8 52.8	8 54.2	8 28.5	3.1 1.8	9.1 5.4	15.1 8.9
32	8 38.0	8 39.4	8 14.4	3.2 1.8	9.2 5.3	15.2 8.7	32	8 53.0	8 54.5	8 28.7	3.2 1.9	9.2 5.4	15.2 9.0
33	8 38.3	8 39.7	8 14.6	3.3 1.9	9.3 5.3	15.3 8.8	33	8 53.3	8 54.7	8 29.0	3.3 2.0	9.3 5.5	15.3 9.1
34	8 38.5	8 39.9	8 14.9	3.4 2.0	9.4 5.4	15.4 8.9	34	8 53.5	8 55.0	8 29.2	3.4 2.0	9.4 5.6	15.4 9.1
35	8 38.8	8 40.2	8 15.1	3.5 2.0	9.5 5.5	15.5 8.9	35	8 53.8	8 55.2	8 29.4	3.5 2.1	9.5 5.6	15.5 9.2
36	8 39.0	8 40.4	8 15.4	3.6 2.1	9.6 5.5	15.6 9.0	36	8 54.0	8 55.5	8 29.7	3.6 2.1	9.6 5.7	15.6 9.2
37	8 39.3	8 40.7	8 15.6	3.7 2.1	9.7 5.6	15.7 9.0	37	8 54.3	8 55.7	8 29.9	3.7 2.2	9.7 5.7	15.7 9.3
38	8 39.5	8 40.9	8 15.8	3.8 2.2	9.8 5.6	15.8 9.1	38	8 54.5	8 56.0	8 30.2	3.8 2.2	9.8 5.8	15.8 9.3
39	8 39.8	8 41.2	8 16.1	3.9 2.2	9.9 5.7	15.9 9.1	39	8 54.8	8 56.2	8 30.4	3.9 2.3	9.9 5.9	15.9 9.4
40	8 40.0	8 41.4	8 16.3	4.0 2.3	10.0 5.8	16.0 9.2	40	8 55.0	8 56.5	8 30.6	4.0 2.4	10.0 5.9	16.0 9.5
41	8 40.3	8 41.7	8 16.5	4.1 2.4	10.1 5.8	16.1 9.3	41	8 55.3	8 56.7	8 30.9	4.1 2.4	10.1 6.0	16.1 9.5
42	8 40.5	8 41.9	8 16.8	4.2 2.4	10.2 5.9	16.2 9.3	42	8 55.5	8 57.0	8 31.1	4.2 2.5	10.2 6.0	16.2 9.6
43	8 40.8	8 42.2	8 17.0	4.3 2.5	10.3 5.9	16.3 9.4	43	8 55.8	8 57.2	8 31.3	4.3 2.5	10.3 6.1	16.3 9.6
44	8 41.0	8 42.4	8 17.3	4.4 2.5	10.4 6.0	16.4 9.4	44	8 56.0	8 57.5	8 31.6	4.4 2.6	10.4 6.2	16.4 9.7
45	8 41.3	8 42.7	8 17.5	4.5 2.6	10.5 6.0	16.5 9.5	45	8 56.3	8 57.7	8 31.8	4.5 2.7	10.5 6.2	16.5 9.8
46	8 41.5	8 42.9	8 17.7	4.6 2.6	10.6 6.1	16.6 9.5	46	8 56.5	8 58.0	8 32.1	4.6 2.7	10.6 6.3	16.6 9.8
47	8 41.8	8 43.2	8 18.0	4.7 2.7	10.7 6.2	16.7 9.6	47	8 56.8	8 58.2	8 32.3	4.7 2.8	10.7 6.3	16.7 9.9
48	8 42.0	8 43.4	8 18.2	4.8 2.8	10.8 6.2	16.8 9.7	48	8 57.0	8 58.5	8 32.5	4.8 2.8	10.8 6.4	16.8 9.9
49	8 42.3	8 43.7	8 18.5	4.9 2.8	10.9 6.3	16.9 9.7	49	8 57.3	8 58.7	8 32.8	4.9 2.9	10.9 6.4	16.9 10.0
50	8 42.5	8 43.9	8 18.7	5.0 2.9	11.0 6.3	17.0 9.8	50	8 57.5	8 59.0	8 33.0	5.0 3.0	11.0 6.5	17.0 10.1
51	8 42.8	8 44.2	8 18.9	5.1 2.9	11.1 6.4	17.1 9.8	51	8 57.8	8 59.2	8 33.3	5.1 3.0	11.1 6.6	17.1 10.1
52	8 43.0	8 44.4	8 19.2	5.2 3.0	11.2 6.4	17.2 9.9	52	8 58.0	8 59.5	8 33.5	5.2 3.1	11.2 6.6	17.2 10.2
53	8 43.3	8 44.7	8 19.4	5.3 3.0	11.3 6.5	17.3 9.9	53	8 58.3	8 59.7	8 33.7	5.3 3.1	11.3 6.7	17.3 10.2
54	8 43.5	8 44.9	8 19.7	5.4 3.1	11.4 6.6	17.4 10.0	54	8 58.5	9 00.0	8 34.0	5.4 3.2	11.4 6.7	17.4 10.3
55	8 43.8	8 45.2	8 19.9	5.5 3.2	11.5 6.6	17.5 10.1	55	8 58.8	9 00.2	8 34.2	5.5 3.3	11.5 6.8	17.5 10.4
56	8 44.0	8 45.4	8 20.1	5.6 3.2	11.6 6.7	17.6 10.1	56	8 59.0	9 00.5	8 34.4	5.6 3.3	11.6 6.9	17.6 10.4
57	8 44.3	8 45.7	8 20.4	5.7 3.3	11.7 6.7	17.7 10.2	57	8 59.3	9 00.7	8 34.7	5.7 3.4	11.7 6.9	17.7 10.5
58	8 44.5	8 45.9	8 20.6	5.8 3.3	11.8 6.8	17.8 10.2	58	8 59.5	9 01.0	8 34.9	5.8 3.4	11.8 7.0	17.8 10.5
59	8 44.8	8 46.2	8 20.8	5.9 3.4	11.9 6.8	17.9 10.3	59	8 59.8	9 01.2	8 35.2	5.9 3.5	11.9 7.0	17.9 10.6
60	8 45.0	8 46.4	8 21.1	6.0 3.5	12.0 6.9	18.0 10.4	60	9 00.0	9 01.5	8 35.4	6.0 3.6	12.0 7.1	18.0 10.7

36 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	37 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	9 00.0	9 01.5	8 35.4	0.0 0.0	6.0 3.7	12.0 7.3	00	9 15.0	9 16.5	8 49.7	0.0 0.0	6.0 3.8	12.0 7.5
01	9 00.3	9 01.7	8 35.6	0.1 0.1	6.1 3.7	12.1 7.4	01	9 15.3	9 16.8	8 50.0	0.1 0.1	6.1 3.8	12.1 7.6
02	9 00.5	9 02.0	8 35.9	0.2 0.1	6.2 3.8	12.2 7.4	02	9 15.5	9 17.0	8 50.2	0.2 0.1	6.2 3.9	12.2 7.6
03	9 00.8	9 02.2	8 36.1	0.3 0.2	6.3 3.8	12.3 7.5	03	9 15.8	9 17.3	8 50.4	0.3 0.2	6.3 3.9	12.3 7.7
04	9 01.0	9 02.5	8 36.4	0.4 0.2	6.4 3.9	12.4 7.5	04	9 16.0	9 17.5	8 50.7	0.4 0.3	6.4 4.0	12.4 7.8
05	9 01.3	9 02.7	8 36.6	0.5 0.3	6.5 4.0	12.5 7.6	05	9 16.3	9 17.8	8 50.9	0.5 0.3	6.5 4.1	12.5 7.8
06	9 01.5	9 03.0	8 36.8	0.6 0.4	6.6 4.0	12.6 7.7	06	9 16.5	9 18.0	8 51.1	0.6 0.4	6.6 4.1	12.6 7.9
07	9 01.8	9 03.2	8 37.1	0.7 0.4	6.7 4.1	12.7 7.7	07	9 16.8	9 18.3	8 51.4	0.7 0.4	6.7 4.2	12.7 7.9
08	9 02.0	9 03.5	8 37.3	0.8 0.5	6.8 4.1	12.8 7.8	08	9 17.0	9 18.5	8 51.6	0.8 0.5	6.8 4.3	12.8 8.0
09	9 02.3	9 03.7	8 37.5	0.9 0.5	6.9 4.2	12.9 7.8	09	9 17.3	9 18.8	8 51.9	0.9 0.6	6.9 4.3	12.9 8.1
10	9 02.5	9 04.0	8 37.8	1.0 0.6	7.0 4.3	13.0 7.9	10	9 17.5	9 19.0	8 52.1	1.0 0.6	7.0 4.4	13.0 8.1
11	9 02.8	9 04.2	8 38.0	1.1 0.7	7.1 4.3	13.1 8.0	11	9 17.8	9 19.3	8 52.3	1.1 0.7	7.1 4.4	13.1 8.2
12	9 03.0	9 04.5	8 38.3	1.2 0.7	7.2 4.4	13.2 8.0	12	9 18.0	9 19.5	8 52.6	1.2 0.8	7.2 4.5	13.2 8.3
13	9 03.3	9 04.7	8 38.5	1.3 0.8	7.3 4.4	13.3 8.1	13	9 18.3	9 19.8	8 52.8	1.3 0.8	7.3 4.6	13.3 8.3
14	9 03.5	9 05.0	8 38.7	1.4 0.9	7.4 4.5	13.4 8.2	14	9 18.5	9 20.0	8 53.1	1.4 0.9	7.4 4.6	13.4 8.4
15	9 03.8	9 05.2	8 39.0	1.5 0.9	7.5 4.6	13.5 8.2	15	9 18.8	9 20.3	8 53.3	1.5 0.9	7.5 4.7	13.5 8.4
16	9 04.0	9 05.5	8 39.2	1.6 1.0	7.6 4.6	13.6 8.3	16	9 19.0	9 20.5	8 53.5	1.6 1.0	7.6 4.8	13.6 8.5
17	9 04.3	9 05.7	8 39.5	1.7 1.0	7.7 4.7	13.7 8.3	17	9 19.3	9 20.8	8 53.8	1.7 1.1	7.7 4.8	13.7 8.6
18	9 04.5	9 06.0	8 39.7	1.8 1.1	7.8 4.7	13.8 8.4	18	9 19.5	9 21.0	8 54.0	1.8 1.1	7.8 4.9	13.8 8.6
19	9 04.8	9 06.2	8 39.9	1.9 1.2	7.9 4.8	13.9 8.5	19	9 19.8	9 21.3	8 54.3	1.9 1.2	7.9 4.9	13.9 8.7
20	9 05.0	9 06.5	8 40.2	2.0 1.2	8.0 4.9	14.0 8.5	20	9 20.0	9 21.5	8 54.5	2.0 1.3	8.0 5.0	14.0 8.8
21	9 05.3	9 06.7	8 40.4	2.1 1.3	8.1 4.9	14.1 8.6	21	9 20.3	9 21.8	8 54.7	2.1 1.3	8.1 5.1	14.1 8.8
22	9 05.5	9 07.0	8 40.6	2.2 1.3	8.2 5.0	14.2 8.6	22	9 20.5	9 22.0	8 55.0	2.2 1.4	8.2 5.1	14.2 8.9
23	9 05.8	9 07.2	8 40.9	2.3 1.4	8.3 5.0	14.3 8.7	23	9 20.8	9 22.3	8 55.2	2.3 1.4	8.3 5.2	14.3 8.9
24	9 06.0	9 07.5	8 41.1	2.4 1.5	8.4 5.1	14.4 8.8	24	9 21.0	9 22.5	8 55.4	2.4 1.5	8.4 5.3	14.4 9.0
25	9 06.3	9 07.7	8 41.4	2.5 1.5	8.5 5.2	14.5 8.8	25	9 21.3	9 22.8	8 55.7	2.5 1.6	8.5 5.3	14.5 9.1
26	9 06.5	9 08.0	8 41.6	2.6 1.6	8.6 5.2	14.6 8.9	26	9 21.5	9 23.0	8 55.9	2.6 1.6	8.6 5.4	14.6 9.1
27	9 06.8	9 08.2	8 41.8	2.7 1.6	8.7 5.3	14.7 8.9	27	9 21.8	9 23.3	8 56.2	2.7 1.7	8.7 5.4	14.7 9.2
28	9 07.0	9 08.5	8 42.1	2.8 1.7	8.8 5.4	14.8 9.0	28	9 22.0	9 23.5	8 56.4	2.8 1.8	8.8 5.5	14.8 9.3
29	9 07.3	9 08.7	8 42.3	2.9 1.8	8.9 5.4	14.9 9.1	29	9 22.3	9 23.8	8 56.6	2.9 1.8	8.9 5.6	14.9 9.3
30	9 07.5	9 09.0	8 42.6	3.0 1.8	9.0 5.5	15.0 9.1	30	9 22.5	9 24.0	8 56.9	3.0 1.9	9.0 5.6	15.0 9.4
31	9 07.8	9 09.2	8 42.8	3.1 1.9	9.1 5.5	15.1 9.2	31	9 22.8	9 24.3	8 57.1	3.1 1.9	9.1 5.7	15.1 9.4
32	9 08.0	9 09.5	8 43.0	3.2 1.9	9.2 5.6	15.2 9.2	32	9 23.0	9 24.5	8 57.4	3.2 2.0	9.2 5.8	15.2 9.5
33	9 08.3	9 09.8	8 43.3	3.3 2.0	9.3 5.7	15.3 9.3	33	9 23.3	9 24.8	8 57.6	3.3 2.1	9.3 5.8	15.3 9.6
34	9 08.5	9 10.0	8 43.5	3.4 2.1	9.4 5.7	15.4 9.4	34	9 23.5	9 25.0	8 57.8	3.4 2.1	9.4 5.9	15.4 9.6
35	9 08.8	9 10.3	8 43.8	3.5 2.1	9.5 5.8	15.5 9.4	35	9 23.8	9 25.3	8 58.1	3.5 2.2	9.5 5.9	15.5 9.7
36	9 09.0	9 10.5	8 44.0	3.6 2.2	9.6 5.8	15.6 9.5	36	9 24.0	9 25.5	8 58.3	3.6 2.3	9.6 6.0	15.6 9.8
37	9 09.3	9 10.8	8 44.2	3.7 2.3	9.7 5.9	15.7 9.6	37	9 24.3	9 25.8	8 58.5	3.7 2.3	9.7 6.1	15.7 9.8
38	9 09.5	9 11.0	8 44.5	3.8 2.3	9.8 6.0	15.8 9.6	38	9 24.5	9 26.0	8 58.8	3.8 2.4	9.8 6.1	15.8 9.9
39	9 09.8	9 11.3	8 44.7	3.9 2.4	9.9 6.0	15.9 9.7	39	9 24.8	9 26.3	8 59.0	3.9 2.4	9.9 6.2	15.9 9.9
40	9 10.0	9 11.5	8 44.9	4.0 2.4	10.0 6.1	16.0 9.7	40	9 25.0	9 26.5	8 59.3	4.0 2.5	10.0 6.3	16.0 10.0
41	9 10.3	9 11.8	8 45.2	4.1 2.5	10.1 6.1	16.1 9.8	41	9 25.3	9 26.8	8 59.5	4.1 2.6	10.1 6.3	16.1 10.1
42	9 10.5	9 12.0	8 45.4	4.2 2.6	10.2 6.2	16.2 9.9	42	9 25.5	9 27.0	8 59.7	4.2 2.6	10.2 6.4	16.2 10.1
43	9 10.8	9 12.3	8 45.7	4.3 2.6	10.3 6.3	16.3 9.9	43	9 25.8	9 27.3	9 00.0	4.3 2.7	10.3 6.4	16.3 10.2
44	9 11.0	9 12.5	8 45.9	4.4 2.7	10.4 6.3	16.4 10.0	44	9 26.0	9 27.5	9 00.2	4.4 2.8	10.4 6.5	16.4 10.3
45	9 11.3	9 12.8	8 46.1	4.5 2.7	10.5 6.4	16.5 10.0	45	9 26.3	9 27.8	9 00.5	4.5 2.8	10.5 6.6	16.5 10.3
46	9 11.5	9 13.0	8 46.4	4.6 2.8	10.6 6.4	16.6 10.1	46	9 26.5	9 28.1	9 00.7	4.6 2.9	10.6 6.6	16.6 10.4
47	9 11.8	9 13.3	8 46.6	4.7 2.9	10.7 6.5	16.7 10.2	47	9 26.8	9 28.3	9 00.9	4.7 2.9	10.7 6.7	16.7 10.4
48	9 12.0	9 13.5	8 46.9	4.8 2.9	10.8 6.6	16.8 10.2	48	9 27.0	9 28.6	9 01.2	4.8 3.0	10.8 6.8	16.8 10.5
49	9 12.3	9 13.8	8 47.1	4.9 3.0	10.9 6.6	16.9 10.3	49	9 27.3	9 28.8	9 01.4	4.9 3.1	10.9 6.8	16.9 10.6
50	9 12.5	9 14.0	8 47.3	5.0 3.0	11.0 6.7	17.0 10.3	50	9 27.5	9 29.1	9 01.6	5.0 3.1	11.0 6.9	17.0 10.6
51	9 12.8	9 14.3	8 47.6	5.1 3.1	11.1 6.8	17.1 10.4	51	9 27.8	9 29.3	9 01.9	5.1 3.2	11.1 6.9	17.1 10.7
52	9 13.0	9 14.5	8 47.8	5.2 3.2	11.2 6.8	17.2 10.5	52	9 28.0	9 29.6	9 02.1	5.2 3.3	11.2 7.0	17.2 10.8
53	9 13.3	9 14.8	8 48.0	5.3 3.2	11.3 6.9	17.3 10.5	53	9 28.3	9 29.8	9 02.4	5.3 3.3	11.3 7.1	17.3 10.8
54	9 13.5	9 15.0	8 48.3	5.4 3.3	11.4 6.9	17.4 10.6	54	9 28.5	9 30.1	9 02.6	5.4 3.4	11.4 7.1	17.4 10.9
55	9 13.8	9 15.3	8 48.5	5.5 3.3	11.5 7.0	17.5 10.6	55	9 28.8	9 30.3	9 02.8	5.5 3.4	11.5 7.2	17.5 10.9
56	9 14.0	9 15.5	8 48.8	5.6 3.4	11.6 7.1	17.6 10.7	56	9 29.0	9 30.6	9 03.1	5.6 3.5	11.6 7.3	17.6 11.0
57	9 14.3	9 15.8	8 49.0	5.7 3.5	11.7 7.1	17.7 10.8	57	9 29.3	9 30.8	9 03.3	5.7 3.6	11.7 7.3	17.7 11.1
58	9 14.5	9 16.0	8 49.2	5.8 3.5	11.8 7.2	17.8 10.8	58	9 29.5	9 31.1	9 03.6	5.8 3.6	11.8 7.4	17.8 11.1
59	9 14.8	9 16.3	8 49.5	5.9 3.6	11.9 7.2	17.9 10.9	59	9 29.8	9 31.3	9 03.8	5.9 3.7	11.9 7.4	17.9 11.2
60	9 15.0	9 16.5	8 49.7	6.0 3.7	12.0 7.3	18.0 11.0	60	9 30.0	9 31.6	9 04.0	6.0 3.8	12.0 7.5	18.0 11.3

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^m 38	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	^m 39	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	° /	° /	° /	/ /	/ /	/ /	s	° /	° /	° /	/ /	/ /	/ /
00	9 30.0	9 31.6	9 04.0	0.0 0.0	6.0 3.9	12.0 7.7	00	9 45.0	9 46.6	9 18.4	0.0 0.0	6.0 4.0	12.0 7.9
01	9 30.3	9 31.8	9 04.3	0.1 0.1	6.1 3.9	12.1 7.8	01	9 45.3	9 46.9	9 18.6	0.1 0.1	6.1 4.0	12.1 8.0
02	9 30.5	9 32.1	9 04.5	0.2 0.1	6.2 4.0	12.2 7.8	02	9 45.5	9 47.1	9 18.8	0.2 0.1	6.2 4.1	12.2 8.0
03	9 30.8	9 32.3	9 04.7	0.3 0.2	6.3 4.0	12.3 7.9	03	9 45.8	9 47.4	9 19.1	0.3 0.2	6.3 4.1	12.3 8.1
04	9 31.0	9 32.6	9 05.0	0.4 0.3	6.4 4.1	12.4 8.0	04	9 46.0	9 47.6	9 19.3	0.4 0.3	6.4 4.2	12.4 8.2
05	9 31.3	9 32.8	9 05.2	0.5 0.3	6.5 4.2	12.5 8.0	05	9 46.3	9 47.9	9 19.5	0.5 0.3	6.5 4.3	12.5 8.2
06	9 31.5	9 33.1	9 05.5	0.6 0.4	6.6 4.2	12.6 8.1	06	9 46.5	9 48.1	9 19.8	0.6 0.4	6.6 4.3	12.6 8.3
07	9 31.8	9 33.3	9 05.7	0.7 0.4	6.7 4.3	12.7 8.1	07	9 46.8	9 48.4	9 20.0	0.7 0.5	6.7 4.4	12.7 8.4
08	9 32.0	9 33.6	9 05.9	0.8 0.5	6.8 4.4	12.8 8.2	08	9 47.0	9 48.6	9 20.3	0.8 0.5	6.8 4.5	12.8 8.4
09	9 32.3	9 33.8	9 06.2	0.9 0.6	6.9 4.4	12.9 8.3	09	9 47.3	9 48.9	9 20.5	0.9 0.6	6.9 4.5	12.9 8.5
10	9 32.5	9 34.1	9 06.4	1.0 0.6	7.0 4.5	13.0 8.3	10	9 47.5	9 49.1	9 20.7	1.0 0.7	7.0 4.6	13.0 8.6
11	9 32.8	9 34.3	9 06.7	1.1 0.7	7.1 4.6	13.1 8.4	11	9 47.8	9 49.4	9 21.0	1.1 0.7	7.1 4.7	13.1 8.6
12	9 33.0	9 34.6	9 06.9	1.2 0.8	7.2 4.6	13.2 8.5	12	9 48.0	9 49.6	9 21.2	1.2 0.8	7.2 4.7	13.2 8.7
13	9 33.3	9 34.8	9 07.1	1.3 0.8	7.3 4.7	13.3 8.5	13	9 48.3	9 49.9	9 21.5	1.3 0.9	7.3 4.8	13.3 8.8
14	9 33.5	9 35.1	9 07.4	1.4 0.9	7.4 4.7	13.4 8.6	14	9 48.5	9 50.1	9 21.7	1.4 0.9	7.4 4.9	13.4 8.8
15	9 33.8	9 35.3	9 07.6	1.5 1.0	7.5 4.8	13.5 8.7	15	9 48.8	9 50.4	9 21.9	1.5 1.0	7.5 4.9	13.5 8.9
16	9 34.0	9 35.6	9 07.9	1.6 1.0	7.6 4.9	13.6 8.7	16	9 49.0	9 50.6	9 22.2	1.6 1.1	7.6 5.0	13.6 9.0
17	9 34.3	9 35.8	9 08.1	1.7 1.1	7.7 4.9	13.7 8.8	17	9 49.3	9 50.9	9 22.4	1.7 1.1	7.7 5.1	13.7 9.0
18	9 34.5	9 36.1	9 08.3	1.8 1.2	7.8 5.0	13.8 8.9	18	9 49.5	9 51.1	9 22.6	1.8 1.2	7.8 5.1	13.8 9.1
19	9 34.8	9 36.3	9 08.6	1.9 1.2	7.9 5.1	13.9 8.9	19	9 49.8	9 51.4	9 22.9	1.9 1.3	7.9 5.2	13.9 9.2
20	9 35.0	9 36.6	9 08.8	2.0 1.3	8.0 5.1	14.0 9.0	20	9 50.0	9 51.6	9 23.1	2.0 1.3	8.0 5.3	14.0 9.2
21	9 35.3	9 36.8	9 09.0	2.1 1.3	8.1 5.2	14.1 9.0	21	9 50.3	9 51.9	9 23.4	2.1 1.4	8.1 5.3	14.1 9.3
22	9 35.5	9 37.1	9 09.3	2.2 1.4	8.2 5.3	14.2 9.1	22	9 50.5	9 52.1	9 23.6	2.2 1.4	8.2 5.4	14.2 9.3
23	9 35.8	9 37.3	9 09.5	2.3 1.5	8.3 5.3	14.3 9.2	23	9 50.8	9 52.4	9 23.8	2.3 1.5	8.3 5.5	14.3 9.4
24	9 36.0	9 37.6	9 09.8	2.4 1.5	8.4 5.4	14.4 9.2	24	9 51.0	9 52.6	9 24.1	2.4 1.6	8.4 5.5	14.4 9.5
25	9 36.3	9 37.8	9 10.0	2.5 1.6	8.5 5.5	14.5 9.3	25	9 51.3	9 52.9	9 24.3	2.5 1.6	8.5 5.6	14.5 9.5
26	9 36.5	9 38.1	9 10.2	2.6 1.7	8.6 5.5	14.6 9.4	26	9 51.5	9 53.1	9 24.6	2.6 1.7	8.6 5.7	14.6 9.6
27	9 36.8	9 38.3	9 10.5	2.7 1.7	8.7 5.6	14.7 9.4	27	9 51.8	9 53.4	9 24.8	2.7 1.8	8.7 5.7	14.7 9.7
28	9 37.0	9 38.6	9 10.7	2.8 1.8	8.8 5.6	14.8 9.5	28	9 52.0	9 53.6	9 25.0	2.8 1.8	8.8 5.8	14.8 9.7
29	9 37.3	9 38.8	9 11.0	2.9 1.9	8.9 5.7	14.9 9.6	29	9 52.3	9 53.9	9 25.3	2.9 1.9	8.9 5.9	14.9 9.8
30	9 37.5	9 39.1	9 11.2	3.0 1.9	9.0 5.8	15.0 9.6	30	9 52.5	9 54.1	9 25.5	3.0 2.0	9.0 5.9	15.0 9.9
31	9 37.8	9 39.3	9 11.4	3.1 2.0	9.1 5.8	15.1 9.7	31	9 52.8	9 54.4	9 25.7	3.1 2.0	9.1 6.0	15.1 9.9
32	9 38.0	9 39.6	9 11.7	3.2 2.1	9.2 5.9	15.2 9.8	32	9 53.0	9 54.6	9 26.0	3.2 2.1	9.2 6.1	15.2 10.0
33	9 38.3	9 39.8	9 11.9	3.3 2.1	9.3 6.0	15.3 9.8	33	9 53.3	9 54.9	9 26.2	3.3 2.2	9.3 6.1	15.3 10.1
34	9 38.5	9 40.1	9 12.1	3.4 2.2	9.4 6.0	15.4 9.9	34	9 53.5	9 55.1	9 26.5	3.4 2.2	9.4 6.2	15.4 10.1
35	9 38.8	9 40.3	9 12.4	3.5 2.2	9.5 6.1	15.5 9.9	35	9 53.8	9 55.4	9 26.7	3.5 2.3	9.5 6.3	15.5 10.2
36	9 39.0	9 40.6	9 12.6	3.6 2.3	9.6 6.2	15.6 10.0	36	9 54.0	9 55.6	9 26.9	3.6 2.4	9.6 6.3	15.6 10.3
37	9 39.3	9 40.8	9 12.9	3.7 2.4	9.7 6.2	15.7 10.1	37	9 54.3	9 55.9	9 27.2	3.7 2.4	9.7 6.4	15.7 10.3
38	9 39.5	9 41.1	9 13.1	3.8 2.4	9.8 6.3	15.8 10.1	38	9 54.5	9 56.1	9 27.4	3.8 2.5	9.8 6.5	15.8 10.4
39	9 39.8	9 41.3	9 13.3	3.9 2.5	9.9 6.4	15.9 10.2	39	9 54.8	9 56.4	9 27.7	3.9 2.6	9.9 6.5	15.9 10.5
40	9 40.0	9 41.6	9 13.6	4.0 2.6	10.0 6.4	16.0 10.3	40	9 55.0	9 56.6	9 27.9	4.0 2.6	10.0 6.6	16.0 10.5
41	9 40.3	9 41.8	9 13.8	4.1 2.6	10.1 6.5	16.1 10.3	41	9 55.3	9 56.9	9 28.1	4.1 2.7	10.1 6.6	16.1 10.6
42	9 40.5	9 42.1	9 14.1	4.2 2.7	10.2 6.5	16.2 10.4	42	9 55.5	9 57.1	9 28.4	4.2 2.8	10.2 6.7	16.2 10.7
43	9 40.8	9 42.3	9 14.3	4.3 2.8	10.3 6.6	16.3 10.5	43	9 55.8	9 57.4	9 28.6	4.3 2.8	10.3 6.8	16.3 10.7
44	9 41.0	9 42.6	9 14.5	4.4 2.8	10.4 6.7	16.4 10.5	44	9 56.0	9 57.6	9 28.8	4.4 2.9	10.4 6.8	16.4 10.8
45	9 41.3	9 42.8	9 14.8	4.5 2.9	10.5 6.7	16.5 10.6	45	9 56.3	9 57.9	9 29.1	4.5 3.0	10.5 6.9	16.5 10.9
46	9 41.5	9 43.1	9 15.0	4.6 3.0	10.6 6.8	16.6 10.7	46	9 56.5	9 58.1	9 29.3	4.6 3.0	10.6 7.0	16.6 10.9
47	9 41.8	9 43.3	9 15.2	4.7 3.0	10.7 6.9	16.7 10.7	47	9 56.8	9 58.4	9 29.6	4.7 3.1	10.7 7.0	16.7 11.0
48	9 42.0	9 43.6	9 15.5	4.8 3.1	10.8 6.9	16.8 10.8	48	9 57.0	9 58.6	9 29.8	4.8 3.2	10.8 7.1	16.8 11.1
49	9 42.3	9 43.8	9 15.7	4.9 3.1	10.9 7.0	16.9 10.8	49	9 57.3	9 58.9	9 30.0	4.9 3.2	10.9 7.2	16.9 11.1
50	9 42.5	9 44.1	9 16.0	5.0 3.2	11.0 7.1	17.0 10.9	50	9 57.5	9 59.1	9 30.3	5.0 3.3	11.0 7.2	17.0 11.2
51	9 42.8	9 44.3	9 16.2	5.1 3.3	11.1 7.1	17.1 11.0	51	9 57.8	9 59.4	9 30.5	5.1 3.4	11.1 7.3	17.1 11.3
52	9 43.0	9 44.6	9 16.4	5.2 3.3	11.2 7.2	17.2 11.0	52	9 58.0	9 59.6	9 30.8	5.2 3.4	11.2 7.4	17.2 11.3
53	9 43.3	9 44.8	9 16.7	5.3 3.4	11.3 7.3	17.3 11.1	53	9 58.3	9 59.9	9 31.0	5.3 3.5	11.3 7.4	17.3 11.4
54	9 43.5	9 45.1	9 16.9	5.4 3.5	11.4 7.3	17.4 11.2	54	9 58.5	10 00.1	9 31.2	5.4 3.6	11.4 7.5	17.4 11.5
55	9 43.8	9 45.3	9 17.2	5.5 3.5	11.5 7.4	17.5 11.2	55	9 58.8	10 00.4	9 31.5	5.5 3.6	11.5 7.6	17.5 11.5
56	9 44.0	9 45.6	9 17.4	5.6 3.6	11.6 7.4	17.6 11.3	56	9 59.0	10 00.6	9 31.7	5.6 3.7	11.6 7.6	17.6 11.6
57	9 44.3	9 45.8	9 17.6	5.7 3.7	11.7 7.5	17.7 11.4	57	9 59.3	10 00.9	9 32.0	5.7 3.8	11.7 7.7	17.7 11.7
58	9 44.5	9 46.1	9 17.9	5.8 3.7	11.8 7.6	17.8 11.4	58	9 59.5	10 01.1	9 32.2	5.8 3.8	11.8 7.8	17.8 11.7
59	9 44.8	9 46.4	9 18.1	5.9 3.8	11.9 7.6	17.9 11.5	59	9 59.8	10 01.4	9 32.4	5.9 3.9	11.9 7.8	17.9 11.8
60	9 45.0	9 46.6	9 18.4	6.0 3.9	12.0 7.7	18.0 11.6	60	10 00.0	10 01.6	9 32.7	6.0 4.0	12.0 7.9	18.0 11.9

40 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	41 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	10 00.0	10 01.6	9 32.7	0.0 0.0	6.0 4.1	12.0 8.1	00	10 15.0	10 16.7	9 47.0	0.0 0.0	6.0 4.2	12.0 8.3
01	10 00.3	10 01.9	9 32.9	0.1 0.1	6.1 4.1	12.1 8.2	01	10 15.3	10 16.9	9 47.2	0.1 0.1	6.1 4.2	12.1 8.4
02	10 00.5	10 02.1	9 33.1	0.2 0.1	6.2 4.2	12.2 8.2	02	10 15.5	10 17.2	9 47.5	0.2 0.1	6.2 4.3	12.2 8.4
03	10 00.8	10 02.4	9 33.4	0.3 0.2	6.3 4.3	12.3 8.3	03	10 15.8	10 17.4	9 47.7	0.3 0.2	6.3 4.4	12.3 8.5
04	10 01.0	10 02.6	9 33.6	0.4 0.3	6.4 4.3	12.4 8.4	04	10 16.0	10 17.7	9 47.9	0.4 0.3	6.4 4.4	12.4 8.6
05	10 01.3	10 02.9	9 33.9	0.5 0.3	6.5 4.4	12.5 8.4	05	10 16.3	10 17.9	9 48.2	0.5 0.3	6.5 4.5	12.5 8.6
06	10 01.5	10 03.1	9 34.1	0.6 0.4	6.6 4.5	12.6 8.5	06	10 16.5	10 18.2	9 48.4	0.6 0.4	6.6 4.6	12.6 8.7
07	10 01.8	10 03.4	9 34.3	0.7 0.5	6.7 4.5	12.7 8.6	07	10 16.8	10 18.4	9 48.7	0.7 0.5	6.7 4.6	12.7 8.8
08	10 02.0	10 03.6	9 34.6	0.8 0.5	6.8 4.6	12.8 8.6	08	10 17.0	10 18.7	9 48.9	0.8 0.6	6.8 4.7	12.8 8.9
09	10 02.3	10 03.9	9 34.8	0.9 0.6	6.9 4.7	12.9 8.7	09	10 17.3	10 18.9	9 49.1	0.9 0.6	6.9 4.8	12.9 8.9
10	10 02.5	10 04.1	9 35.1	1.0 0.7	7.0 4.7	13.0 8.8	10	10 17.5	10 19.2	9 49.4	1.0 0.7	7.0 4.8	13.0 9.0
11	10 02.8	10 04.4	9 35.3	1.1 0.7	7.1 4.8	13.1 8.8	11	10 17.8	10 19.4	9 49.6	1.1 0.8	7.1 4.9	13.1 9.1
12	10 03.0	10 04.7	9 35.5	1.2 0.8	7.2 4.9	13.2 8.9	12	10 18.0	10 19.7	9 49.8	1.2 0.8	7.2 5.0	13.2 9.1
13	10 03.3	10 04.9	9 35.8	1.3 0.9	7.3 4.9	13.3 9.0	13	10 18.3	10 19.9	9 50.1	1.3 0.9	7.3 5.0	13.3 9.2
14	10 03.5	10 05.2	9 36.0	1.4 0.9	7.4 5.0	13.4 9.0	14	10 18.5	10 20.2	9 50.3	1.4 1.0	7.4 5.1	13.4 9.3
15	10 03.8	10 05.4	9 36.2	1.5 1.0	7.5 5.1	13.5 9.1	15	10 18.8	10 20.4	9 50.6	1.5 1.0	7.5 5.2	13.5 9.3
16	10 04.0	10 05.7	9 36.5	1.6 1.1	7.6 5.1	13.6 9.2	16	10 19.0	10 20.7	9 50.8	1.6 1.1	7.6 5.3	13.6 9.4
17	10 04.3	10 05.9	9 36.7	1.7 1.1	7.7 5.2	13.7 9.2	17	10 19.3	10 20.9	9 51.0	1.7 1.2	7.7 5.3	13.7 9.5
18	10 04.5	10 06.2	9 37.0	1.8 1.2	7.8 5.3	13.8 9.3	18	10 19.5	10 21.2	9 51.3	1.8 1.2	7.8 5.4	13.8 9.5
19	10 04.8	10 06.4	9 37.2	1.9 1.3	7.9 5.3	13.9 9.4	19	10 19.8	10 21.4	9 51.5	1.9 1.3	7.9 5.5	13.9 9.6
20	10 05.0	10 06.7	9 37.4	2.0 1.4	8.0 5.4	14.0 9.5	20	10 20.0	10 21.7	9 51.8	2.0 1.4	8.0 5.5	14.0 9.7
21	10 05.3	10 06.9	9 37.7	2.1 1.4	8.1 5.5	14.1 9.5	21	10 20.3	10 21.9	9 52.0	2.1 1.5	8.1 5.6	14.1 9.8
22	10 05.5	10 07.2	9 37.9	2.2 1.5	8.2 5.5	14.2 9.6	22	10 20.5	10 22.2	9 52.2	2.2 1.5	8.2 5.7	14.2 9.8
23	10 05.8	10 07.4	9 38.2	2.3 1.6	8.3 5.6	14.3 9.7	23	10 20.8	10 22.4	9 52.5	2.3 1.6	8.3 5.7	14.3 9.9
24	10 06.0	10 07.7	9 38.4	2.4 1.6	8.4 5.7	14.4 9.7	24	10 21.0	10 22.7	9 52.7	2.4 1.7	8.4 5.8	14.4 10.0
25	10 06.3	10 07.9	9 38.6	2.5 1.7	8.5 5.7	14.5 9.8	25	10 21.3	10 23.0	9 52.9	2.5 1.7	8.5 5.9	14.5 10.0
26	10 06.5	10 08.2	9 38.9	2.6 1.8	8.6 5.8	14.6 9.9	26	10 21.5	10 23.2	9 53.2	2.6 1.8	8.6 5.9	14.6 10.1
27	10 06.8	10 08.4	9 39.1	2.7 1.8	8.7 5.9	14.7 9.9	27	10 21.8	10 23.5	9 53.4	2.7 1.9	8.7 6.0	14.7 10.2
28	10 07.0	10 08.7	9 39.3	2.8 1.9	8.8 5.9	14.8 10.0	28	10 22.0	10 23.7	9 53.7	2.8 1.9	8.8 6.1	14.8 10.2
29	10 07.3	10 08.9	9 39.6	2.9 2.0	8.9 6.0	14.9 10.1	29	10 22.3	10 24.0	9 53.9	2.9 2.0	8.9 6.2	14.9 10.3
30	10 07.5	10 09.2	9 39.8	3.0 2.0	9.0 6.1	15.0 10.1	30	10 22.5	10 24.2	9 54.1	3.0 2.1	9.0 6.2	15.0 10.4
31	10 07.8	10 09.4	9 40.1	3.1 2.1	9.1 6.1	15.1 10.2	31	10 22.8	10 24.5	9 54.4	3.1 2.1	9.1 6.3	15.1 10.4
32	10 08.0	10 09.7	9 40.3	3.2 2.2	9.2 6.2	15.2 10.3	32	10 23.0	10 24.7	9 54.6	3.2 2.2	9.2 6.4	15.2 10.5
33	10 08.3	10 09.9	9 40.5	3.3 2.2	9.3 6.3	15.3 10.3	33	10 23.3	10 25.0	9 54.9	3.3 2.3	9.3 6.4	15.3 10.6
34	10 08.5	10 10.2	9 40.8	3.4 2.3	9.4 6.3	15.4 10.4	34	10 23.5	10 25.2	9 55.1	3.4 2.4	9.4 6.5	15.4 10.7
35	10 08.8	10 10.4	9 41.0	3.5 2.4	9.5 6.4	15.5 10.5	35	10 23.8	10 25.5	9 55.3	3.5 2.4	9.5 6.6	15.5 10.7
36	10 09.0	10 10.7	9 41.3	3.6 2.4	9.6 6.5	15.6 10.5	36	10 24.0	10 25.7	9 55.6	3.6 2.5	9.6 6.6	15.6 10.8
37	10 09.3	10 10.9	9 41.5	3.7 2.5	9.7 6.5	15.7 10.6	37	10 24.3	10 26.0	9 55.8	3.7 2.6	9.7 6.7	15.7 10.9
38	10 09.5	10 11.2	9 41.7	3.8 2.6	9.8 6.6	15.8 10.7	38	10 24.5	10 26.2	9 56.1	3.8 2.6	9.8 6.8	15.8 10.9
39	10 09.8	10 11.4	9 42.0	3.9 2.6	9.9 6.7	15.9 10.7	39	10 24.8	10 26.5	9 56.3	3.9 2.7	9.9 6.8	15.9 11.0
40	10 10.0	10 11.7	9 42.2	4.0 2.7	10.0 6.8	16.0 10.8	40	10 25.0	10 26.7	9 56.5	4.0 2.8	10.0 6.9	16.0 11.1
41	10 10.3	10 11.9	9 42.4	4.1 2.8	10.1 6.8	16.1 10.9	41	10 25.3	10 27.0	9 56.8	4.1 2.8	10.1 7.0	16.1 11.1
42	10 10.5	10 12.2	9 42.7	4.2 2.8	10.2 6.9	16.2 10.9	42	10 25.5	10 27.2	9 57.0	4.2 2.9	10.2 7.1	16.2 11.2
43	10 10.8	10 12.4	9 42.9	4.3 2.9	10.3 7.0	16.3 11.0	43	10 25.8	10 27.5	9 57.2	4.3 3.0	10.3 7.1	16.3 11.3
44	10 11.0	10 12.7	9 43.2	4.4 3.0	10.4 7.0	16.4 11.1	44	10 26.0	10 27.7	9 57.5	4.4 3.0	10.4 7.2	16.4 11.3
45	10 11.3	10 12.9	9 43.4	4.5 3.0	10.5 7.1	16.5 11.1	45	10 26.3	10 28.0	9 57.7	4.5 3.1	10.5 7.3	16.5 11.4
46	10 11.5	10 13.2	9 43.6	4.6 3.1	10.6 7.2	16.6 11.2	46	10 26.5	10 28.2	9 58.0	4.6 3.2	10.6 7.3	16.6 11.5
47	10 11.8	10 13.4	9 43.9	4.7 3.2	10.7 7.2	16.7 11.3	47	10 26.8	10 28.5	9 58.2	4.7 3.3	10.7 7.4	16.7 11.6
48	10 12.0	10 13.7	9 44.1	4.8 3.2	10.8 7.3	16.8 11.3	48	10 27.0	10 28.7	9 58.4	4.8 3.3	10.8 7.5	16.8 11.6
49	10 12.3	10 13.9	9 44.4	4.9 3.3	10.9 7.4	16.9 11.4	49	10 27.3	10 29.0	9 58.7	4.9 3.4	10.9 7.5	16.9 11.7
50	10 12.5	10 14.2	9 44.6	5.0 3.4	11.0 7.4	17.0 11.5	50	10 27.5	10 29.2	9 58.9	5.0 3.5	11.0 7.6	17.0 11.8
51	10 12.8	10 14.4	9 44.8	5.1 3.4	11.1 7.5	17.1 11.5	51	10 27.8	10 29.5	9 59.2	5.1 3.5	11.1 7.7	17.1 11.8
52	10 13.0	10 14.7	9 45.1	5.2 3.5	11.2 7.6	17.2 11.6	52	10 28.0	10 29.7	9 59.4	5.2 3.6	11.2 7.7	17.2 11.9
53	10 13.3	10 14.9	9 45.3	5.3 3.6	11.3 7.6	17.3 11.7	53	10 28.3	10 30.0	9 59.6	5.3 3.7	11.3 7.8	17.3 12.0
54	10 13.5	10 15.2	9 45.6	5.4 3.6	11.4 7.7	17.4 11.7	54	10 28.5	10 30.2	9 59.9	5.4 3.7	11.4 7.9	17.4 12.0
55	10 13.8	10 15.4	9 45.8	5.5 3.7	11.5 7.8	17.5 11.8	55	10 28.8	10 30.5	10 00.1	5.5 3.8	11.5 8.0	17.5 12.1
56	10 14.0	10 15.7	9 46.0	5.6 3.8	11.6 7.8	17.6 11.9	56	10 29.0	10 30.7	10 00.3	5.6 3.9	11.6 8.0	17.6 12.2
57	10 14.3	10 15.9	9 46.3	5.7 3.8	11.7 7.9	17.7 11.9	57	10 29.3	10 31.0	10 00.6	5.7 3.9	11.7 8.1	17.7 12.2
58	10 14.5	10 16.2	9 46.5	5.8 3.9	11.8 8.0	17.8 12.0	58	10 29.5	10 31.2	10 00.8	5.8 4.0	11.8 8.2	17.8 12.3
59	10 14.8	10 16.4	9 46.7	5.9 4.0	11.9 8.0	17.9 12.1	59	10 29.8	10 31.5	10 01.1	5.9 4.1	11.9 8.2	17.9 12.4
60	10 15.0	10 16.7	9 47.0	6.0 4.1	12.0 8.1	18.0 12.2	60	10 30.0	10 31.7	10 01.3	6.0 4.2	12.0 8.3	18.0 12.5

^m 42	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	° /	° /	° /	/ /	/ /	/ /
00	10 30.0	10 31.7	10 01.3	0.0 0.0	6.0 4.3	12.0 8.5
01	10 30.3	10 32.0	10 01.5	0.1 0.1	6.1 4.3	12.1 8.6
02	10 30.5	10 32.2	10 01.8	0.2 0.1	6.2 4.4	12.2 8.6
03	10 30.8	10 32.5	10 02.0	0.3 0.2	6.3 4.5	12.3 8.7
04	10 31.0	10 32.7	10 02.3	0.4 0.3	6.4 4.5	12.4 8.8
05	10 31.3	10 33.0	10 02.5	0.5 0.4	6.5 4.6	12.5 8.9
06	10 31.5	10 33.2	10 02.7	0.6 0.4	6.6 4.7	12.6 8.9
07	10 31.8	10 33.5	10 03.0	0.7 0.5	6.7 4.7	12.7 9.0
08	10 32.0	10 33.7	10 03.2	0.8 0.6	6.8 4.8	12.8 9.1
09	10 32.3	10 34.0	10 03.4	0.9 0.6	6.9 4.9	12.9 9.1
10	10 32.5	10 34.2	10 03.7	1.0 0.7	7.0 5.0	13.0 9.2
11	10 32.8	10 34.5	10 03.9	1.1 0.8	7.1 5.0	13.1 9.3
12	10 33.0	10 34.7	10 04.2	1.2 0.9	7.2 5.1	13.2 9.4
13	10 33.3	10 35.0	10 04.4	1.3 0.9	7.3 5.2	13.3 9.4
14	10 33.5	10 35.2	10 04.6	1.4 1.0	7.4 5.2	13.4 9.5
15	10 33.8	10 35.5	10 04.9	1.5 1.1	7.5 5.3	13.5 9.6
16	10 34.0	10 35.7	10 05.1	1.6 1.1	7.6 5.4	13.6 9.6
17	10 34.3	10 36.0	10 05.4	1.7 1.2	7.7 5.5	13.7 9.7
18	10 34.5	10 36.2	10 05.6	1.8 1.3	7.8 5.5	13.8 9.8
19	10 34.8	10 36.5	10 05.8	1.9 1.3	7.9 5.6	13.9 9.8
20	10 35.0	10 36.7	10 06.1	2.0 1.4	8.0 5.7	14.0 9.9
21	10 35.3	10 37.0	10 06.3	2.1 1.5	8.1 5.7	14.1 10.0
22	10 35.5	10 37.2	10 06.5	2.2 1.6	8.2 5.8	14.2 10.1
23	10 35.8	10 37.5	10 06.8	2.3 1.6	8.3 5.9	14.3 10.1
24	10 36.0	10 37.7	10 07.0	2.4 1.7	8.4 6.0	14.4 10.2
25	10 36.3	10 38.0	10 07.3	2.5 1.8	8.5 6.0	14.5 10.3
26	10 36.5	10 38.2	10 07.5	2.6 1.8	8.6 6.1	14.6 10.3
27	10 36.8	10 38.5	10 07.7	2.7 1.9	8.7 6.2	14.7 10.4
28	10 37.0	10 38.7	10 08.0	2.8 2.0	8.8 6.2	14.8 10.5
29	10 37.3	10 39.0	10 08.2	2.9 2.1	8.9 6.3	14.9 10.6
30	10 37.5	10 39.2	10 08.5	3.0 2.1	9.0 6.4	15.0 10.6
31	10 37.8	10 39.5	10 08.7	3.1 2.2	9.1 6.4	15.1 10.7
32	10 38.0	10 39.7	10 08.9	3.2 2.3	9.2 6.5	15.2 10.8
33	10 38.3	10 40.0	10 09.2	3.3 2.3	9.3 6.6	15.3 10.8
34	10 38.5	10 40.2	10 09.4	3.4 2.4	9.4 6.7	15.4 10.9
35	10 38.8	10 40.5	10 09.7	3.5 2.5	9.5 6.7	15.5 11.0
36	10 39.0	10 40.7	10 09.9	3.6 2.6	9.6 6.8	15.6 11.1
37	10 39.3	10 41.0	10 10.1	3.7 2.6	9.7 6.9	15.7 11.1
38	10 39.5	10 41.3	10 10.4	3.8 2.7	9.8 6.9	15.8 11.2
39	10 39.8	10 41.5	10 10.6	3.9 2.8	9.9 7.0	15.9 11.3
40	10 40.0	10 41.8	10 10.8	4.0 2.8	10.0 7.1	16.0 11.3
41	10 40.3	10 42.0	10 11.1	4.1 2.9	10.1 7.2	16.1 11.4
42	10 40.5	10 42.3	10 11.3	4.2 3.0	10.2 7.2	16.2 11.5
43	10 40.8	10 42.5	10 11.6	4.3 3.0	10.3 7.3	16.3 11.5
44	10 41.0	10 42.8	10 11.8	4.4 3.1	10.4 7.4	16.4 11.6
45	10 41.3	10 43.0	10 12.0	4.5 3.2	10.5 7.4	16.5 11.7
46	10 41.5	10 43.3	10 12.3	4.6 3.3	10.6 7.5	16.6 11.8
47	10 41.8	10 43.5	10 12.5	4.7 3.3	10.7 7.6	16.7 11.8
48	10 42.0	10 43.8	10 12.8	4.8 3.4	10.8 7.7	16.8 11.9
49	10 42.3	10 44.0	10 13.0	4.9 3.5	10.9 7.7	16.9 12.0
50	10 42.5	10 44.3	10 13.2	5.0 3.5	11.0 7.8	17.0 12.0
51	10 42.8	10 44.5	10 13.5	5.1 3.6	11.1 7.9	17.1 12.1
52	10 43.0	10 44.8	10 13.7	5.2 3.7	11.2 7.9	17.2 12.2
53	10 43.3	10 45.0	10 13.9	5.3 3.8	11.3 8.0	17.3 12.3
54	10 43.5	10 45.3	10 14.2	5.4 3.8	11.4 8.1	17.4 12.3
55	10 43.8	10 45.5	10 14.4	5.5 3.9	11.5 8.1	17.5 12.4
56	10 44.0	10 45.8	10 14.7	5.6 4.0	11.6 8.2	17.6 12.5
57	10 44.3	10 46.0	10 14.9	5.7 4.0	11.7 8.3	17.7 12.5
58	10 44.5	10 46.3	10 15.1	5.8 4.1	11.8 8.4	17.8 12.6
59	10 44.8	10 46.5	10 15.4	5.9 4.2	11.9 8.4	17.9 12.7
60	10 45.0	10 46.8	10 15.6	6.0 4.3	12.0 8.5	18.0 12.8

^m 43	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	° /	° /	° /	/ /	/ /	/ /
00	10 45.0	10 46.8	10 15.6	0.0 0.0	6.0 4.4	12.0 8.7
01	10 45.3	10 47.0	10 15.9	0.1 0.1	6.1 4.4	12.1 8.8
02	10 45.5	10 47.3	10 16.1	0.2 0.1	6.2 4.5	12.2 8.8
03	10 45.8	10 47.5	10 16.3	0.3 0.2	6.3 4.6	12.3 8.9
04	10 46.0	10 47.8	10 16.6	0.4 0.3	6.4 4.6	12.4 9.0
05	10 46.3	10 48.0	10 16.8	0.5 0.4	6.5 4.7	12.5 9.1
06	10 46.5	10 48.3	10 17.0	0.6 0.4	6.6 4.8	12.6 9.1
07	10 46.8	10 48.5	10 17.3	0.7 0.5	6.7 4.9	12.7 9.2
08	10 47.0	10 48.8	10 17.5	0.8 0.6	6.8 4.9	12.8 9.3
09	10 47.3	10 49.0	10 17.8	0.9 0.7	6.9 5.0	12.9 9.4
10	10 47.5	10 49.3	10 18.0	1.0 0.7	7.0 5.1	13.0 9.4
11	10 47.8	10 49.5	10 18.2	1.1 0.8	7.1 5.1	13.1 9.5
12	10 48.0	10 49.8	10 18.5	1.2 0.9	7.2 5.2	13.2 9.6
13	10 48.3	10 50.0	10 18.7	1.3 0.9	7.3 5.3	13.3 9.6
14	10 48.5	10 50.3	10 19.0	1.4 1.0	7.4 5.4	13.4 9.7
15	10 48.8	10 50.5	10 19.2	1.5 1.1	7.5 5.4	13.5 9.8
16	10 49.0	10 50.8	10 19.4	1.6 1.2	7.6 5.5	13.6 9.9
17	10 49.3	10 51.0	10 19.7	1.7 1.2	7.7 5.6	13.7 9.9
18	10 49.5	10 51.3	10 19.9	1.8 1.3	7.8 5.7	13.8 10.0
19	10 49.8	10 51.5	10 20.2	1.9 1.4	7.9 5.7	13.9 10.1
20	10 50.0	10 51.8	10 20.4	2.0 1.5	8.0 5.8	14.0 10.2
21	10 50.3	10 52.0	10 20.6	2.1 1.5	8.1 5.9	14.1 10.2
22	10 50.5	10 52.3	10 20.9	2.2 1.6	8.2 5.9	14.2 10.3
23	10 50.8	10 52.5	10 21.1	2.3 1.7	8.3 6.0	14.3 10.4
24	10 51.0	10 52.8	10 21.3	2.4 1.7	8.4 6.1	14.4 10.4
25	10 51.3	10 53.0	10 21.6	2.5 1.8	8.5 6.2	14.5 10.5
26	10 51.5	10 53.3	10 21.8	2.6 1.9	8.6 6.2	14.6 10.6
27	10 51.8	10 53.5	10 22.1	2.7 2.0	8.7 6.3	14.7 10.7
28	10 52.0	10 53.8	10 22.3	2.8 2.0	8.8 6.4	14.8 10.7
29	10 52.3	10 54.0	10 22.5	2.9 2.1	8.9 6.5	14.9 10.8
30	10 52.5	10 54.3	10 22.8	3.0 2.2	9.0 6.5	15.0 10.9
31	10 52.8	10 54.5	10 23.0	3.1 2.2	9.1 6.6	15.1 10.9
32	10 53.0	10 54.8	10 23.3	3.2 2.3	9.2 6.7	15.2 11.0
33	10 53.3	10 55.0	10 23.5	3.3 2.4	9.3 6.7	15.3 11.1
34	10 53.5	10 55.3	10 23.7	3.4 2.5	9.4 6.8	15.4 11.2
35	10 53.8	10 55.5	10 24.0	3.5 2.5	9.5 6.9	15.5 11.2
36	10 54.0	10 55.8	10 24.2	3.6 2.6	9.6 7.0	15.6 11.3
37	10 54.3	10 56.0	10 24.4	3.7 2.7	9.7 7.0	15.7 11.4
38	10 54.5	10 56.3	10 24.7	3.8 2.8	9.8 7.1	15.8 11.5
39	10 54.8	10 56.5	10 24.9	3.9 2.8	9.9 7.2	15.9 11.5
40	10 55.0	10 56.8	10 25.2	4.0 2.9	10.0 7.3	16.0 11.6
41	10 55.3	10 57.0	10 25.4	4.1 3.0	10.1 7.3	16.1 11.7
42	10 55.5	10 57.3	10 25.6	4.2 3.0	10.2 7.4	16.2 11.7
43	10 55.8	10 57.5	10 25.9	4.3 3.1	10.3 7.5	16.3 11.8
44	10 56.0	10 57.8	10 26.1	4.4 3.2	10.4 7.5	16.4 11.9
45	10 56.3	10 58.0	10 26.4	4.5 3.3	10.5 7.6	16.5 12.0
46	10 56.5	10 58.3	10 26.6	4.6 3.3	10.6 7.7	16.6 12.0
47	10 56.8	10 58.5	10 26.8	4.7 3.4	10.7 7.8	16.7 12.1
48	10 57.0	10 58.8	10 27.1	4.8 3.5	10.8 7.8	16.8 12.2
49	10 57.3	10 59.0	10 27.3	4.9 3.6	10.9 7.9	16.9 12.3
50	10 57.5	10 59.3	10 27.5	5.0 3.6	11.0 8.0	17.0 12.3
51	10 57.8	10 59.6	10 27.8	5.1 3.7	11.1 8.0	17.1 12.4
52	10 58.0	10 59.8	10 28.0	5.2 3.8	11.2 8.1	17.2 12.5
53	10 58.3	11 00.1	10 28.3	5.3 3.8	11.3 8.2	17.3 12.5
54	10 58.5	11 00.3	10 28.5	5.4 3.9	11.4 8.3	17.4 12.6
55	10 58.8	11 00.6	10 28.7	5.5 4.0	11.5 8.3	17.5 12.7
56	10 59.0	11 00.8	10 29.0	5.6 4.1	11.6 8.4	17.6 12.8
57	10 59.3	11 01.1	10 29.2	5.7 4.1	11.7 8.5	17.7 12.8
58	10 59.5	11 01.3	10 29.5	5.8 4.2	11.8 8.6	17.8 12.9
59	10 59.8	11 01.6	10 29.7	5.9 4.3	11.9 8.6	17.9 13.0
60	11 00.0	11 01.8	10 29.9	6.0 4.4	12.0 8.7	18.0 13.1

44 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	45 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	s	o /	o /	o /	/ /	/ /	/ /
00	11 00-0	11 01-8	10 29-9	0-0 0-0	6-0 4-5	12-0 8-9	00	11 15-0	11 16-8	10 44-3	0-0 0-0	6-0 4-6	12-0 9-1
01	11 00-3	11 02-1	10 30-2	0-1 0-1	6-1 4-5	12-1 9-0	01	11 15-3	11 17-1	10 44-5	0-1 0-1	6-1 4-6	12-1 9-2
02	11 00-5	11 02-3	10 30-4	0-2 0-1	6-2 4-6	12-2 9-0	02	11 15-5	11 17-3	10 44-7	0-2 0-2	6-2 4-7	12-2 9-3
03	11 00-8	11 02-6	10 30-6	0-3 0-2	6-3 4-7	12-3 9-1	03	11 15-8	11 17-6	10 45-0	0-3 0-2	6-3 4-8	12-3 9-3
04	11 01-0	11 02-8	10 30-9	0-4 0-3	6-4 4-7	12-4 9-2	04	11 16-0	11 17-9	10 45-2	0-4 0-3	6-4 4-9	12-4 9-4
05	11 01-3	11 03-1	10 31-1	0-5 0-4	6-5 4-8	12-5 9-3	05	11 16-3	11 18-1	10 45-4	0-5 0-4	6-5 4-9	12-5 9-5
06	11 01-5	11 03-3	10 31-4	0-6 0-4	6-6 4-9	12-6 9-3	06	11 16-5	11 18-4	10 45-7	0-6 0-5	6-6 5-0	12-6 9-6
07	11 01-8	11 03-6	10 31-6	0-7 0-5	6-7 5-0	12-7 9-4	07	11 16-8	11 18-6	10 45-9	0-7 0-5	6-7 5-1	12-7 9-6
08	11 02-0	11 03-8	10 31-8	0-8 0-6	6-8 5-0	12-8 9-5	08	11 17-0	11 18-9	10 46-2	0-8 0-6	6-8 5-2	12-8 9-7
09	11 02-3	11 04-1	10 32-1	0-9 0-7	6-9 5-1	12-9 9-6	09	11 17-3	11 19-1	10 46-4	0-9 0-7	6-9 5-2	12-9 9-8
10	11 02-5	11 04-3	10 32-3	1-0 0-7	7-0 5-2	13-0 9-6	10	11 17-5	11 19-4	10 46-6	1-0 0-8	7-0 5-3	13-0 9-9
11	11 02-8	11 04-6	10 32-6	1-1 0-8	7-1 5-3	13-1 9-7	11	11 17-8	11 19-6	10 46-9	1-1 0-8	7-1 5-4	13-1 9-9
12	11 03-0	11 04-8	10 32-8	1-2 0-9	7-2 5-3	13-2 9-8	12	11 18-0	11 19-9	10 47-1	1-2 0-9	7-2 5-5	13-2 10-0
13	11 03-3	11 05-1	10 33-0	1-3 1-0	7-3 5-4	13-3 9-9	13	11 18-3	11 20-1	10 47-4	1-3 1-0	7-3 5-5	13-3 10-1
14	11 03-5	11 05-3	10 33-3	1-4 1-0	7-4 5-5	13-4 9-9	14	11 18-5	11 20-4	10 47-6	1-4 1-1	7-4 5-6	13-4 10-2
15	11 03-8	11 05-6	10 33-5	1-5 1-1	7-5 5-6	13-5 10-0	15	11 18-8	11 20-6	10 47-8	1-5 1-1	7-5 5-7	13-5 10-2
16	11 04-0	11 05-8	10 33-8	1-6 1-2	7-6 5-6	13-6 10-1	16	11 19-0	11 20-9	10 48-1	1-6 1-2	7-6 5-8	13-6 10-3
17	11 04-3	11 06-1	10 34-0	1-7 1-3	7-7 5-7	13-7 10-2	17	11 19-3	11 21-1	10 48-3	1-7 1-3	7-7 5-8	13-7 10-4
18	11 04-5	11 06-3	10 34-2	1-8 1-3	7-8 5-8	13-8 10-2	18	11 19-5	11 21-4	10 48-5	1-8 1-4	7-8 5-9	13-8 10-5
19	11 04-8	11 06-6	10 34-5	1-9 1-4	7-9 5-9	13-9 10-3	19	11 19-8	11 21-6	10 48-8	1-9 1-4	7-9 6-0	13-9 10-5
20	11 05-0	11 06-8	10 34-7	2-0 1-5	8-0 5-9	14-0 10-4	20	11 20-0	11 21-9	10 49-0	2-0 1-5	8-0 6-1	14-0 10-6
21	11 05-3	11 07-1	10 34-9	2-1 1-6	8-1 6-0	14-1 10-5	21	11 20-3	11 22-1	10 49-3	2-1 1-6	8-1 6-1	14-1 10-7
22	11 05-5	11 07-3	10 35-2	2-2 1-6	8-2 6-1	14-2 10-5	22	11 20-5	11 22-4	10 49-5	2-2 1-7	8-2 6-2	14-2 10-8
23	11 05-8	11 07-6	10 35-4	2-3 1-7	8-3 6-2	14-3 10-6	23	11 20-8	11 22-6	10 49-7	2-3 1-7	8-3 6-3	14-3 10-8
24	11 06-0	11 07-8	10 35-7	2-4 1-8	8-4 6-2	14-4 10-7	24	11 21-0	11 22-9	10 50-0	2-4 1-8	8-4 6-4	14-4 10-9
25	11 06-3	11 08-1	10 35-9	2-5 1-9	8-5 6-3	14-5 10-8	25	11 21-3	11 23-1	10 50-2	2-5 1-9	8-5 6-4	14-5 11-0
26	11 06-5	11 08-3	10 36-1	2-6 1-9	8-6 6-4	14-6 10-8	26	11 21-5	11 23-4	10 50-5	2-6 2-0	8-6 6-5	14-6 11-1
27	11 06-8	11 08-6	10 36-4	2-7 2-0	8-7 6-5	14-7 10-9	27	11 21-8	11 23-6	10 50-7	2-7 2-0	8-7 6-6	14-7 11-1
28	11 07-0	11 08-8	10 36-6	2-8 2-1	8-8 6-5	14-8 11-0	28	11 22-0	11 23-9	10 50-9	2-8 2-1	8-8 6-7	14-8 11-2
29	11 07-3	11 09-1	10 36-9	2-9 2-2	8-9 6-6	14-9 11-1	29	11 22-3	11 24-1	10 51-2	2-9 2-2	8-9 6-7	14-9 11-3
30	11 07-5	11 09-3	10 37-1	3-0 2-2	9-0 6-7	15-0 11-1	30	11 22-5	11 24-4	10 51-4	3-0 2-3	9-0 6-8	15-0 11-4
31	11 07-8	11 09-6	10 37-3	3-1 2-3	9-1 6-7	15-1 11-2	31	11 22-8	11 24-6	10 51-6	3-1 2-4	9-1 6-9	15-1 11-5
32	11 08-0	11 09-8	10 37-6	3-2 2-4	9-2 6-8	15-2 11-3	32	11 23-0	11 24-9	10 51-9	3-2 2-4	9-2 7-0	15-2 11-5
33	11 08-3	11 10-1	10 37-8	3-3 2-4	9-3 6-9	15-3 11-3	33	11 23-3	11 25-1	10 52-1	3-3 2-5	9-3 7-1	15-3 11-6
34	11 08-5	11 10-3	10 38-0	3-4 2-5	9-4 7-0	15-4 11-4	34	11 23-5	11 25-4	10 52-4	3-4 2-6	9-4 7-1	15-4 11-7
35	11 08-8	11 10-6	10 38-3	3-5 2-6	9-5 7-0	15-5 11-5	35	11 23-8	11 25-6	10 52-6	3-5 2-7	9-5 7-2	15-5 11-8
36	11 09-0	11 10-8	10 38-5	3-6 2-7	9-6 7-1	15-6 11-6	36	11 24-0	11 25-9	10 52-8	3-6 2-7	9-6 7-3	15-6 11-8
37	11 09-3	11 11-1	10 38-8	3-7 2-7	9-7 7-2	15-7 11-6	37	11 24-3	11 26-1	10 53-1	3-7 2-8	9-7 7-4	15-7 11-9
38	11 09-5	11 11-3	10 39-0	3-8 2-8	9-8 7-3	15-8 11-7	38	11 24-5	11 26-4	10 53-3	3-8 2-9	9-8 7-4	15-8 12-0
39	11 09-8	11 11-6	10 39-2	3-9 2-9	9-9 7-3	15-9 11-8	39	11 24-8	11 26-6	10 53-6	3-9 3-0	9-9 7-5	15-9 12-1
40	11 10-0	11 11-8	10 39-5	4-0 3-0	10-0 7-4	16-0 11-9	40	11 25-0	11 26-9	10 53-8	4-0 3-0	10-0 7-6	16-0 12-1
41	11 10-3	11 12-1	10 39-7	4-1 3-0	10-1 7-5	16-1 11-9	41	11 25-3	11 27-1	10 54-0	4-1 3-1	10-1 7-7	16-1 12-2
42	11 10-5	11 12-3	10 40-0	4-2 3-1	10-2 7-6	16-2 12-0	42	11 25-5	11 27-4	10 54-3	4-2 3-2	10-2 7-7	16-2 12-3
43	11 10-8	11 12-6	10 40-2	4-3 3-2	10-3 7-6	16-3 12-1	43	11 25-8	11 27-6	10 54-5	4-3 3-3	10-3 7-8	16-3 12-4
44	11 11-0	11 12-8	10 40-4	4-4 3-3	10-4 7-7	16-4 12-2	44	11 26-0	11 27-9	10 54-7	4-4 3-3	10-4 7-9	16-4 12-4
45	11 11-3	11 13-1	10 40-7	4-5 3-3	10-5 7-8	16-5 12-2	45	11 26-3	11 28-1	10 55-0	4-5 3-4	10-5 8-0	16-5 12-5
46	11 11-5	11 13-3	10 40-9	4-6 3-4	10-6 7-9	16-6 12-3	46	11 26-5	11 28-4	10 55-2	4-6 3-5	10-6 8-0	16-6 12-6
47	11 11-8	11 13-6	10 41-1	4-7 3-5	10-7 7-9	16-7 12-4	47	11 26-8	11 28-6	10 55-5	4-7 3-6	10-7 8-1	16-7 12-7
48	11 12-0	11 13-8	10 41-4	4-8 3-6	10-8 8-0	16-8 12-5	48	11 27-0	11 28-9	10 55-7	4-8 3-6	10-8 8-2	16-8 12-7
49	11 12-3	11 14-1	10 41-6	4-9 3-6	10-9 8-1	16-9 12-5	49	11 27-3	11 29-1	10 55-9	4-9 3-7	10-9 8-3	16-9 12-8
50	11 12-5	11 14-3	10 41-9	5-0 3-7	11-0 8-2	17-0 12-6	50	11 27-5	11 29-4	10 56-2	5-0 3-8	11-0 8-3	17-0 12-9
51	11 12-8	11 14-6	10 42-1	5-1 3-8	11-1 8-2	17-1 12-7	51	11 27-8	11 29-6	10 56-4	5-1 3-9	11-1 8-4	17-1 13-0
52	11 13-0	11 14-8	10 42-3	5-2 3-9	11-2 8-3	17-2 12-8	52	11 28-0	11 29-9	10 56-7	5-2 3-9	11-2 8-5	17-2 13-0
53	11 13-3	11 15-1	10 42-6	5-3 3-9	11-3 8-4	17-3 12-8	53	11 28-3	11 30-1	10 56-9	5-3 4-0	11-3 8-6	17-3 13-1
54	11 13-5	11 15-3	10 42-8	5-4 4-0	11-4 8-5	17-4 12-9	54	11 28-5	11 30-4	10 57-1	5-4 4-1	11-4 8-6	17-4 13-2
55	11 13-8	11 15-6	10 43-1	5-5 4-1	11-5 8-5	17-5 13-0	55	11 28-8	11 30-6	10 57-4	5-5 4-2	11-5 8-7	17-5 13-3
56	11 14-0	11 15-8	10 43-3	5-6 4-2	11-6 8-6	17-6 13-1	56	11 29-0	11 30-9	10 57-6	5-6 4-2	11-6 8-8	17-6 13-3
57	11 14-3	11 16-1	10 43-5	5-7 4-2	11-7 8-7	17-7 13-1	57	11 29-3	11 31-1	10 57-9	5-7 4-3	11-7 8-9	17-7 13-4
58	11 14-5	11 16-3	10 43-8	5-8 4-3	11-8 8-8	17-8 13-2	58	11 29-5	11 31-4	10 58-1	5-8 4-4	11-8 8-9	17-8 13-5
59	11 14-8	11 16-6	10 44-0	5-9 4-4	11-9 8-8	17-9 13-3	59	11 29-8	11 31-6	10 58-3	5-9 4-5	11-9 9-0	17-9 13-6
60	11 15-0	11 16-8	10 44-3	6-0 4-5	12-0 8-9	18-0 13-4	60	11 30-0	11 31-9	10 58-6	6-0 4-6	12-0 9-1	18-0 13-7

46 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	11 30.0	11 31.9	10 58.6	0.0 0.0	6.0 4.7	12.0 9.3
01	11 30.3	11 32.1	10 58.8	0.1 0.1	6.1 4.7	12.1 9.4
02	11 30.5	11 32.4	10 59.0	0.2 0.2	6.2 4.8	12.2 9.5
03	11 30.8	11 32.6	10 59.3	0.3 0.2	6.3 4.9	12.3 9.5
04	11 31.0	11 32.9	10 59.5	0.4 0.3	6.4 5.0	12.4 9.6
05	11 31.3	11 33.1	10 59.8	0.5 0.4	6.5 5.0	12.5 9.7
06	11 31.5	11 33.4	11 00.0	0.6 0.5	6.6 5.1	12.6 9.8
07	11 31.8	11 33.6	11 00.2	0.7 0.5	6.7 5.2	12.7 9.8
08	11 32.0	11 33.9	11 00.5	0.8 0.6	6.8 5.3	12.8 9.9
09	11 32.3	11 34.1	11 00.7	0.9 0.7	6.9 5.3	12.9 10.0
10	11 32.5	11 34.4	11 01.0	1.0 0.8	7.0 5.4	13.0 10.1
11	11 32.8	11 34.6	11 01.2	1.1 0.9	7.1 5.5	13.1 10.2
12	11 33.0	11 34.9	11 01.4	1.2 0.9	7.2 5.6	13.2 10.2
13	11 33.3	11 35.1	11 01.7	1.3 1.0	7.3 5.7	13.3 10.3
14	11 33.5	11 35.4	11 01.9	1.4 1.1	7.4 5.7	13.4 10.4
15	11 33.8	11 35.6	11 02.1	1.5 1.2	7.5 5.8	13.5 10.5
16	11 34.0	11 35.9	11 02.4	1.6 1.2	7.6 5.9	13.6 10.5
17	11 34.3	11 36.2	11 02.6	1.7 1.3	7.7 6.0	13.7 10.6
18	11 34.5	11 36.4	11 02.9	1.8 1.4	7.8 6.0	13.8 10.7
19	11 34.8	11 36.7	11 03.1	1.9 1.5	7.9 6.1	13.9 10.8
20	11 35.0	11 36.9	11 03.3	2.0 1.6	8.0 6.2	14.0 10.9
21	11 35.3	11 37.2	11 03.6	2.1 1.6	8.1 6.3	14.1 10.9
22	11 35.5	11 37.4	11 03.8	2.2 1.7	8.2 6.4	14.2 11.0
23	11 35.8	11 37.7	11 04.1	2.3 1.8	8.3 6.4	14.3 11.1
24	11 36.0	11 37.9	11 04.3	2.4 1.9	8.4 6.5	14.4 11.2
25	11 36.3	11 38.2	11 04.5	2.5 1.9	8.5 6.6	14.5 11.2
26	11 36.5	11 38.4	11 04.8	2.6 2.0	8.6 6.7	14.6 11.3
27	11 36.8	11 38.7	11 05.0	2.7 2.1	8.7 6.7	14.7 11.4
28	11 37.0	11 38.9	11 05.2	2.8 2.2	8.8 6.8	14.8 11.5
29	11 37.3	11 39.2	11 05.5	2.9 2.2	8.9 6.9	14.9 11.5
30	11 37.5	11 39.4	11 05.7	3.0 2.3	9.0 7.0	15.0 11.6
31	11 37.8	11 39.7	11 06.0	3.1 2.4	9.1 7.1	15.1 11.7
32	11 38.0	11 39.9	11 06.2	3.2 2.5	9.2 7.1	15.2 11.8
33	11 38.3	11 40.2	11 06.4	3.3 2.6	9.3 7.2	15.3 11.9
34	11 38.5	11 40.4	11 06.7	3.4 2.6	9.4 7.3	15.4 11.9
35	11 38.8	11 40.7	11 06.9	3.5 2.7	9.5 7.4	15.5 12.0
36	11 39.0	11 40.9	11 07.2	3.6 2.8	9.6 7.4	15.6 12.1
37	11 39.3	11 41.2	11 07.4	3.7 2.9	9.7 7.5	15.7 12.2
38	11 39.5	11 41.4	11 07.6	3.8 2.9	9.8 7.6	15.8 12.2
39	11 39.8	11 41.7	11 07.9	3.9 3.0	9.9 7.7	15.9 12.3
40	11 40.0	11 41.9	11 08.1	4.0 3.1	10.0 7.8	16.0 12.4
41	11 40.3	11 42.2	11 08.3	4.1 3.2	10.1 7.8	16.1 12.5
42	11 40.5	11 42.4	11 08.6	4.2 3.3	10.2 7.9	16.2 12.6
43	11 40.8	11 42.7	11 08.8	4.3 3.3	10.3 8.0	16.3 12.6
44	11 41.0	11 42.9	11 09.1	4.4 3.4	10.4 8.1	16.4 12.7
45	11 41.3	11 43.2	11 09.3	4.5 3.5	10.5 8.1	16.5 12.8
46	11 41.5	11 43.4	11 09.5	4.6 3.6	10.6 8.2	16.6 12.9
47	11 41.8	11 43.7	11 09.8	4.7 3.6	10.7 8.3	16.7 12.9
48	11 42.0	11 43.9	11 10.0	4.8 3.7	10.8 8.4	16.8 13.0
49	11 42.3	11 44.2	11 10.3	4.9 3.8	10.9 8.4	16.9 13.1
50	11 42.5	11 44.4	11 10.5	5.0 3.9	11.0 8.5	17.0 13.2
51	11 42.8	11 44.7	11 10.7	5.1 4.0	11.1 8.6	17.1 13.3
52	11 43.0	11 44.9	11 11.0	5.2 4.0	11.2 8.7	17.2 13.3
53	11 43.3	11 45.2	11 11.2	5.3 4.1	11.3 8.8	17.3 13.4
54	11 43.5	11 45.4	11 11.5	5.4 4.2	11.4 8.8	17.4 13.5
55	11 43.8	11 45.7	11 11.7	5.5 4.3	11.5 8.9	17.5 13.6
56	11 44.0	11 45.9	11 11.9	5.6 4.3	11.6 9.0	17.6 13.6
57	11 44.3	11 46.2	11 12.2	5.7 4.4	11.7 9.1	17.7 13.7
58	11 44.5	11 46.4	11 12.4	5.8 4.5	11.8 9.1	17.8 13.8
59	11 44.8	11 46.7	11 12.6	5.9 4.6	11.9 9.2	17.9 13.9
60	11 45.0	11 46.9	11 12.9	6.0 4.7	12.0 9.3	18.0 14.0

47 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	11 45.0	11 46.9	11 12.9	0.0 0.0	6.0 4.8	12.0 9.5
01	11 45.3	11 47.2	11 13.1	0.1 0.1	6.1 4.8	12.1 9.6
02	11 45.5	11 47.4	11 13.4	0.2 0.2	6.2 4.9	12.2 9.7
03	11 45.8	11 47.7	11 13.6	0.3 0.2	6.3 5.0	12.3 9.7
04	11 46.0	11 47.9	11 13.8	0.4 0.3	6.4 5.1	12.4 9.8
05	11 46.3	11 48.2	11 14.1	0.5 0.4	6.5 5.1	12.5 9.9
06	11 46.5	11 48.4	11 14.3	0.6 0.5	6.6 5.2	12.6 10.0
07	11 46.8	11 48.7	11 14.6	0.7 0.6	6.7 5.3	12.7 10.1
08	11 47.0	11 48.9	11 14.8	0.8 0.6	6.8 5.4	12.8 10.1
09	11 47.3	11 49.2	11 15.0	0.9 0.7	6.9 5.5	12.9 10.2
10	11 47.5	11 49.4	11 15.3	1.0 0.8	7.0 5.5	13.0 10.3
11	11 47.8	11 49.7	11 15.5	1.1 0.9	7.1 5.6	13.1 10.4
12	11 48.0	11 49.9	11 15.7	1.2 1.0	7.2 5.7	13.2 10.5
13	11 48.3	11 50.2	11 16.0	1.3 1.0	7.3 5.8	13.3 10.5
14	11 48.5	11 50.4	11 16.2	1.4 1.1	7.4 5.9	13.4 10.6
15	11 48.8	11 50.7	11 16.5	1.5 1.2	7.5 5.9	13.5 10.7
16	11 49.0	11 50.9	11 16.7	1.6 1.3	7.6 6.0	13.6 10.8
17	11 49.3	11 51.2	11 16.9	1.7 1.3	7.7 6.1	13.7 10.8
18	11 49.5	11 51.4	11 17.2	1.8 1.4	7.8 6.2	13.8 10.9
19	11 49.8	11 51.7	11 17.4	1.9 1.5	7.9 6.3	13.9 11.0
20	11 50.0	11 51.9	11 17.7	2.0 1.6	8.0 6.3	14.0 11.1
21	11 50.3	11 52.2	11 17.9	2.1 1.7	8.1 6.4	14.1 11.2
22	11 50.5	11 52.4	11 18.1	2.2 1.7	8.2 6.5	14.2 11.2
23	11 50.8	11 52.7	11 18.4	2.3 1.8	8.3 6.6	14.3 11.3
24	11 51.0	11 52.9	11 18.6	2.4 1.9	8.4 6.7	14.4 11.4
25	11 51.3	11 53.2	11 18.8	2.5 2.0	8.5 6.7	14.5 11.5
26	11 51.5	11 53.4	11 19.1	2.6 2.1	8.6 6.8	14.6 11.6
27	11 51.8	11 53.7	11 19.3	2.7 2.1	8.7 6.9	14.7 11.6
28	11 52.0	11 53.9	11 19.6	2.8 2.2	8.8 7.0	14.8 11.7
29	11 52.3	11 54.2	11 19.8	2.9 2.3	8.9 7.0	14.9 11.8
30	11 52.5	11 54.5	11 20.0	3.0 2.4	9.0 7.1	15.0 11.9
31	11 52.8	11 54.7	11 20.3	3.1 2.5	9.1 7.2	15.1 12.0
32	11 53.0	11 55.0	11 20.5	3.2 2.5	9.2 7.3	15.2 12.0
33	11 53.3	11 55.2	11 20.8	3.3 2.6	9.3 7.4	15.3 12.1
34	11 53.5	11 55.5	11 21.0	3.4 2.7	9.4 7.4	15.4 12.2
35	11 53.8	11 55.7	11 21.2	3.5 2.8	9.5 7.5	15.5 12.3
36	11 54.0	11 56.0	11 21.5	3.6 2.9	9.6 7.6	15.6 12.4
37	11 54.3	11 56.2	11 21.7	3.7 2.9	9.7 7.7	15.7 12.4
38	11 54.5	11 56.5	11 22.0	3.8 3.0	9.8 7.8	15.8 12.5
39	11 54.8	11 56.7	11 22.2	3.9 3.1	9.9 7.8	15.9 12.6
40	11 55.0	11 57.0	11 22.4	4.0 3.2	10.0 7.9	16.0 12.7
41	11 55.3	11 57.2	11 22.7	4.1 3.2	10.1 8.0	16.1 12.7
42	11 55.5	11 57.5	11 22.9	4.2 3.3	10.2 8.1	16.2 12.8
43	11 55.8	11 57.7	11 23.1	4.3 3.4	10.3 8.2	16.3 12.9
44	11 56.0	11 58.0	11 23.4	4.4 3.5	10.4 8.2	16.4 13.0
45	11 56.3	11 58.2	11 23.6	4.5 3.6	10.5 8.3	16.5 13.1
46	11 56.5	11 58.5	11 23.9	4.6 3.6	10.6 8.4	16.6 13.1
47	11 56.8	11 58.7	11 24.1	4.7 3.7	10.7 8.5	16.7 13.2
48	11 57.0	11 59.0	11 24.3	4.8 3.8	10.8 8.6	16.8 13.3
49	11 57.3	11 59.2	11 24.6	4.9 3.9	10.9 8.6	16.9 13.4
50	11 57.5	11 59.5	11 24.8	5.0 4.0	11.0 8.7	17.0 13.5
51	11 57.8	11 59.7	11 25.1	5.1 4.0	11.1 8.8	17.1 13.5
52	11 58.0	12 00.0	11 25.3	5.2 4.1	11.2 8.9	17.2 13.6
53	11 58.3	12 00.2	11 25.5	5.3 4.2	11.3 8.9	17.3 13.7
54	11 58.5	12 00.5	11 25.8	5.4 4.3	11.4 9.0	17.4 13.8
55	11 58.8	12 00.7	11 26.0	5.5 4.4	11.5 9.1	17.5 13.9
56	11 59.0	12 01.0	11 26.2	5.6 4.4	11.6 9.2	17.6 13.9
57	11 59.3	12 01.2	11 26.5	5.7 4.5	11.7 9.3	17.7 14.0
58	11 59.5	12 01.5	11 26.7	5.8 4.6	11.8 9.3	17.8 14.1
59	11 59.8	12 01.7	11 27.0	5.9 4.7	11.9 9.4	17.9 14.2
60	12 00.0	12 02.0	11 27.2	6.0 4.8	12.0 9.5	18.0 14.3

^m 48	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	12 00-0	12 02-0	11 27-2	0-0 0-0	6-0 4-9	12-0 9-7
01	12 00-3	12 02-2	11 27-4	0-1 0-1	6-1 4-9	12-1 9-8
02	12 00-5	12 02-5	11 27-7	0-2 0-2	6-2 5-0	12-2 9-9
03	12 00-8	12 02-7	11 27-9	0-3 0-2	6-3 5-1	12-3 9-9
04	12 01-0	12 03-0	11 28-2	0-4 0-3	6-4 5-2	12-4 10-0
05	12 01-3	12 03-2	11 28-4	0-5 0-4	6-5 5-3	12-5 10-1
06	12 01-5	12 03-5	11 28-6	0-6 0-5	6-6 5-3	12-6 10-2
07	12 01-8	12 03-7	11 28-9	0-7 0-6	6-7 5-4	12-7 10-3
08	12 02-0	12 04-0	11 29-1	0-8 0-6	6-8 5-5	12-8 10-3
09	12 02-3	12 04-2	11 29-3	0-9 0-7	6-9 5-6	12-9 10-4
10	12 02-5	12 04-5	11 29-6	1-0 0-8	7-0 5-7	13-0 10-5
11	12 02-8	12 04-7	11 29-8	1-1 0-9	7-1 5-7	13-1 10-6
12	12 03-0	12 05-0	11 30-1	1-2 1-0	7-2 5-8	13-2 10-7
13	12 03-3	12 05-2	11 30-3	1-3 1-1	7-3 5-9	13-3 10-8
14	12 03-5	12 05-5	11 30-5	1-4 1-1	7-4 6-0	13-4 10-8
15	12 03-8	12 05-7	11 30-8	1-5 1-2	7-5 6-1	13-5 10-9
16	12 04-0	12 06-0	11 31-0	1-6 1-3	7-6 6-1	13-6 11-0
17	12 04-3	12 06-2	11 31-3	1-7 1-4	7-7 6-2	13-7 11-1
18	12 04-5	12 06-5	11 31-5	1-8 1-5	7-8 6-3	13-8 11-2
19	12 04-8	12 06-7	11 31-7	1-9 1-5	7-9 6-4	13-9 11-2
20	12 05-0	12 07-0	11 32-0	2-0 1-6	8-0 6-5	14-0 11-3
21	12 05-3	12 07-2	11 32-2	2-1 1-7	8-1 6-5	14-1 11-4
22	12 05-5	12 07-5	11 32-4	2-2 1-8	8-2 6-6	14-2 11-5
23	12 05-8	12 07-7	11 32-7	2-3 1-9	8-3 6-7	14-3 11-6
24	12 06-0	12 08-0	11 32-9	2-4 1-9	8-4 6-8	14-4 11-6
25	12 06-3	12 08-2	11 33-2	2-5 2-0	8-5 6-9	14-5 11-7
26	12 06-5	12 08-5	11 33-4	2-6 2-1	8-6 7-0	14-6 11-8
27	12 06-8	12 08-7	11 33-6	2-7 2-2	8-7 7-0	14-7 11-9
28	12 07-0	12 09-0	11 33-9	2-8 2-3	8-8 7-1	14-8 12-0
29	12 07-3	12 09-2	11 34-1	2-9 2-3	8-9 7-2	14-9 12-0
30	12 07-5	12 09-5	11 34-4	3-0 2-4	9-0 7-3	15-0 12-1
31	12 07-8	12 09-7	11 34-6	3-1 2-5	9-1 7-4	15-1 12-2
32	12 08-0	12 10-0	11 34-8	3-2 2-6	9-2 7-4	15-2 12-3
33	12 08-3	12 10-2	11 35-1	3-3 2-7	9-3 7-5	15-3 12-4
34	12 08-5	12 10-5	11 35-3	3-4 2-7	9-4 7-6	15-4 12-4
35	12 08-8	12 10-7	11 35-6	3-5 2-8	9-5 7-7	15-5 12-5
36	12 09-0	12 11-0	11 35-8	3-6 2-9	9-6 7-8	15-6 12-6
37	12 09-3	12 11-2	11 36-0	3-7 3-0	9-7 7-8	15-7 12-7
38	12 09-5	12 11-5	11 36-3	3-8 3-1	9-8 7-9	15-8 12-8
39	12 09-8	12 11-7	11 36-5	3-9 3-2	9-9 8-0	15-9 12-9
40	12 10-0	12 12-0	11 36-7	4-0 3-2	10-0 8-1	16-0 12-9
41	12 10-3	12 12-2	11 37-0	4-1 3-3	10-1 8-2	16-1 13-0
42	12 10-5	12 12-5	11 37-2	4-2 3-4	10-2 8-2	16-2 13-1
43	12 10-8	12 12-8	11 37-5	4-3 3-5	10-3 8-3	16-3 13-2
44	12 11-0	12 13-0	11 37-7	4-4 3-6	10-4 8-4	16-4 13-3
45	12 11-3	12 13-3	11 37-9	4-5 3-6	10-5 8-5	16-5 13-3
46	12 11-5	12 13-5	11 38-2	4-6 3-7	10-6 8-6	16-6 13-4
47	12 11-8	12 13-8	11 38-4	4-7 3-8	10-7 8-6	16-7 13-5
48	12 12-0	12 14-0	11 38-7	4-8 3-9	10-8 8-7	16-8 13-6
49	12 12-3	12 14-3	11 38-9	4-9 4-0	10-9 8-8	16-9 13-7
50	12 12-5	12 14-5	11 39-1	5-0 4-0	11-0 8-9	17-0 13-7
51	12 12-8	12 14-8	11 39-4	5-1 4-1	11-1 9-0	17-1 13-8
52	12 13-0	12 15-0	11 39-6	5-2 4-2	11-2 9-1	17-2 13-9
53	12 13-3	12 15-3	11 39-8	5-3 4-3	11-3 9-1	17-3 14-0
54	12 13-5	12 15-5	11 40-1	5-4 4-4	11-4 9-2	17-4 14-1
55	12 13-8	12 15-8	11 40-3	5-5 4-4	11-5 9-3	17-5 14-1
56	12 14-0	12 16-0	11 40-6	5-6 4-5	11-6 9-4	17-6 14-2
57	12 14-3	12 16-3	11 40-8	5-7 4-6	11-7 9-5	17-7 14-3
58	12 14-5	12 16-5	11 41-0	5-8 4-7	11-8 9-5	17-8 14-4
59	12 14-8	12 16-8	11 41-3	5-9 4-8	11-9 9-6	17-9 14-5
60	12 15-0	12 17-0	11 41-5	6-0 4-9	12-0 9-7	18-0 14-6

^m 49	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	12 15-0	12 17-0	11 41-5	0-0 0-0	6-0 5-0	12-0 9-9
01	12 15-3	12 17-3	11 41-8	0-1 0-1	6-1 5-0	12-1 10-0
02	12 15-5	12 17-5	11 42-0	0-2 0-2	6-2 5-1	12-2 10-1
03	12 15-8	12 17-8	11 42-2	0-3 0-2	6-3 5-2	12-3 10-1
04	12 16-0	12 18-0	11 42-5	0-4 0-3	6-4 5-3	12-4 10-2
05	12 16-3	12 18-3	11 42-7	0-5 0-4	6-5 5-4	12-5 10-3
06	12 16-5	12 18-5	11 42-9	0-6 0-5	6-6 5-4	12-6 10-4
07	12 16-8	12 18-8	11 43-2	0-7 0-6	6-7 5-5	12-7 10-5
08	12 17-0	12 19-0	11 43-4	0-8 0-7	6-8 5-6	12-8 10-6
09	12 17-3	12 19-3	11 43-7	0-9 0-7	6-9 5-7	12-9 10-6
10	12 17-5	12 19-5	11 43-9	1-0 0-8	7-0 5-8	13-0 10-7
11	12 17-8	12 19-8	11 44-1	1-1 0-9	7-1 5-9	13-1 10-8
12	12 18-0	12 20-0	11 44-4	1-2 1-0	7-2 5-9	13-2 10-9
13	12 18-3	12 20-3	11 44-6	1-3 1-1	7-3 6-0	13-3 11-0
14	12 18-5	12 20-5	11 44-9	1-4 1-2	7-4 6-1	13-4 11-1
15	12 18-8	12 20-8	11 45-1	1-5 1-2	7-5 6-2	13-5 11-1
16	12 19-0	12 21-0	11 45-3	1-6 1-3	7-6 6-3	13-6 11-2
17	12 19-3	12 21-3	11 45-6	1-7 1-4	7-7 6-4	13-7 11-3
18	12 19-5	12 21-5	11 45-8	1-8 1-5	7-8 6-4	13-8 11-4
19	12 19-8	12 21-8	11 46-1	1-9 1-6	7-9 6-5	13-9 11-5
20	12 20-0	12 22-0	11 46-3	2-0 1-7	8-0 6-6	14-0 11-6
21	12 20-3	12 22-3	11 46-5	2-1 1-7	8-1 6-7	14-1 11-6
22	12 20-5	12 22-5	11 46-8	2-2 1-8	8-2 6-8	14-2 11-7
23	12 20-8	12 22-8	11 47-0	2-3 1-9	8-3 6-8	14-3 11-8
24	12 21-0	12 23-0	11 47-2	2-4 2-0	8-4 6-9	14-4 11-9
25	12 21-3	12 23-3	11 47-5	2-5 2-1	8-5 7-0	14-5 12-0
26	12 21-5	12 23-5	11 47-7	2-6 2-1	8-6 7-1	14-6 12-0
27	12 21-8	12 23-8	11 48-0	2-7 2-2	8-7 7-2	14-7 12-1
28	12 22-0	12 24-0	11 48-2	2-8 2-3	8-8 7-3	14-8 12-2
29	12 22-3	12 24-3	11 48-4	2-9 2-4	8-9 7-3	14-9 12-3
30	12 22-5	12 24-5	11 48-7	3-0 2-5	9-0 7-4	15-0 12-4
31	12 22-8	12 24-8	11 48-9	3-1 2-6	9-1 7-5	15-1 12-5
32	12 23-0	12 25-0	11 49-2	3-2 2-6	9-2 7-6	15-2 12-5
33	12 23-3	12 25-3	11 49-4	3-3 2-7	9-3 7-7	15-3 12-6
34	12 23-5	12 25-5	11 49-6	3-4 2-8	9-4 7-8	15-4 12-7
35	12 23-8	12 25-8	11 49-9	3-5 2-9	9-5 7-8	15-5 12-8
36	12 24-0	12 26-0	11 50-1	3-6 3-0	9-6 7-9	15-6 12-9
37	12 24-3	12 26-3	11 50-3	3-7 3-1	9-7 8-0	15-7 13-0
38	12 24-5	12 26-5	11 50-6	3-8 3-1	9-8 8-1	15-8 13-0
39	12 24-8	12 26-8	11 50-8	3-9 3-2	9-9 8-2	15-9 13-1
40	12 25-0	12 27-0	11 51-1	4-0 3-3	10-0 8-3	16-0 13-2
41	12 25-3	12 27-3	11 51-3	4-1 3-4	10-1 8-3	16-1 13-3
42	12 25-5	12 27-5	11 51-5	4-2 3-5	10-2 8-4	16-2 13-4
43	12 25-8	12 27-8	11 51-8	4-3 3-5	10-3 8-5	16-3 13-4
44	12 26-0	12 28-0	11 52-0	4-4 3-6	10-4 8-6	16-4 13-5
45	12 26-3	12 28-3	11 52-3	4-5 3-7	10-5 8-7	16-5 13-6
46	12 26-5	12 28-5	11 52-5	4-6 3-8	10-6 8-7	16-6 13-7
47	12 26-8	12 28-8	11 52-7	4-7 3-9	10-7 8-8	16-7 13-8
48	12 27-0	12 29-0	11 53-0	4-8 4-0	10-8 8-9	16-8 13-9
49	12 27-3	12 29-3	11 53-2	4-9 4-0	10-9 9-0	16-9 13-9
50	12 27-5	12 29-5	11 53-4	5-0 4-1	11-0 9-1	17-0 14-0
51	12 27-8	12 29-8	11 53-7	5-1 4-2	11-1 9-2	17-1 14-1
52	12 28-0	12 30-0	11 53-9	5-2 4-3	11-2 9-2	17-2 14-2
53	12 28-3	12 30-3	11 54-2	5-3 4-4	11-3 9-3	17-3 14-3
54	12 28-5	12 30-5	11 54-4	5-4 4-5	11-4 9-4	17-4 14-4
55	12 28-8	12 30-8	11 54-6	5-5 4-5	11-5 9-5	17-5 14-4
56	12 29-0	12 31-1	11 54-9	5-6 4-6	11-6 9-6	17-6 14-5
57	12 29-3	12 31-3	11 55-1	5-7 4-7	11-7 9-7	17-7 14-6
58	12 29-5	12 31-6	11 55-4	5-8 4-8	11-8 9-7	17-8 14-7
59	12 29-8	12 31-8	11 55-6	5-9 4-9	11-9 9-8	17-9 14-8
60	12 30-0	12 32-1	11 55-8	6-0 5-0	12-0 9-9	18-0 14-9

^m 50	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	12 30.0	12 32.1	11 55.8	0.0	0.0	6.0 5.1 12.0 10.1
01	12 30.3	12 32.3	11 56.1	0.1	0.1	6.1 5.1 12.1 10.2
02	12 30.5	12 32.6	11 56.3	0.2	0.2	6.2 5.2 12.2 10.3
03	12 30.8	12 32.8	11 56.5	0.3	0.3	6.3 5.3 12.3 10.4
04	12 31.0	12 33.1	11 56.8	0.4	0.3	6.4 5.4 12.4 10.4
05	12 31.3	12 33.3	11 57.0	0.5	0.4	6.5 5.5 12.5 10.5
06	12 31.5	12 33.6	11 57.3	0.6	0.5	6.6 5.6 12.6 10.6
07	12 31.8	12 33.8	11 57.5	0.7	0.6	6.7 5.6 12.7 10.7
08	12 32.0	12 34.1	11 57.7	0.8	0.7	6.8 5.7 12.8 10.8
09	12 32.3	12 34.3	11 58.0	0.9	0.8	6.9 5.8 12.9 10.9
10	12 32.5	12 34.6	11 58.2	1.0	0.8	7.0 5.9 13.0 10.9
11	12 32.8	12 34.8	11 58.5	1.1	0.9	7.1 6.0 13.1 11.0
12	12 33.0	12 35.1	11 58.7	1.2	1.0	7.2 6.1 13.2 11.1
13	12 33.3	12 35.3	11 58.9	1.3	1.1	7.3 6.1 13.3 11.2
14	12 33.5	12 35.6	11 59.2	1.4	1.2	7.4 6.2 13.4 11.3
15	12 33.8	12 35.8	11 59.4	1.5	1.3	7.5 6.3 13.5 11.4
16	12 34.0	12 36.1	11 59.7	1.6	1.3	7.6 6.4 13.6 11.4
17	12 34.3	12 36.3	11 59.9	1.7	1.4	7.7 6.5 13.7 11.5
18	12 34.5	12 36.6	12 00.1	1.8	1.5	7.8 6.6 13.8 11.6
19	12 34.8	12 36.8	12 00.4	1.9	1.6	7.9 6.6 13.9 11.7
20	12 35.0	12 37.1	12 00.6	2.0	1.7	8.0 6.7 14.0 11.8
21	12 35.3	12 37.3	12 00.8	2.1	1.8	8.1 6.8 14.1 11.9
22	12 35.5	12 37.6	12 01.1	2.2	1.9	8.2 6.9 14.2 12.0
23	12 35.8	12 37.8	12 01.3	2.3	1.9	8.3 7.0 14.3 12.0
24	12 36.0	12 38.1	12 01.6	2.4	2.0	8.4 7.1 14.4 12.1
25	12 36.3	12 38.3	12 01.8	2.5	2.1	8.5 7.2 14.5 12.2
26	12 36.5	12 38.6	12 02.0	2.6	2.2	8.6 7.2 14.6 12.3
27	12 36.8	12 38.8	12 02.3	2.7	2.3	8.7 7.3 14.7 12.4
28	12 37.0	12 39.1	12 02.5	2.8	2.4	8.8 7.4 14.8 12.5
29	12 37.3	12 39.3	12 02.8	2.9	2.4	8.9 7.5 14.9 12.5
30	12 37.5	12 39.6	12 03.0	3.0	2.5	9.0 7.6 15.0 12.6
31	12 37.8	12 39.8	12 03.2	3.1	2.6	9.1 7.7 15.1 12.7
32	12 38.0	12 40.1	12 03.5	3.2	2.7	9.2 7.7 15.2 12.8
33	12 38.3	12 40.3	12 03.7	3.3	2.8	9.3 7.8 15.3 12.9
34	12 38.5	12 40.6	12 03.9	3.4	2.9	9.4 7.9 15.4 13.0
35	12 38.8	12 40.8	12 04.2	3.5	2.9	9.5 8.0 15.5 13.0
36	12 39.0	12 41.1	12 04.4	3.6	3.0	9.6 8.1 15.6 13.1
37	12 39.3	12 41.3	12 04.7	3.7	3.1	9.7 8.2 15.7 13.2
38	12 39.5	12 41.6	12 04.9	3.8	3.2	9.8 8.2 15.8 13.3
39	12 39.8	12 41.8	12 05.1	3.9	3.3	9.9 8.3 15.9 13.4
40	12 40.0	12 42.1	12 05.4	4.0	3.4	10.0 8.4 16.0 13.5
41	12 40.3	12 42.3	12 05.6	4.1	3.5	10.1 8.5 16.1 13.6
42	12 40.5	12 42.6	12 05.9	4.2	3.5	10.2 8.6 16.2 13.6
43	12 40.8	12 42.8	12 06.1	4.3	3.6	10.3 8.7 16.3 13.7
44	12 41.0	12 43.1	12 06.3	4.4	3.7	10.4 8.8 16.4 13.8
45	12 41.3	12 43.3	12 06.6	4.5	3.8	10.5 8.8 16.5 13.9
46	12 41.5	12 43.6	12 06.8	4.6	3.9	10.6 8.9 16.6 14.0
47	12 41.8	12 43.8	12 07.0	4.7	4.0	10.7 9.0 16.7 14.1
48	12 42.0	12 44.1	12 07.3	4.8	4.0	10.8 9.1 16.8 14.1
49	12 42.3	12 44.3	12 07.5	4.9	4.1	10.9 9.2 16.9 14.2
50	12 42.5	12 44.6	12 07.8	5.0	4.2	11.0 9.3 17.0 14.3
51	12 42.8	12 44.8	12 08.0	5.1	4.3	11.1 9.3 17.1 14.4
52	12 43.0	12 45.1	12 08.2	5.2	4.4	11.2 9.4 17.2 14.5
53	12 43.3	12 45.3	12 08.5	5.3	4.5	11.3 9.5 17.3 14.6
54	12 43.5	12 45.6	12 08.7	5.4	4.5	11.4 9.6 17.4 14.6
55	12 43.8	12 45.8	12 09.0	5.5	4.6	11.5 9.7 17.5 14.7
56	12 44.0	12 46.1	12 09.2	5.6	4.7	11.6 9.8 17.6 14.8
57	12 44.3	12 46.3	12 09.4	5.7	4.8	11.7 9.8 17.7 14.9
58	12 44.5	12 46.6	12 09.7	5.8	4.9	11.8 9.9 17.8 15.0
59	12 44.8	12 46.8	12 09.9	5.9	5.0	11.9 10.0 17.9 15.1
60	12 45.0	12 47.1	12 10.2	6.0	5.1	12.0 10.1 18.0 15.2

^m 51	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	12 45.0	12 47.1	12 10.2	0.0	0.0	6.0 5.2 12.0 10.3
01	12 45.3	12 47.3	12 10.4	0.1	0.1	6.1 5.2 12.1 10.4
02	12 45.5	12 47.6	12 10.6	0.2	0.2	6.2 5.3 12.2 10.5
03	12 45.8	12 47.8	12 10.9	0.3	0.3	6.3 5.4 12.3 10.6
04	12 46.0	12 48.1	12 11.1	0.4	0.3	6.4 5.5 12.4 10.6
05	12 46.3	12 48.3	12 11.3	0.5	0.4	6.5 5.6 12.5 10.7
06	12 46.5	12 48.6	12 11.6	0.6	0.5	6.6 5.7 12.6 10.8
07	12 46.8	12 48.8	12 11.8	0.7	0.6	6.7 5.8 12.7 10.9
08	12 47.0	12 49.1	12 12.1	0.8	0.7	6.8 5.8 12.8 11.0
09	12 47.3	12 49.4	12 12.3	0.9	0.8	6.9 5.9 12.9 11.1
10	12 47.5	12 49.6	12 12.5	1.0	0.9	7.0 6.0 13.0 11.2
11	12 47.8	12 49.9	12 12.8	1.1	0.9	7.1 6.1 13.1 11.2
12	12 48.0	12 50.1	12 13.0	1.2	1.0	7.2 6.2 13.2 11.3
13	12 48.3	12 50.4	12 13.3	1.3	1.1	7.3 6.3 13.3 11.4
14	12 48.5	12 50.6	12 13.5	1.4	1.2	7.4 6.4 13.4 11.5
15	12 48.8	12 50.9	12 13.7	1.5	1.3	7.5 6.4 13.5 11.6
16	12 49.0	12 51.1	12 14.0	1.6	1.4	7.6 6.5 13.6 11.7
17	12 49.3	12 51.4	12 14.2	1.7	1.5	7.7 6.6 13.7 11.8
18	12 49.5	12 51.6	12 14.4	1.8	1.5	7.8 6.7 13.8 11.8
19	12 49.8	12 51.9	12 14.7	1.9	1.6	7.9 6.8 13.9 11.9
20	12 50.0	12 52.1	12 14.9	2.0	1.7	8.0 6.9 14.0 12.0
21	12 50.3	12 52.4	12 15.2	2.1	1.8	8.1 7.0 14.1 12.1
22	12 50.5	12 52.6	12 15.4	2.2	1.9	8.2 7.0 14.2 12.2
23	12 50.8	12 52.9	12 15.6	2.3	2.0	8.3 7.1 14.3 12.3
24	12 51.0	12 53.1	12 15.9	2.4	2.1	8.4 7.2 14.4 12.4
25	12 51.3	12 53.4	12 16.1	2.5	2.1	8.5 7.3 14.5 12.4
26	12 51.5	12 53.6	12 16.4	2.6	2.2	8.6 7.4 14.6 12.5
27	12 51.8	12 53.9	12 16.6	2.7	2.3	8.7 7.5 14.7 12.6
28	12 52.0	12 54.1	12 16.8	2.8	2.4	8.8 7.6 14.8 12.7
29	12 52.3	12 54.4	12 17.1	2.9	2.5	8.9 7.6 14.9 12.8
30	12 52.5	12 54.6	12 17.3	3.0	2.6	9.0 7.7 15.0 12.9
31	12 52.8	12 54.9	12 17.5	3.1	2.7	9.1 7.8 15.1 13.0
32	12 53.0	12 55.1	12 17.8	3.2	2.7	9.2 7.9 15.2 13.0
33	12 53.3	12 55.4	12 18.0	3.3	2.8	9.3 8.0 15.3 13.1
34	12 53.5	12 55.6	12 18.3	3.4	2.9	9.4 8.1 15.4 13.2
35	12 53.8	12 55.9	12 18.5	3.5	3.0	9.5 8.2 15.5 13.3
36	12 54.0	12 56.1	12 18.7	3.6	3.1	9.6 8.2 15.6 13.4
37	12 54.3	12 56.4	12 19.0	3.7	3.2	9.7 8.3 15.7 13.5
38	12 54.5	12 56.6	12 19.2	3.8	3.3	9.8 8.4 15.8 13.6
39	12 54.8	12 56.9	12 19.5	3.9	3.3	9.9 8.5 15.9 13.6
40	12 55.0	12 57.1	12 19.7	4.0	3.4	10.0 8.6 16.0 13.7
41	12 55.3	12 57.4	12 19.9	4.1	3.5	10.1 8.7 16.1 13.8
42	12 55.5	12 57.6	12 20.2	4.2	3.6	10.2 8.8 16.2 13.9
43	12 55.8	12 57.9	12 20.4	4.3	3.7	10.3 8.8 16.3 14.0
44	12 56.0	12 58.1	12 20.6	4.4	3.8	10.4 8.9 16.4 14.1
45	12 56.3	12 58.4	12 20.9	4.5	3.9	10.5 9.0 16.5 14.2
46	12 56.5	12 58.6	12 21.1	4.6	3.9	10.6 9.1 16.6 14.2
47	12 56.8	12 58.9	12 21.4	4.7	4.0	10.7 9.2 16.7 14.3
48	12 57.0	12 59.1	12 21.6	4.8	4.1	10.8 9.3 16.8 14.4
49	12 57.3	12 59.4	12 21.8	4.9	4.2	10.9 9.4 16.9 14.5
50	12 57.5	12 59.6	12 22.1	5.0	4.3	11.0 9.4 17.0 14.6
51	12 57.8	12 59.9	12 22.3	5.1	4.4	11.1 9.5 17.1 14.7
52	12 58.0	13 00.1	12 22.6	5.2	4.5	11.2 9.6 17.2 14.8
53	12 58.3	13 00.4	12 22.8	5.3	4.5	11.3 9.7 17.3 14.8
54	12 58.5	13 00.6	12 23.0	5.4	4.6	11.4 9.8 17.4 14.9
55	12 58.8	13 00.9	12 23.3	5.5	4.7	11.5 9.9 17.5 15.0
56	12 59.0	13 01.1	12 23.5	5.6	4.8	11.6 10.0 17.6 15.1
57	12 59.3	13 01.4	12 23.8	5.7	4.9	11.7 10.0 17.7 15.2
58	12 59.5	13 01.6	12 24.0	5.8	5.0	11.8 10.1 17.8 15.3
59	12 59.8	13 01.9	12 24.2	5.9	5.1	11.9 10.2 17.9 15.4
60	13 00.0	13 02.1	12 24.5	6.0	5.2	12.0 10.3 18.0 15.5

52 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	13 00-0	13 02-1	12 24-5	0-0 0-0	6-0 5-3	12-0 10-5
01	13 00-3	13 02-4	12 24-7	0-1 0-1	6-1 5-3	12-1 10-6
02	13 00-5	13 02-6	12 24-9	0-2 0-2	6-2 5-4	12-2 10-7
03	13 00-8	13 02-9	12 25-2	0-3 0-3	6-3 5-5	12-3 10-8
04	13 01-0	13 03-1	12 25-4	0-4 0-4	6-4 5-6	12-4 10-9
05	13 01-3	13 03-4	12 25-7	0-5 0-4	6-5 5-7	12-5 10-9
06	13 01-5	13 03-6	12 25-9	0-6 0-5	6-6 5-8	12-6 11-0
07	13 01-8	13 03-9	12 26-1	0-7 0-6	6-7 5-9	12-7 11-1
08	13 02-0	13 04-1	12 26-4	0-8 0-7	6-8 6-0	12-8 11-2
09	13 02-3	13 04-4	12 26-6	0-9 0-8	6-9 6-0	12-9 11-3
10	13 02-5	13 04-6	12 26-9	1-0 0-9	7-0 6-1	13-0 11-4
11	13 02-8	13 04-9	12 27-1	1-1 1-0	7-1 6-2	13-1 11-5
12	13 03-0	13 05-1	12 27-3	1-2 1-1	7-2 6-3	13-2 11-6
13	13 03-3	13 05-4	12 27-6	1-3 1-1	7-3 6-4	13-3 11-6
14	13 03-5	13 05-6	12 27-8	1-4 1-2	7-4 6-5	13-4 11-7
15	13 03-8	13 05-9	12 28-0	1-5 1-3	7-5 6-6	13-5 11-8
16	13 04-0	13 06-1	12 28-3	1-6 1-4	7-6 6-7	13-6 11-9
17	13 04-3	13 06-4	12 28-5	1-7 1-5	7-7 6-7	13-7 12-0
18	13 04-5	13 06-6	12 28-8	1-8 1-6	7-8 6-8	13-8 12-1
19	13 04-8	13 06-9	12 29-0	1-9 1-7	7-9 6-9	13-9 12-2
20	13 05-0	13 07-1	12 29-2	2-0 1-8	8-0 7-0	14-0 12-3
21	13 05-3	13 07-4	12 29-5	2-1 1-8	8-1 7-1	14-1 12-3
22	13 05-5	13 07-7	12 29-7	2-2 1-9	8-2 7-2	14-2 12-4
23	13 05-8	13 07-9	12 30-0	2-3 2-0	8-3 7-3	14-3 12-5
24	13 06-0	13 08-2	12 30-2	2-4 2-1	8-4 7-4	14-4 12-6
25	13 06-3	13 08-4	12 30-4	2-5 2-2	8-5 7-4	14-5 12-7
26	13 06-5	13 08-7	12 30-7	2-6 2-3	8-6 7-5	14-6 12-8
27	13 06-8	13 08-9	12 30-9	2-7 2-4	8-7 7-6	14-7 12-9
28	13 07-0	13 09-2	12 31-1	2-8 2-5	8-8 7-7	14-8 13-0
29	13 07-3	13 09-4	12 31-4	2-9 2-5	8-9 7-8	14-9 13-0
30	13 07-5	13 09-7	12 31-6	3-0 2-6	9-0 7-9	15-0 13-1
31	13 07-8	13 09-9	12 31-9	3-1 2-7	9-1 8-0	15-1 13-2
32	13 08-0	13 10-2	12 32-1	3-2 2-8	9-2 8-0	15-2 13-3
33	13 08-3	13 10-4	12 32-3	3-3 2-9	9-3 8-1	15-3 13-4
34	13 08-5	13 10-7	12 32-6	3-4 3-0	9-4 8-2	15-4 13-5
35	13 08-8	13 10-9	12 32-8	3-5 3-1	9-5 8-3	15-5 13-6
36	13 09-0	13 11-2	12 33-1	3-6 3-2	9-6 8-4	15-6 13-7
37	13 09-3	13 11-4	12 33-3	3-7 3-2	9-7 8-5	15-7 13-7
38	13 09-5	13 11-7	12 33-5	3-8 3-3	9-8 8-6	15-8 13-8
39	13 09-8	13 11-9	12 33-8	3-9 3-4	9-9 8-7	15-9 13-9
40	13 10-0	13 12-2	12 34-0	4-0 3-5	10-0 8-8	16-0 14-0
41	13 10-3	13 12-4	12 34-2	4-1 3-6	10-1 8-8	16-1 14-1
42	13 10-5	13 12-7	12 34-5	4-2 3-7	10-2 8-9	16-2 14-2
43	13 10-8	13 12-9	12 34-7	4-3 3-8	10-3 9-0	16-3 14-3
44	13 11-0	13 13-2	12 35-0	4-4 3-9	10-4 9-1	16-4 14-3
45	13 11-3	13 13-4	12 35-2	4-5 3-9	10-5 9-2	16-5 14-4
46	13 11-5	13 13-7	12 35-4	4-6 4-0	10-6 9-3	16-6 14-5
47	13 11-8	13 13-9	12 35-7	4-7 4-1	10-7 9-4	16-7 14-6
48	13 12-0	13 14-2	12 35-9	4-8 4-2	10-8 9-5	16-8 14-7
49	13 12-3	13 14-4	12 36-2	4-9 4-3	10-9 9-5	16-9 14-8
50	13 12-5	13 14-7	12 36-4	5-0 4-4	11-0 9-6	17-0 14-9
51	13 12-8	13 14-9	12 36-6	5-1 4-5	11-1 9-7	17-1 15-0
52	13 13-0	13 15-2	12 36-9	5-2 4-6	11-2 9-8	17-2 15-1
53	13 13-3	13 15-4	12 37-1	5-3 4-6	11-3 9-9	17-3 15-1
54	13 13-5	13 15-7	12 37-4	5-4 4-7	11-4 10-0	17-4 15-2
55	13 13-8	13 15-9	12 37-6	5-5 4-8	11-5 10-1	17-5 15-3
56	13 14-0	13 16-2	12 37-8	5-6 4-9	11-6 10-2	17-6 15-4
57	13 14-3	13 16-4	12 38-1	5-7 5-0	11-7 10-2	17-7 15-5
58	13 14-5	13 16-7	12 38-3	5-8 5-1	11-8 10-3	17-8 15-6
59	13 14-8	13 16-9	12 38-5	5-9 5-2	11-9 10-4	17-9 15-7
60	13 15-0	13 17-2	12 38-8	6-0 5-3	12-0 10-5	18-0 15-8

53 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	13 15-0	13 17-2	12 38-8	0-0 0-0	6-0 5-4	12-0 10-7
01	13 15-3	13 17-4	12 39-0	0-1 0-1	6-1 5-4	12-1 10-8
02	13 15-5	13 17-7	12 39-3	0-2 0-2	6-2 5-5	12-2 10-9
03	13 15-8	13 17-9	12 39-5	0-3 0-3	6-3 5-6	12-3 11-0
04	13 16-0	13 18-2	12 39-7	0-4 0-4	6-4 5-7	12-4 11-1
05	13 16-3	13 18-4	12 40-0	0-5 0-4	6-5 5-8	12-5 11-1
06	13 16-5	13 18-7	12 40-2	0-6 0-5	6-6 5-9	12-6 11-2
07	13 16-8	13 18-9	12 40-5	0-7 0-6	6-7 6-0	12-7 11-3
08	13 17-0	13 19-2	12 40-7	0-8 0-7	6-8 6-1	12-8 11-4
09	13 17-3	13 19-4	12 40-9	0-9 0-8	6-9 6-2	12-9 11-5
10	13 17-5	13 19-7	12 41-2	1-0 0-9	7-0 6-2	13-0 11-6
11	13 17-8	13 19-9	12 41-4	1-1 1-0	7-1 6-3	13-1 11-7
12	13 18-0	13 20-2	12 41-6	1-2 1-1	7-2 6-4	13-2 11-8
13	13 18-3	13 20-4	12 41-9	1-3 1-2	7-3 6-5	13-3 11-9
14	13 18-5	13 20-7	12 42-1	1-4 1-2	7-4 6-6	13-4 11-9
15	13 18-8	13 20-9	12 42-4	1-5 1-3	7-5 6-7	13-5 12-0
16	13 19-0	13 21-2	12 42-6	1-6 1-4	7-6 6-8	13-6 12-1
17	13 19-3	13 21-4	12 42-8	1-7 1-5	7-7 6-9	13-7 12-2
18	13 19-5	13 21-7	12 43-1	1-8 1-6	7-8 7-0	13-8 12-3
19	13 19-8	13 21-9	12 43-3	1-9 1-7	7-9 7-0	13-9 12-4
20	13 20-0	13 22-2	12 43-6	2-0 1-8	8-0 7-1	14-0 12-5
21	13 20-3	13 22-4	12 43-8	2-1 1-9	8-1 7-2	14-1 12-6
22	13 20-5	13 22-7	12 44-0	2-2 2-0	8-2 7-3	14-2 12-7
23	13 20-8	13 22-9	12 44-3	2-3 2-1	8-3 7-4	14-3 12-8
24	13 21-0	13 23-2	12 44-5	2-4 2-1	8-4 7-5	14-4 12-8
25	13 21-3	13 23-4	12 44-7	2-5 2-2	8-5 7-6	14-5 12-9
26	13 21-5	13 23-7	12 45-0	2-6 2-3	8-6 7-7	14-6 13-0
27	13 21-8	13 23-9	12 45-2	2-7 2-4	8-7 7-8	14-7 13-1
28	13 22-0	13 24-2	12 45-5	2-8 2-5	8-8 7-8	14-8 13-2
29	13 22-3	13 24-4	12 45-7	2-9 2-6	8-9 7-9	14-9 13-3
30	13 22-5	13 24-7	12 45-9	3-0 2-7	9-0 8-0	15-0 13-4
31	13 22-8	13 24-9	12 46-2	3-1 2-8	9-1 8-1	15-1 13-5
32	13 23-0	13 25-2	12 46-4	3-2 2-9	9-2 8-2	15-2 13-6
33	13 23-3	13 25-4	12 46-7	3-3 2-9	9-3 8-3	15-3 13-6
34	13 23-5	13 25-7	12 46-9	3-4 3-0	9-4 8-4	15-4 13-7
35	13 23-8	13 26-0	12 47-1	3-5 3-1	9-5 8-5	15-5 13-8
36	13 24-0	13 26-2	12 47-4	3-6 3-2	9-6 8-6	15-6 13-9
37	13 24-3	13 26-5	12 47-6	3-7 3-3	9-7 8-6	15-7 14-0
38	13 24-5	13 26-7	12 47-9	3-8 3-4	9-8 8-7	15-8 14-1
39	13 24-8	13 27-0	12 48-1	3-9 3-5	9-9 8-8	15-9 14-2
40	13 25-0	13 27-2	12 48-3	4-0 3-6	10-0 8-9	16-0 14-3
41	13 25-3	13 27-5	12 48-6	4-1 3-7	10-1 9-0	16-1 14-4
42	13 25-5	13 27-7	12 48-8	4-2 3-7	10-2 9-1	16-2 14-4
43	13 25-8	13 28-0	12 49-0	4-3 3-8	10-3 9-2	16-3 14-5
44	13 26-0	13 28-2	12 49-3	4-4 3-9	10-4 9-3	16-4 14-6
45	13 26-3	13 28-5	12 49-5	4-5 4-0	10-5 9-4	16-5 14-7
46	13 26-5	13 28-7	12 49-8	4-6 4-1	10-6 9-5	16-6 14-8
47	13 26-8	13 29-0	12 50-0	4-7 4-2	10-7 9-5	16-7 14-9
48	13 27-0	13 29-2	12 50-2	4-8 4-3	10-8 9-6	16-8 15-0
49	13 27-3	13 29-5	12 50-5	4-9 4-4	10-9 9-7	16-9 15-1
50	13 27-5	13 29-7	12 50-7	5-0 4-5	11-0 9-8	17-0 15-2
51	13 27-8	13 30-0	12 51-0	5-1 4-5	11-1 9-9	17-1 15-2
52	13 28-0	13 30-2	12 51-2	5-2 4-6	11-2 10-0	17-2 15-3
53	13 28-3	13 30-5	12 51-4	5-3 4-7	11-3 10-1	17-3 15-4
54	13 28-5	13 30-7	12 51-7	5-4 4-8	11-4 10-2	17-4 15-5
55	13 28-8	13 31-0	12 51-9	5-5 4-9	11-5 10-3	17-5 15-6
56	13 29-0	13 31-2	12 52-1	5-6 5-0	11-6 10-3	17-6 15-7
57	13 29-3	13 31-5	12 52-4	5-7 5-1	11-7 10-4	17-7 15-8
58	13 29-5	13 31-7	12 52-6	5-8 5-2	11-8 10-5	17-8 15-9
59	13 29-8	13 32-0	12 52-9	5-9 5-3	11-9 10-6	17-9 16-0
60	13 30-0	13 32-2	12 53-1	6-0 5-4	12-0 10-7	18-0 16-1

54 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	13 30-0	13 32-2	12 53-1	0-0 0-0	6-0 5-5	12-0 10-9
01	13 30-3	13 32-5	12 53-3	0-1 0-1	6-1 5-5	12-1 11-0
02	13 30-5	13 32-7	12 53-6	0-2 0-2	6-2 5-6	12-2 11-1
03	13 30-8	13 33-0	12 53-8	0-3 0-3	6-3 5-7	12-3 11-2
04	13 31-0	13 33-2	12 54-1	0-4 0-4	6-4 5-8	12-4 11-3
05	13 31-3	13 33-5	12 54-3	0-5 0-5	6-5 5-9	12-5 11-4
06	13 31-5	13 33-7	12 54-5	0-6 0-5	6-6 6-0	12-6 11-4
07	13 31-8	13 34-0	12 54-8	0-7 0-6	6-7 6-1	12-7 11-5
08	13 32-0	13 34-2	12 55-0	0-8 0-7	6-8 6-2	12-8 11-6
09	13 32-3	13 34-5	12 55-2	0-9 0-8	6-9 6-3	12-9 11-7
10	13 32-5	13 34-7	12 55-5	1-0 0-9	7-0 6-4	13-0 11-8
11	13 32-8	13 35-0	12 55-7	1-1 1-0	7-1 6-4	13-1 11-9
12	13 33-0	13 35-2	12 56-0	1-2 1-1	7-2 6-5	13-2 12-0
13	13 33-3	13 35-5	12 56-2	1-3 1-2	7-3 6-6	13-3 12-1
14	13 33-5	13 35-7	12 56-4	1-4 1-3	7-4 6-7	13-4 12-2
15	13 33-8	13 36-0	12 56-7	1-5 1-4	7-5 6-8	13-5 12-3
16	13 34-0	13 36-2	12 56-9	1-6 1-5	7-6 6-9	13-6 12-4
17	13 34-3	13 36-5	12 57-2	1-7 1-5	7-7 7-0	13-7 12-4
18	13 34-5	13 36-7	12 57-4	1-8 1-6	7-8 7-1	13-8 12-5
19	13 34-8	13 37-0	12 57-6	1-9 1-7	7-9 7-2	13-9 12-6
20	13 35-0	13 37-2	12 57-9	2-0 1-8	8-0 7-3	14-0 12-7
21	13 35-3	13 37-5	12 58-1	2-1 1-9	8-1 7-4	14-1 12-8
22	13 35-5	13 37-7	12 58-3	2-2 2-0	8-2 7-4	14-2 12-9
23	13 35-8	13 38-0	12 58-6	2-3 2-1	8-3 7-5	14-3 13-0
24	13 36-0	13 38-2	12 58-8	2-4 2-2	8-4 7-6	14-4 13-1
25	13 36-3	13 38-5	12 59-1	2-5 2-3	8-5 7-7	14-5 13-2
26	13 36-5	13 38-7	12 59-3	2-6 2-4	8-6 7-8	14-6 13-3
27	13 36-8	13 39-0	12 59-5	2-7 2-5	8-7 7-9	14-7 13-4
28	13 37-0	13 39-2	12 59-8	2-8 2-5	8-8 8-0	14-8 13-4
29	13 37-3	13 39-5	13 00-0	2-9 2-6	8-9 8-1	14-9 13-5
30	13 37-5	13 39-7	13 00-3	3-0 2-7	9-0 8-2	15-0 13-6
31	13 37-8	13 40-0	13 00-5	3-1 2-8	9-1 8-3	15-1 13-7
32	13 38-0	13 40-2	13 00-7	3-2 2-9	9-2 8-4	15-2 13-8
33	13 38-3	13 40-5	13 01-0	3-3 3-0	9-3 8-4	15-3 13-9
34	13 38-5	13 40-7	13 01-2	3-4 3-1	9-4 8-5	15-4 14-0
35	13 38-8	13 41-0	13 01-5	3-5 3-2	9-5 8-6	15-5 14-1
36	13 39-0	13 41-2	13 01-7	3-6 3-3	9-6 8-7	15-6 14-2
37	13 39-3	13 41-5	13 01-9	3-7 3-4	9-7 8-8	15-7 14-3
38	13 39-5	13 41-7	13 02-2	3-8 3-5	9-8 8-9	15-8 14-4
39	13 39-8	13 42-0	13 02-4	3-9 3-5	9-9 9-0	15-9 14-4
40	13 40-0	13 42-2	13 02-6	4-0 3-6	10-0 9-1	16-0 14-5
41	13 40-3	13 42-5	13 02-9	4-1 3-7	10-1 9-2	16-1 14-6
42	13 40-5	13 42-7	13 03-1	4-2 3-8	10-2 9-3	16-2 14-7
43	13 40-8	13 43-0	13 03-4	4-3 3-9	10-3 9-4	16-3 14-8
44	13 41-0	13 43-2	13 03-6	4-4 4-0	10-4 9-4	16-4 14-9
45	13 41-3	13 43-5	13 03-8	4-5 4-1	10-5 9-5	16-5 15-0
46	13 41-5	13 43-7	13 04-1	4-6 4-2	10-6 9-6	16-6 15-1
47	13 41-8	13 44-0	13 04-3	4-7 4-3	10-7 9-7	16-7 15-2
48	13 42-0	13 44-3	13 04-6	4-8 4-4	10-8 9-8	16-8 15-3
49	13 42-3	13 44-5	13 04-8	4-9 4-5	10-9 9-9	16-9 15-4
50	13 42-5	13 44-8	13 05-0	5-0 4-5	11-0 10-0	17-0 15-4
51	13 42-8	13 45-0	13 05-3	5-1 4-6	11-1 10-1	17-1 15-5
52	13 43-0	13 45-3	13 05-5	5-2 4-7	11-2 10-2	17-2 15-6
53	13 43-3	13 45-5	13 05-7	5-3 4-8	11-3 10-3	17-3 15-7
54	13 43-5	13 45-8	13 06-0	5-4 4-9	11-4 10-4	17-4 15-8
55	13 43-8	13 46-0	13 06-2	5-5 5-0	11-5 10-4	17-5 15-9
56	13 44-0	13 46-3	13 06-5	5-6 5-1	11-6 10-5	17-6 16-0
57	13 44-3	13 46-5	13 06-7	5-7 5-2	11-7 10-6	17-7 16-1
58	13 44-5	13 46-8	13 06-9	5-8 5-3	11-8 10-7	17-8 16-2
59	13 44-8	13 47-0	13 07-2	5-9 5-4	11-9 10-8	17-9 16-3
60	13 45-0	13 47-3	13 07-4	6-0 5-5	12-0 10-9	18-0 16-4

55 ^m	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ	$\frac{v}{d}$ Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /
00	13 45-0	13 47-3	13 07-4	0-0 0-0	6-0 5-6	12-0 11-1
01	13 45-3	13 47-5	13 07-7	0-1 0-1	6-1 5-6	12-1 11-2
02	13 45-5	13 47-8	13 07-9	0-2 0-2	6-2 5-7	12-2 11-3
03	13 45-8	13 48-0	13 08-1	0-3 0-3	6-3 5-8	12-3 11-4
04	13 46-0	13 48-3	13 08-4	0-4 0-4	6-4 5-9	12-4 11-5
05	13 46-3	13 48-5	13 08-6	0-5 0-5	6-5 6-0	12-5 11-6
06	13 46-5	13 48-8	13 08-8	0-6 0-6	6-6 6-1	12-6 11-7
07	13 46-8	13 49-0	13 09-1	0-7 0-6	6-7 6-2	12-7 11-7
08	13 47-0	13 49-3	13 09-3	0-8 0-7	6-8 6-3	12-8 11-8
09	13 47-3	13 49-5	13 09-6	0-9 0-8	6-9 6-4	12-9 11-9
10	13 47-5	13 49-8	13 09-8	1-0 0-9	7-0 6-5	13-0 12-0
11	13 47-8	13 50-0	13 10-0	1-1 1-0	7-1 6-6	13-1 12-1
12	13 48-0	13 50-3	13 10-3	1-2 1-1	7-2 6-7	13-2 12-2
13	13 48-3	13 50-5	13 10-5	1-3 1-2	7-3 6-8	13-3 12-3
14	13 48-5	13 50-8	13 10-8	1-4 1-3	7-4 6-8	13-4 12-4
15	13 48-8	13 51-0	13 11-0	1-5 1-4	7-5 6-9	13-5 12-5
16	13 49-0	13 51-3	13 11-2	1-6 1-5	7-6 7-0	13-6 12-6
17	13 49-3	13 51-5	13 11-5	1-7 1-6	7-7 7-1	13-7 12-7
18	13 49-5	13 51-8	13 11-7	1-8 1-7	7-8 7-2	13-8 12-8
19	13 49-8	13 52-0	13 12-0	1-9 1-8	7-9 7-3	13-9 12-9
20	13 50-0	13 52-3	13 12-2	2-0 1-9	8-0 7-4	14-0 13-0
21	13 50-3	13 52-5	13 12-4	2-1 1-9	8-1 7-5	14-1 13-0
22	13 50-5	13 52-8	13 12-7	2-2 2-0	8-2 7-6	14-2 13-1
23	13 50-8	13 53-0	13 12-9	2-3 2-1	8-3 7-7	14-3 13-2
24	13 51-0	13 53-3	13 13-1	2-4 2-2	8-4 7-8	14-4 13-3
25	13 51-3	13 53-5	13 13-4	2-5 2-3	8-5 7-9	14-5 13-4
26	13 51-5	13 53-8	13 13-6	2-6 2-4	8-6 8-0	14-6 13-5
27	13 51-8	13 54-0	13 13-9	2-7 2-5	8-7 8-0	14-7 13-6
28	13 52-0	13 54-3	13 14-1	2-8 2-6	8-8 8-1	14-8 13-7
29	13 52-3	13 54-5	13 14-3	2-9 2-7	8-9 8-2	14-9 13-8
30	13 52-5	13 54-8	13 14-6	3-0 2-8	9-0 8-3	15-0 13-9
31	13 52-8	13 55-0	13 14-8	3-1 2-9	9-1 8-4	15-1 14-0
32	13 53-0	13 55-3	13 15-1	3-2 3-0	9-2 8-5	15-2 14-1
33	13 53-3	13 55-5	13 15-3	3-3 3-1	9-3 8-6	15-3 14-2
34	13 53-5	13 55-8	13 15-5	3-4 3-1	9-4 8-7	15-4 14-2
35	13 53-8	13 56-0	13 15-8	3-5 3-2	9-5 8-8	15-5 14-3
36	13 54-0	13 56-3	13 16-0	3-6 3-3	9-6 8-9	15-6 14-4
37	13 54-3	13 56-5	13 16-2	3-7 3-4	9-7 9-0	15-7 14-5
38	13 54-5	13 56-8	13 16-5	3-8 3-5	9-8 9-1	15-8 14-6
39	13 54-8	13 57-0	13 16-7	3-9 3-6	9-9 9-2	15-9 14-7
40	13 55-0	13 57-3	13 17-0	4-0 3-7	10-0 9-3	16-0 14-8
41	13 55-3	13 57-5	13 17-2	4-1 3-8	10-1 9-3	16-1 14-9
42	13 55-5	13 57-8	13 17-4	4-2 3-9	10-2 9-4	16-2 15-0
43	13 55-8	13 58-0	13 17-7	4-3 4-0	10-3 9-5	16-3 15-1
44	13 56-0	13 58-3	13 17-9	4-4 4-1	10-4 9-6	16-4 15-2
45	13 56-3	13 58-5	13 18-2	4-5 4-2	10-5 9-7	16-5 15-3
46	13 56-5	13 58-8	13 18-4	4-6 4-3	10-6 9-8	16-6 15-4
47	13 56-8	13 59-0	13 18-6	4-7 4-3	10-7 9-9	16-7 15-4
48	13 57-0	13 59-3	13 18-9	4-8 4-4	10-8 10-0	16-8 15-5
49	13 57-3	13 59-5	13 19-1	4-9 4-5	10-9 10-1	16-9 15-6
50	13 57-5	13 59-8	13 19-3	5-0 4-6	11-0 10-2	17-0 15-7
51	13 57-8	14 00-0	13 19-6	5-1 4-7	11-1 10-3	17-1 15-8
52	13 58-0	14 00-3	13 19-8	5-2 4-8	11-2 10-4	17-2 15-9
53	13 58-3	14 00-5	13 20-1	5-3 4-9	11-3 10-5	17-3 16-0
54	13 58-5	14 00-8	13 20-3	5-4 5-0	11-4 10-5	17-4 16-1
55	13 58-8	14 01-0	13 20-5	5-5 5-1	11-5 10-6	17-5 16-2
56	13 59-0	14 01-3	13 20-8	5-6 5-2	11-6 10-7	17-6 16-3
57	13 59-3	14 01-5	13 21-0	5-7 5-3	11-7 10-8	17-7 16-4
58	13 59-5	14 01-8	13 21-3	5-8 5-4	11-8 10-9	17-8 16-5
59	13 59-8	14 02-0	13 21-5	5-9 5-5	11-9 11-0	17-9 16-6
60	14 00-0	14 02-3	13 21-7	6-0 5-6	12-0 11-1	18-0 16-7

^m 56	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or d	Corr ⁿ	$\frac{v}{d}$ or d	Corr ⁿ	$\frac{v}{d}$ or d	Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	/ /	/ /	/ /
00	14 00.0	14 02.3	13 21.7	0.0	0.0	6.0	5.7	12.0	11.3
01	14 00.3	14 02.6	13 22.0	0.1	0.1	6.1	5.7	12.1	11.4
02	14 00.5	14 02.8	13 22.2	0.2	0.2	6.2	5.8	12.2	11.5
03	14 00.8	14 03.1	13 22.4	0.3	0.3	6.3	5.9	12.3	11.6
04	14 01.0	14 03.3	13 22.7	0.4	0.4	6.4	6.0	12.4	11.7
05	14 01.3	14 03.6	13 22.9	0.5	0.5	6.5	6.1	12.5	11.8
06	14 01.5	14 03.8	13 23.2	0.6	0.6	6.6	6.2	12.6	11.9
07	14 01.8	14 04.1	13 23.4	0.7	0.7	6.7	6.3	12.7	12.0
08	14 02.0	14 04.3	13 23.6	0.8	0.8	6.8	6.4	12.8	12.1
09	14 02.3	14 04.6	13 23.9	0.9	0.8	6.9	6.5	12.9	12.1
10	14 02.5	14 04.8	13 24.1	1.0	0.9	7.0	6.6	13.0	12.2
11	14 02.8	14 05.1	13 24.4	1.1	1.0	7.1	6.7	13.1	12.3
12	14 03.0	14 05.3	13 24.6	1.2	1.1	7.2	6.8	13.2	12.4
13	14 03.3	14 05.6	13 24.8	1.3	1.2	7.3	6.9	13.3	12.5
14	14 03.5	14 05.8	13 25.1	1.4	1.3	7.4	7.0	13.4	12.6
15	14 03.8	14 06.1	13 25.3	1.5	1.4	7.5	7.1	13.5	12.7
16	14 04.0	14 06.3	13 25.6	1.6	1.5	7.6	7.2	13.6	12.8
17	14 04.3	14 06.6	13 25.8	1.7	1.6	7.7	7.3	13.7	12.9
18	14 04.5	14 06.8	13 26.0	1.8	1.7	7.8	7.3	13.8	13.0
19	14 04.8	14 07.1	13 26.3	1.9	1.8	7.9	7.4	13.9	13.1
20	14 05.0	14 07.3	13 26.5	2.0	1.9	8.0	7.5	14.0	13.2
21	14 05.3	14 07.6	13 26.7	2.1	2.0	8.1	7.6	14.1	13.3
22	14 05.5	14 07.8	13 27.0	2.2	2.1	8.2	7.7	14.2	13.4
23	14 05.8	14 08.1	13 27.2	2.3	2.2	8.3	7.8	14.3	13.5
24	14 06.0	14 08.3	13 27.5	2.4	2.3	8.4	7.9	14.4	13.6
25	14 06.3	14 08.6	13 27.7	2.5	2.4	8.5	8.0	14.5	13.7
26	14 06.5	14 08.8	13 27.9	2.6	2.4	8.6	8.1	14.6	13.7
27	14 06.8	14 09.1	13 28.2	2.7	2.5	8.7	8.2	14.7	13.8
28	14 07.0	14 09.3	13 28.4	2.8	2.6	8.8	8.3	14.8	13.9
29	14 07.3	14 09.6	13 28.7	2.9	2.7	8.9	8.4	14.9	14.0
30	14 07.5	14 09.8	13 28.9	3.0	2.8	9.0	8.5	15.0	14.1
31	14 07.8	14 10.1	13 29.1	3.1	2.9	9.1	8.6	15.1	14.2
32	14 08.0	14 10.3	13 29.4	3.2	3.0	9.2	8.7	15.2	14.3
33	14 08.3	14 10.6	13 29.6	3.3	3.1	9.3	8.8	15.3	14.4
34	14 08.5	14 10.8	13 29.8	3.4	3.2	9.4	8.9	15.4	14.5
35	14 08.8	14 11.1	13 30.1	3.5	3.3	9.5	8.9	15.5	14.6
36	14 09.0	14 11.3	13 30.3	3.6	3.4	9.6	9.0	15.6	14.7
37	14 09.3	14 11.6	13 30.6	3.7	3.5	9.7	9.1	15.7	14.8
38	14 09.5	14 11.8	13 30.8	3.8	3.6	9.8	9.2	15.8	14.9
39	14 09.8	14 12.1	13 31.0	3.9	3.7	9.9	9.3	15.9	15.0
40	14 10.0	14 12.3	13 31.3	4.0	3.8	10.0	9.4	16.0	15.1
41	14 10.3	14 12.6	13 31.5	4.1	3.9	10.1	9.5	16.1	15.2
42	14 10.5	14 12.8	13 31.8	4.2	4.0	10.2	9.6	16.2	15.3
43	14 10.8	14 13.1	13 32.0	4.3	4.0	10.3	9.7	16.3	15.3
44	14 11.0	14 13.3	13 32.2	4.4	4.1	10.4	9.8	16.4	15.4
45	14 11.3	14 13.6	13 32.5	4.5	4.2	10.5	9.9	16.5	15.5
46	14 11.5	14 13.8	13 32.7	4.6	4.3	10.6	10.0	16.6	15.6
47	14 11.8	14 14.1	13 32.9	4.7	4.4	10.7	10.1	16.7	15.7
48	14 12.0	14 14.3	13 33.2	4.8	4.5	10.8	10.2	16.8	15.8
49	14 12.3	14 14.6	13 33.4	4.9	4.6	10.9	10.3	16.9	15.9
50	14 12.5	14 14.8	13 33.7	5.0	4.7	11.0	10.4	17.0	16.0
51	14 12.8	14 15.1	13 33.9	5.1	4.8	11.1	10.5	17.1	16.1
52	14 13.0	14 15.3	13 34.1	5.2	4.9	11.2	10.5	17.2	16.2
53	14 13.3	14 15.6	13 34.4	5.3	5.0	11.3	10.6	17.3	16.3
54	14 13.5	14 15.8	13 34.6	5.4	5.1	11.4	10.7	17.4	16.4
55	14 13.8	14 16.1	13 34.9	5.5	5.2	11.5	10.8	17.5	16.5
56	14 14.0	14 16.3	13 35.1	5.6	5.3	11.6	10.9	17.6	16.6
57	14 14.3	14 16.6	13 35.3	5.7	5.4	11.7	11.0	17.7	16.7
58	14 14.5	14 16.8	13 35.6	5.8	5.5	11.8	11.1	17.8	16.8
59	14 14.8	14 17.1	13 35.8	5.9	5.6	11.9	11.2	17.9	16.9
60	14 15.0	14 17.3	13 36.1	6.0	5.7	12.0	11.3	18.0	17.0

^m 57	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or d	Corr ⁿ	$\frac{v}{d}$ or d	Corr ⁿ	$\frac{v}{d}$ or d	Corr ⁿ
s	o /	o /	o /	/ /	/ /	/ /	/ /	/ /	/ /
00	14 15.0	14 17.3	13 36.1	0.0	0.0	6.0	5.8	12.0	11.5
01	14 15.3	14 17.6	13 36.3	0.1	0.1	6.1	5.8	12.1	11.6
02	14 15.5	14 17.8	13 36.5	0.2	0.2	6.2	5.9	12.2	11.7
03	14 15.8	14 18.1	13 36.8	0.3	0.3	6.3	6.0	12.3	11.8
04	14 16.0	14 18.3	13 37.0	0.4	0.4	6.4	6.1	12.4	11.9
05	14 16.3	14 18.6	13 37.2	0.5	0.5	6.5	6.2	12.5	12.0
06	14 16.5	14 18.8	13 37.5	0.6	0.6	6.6	6.3	12.6	12.1
07	14 16.8	14 19.1	13 37.7	0.7	0.7	6.7	6.4	12.7	12.2
08	14 17.0	14 19.3	13 38.0	0.8	0.8	6.8	6.5	12.8	12.3
09	14 17.3	14 19.6	13 38.2	0.9	0.9	6.9	6.6	12.9	12.4
10	14 17.5	14 19.8	13 38.4	1.0	1.0	7.0	6.7	13.0	12.5
11	14 17.8	14 20.1	13 38.7	1.1	1.1	7.1	6.8	13.1	12.6
12	14 18.0	14 20.3	13 38.9	1.2	1.2	7.2	6.9	13.2	12.7
13	14 18.3	14 20.6	13 39.2	1.3	1.2	7.3	7.0	13.3	12.7
14	14 18.5	14 20.9	13 39.4	1.4	1.3	7.4	7.1	13.4	12.8
15	14 18.8	14 21.1	13 39.6	1.5	1.4	7.5	7.2	13.5	12.9
16	14 19.0	14 21.4	13 39.9	1.6	1.5	7.6	7.3	13.6	13.0
17	14 19.3	14 21.6	13 40.1	1.7	1.6	7.7	7.4	13.7	13.1
18	14 19.5	14 21.9	13 40.3	1.8	1.7	7.8	7.5	13.8	13.2
19	14 19.8	14 22.1	13 40.6	1.9	1.8	7.9	7.6	13.9	13.3
20	14 20.0	14 22.4	13 40.8	2.0	1.9	8.0	7.7	14.0	13.4
21	14 20.3	14 22.6	13 41.1	2.1	2.0	8.1	7.8	14.1	13.5
22	14 20.5	14 22.9	13 41.3	2.2	2.1	8.2	7.9	14.2	13.6
23	14 20.8	14 23.1	13 41.5	2.3	2.2	8.3	8.0	14.3	13.7
24	14 21.0	14 23.4	13 41.8	2.4	2.3	8.4	8.1	14.4	13.8
25	14 21.3	14 23.6	13 42.0	2.5	2.4	8.5	8.1	14.5	13.9
26	14 21.5	14 23.9	13 42.3	2.6	2.5	8.6	8.2	14.6	14.0
27	14 21.8	14 24.1	13 42.5	2.7	2.6	8.7	8.3	14.7	14.1
28	14 22.0	14 24.4	13 42.7	2.8	2.7	8.8	8.4	14.8	14.2
29	14 22.3	14 24.6	13 43.0	2.9	2.8	8.9	8.5	14.9	14.3
30	14 22.5	14 24.9	13 43.2	3.0	2.9	9.0	8.6	15.0	14.4
31	14 22.8	14 25.1	13 43.4	3.1	3.0	9.1	8.7	15.1	14.5
32	14 23.0	14 25.4	13 43.7	3.2	3.1	9.2	8.8	15.2	14.6
33	14 23.3	14 25.6	13 43.9	3.3	3.2	9.3	8.9	15.3	14.7
34	14 23.5	14 25.9	13 44.2	3.4	3.3	9.4	9.0	15.4	14.8
35	14 23.8	14 26.1	13 44.4	3.5	3.4	9.5	9.1	15.5	14.9
36	14 24.0	14 26.4	13 44.6	3.6	3.5	9.6	9.2	15.6	15.0
37	14 24.3	14 26.6	13 44.9	3.7	3.5	9.7	9.3	15.7	15.0
38	14 24.5	14 26.9	13 45.1	3.8	3.6	9.8	9.4	15.8	15.1
39	14 24.8	14 27.1	13 45.4	3.9	3.7	9.9	9.5	15.9	15.2
40	14 25.0	14 27.4	13 45.6	4.0	3.8	10.0	9.6	16.0	15.3
41	14 25.3	14 27.6	13 45.8	4.1	3.9	10.1	9.7	16.1	15.4
42	14 25.5	14 27.9	13 46.1	4.2	4.0	10.2	9.8	16.2	15.5
43	14 25.8	14 28.1	13 46.3	4.3	4.1	10.3	9.9	16.3	15.6
44	14 26.0	14 28.4	13 46.5	4.4	4.2	10.4	10.0	16.4	15.7
45	14 26.3	14 28.6	13 46.8	4.5	4.3	10.5	10.1	16.5	15.8
46	14 26.5	14 28.9	13 47.0	4.6	4.4	10.6	10.2	16.6	15.9
47	14 26.8	14 29.1	13 47.3	4.7	4.5	10.7	10.3	16.7	16.0
48	14 27.0	14 29.4	13 47.5	4.8	4.6	10.8	10.4	16.8	16.1
49	14 27.3	14 29.6	13 47.7	4.9	4.7	10.9	10.4	16.9	16.2
50	14 27.5	14 29.9	13 48.0	5.0	4.8	11.0	10.5	17.0	16.3
51	14 27.8	14 30.1	13 48.2	5.1	4.9	11.1	10.6	17.1	16.4
52	14 28.0	14 30.4	13 48.5	5.2	5.0	11.2	10.7	17.2	16.5
53	14 28.3	14 30.6	13 48.7	5.3	5.1	11.3	10.8	17.3	16.6
54	14 28.5	14 30.9	13 48.9	5.4	5.2	11.4	10.9	17.4	16.7
55	14 28.8	14 31.1	13 49.2	5.5	5.3	11.5	11.0	17.5	16.8
56	14 29.0	14 31.4	13 49.4	5.6	5.4	11.6	11.1	17.6	16.9
57	14 29.3	14 31.6	13 49.7	5.7	5.5	11.7	11.2	17.7	17.0
58	14 29.5	14 31.9	13 49.9	5.8	5.6	11.8	11.3	17.8	17.1
59	14 29.8	14 32.1	13 50.1	5.9	5.7	11.9	11.4	17.9	17.2
60	14 30.0	14 32.4	13 50.4	6.0	5.8	12.0	11.5	18.0	17.3

^m 58	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	° /	° /	° /	/ /	/ /	/ /
00	14 30.0	14 32.4	13 50.4	0.0 0.0	6.0 5.9	12.0 11.7
01	14 30.3	14 32.6	13 50.6	0.1 0.1	6.1 5.9	12.1 11.8
02	14 30.5	14 32.9	13 50.8	0.2 0.2	6.2 6.0	12.2 11.9
03	14 30.8	14 33.1	13 51.1	0.3 0.3	6.3 6.1	12.3 12.0
04	14 31.0	14 33.4	13 51.3	0.4 0.4	6.4 6.2	12.4 12.1
05	14 31.3	14 33.6	13 51.6	0.5 0.5	6.5 6.3	12.5 12.2
06	14 31.5	14 33.9	13 51.8	0.6 0.6	6.6 6.4	12.6 12.3
07	14 31.8	14 34.1	13 52.0	0.7 0.7	6.7 6.5	12.7 12.4
08	14 32.0	14 34.4	13 52.3	0.8 0.8	6.8 6.6	12.8 12.5
09	14 32.3	14 34.6	13 52.5	0.9 0.9	6.9 6.7	12.9 12.6
10	14 32.5	14 34.9	13 52.8	1.0 1.0	7.0 6.8	13.0 12.7
11	14 32.8	14 35.1	13 53.0	1.1 1.1	7.1 6.9	13.1 12.8
12	14 33.0	14 35.4	13 53.2	1.2 1.2	7.2 7.0	13.2 12.9
13	14 33.3	14 35.6	13 53.5	1.3 1.3	7.3 7.1	13.3 13.0
14	14 33.5	14 35.9	13 53.7	1.4 1.4	7.4 7.2	13.4 13.1
15	14 33.8	14 36.1	13 53.9	1.5 1.5	7.5 7.3	13.5 13.2
16	14 34.0	14 36.4	13 54.2	1.6 1.6	7.6 7.4	13.6 13.3
17	14 34.3	14 36.6	13 54.4	1.7 1.7	7.7 7.5	13.7 13.4
18	14 34.5	14 36.9	13 54.7	1.8 1.8	7.8 7.6	13.8 13.5
19	14 34.8	14 37.1	13 54.9	1.9 1.9	7.9 7.7	13.9 13.6
20	14 35.0	14 37.4	13 55.1	2.0 2.0	8.0 7.8	14.0 13.7
21	14 35.3	14 37.6	13 55.4	2.1 2.0	8.1 7.9	14.1 13.7
22	14 35.5	14 37.9	13 55.6	2.2 2.1	8.2 8.0	14.2 13.8
23	14 35.8	14 38.1	13 55.9	2.3 2.2	8.3 8.1	14.3 13.9
24	14 36.0	14 38.4	13 56.1	2.4 2.3	8.4 8.2	14.4 14.0
25	14 36.3	14 38.6	13 56.3	2.5 2.4	8.5 8.3	14.5 14.1
26	14 36.5	14 38.9	13 56.6	2.6 2.5	8.6 8.4	14.6 14.2
27	14 36.8	14 39.2	13 56.8	2.7 2.6	8.7 8.5	14.7 14.3
28	14 37.0	14 39.4	13 57.0	2.8 2.7	8.8 8.6	14.8 14.4
29	14 37.3	14 39.7	13 57.3	2.9 2.8	8.9 8.7	14.9 14.5
30	14 37.5	14 39.9	13 57.5	3.0 2.9	9.0 8.8	15.0 14.6
31	14 37.8	14 40.2	13 57.8	3.1 3.0	9.1 8.9	15.1 14.7
32	14 38.0	14 40.4	13 58.0	3.2 3.1	9.2 9.0	15.2 14.8
33	14 38.3	14 40.7	13 58.2	3.3 3.2	9.3 9.1	15.3 14.9
34	14 38.5	14 40.9	13 58.5	3.4 3.3	9.4 9.2	15.4 15.0
35	14 38.8	14 41.2	13 58.7	3.5 3.4	9.5 9.3	15.5 15.1
36	14 39.0	14 41.4	13 59.0	3.6 3.5	9.6 9.4	15.6 15.2
37	14 39.3	14 41.7	13 59.2	3.7 3.6	9.7 9.5	15.7 15.3
38	14 39.5	14 41.9	13 59.4	3.8 3.7	9.8 9.6	15.8 15.4
39	14 39.8	14 42.2	13 59.7	3.9 3.8	9.9 9.7	15.9 15.5
40	14 40.0	14 42.4	13 59.9	4.0 3.9	10.0 9.8	16.0 15.6
41	14 40.3	14 42.7	14 00.1	4.1 4.0	10.1 9.8	16.1 15.7
42	14 40.5	14 42.9	14 00.4	4.2 4.1	10.2 9.9	16.2 15.8
43	14 40.8	14 43.2	14 00.6	4.3 4.2	10.3 10.0	16.3 15.9
44	14 41.0	14 43.4	14 00.9	4.4 4.3	10.4 10.1	16.4 16.0
45	14 41.3	14 43.7	14 01.1	4.5 4.4	10.5 10.2	16.5 16.1
46	14 41.5	14 43.9	14 01.3	4.6 4.5	10.6 10.3	16.6 16.2
47	14 41.8	14 44.2	14 01.6	4.7 4.6	10.7 10.4	16.7 16.3
48	14 42.0	14 44.4	14 01.8	4.8 4.7	10.8 10.5	16.8 16.4
49	14 42.3	14 44.7	14 02.1	4.9 4.8	10.9 10.6	16.9 16.5
50	14 42.5	14 44.9	14 02.3	5.0 4.9	11.0 10.7	17.0 16.6
51	14 42.8	14 45.2	14 02.5	5.1 5.0	11.1 10.8	17.1 16.7
52	14 43.0	14 45.4	14 02.8	5.2 5.1	11.2 10.9	17.2 16.8
53	14 43.3	14 45.7	14 03.0	5.3 5.2	11.3 11.0	17.3 16.9
54	14 43.5	14 45.9	14 03.3	5.4 5.3	11.4 11.1	17.4 17.0
55	14 43.8	14 46.2	14 03.5	5.5 5.4	11.5 11.2	17.5 17.1
56	14 44.0	14 46.4	14 03.7	5.6 5.5	11.6 11.3	17.6 17.2
57	14 44.3	14 46.7	14 04.0	5.7 5.6	11.7 11.4	17.7 17.3
58	14 44.5	14 46.9	14 04.2	5.8 5.7	11.8 11.5	17.8 17.4
59	14 44.8	14 47.2	14 04.4	5.9 5.8	11.9 11.6	17.9 17.5
60	14 45.0	14 47.4	14 04.7	6.0 5.9	12.0 11.7	18.0 17.6

^m 59	SUN PLANETS	ARIES	MOON	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ	$\frac{v}{d}$ or Corr ⁿ
s	° /	° /	° /	/ /	/ /	/ /
00	14 45.0	14 47.4	14 04.7	0.0 0.0	6.0 6.0	12.0 11.9
01	14 45.3	14 47.7	14 04.9	0.1 0.1	6.1 6.0	12.1 12.0
02	14 45.5	14 47.9	14 05.2	0.2 0.2	6.2 6.1	12.2 12.1
03	14 45.8	14 48.2	14 05.4	0.3 0.3	6.3 6.2	12.3 12.2
04	14 46.0	14 48.4	14 05.6	0.4 0.4	6.4 6.3	12.4 12.3
05	14 46.3	14 48.7	14 05.9	0.5 0.5	6.5 6.4	12.5 12.4
06	14 46.5	14 48.9	14 06.1	0.6 0.6	6.6 6.5	12.6 12.5
07	14 46.8	14 49.2	14 06.4	0.7 0.7	6.7 6.6	12.7 12.6
08	14 47.0	14 49.4	14 06.6	0.8 0.8	6.8 6.7	12.8 12.7
09	14 47.3	14 49.7	14 06.8	0.9 0.9	6.9 6.8	12.9 12.8
10	14 47.5	14 49.9	14 07.1	1.0 1.0	7.0 6.9	13.0 12.9
11	14 47.8	14 50.2	14 07.3	1.1 1.1	7.1 7.0	13.1 13.0
12	14 48.0	14 50.4	14 07.5	1.2 1.2	7.2 7.1	13.2 13.1
13	14 48.3	14 50.7	14 07.8	1.3 1.3	7.3 7.2	13.3 13.2
14	14 48.5	14 50.9	14 08.0	1.4 1.4	7.4 7.3	13.4 13.3
15	14 48.8	14 51.2	14 08.3	1.5 1.5	7.5 7.4	13.5 13.4
16	14 49.0	14 51.4	14 08.5	1.6 1.6	7.6 7.5	13.6 13.5
17	14 49.3	14 51.7	14 08.7	1.7 1.7	7.7 7.6	13.7 13.6
18	14 49.5	14 51.9	14 09.0	1.8 1.8	7.8 7.7	13.8 13.7
19	14 49.8	14 52.2	14 09.2	1.9 1.9	7.9 7.8	13.9 13.8
20	14 50.0	14 52.4	14 09.5	2.0 2.0	8.0 7.9	14.0 13.9
21	14 50.3	14 52.7	14 09.7	2.1 2.1	8.1 8.0	14.1 14.0
22	14 50.5	14 52.9	14 09.9	2.2 2.2	8.2 8.1	14.2 14.1
23	14 50.8	14 53.2	14 10.2	2.3 2.3	8.3 8.2	14.3 14.2
24	14 51.0	14 53.4	14 10.4	2.4 2.4	8.4 8.3	14.4 14.3
25	14 51.3	14 53.7	14 10.6	2.5 2.5	8.5 8.4	14.5 14.4
26	14 51.5	14 53.9	14 10.9	2.6 2.6	8.6 8.5	14.6 14.5
27	14 51.8	14 54.2	14 11.1	2.7 2.7	8.7 8.6	14.7 14.6
28	14 52.0	14 54.4	14 11.4	2.8 2.8	8.8 8.7	14.8 14.7
29	14 52.3	14 54.7	14 11.6	2.9 2.9	8.9 8.8	14.9 14.8
30	14 52.5	14 54.9	14 11.8	3.0 3.0	9.0 8.9	15.0 14.9
31	14 52.8	14 55.2	14 12.1	3.1 3.1	9.1 9.0	15.1 15.0
32	14 53.0	14 55.4	14 12.3	3.2 3.2	9.2 9.1	15.2 15.1
33	14 53.3	14 55.7	14 12.6	3.3 3.3	9.3 9.2	15.3 15.2
34	14 53.5	14 55.9	14 12.8	3.4 3.4	9.4 9.3	15.4 15.3
35	14 53.8	14 56.2	14 13.0	3.5 3.5	9.5 9.4	15.5 15.4
36	14 54.0	14 56.4	14 13.3	3.6 3.6	9.6 9.5	15.6 15.5
37	14 54.3	14 56.7	14 13.5	3.7 3.7	9.7 9.6	15.7 15.6
38	14 54.5	14 56.9	14 13.8	3.8 3.8	9.8 9.7	15.8 15.7
39	14 54.8	14 57.2	14 14.0	3.9 3.9	9.9 9.8	15.9 15.8
40	14 55.0	14 57.5	14 14.2	4.0 4.0	10.0 9.9	16.0 15.9
41	14 55.3	14 57.7	14 14.5	4.1 4.1	10.1 10.0	16.1 16.0
42	14 55.5	14 58.0	14 14.7	4.2 4.2	10.2 10.1	16.2 16.1
43	14 55.8	14 58.2	14 14.9	4.3 4.3	10.3 10.2	16.3 16.2
44	14 56.0	14 58.5	14 15.2	4.4 4.4	10.4 10.3	16.4 16.3
45	14 56.3	14 58.7	14 15.4	4.5 4.5	10.5 10.4	16.5 16.4
46	14 56.5	14 59.0	14 15.7	4.6 4.6	10.6 10.5	16.6 16.5
47	14 56.8	14 59.2	14 15.9	4.7 4.7	10.7 10.6	16.7 16.6
48	14 57.0	14 59.5	14 16.1	4.8 4.8	10.8 10.7	16.8 16.7
49	14 57.3	14 59.7	14 16.4	4.9 4.9	10.9 10.8	16.9 16.8
50	14 57.5	15 00.0	14 16.6	5.0 5.0	11.0 10.9	17.0 16.9
51	14 57.8	15 00.2	14 16.9	5.1 5.1	11.1 11.0	17.1 17.0
52	14 58.0	15 00.5	14 17.1	5.2 5.2	11.2 11.1	17.2 17.1
53	14 58.3	15 00.7	14 17.3	5.3 5.3	11.3 11.2	17.3 17.2
54	14 58.5	15 01.0	14 17.6	5.4 5.4	11.4 11.3	17.4 17.3
55	14 58.8	15 01.2	14 17.8	5.5 5.5	11.5 11.4	17.5 17.4
56	14 59.0	15 01.5	14 18.0	5.6 5.6	11.6 11.5	17.6 17.5
57	14 59.3	15 01.7	14 18.3	5.7 5.7	11.7 11.6	17.7 17.6
58	14 59.5	15 02.0	14 18.5	5.8 5.8	11.8 11.7	17.8 17.7
59	14 59.8	15 02.2	14 18.8	5.9 5.9	11.9 11.8	17.9 17.8
60	15 00.0	15 02.5	14 19.0	6.0 6.0	12.0 11.9	18.0 17.9

TABLES FOR INTERPOLATING SUNRISE, MOONRISE, ETC.

TABLE I—FOR LATITUDE

Tabular Interval			Difference between the times for consecutive latitudes															
10°	5°	2°	5 ^m	10 ^m	15 ^m	20 ^m	25 ^m	30 ^m	35 ^m	40 ^m	45 ^m	50 ^m	55 ^m	60 ^m	1 ^h 05 ^m	1 ^h 10 ^m	1 ^h 15 ^m	1 ^h 20 ^m
0 30	0 15	0 06	0 0	0 0	0 1	1 1	1 1	1 1	1 2	2 2	2 2	2 2	2 2	2 2	0 02	0 02	0 02	0 02
1 00	0 30	0 12	0 1	0 1	1 1	2 2	2 3	3 3	3 3	4 4	4 4	4 4	4 4	4 5	05	05	05	05
1 30	0 45	0 18	1 1	1 2	2 3	3 3	3 4	4 5	4 5	5 6	5 6	6 7	6 7	7 7	07	07	07	07
2 00	1 00	0 24	1 2	2 3	3 4	4 5	5 5	6 7	6 7	7 8	8 9	8 9	9 10	10 10	10	10	10	10
2 30	1 15	0 30	1 2	2 4	3 5	4 6	5 7	6 8	6 8	7 9	8 10	9 11	10 12	11 12	12	13	13	13
3 00	1 30	0 36	1 3	2 4	3 5	4 6	5 7	6 8	6 9	7 10	8 11	9 12	10 13	11 14	0 15	0 15	0 16	0 16
3 30	1 45	0 42	2 3	3 5	4 6	5 7	6 8	7 9	7 10	8 11	9 12	10 13	11 14	12 15	18	18	19	19
4 00	2 00	0 48	2 4	3 6	4 7	5 8	6 9	7 10	8 11	9 12	10 13	11 14	12 15	13 16	20	21	22	22
4 30	2 15	0 54	2 4	3 7	4 8	5 9	6 10	7 11	8 12	9 13	10 14	11 15	12 16	13 17	23	24	25	26
5 00	2 30	1 00	2 5	3 7	4 9	5 10	6 11	7 12	8 13	9 14	10 15	11 16	12 17	13 18	26	27	28	29
5 30	2 45	1 06	3 5	3 8	4 10	5 11	6 12	7 13	8 14	9 15	10 16	11 17	12 18	13 19	0 29	0 30	0 31	0 32
6 00	3 00	1 12	3 6	3 9	4 11	5 12	6 13	7 14	8 15	9 16	10 17	11 18	12 19	13 20	32	33	34	36
6 30	3 15	1 18	3 6	4 10	5 12	6 13	7 14	8 15	9 16	10 17	11 18	12 19	13 20	14 21	36	37	38	40
7 00	3 30	1 24	3 7	4 11	5 13	6 14	7 15	8 16	9 17	10 18	11 19	12 20	13 21	14 22	39	41	42	44
7 30	3 45	1 30	4 7	4 11	5 14	6 15	7 16	8 17	9 18	10 19	11 20	12 21	13 22	14 23	43	44	46	48
8 00	4 00	1 36	4 8	4 12	5 15	6 16	7 17	8 18	9 19	10 20	11 21	12 22	13 23	14 24	0 47	0 48	0 51	0 53
8 30	4 15	1 42	4 8	4 13	5 16	6 17	7 18	8 19	9 20	10 21	11 22	12 23	13 24	14 25	0 51	0 53	0 56	0 58
9 00	4 30	1 48	4 9	4 13	5 17	6 18	7 19	8 20	9 21	10 22	11 23	12 24	13 25	14 26	0 55	0 58	1 01	1 04
9 30	4 45	1 54	5 9	4 14	5 18	6 19	7 20	8 21	9 22	10 23	11 24	12 25	13 26	14 27	1 00	1 04	1 08	1 12
10 00	5 00	2 00	5 10	4 15	5 19	6 20	7 21	8 22	9 23	10 24	11 25	12 26	13 27	14 28	1 05	1 10	1 15	1 20

Table I is for interpolating the LMT of sunrise, twilight, moonrise, etc., for latitude. It is to be entered, in the appropriate column on the left, with the difference between true latitude and the nearest tabular latitude which is *less* than the true latitude; and with the argument at the top which is the nearest value of the difference between the times for the tabular latitude and the next higher one; the correction so obtained is applied to the time for the tabular latitude; the sign of the correction can be seen by inspection. It is to be noted that the interpolation is not linear, so that when using this table it is essential to take out the tabular phenomenon for the latitude *less* than the true latitude.

TABLE II—FOR LONGITUDE

Long. East or West	Difference between the times for given date and preceding date (for east longitude) or for given date and following date (for west longitude)											
	10 ^m	20 ^m	30 ^m	40 ^m	50 ^m	60 ^m	1 ^h 0 ^m	1 ^h 10 ^m	2 ^h 10 ^m	2 ^h 20 ^m	2 ^h 30 ^m	2 ^h 40 ^m
0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 0
10	0 1	1 1	2 1	3 1	4 1	5 1	6 1	7 1	8 1	9 1	10 1	11 1
20	1 1	2 2	3 2	4 2	5 2	6 2	7 2	8 2	9 2	10 2	11 2	12 2
30	1 2	2 3	3 3	4 3	5 3	6 3	7 3	8 3	9 3	10 3	11 3	12 3
40	1 2	2 3	3 4	4 4	5 4	6 4	7 4	8 4	9 4	10 4	11 4	12 4
50	1 3	2 4	3 4	4 5	5 5	6 5	7 5	8 5	9 5	10 5	11 5	12 5
60	2 3	3 5	4 5	5 6	6 6	7 6	8 6	9 6	10 6	11 6	12 6	13 6
70	2 4	3 6	4 6	5 7	6 7	7 7	8 7	9 7	10 7	11 7	12 7	13 7
80	2 4	3 7	4 7	5 8	6 8	7 8	8 8	9 8	10 8	11 8	12 8	13 8
90	2 5	3 7	4 8	5 9	6 9	7 9	8 9	9 9	10 9	11 9	12 9	13 9
100	3 6	4 8	5 9	6 10	7 10	8 10	9 10	10 10	11 10	12 10	13 10	14 10
110	3 6	4 9	5 10	6 11	7 11	8 11	9 11	10 11	11 11	12 11	13 11	14 11
120	3 7	4 10	5 11	6 12	7 12	8 12	9 12	10 12	11 12	12 12	13 12	14 12
130	4 7	4 11	5 12	6 13	7 13	8 13	9 13	10 13	11 13	12 13	13 13	14 13
140	4 8	4 12	5 13	6 14	7 14	8 14	9 14	10 14	11 14	12 14	13 14	14 14
150	4 8	4 13	5 14	6 15	7 15	8 15	9 15	10 15	11 15	12 15	13 15	14 15
160	4 9	4 13	5 15	6 16	7 16	8 16	9 16	10 16	11 16	12 16	13 16	14 16
170	5 9	4 14	5 16	6 17	7 17	8 17	9 17	10 17	11 17	12 17	13 17	14 17
180	5 10	4 15	5 17	6 18	7 18	8 18	9 18	10 18	11 18	12 18	13 18	14 18

Table II is for interpolating the LMT of moonrise, moonset and the Moon's meridian passage for longitude. It is entered with longitude and with the difference between the times for the given date and for the preceding date (in east longitudes) or following date (in west longitudes). The correction is normally *added* for west longitudes and *subtracted* for east longitudes, but if, as occasionally happens, the times become earlier each day instead of later, the signs of the corrections must be reversed.

INDEX TO SELECTED STARS, 1993

Name	No	Mag	SHA	Dec
<i>Acamar</i>	7	3.1	315	S 40
<i>Achernar</i>	5	0.6	336	S 57
<i>Acrux</i>	30	1.1	173	S 63
<i>Adhara</i>	19	1.6	255	S 29
<i>Aldebaran</i>	10	1.1	291	N 16
<i>Alioth</i>	32	1.7	167	N 56
<i>Alkaid</i>	34	1.9	153	N 49
<i>Al Na'ir</i>	55	2.2	28	S 47
<i>Alnilam</i>	15	1.8	276	S 1
<i>Alphard</i>	25	2.2	218	S 9
<i>Alphecca</i>	41	2.3	126	N 27
<i>Alpheratz</i>	1	2.2	358	N 29
<i>Altair</i>	51	0.9	62	N 9
<i>Ankaa</i>	2	2.4	354	S 42
<i>Antares</i>	42	1.2	113	S 26
<i>Arcturus</i>	37	0.2	146	N 19
<i>Atria</i>	43	1.9	108	S 69
<i>Avior</i>	22	1.7	234	S 59
<i>Bellatrix</i>	13	1.7	279	N 6
<i>Betelgeuse</i>	16	Var.*	271	N 7
<i>Canopus</i>	17	-0.9	264	S 53
<i>Capella</i>	12	0.2	281	N 46
<i>Deneb</i>	53	1.3	50	N 45
<i>Denebola</i>	28	2.2	183	N 15
<i>Diphda</i>	4	2.2	349	S 18
<i>Dubhe</i>	27	2.0	194	N 62
<i>Elnath</i>	14	1.8	279	N 29
<i>Eltanin</i>	47	2.4	91	N 51
<i>Enif</i>	54	2.5	34	N 10
<i>Fomalhaut</i>	56	1.3	16	S 30
<i>Gacrux</i>	31	1.6	172	S 57
<i>Gienah</i>	29	2.8	176	S 18
<i>Hadar</i>	35	0.9	149	S 60
<i>Hamal</i>	6	2.2	328	N 23
<i>Kaus Australis</i>	48	2.0	84	S 34
<i>Kochab</i>	40	2.2	137	N 74
<i>Markab</i>	57	2.6	14	N 15
<i>Menkar</i>	8	2.8	315	N 4
<i>Menkent</i>	36	2.3	148	S 36
<i>Miaplacidus</i>	24	1.8	222	S 70
<i>Mirfak</i>	9	1.9	309	N 50
<i>Nunki</i>	50	2.1	76	S 26
<i>Peacock</i>	52	2.1	54	S 57
<i>Pollux</i>	21	1.2	244	N 28
<i>Procyon</i>	20	0.5	245	N 5
<i>Rasalhague</i>	46	2.1	96	N 13
<i>Regulus</i>	26	1.3	208	N 12
<i>Rigel</i>	11	0.3	281	S 8
<i>Rigel Kentaurus</i>	38	0.1	140	S 61
<i>Sabik</i>	44	2.6	102	S 16
<i>Schedar</i>	3	2.5	350	N 57
<i>Shaula</i>	45	1.7	97	S 37
<i>Sirius</i>	18	-1.6	259	S 17
<i>Spica</i>	33	1.2	159	S 11
<i>Suhail</i>	23	2.2	223	S 43
<i>Vega</i>	49	0.1	81	N 39
<i>Zubenelgenubi</i>	39	2.9	137	S 16

No	Name	Mag	SHA	Dec
1	<i>Alpheratz</i>	2.2	358	N 29
2	<i>Ankaa</i>	2.4	354	S 42
3	<i>Schedar</i>	2.5	350	N 57
4	<i>Diphda</i>	2.2	349	S 18
5	<i>Achernar</i>	0.6	336	S 57
6	<i>Hamal</i>	2.2	328	N 23
7	<i>Acamar</i>	3.1	315	S 40
8	<i>Menkar</i>	2.8	315	N 4
9	<i>Mirfak</i>	1.9	309	N 50
10	<i>Aldebaran</i>	1.1	291	N 16
11	<i>Rigel</i>	0.3	281	S 8
12	<i>Capella</i>	0.2	281	N 46
13	<i>Bellatrix</i>	1.7	279	N 6
14	<i>Elnath</i>	1.8	279	N 29
15	<i>Alnilam</i>	1.8	276	S 1
16	<i>Betelgeuse</i>	Var.*	271	N 7
17	<i>Canopus</i>	-0.9	264	S 53
18	<i>Sirius</i>	-1.6	259	S 17
19	<i>Adhara</i>	1.6	255	S 29
20	<i>Procyon</i>	0.5	245	N 5
21	<i>Pollux</i>	1.2	244	N 28
22	<i>Avior</i>	1.7	234	S 59
23	<i>Suhail</i>	2.2	223	S 43
24	<i>Miaplacidus</i>	1.8	222	S 70
25	<i>Alphard</i>	2.2	218	S 9
26	<i>Regulus</i>	1.3	208	N 12
27	<i>Dubhe</i>	2.0	194	N 62
28	<i>Denebola</i>	2.2	183	N 15
29	<i>Gienah</i>	2.8	176	S 18
30	<i>Acrux</i>	1.1	173	S 63
31	<i>Gacrux</i>	1.6	172	S 57
32	<i>Alioth</i>	1.7	167	N 56
33	<i>Spica</i>	1.2	159	S 11
34	<i>Alkaid</i>	1.9	153	N 49
35	<i>Hadar</i>	0.9	149	S 60
36	<i>Menkent</i>	2.3	148	S 36
37	<i>Arcturus</i>	0.2	146	N 19
38	<i>Rigel Kentaurus</i>	0.1	140	S 61
39	<i>Zubenelgenubi</i>	2.9	137	S 16
40	<i>Kochab</i>	2.2	137	N 74
41	<i>Alphecca</i>	2.3	126	N 27
42	<i>Antares</i>	1.2	113	S 26
43	<i>Atria</i>	1.9	108	S 69
44	<i>Sabik</i>	2.6	102	S 16
45	<i>Shaula</i>	1.7	97	S 37
46	<i>Rasalhague</i>	2.1	96	N 13
47	<i>Eltanin</i>	2.4	91	N 51
48	<i>Kaus Australis</i>	2.0	84	S 34
49	<i>Vega</i>	0.1	81	N 39
50	<i>Nunki</i>	2.1	76	S 26
51	<i>Altair</i>	0.9	62	N 9
52	<i>Peacock</i>	2.1	54	S 57
53	<i>Deneb</i>	1.3	50	N 45
54	<i>Enif</i>	2.5	34	N 10
55	<i>Al Na'ir</i>	2.2	28	S 47
56	<i>Fomalhaut</i>	1.3	16	S 30
57	<i>Markab</i>	2.6	14	N 15

*0.1 — 1.2

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ALTITUDE CORRECTION TABLES 0°–35°— MOON

App. Alt.	0°–4°	5°–9°	10°–14°	15°–19°	20°–24°	25°–29°	30°–34°	App. Alt.
0	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	0
10	34.5	58.2	62.1	62.8	62.2	60.8	58.8	10
20	36.5	58.5	62.2	62.8	62.1	60.7	58.8	20
30	38.3	58.7	62.3	62.8	62.1	60.7	58.7	30
40	40.0	58.9	62.3	62.8	62.0	60.6	58.6	40
50	41.5	59.1	62.4	62.7	62.0	60.6	58.5	50
00	42.9	59.3	62.4	62.7	62.0	60.6	58.5	00
10	44.2	59.5	62.4	62.7	61.9	60.4	58.4	10
20	45.4	59.7	62.4	62.7	61.9	60.4	58.3	20
30	46.5	59.9	62.5	62.7	61.9	60.3	58.2	30
40	47.5	60.0	62.5	62.7	61.8	60.3	58.2	40
50	48.4	60.2	62.5	62.7	61.8	60.2	58.1	50
00	49.3	60.3	62.6	62.7	61.8	60.2	58.1	00
10	50.1	60.5	62.6	62.7	61.7	60.1	57.9	10
20	50.8	60.6	62.6	62.6	61.7	60.1	57.9	20
30	51.5	60.7	62.6	62.6	61.6	60.0	57.8	30
40	52.2	60.9	62.7	62.6	61.6	59.9	57.8	40
50	52.8	61.0	62.7	62.6	61.6	59.9	57.7	50
00	53.4	61.1	62.7	62.6	61.5	59.8	57.6	00
10	53.9	61.2	62.7	62.5	61.5	59.7	57.5	10
20	54.4	61.3	62.7	62.5	61.4	59.7	57.4	20
30	54.9	61.4	62.7	62.5	61.4	59.6	57.4	30
40	55.3	61.5	62.8	62.5	61.3	59.5	57.3	40
50	55.7	61.6	62.8	62.4	61.3	59.5	57.2	50
00	56.1	61.6	62.8	62.4	61.2	59.4	57.1	00
10	56.4	61.7	62.8	62.4	61.2	59.3	57.0	10
20	56.8	61.8	62.8	62.4	61.1	59.3	56.9	20
30	57.1	61.9	62.8	62.3	61.1	59.2	56.9	30
40	57.4	61.9	62.8	62.3	61.0	59.1	56.8	40
50	57.7	62.0	62.8	62.3	61.0	59.1	56.7	50
00	58.0	62.1	62.8	62.2	60.9	59.0	56.6	00
HP	L U	L U	L U	L U	L U	L U	L U	HP
54.0	0.3 0.9	0.3 0.9	0.4 1.0	0.5 1.1	0.6 1.2	0.7 1.3	0.9 1.5	54.0
54.3	0.7 1.1	0.7 1.2	0.8 1.2	0.8 1.3	0.9 1.4	1.1 1.5	1.2 1.7	54.3
54.6	1.1 1.4	1.1 1.4	1.1 1.4	1.2 1.5	1.3 1.6	1.4 1.7	1.5 1.8	54.6
54.9	1.4 1.6	1.5 1.6	1.5 1.6	1.6 1.7	1.6 1.8	1.8 1.9	1.9 2.0	54.9
55.2	1.8 1.8	1.8 1.8	1.9 1.8	1.9 1.9	2.0 2.0	2.1 2.1	2.2 2.2	55.2
55.5	2.2 2.0	2.2 2.0	2.3 2.1	2.3 2.1	2.4 2.2	2.4 2.3	2.5 2.4	55.5
55.8	2.6 2.2	2.6 2.2	2.6 2.3	2.7 2.3	2.7 2.4	2.8 2.4	2.9 2.5	55.8
56.1	3.0 2.4	3.0 2.5	3.0 2.5	3.0 2.5	3.1 2.6	3.1 2.6	3.2 2.7	56.1
56.4	3.3 2.7	3.4 2.7	3.4 2.7	3.4 2.7	3.4 2.8	3.5 2.8	3.5 2.9	56.4
56.7	3.7 2.9	3.7 2.9	3.8 2.9	3.8 2.9	3.8 3.0	3.8 3.0	3.9 3.0	56.7
57.0	4.1 3.1	4.1 3.1	4.1 3.1	4.1 3.1	4.2 3.2	4.2 3.2	4.2 3.2	57.0
57.3	4.5 3.3	4.5 3.3	4.5 3.3	4.5 3.3	4.5 3.3	4.5 3.4	4.6 3.4	57.3
57.6	4.9 3.5	4.9 3.5	4.9 3.5	4.9 3.5	4.9 3.5	4.9 3.5	4.9 3.6	57.6
57.9	5.3 3.8	5.3 3.8	5.2 3.8	5.2 3.7	5.2 3.7	5.2 3.7	5.2 3.7	57.9
58.2	5.6 4.0	5.6 4.0	5.6 4.0	5.6 4.0	5.6 3.9	5.6 3.9	5.6 3.9	58.2
58.5	6.0 4.2	6.0 4.2	6.0 4.2	6.0 4.2	6.0 4.1	5.9 4.1	5.9 4.1	58.5
58.8	6.4 4.4	6.4 4.4	6.4 4.4	6.3 4.4	6.3 4.3	6.3 4.3	6.2 4.2	58.8
59.1	6.8 4.6	6.8 4.6	6.7 4.6	6.7 4.6	6.7 4.5	6.6 4.5	6.6 4.4	59.1
59.4	7.2 4.8	7.1 4.8	7.1 4.8	7.1 4.8	7.0 4.7	7.0 4.7	6.9 4.6	59.4
59.7	7.5 5.1	7.5 5.0	7.5 5.0	7.5 5.0	7.4 4.9	7.3 4.8	7.2 4.8	59.7
60.0	7.9 5.3	7.9 5.3	7.9 5.2	7.8 5.2	7.8 5.1	7.7 5.0	7.6 4.9	60.0
60.3	8.3 5.5	8.3 5.5	8.2 5.4	8.2 5.4	8.1 5.3	8.0 5.2	7.9 5.1	60.3
60.6	8.7 5.7	8.7 5.7	8.6 5.7	8.6 5.6	8.5 5.5	8.4 5.4	8.2 5.3	60.6
60.9	9.1 5.9	9.0 5.9	9.0 5.9	8.9 5.8	8.8 5.7	8.7 5.6	8.6 5.4	60.9
61.2	9.5 6.2	9.4 6.1	9.4 6.1	9.3 6.0	9.2 5.9	9.1 5.8	8.9 5.6	61.2
61.5	9.8 6.4	9.8 6.3	9.7 6.3	9.7 6.2	9.5 6.1	9.4 5.9	9.2 5.8	61.5

DIP			
Ht. of Eye	Corr ⁿ	Ht. of Eye	Corr ⁿ
m	ft.	m	ft.
2.4	-2.8	8.0	9.5
2.6	-2.9	8.6	9.9
2.8	-3.0	9.2	10.3
3.0	-3.1	9.8	10.6
3.2	-3.2	10.5	11.0
3.4	-3.3	11.2	11.4
3.6	-3.4	11.9	11.8
3.8	-3.5	12.6	12.2
4.0	-3.6	13.3	12.6
4.3	-3.7	14.1	13.0
4.5	-3.8	14.9	13.4
4.7	-3.9	15.7	13.8
5.0	-4.0	16.5	14.2
5.2	-4.1	17.4	14.7
5.5	-4.2	18.3	15.1
5.8	-4.3	19.1	15.5
6.1	-4.4	20.1	16.0
6.3	-4.5	21.0	16.5
6.6	-4.6	22.0	16.9
6.9	-4.7	22.9	17.4
7.2	-4.8	23.9	17.9
7.5	-4.9	24.9	18.4
7.9	-5.0	26.0	18.8
8.2	-5.1	27.1	19.3
8.5	-5.2	28.1	19.8
8.8	-5.3	29.2	20.4
9.2	-5.4	30.4	20.9
9.5	-5.5	31.5	21.4

MOON CORRECTION TABLE

The correction is in two parts; the first correction is taken from the upper part of the table with argument apparent altitude, and the second from the lower part, with argument HP, in the same column as that from which the first correction was taken. Separate corrections are given in the lower part for lower (L) and upper (U) limbs. All corrections are to be **added** to apparent altitude, but 30' is to be subtracted from the altitude of the upper limb.

For corrections for pressure and temperature see page A4.

For bubble sextant observations ignore dip, take the mean of upper and lower limb corrections and subtract 15' from the altitude.

App. Alt. = Apparent altitude
= Sextant altitude corrected for index error and dip.

ALTITUDE CORRECTION TABLES 35°-90°— MOON

App. Alt.	35°-39°	40°-44°	45°-49°	50°-54°	55°-59°	60°-64°	65°-69°	70°-74°	75°-79°	80°-84°	85°-89°	App. Alt.
	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	Corr ⁿ	
00	35° 56'5	40° 53'7	45° 50'5	50° 46'9	55° 43'1	60° 38'9	65° 34'6	70° 30'0	75° 25'3	80° 20'5	85° 15'6	00
10	56'4	53'6	50'4	46'8	42'9	38'8	34'4	29'9	25'2	20'4	15'5	10
20	56'3	53'5	50'2	46'7	42'8	38'7	34'3	29'7	25'0	20'2	15'3	20
30	56'2	53'4	50'1	46'5	42'7	38'5	34'1	29'6	24'9	20'0	15'1	30
40	56'2	53'3	50'0	46'4	42'5	38'4	34'0	29'4	24'7	19'9	15'0	40
50	56'1	53'2	49'9	46'3	42'4	38'2	33'8	29'3	24'5	19'7	14'8	50
00	36° 56'0	41° 53'1	46° 49'8	51° 46'2	56° 42'3	61° 38'1	66° 33'7	71° 29'1	76° 24'4	81° 19'6	86° 14'6	00
10	55'9	53'0	49'7	46'0	42'1	37'9	33'5	29'0	24'2	19'4	14'5	10
20	55'8	52'9	49'5	45'9	42'0	37'8	33'4	28'8	24'1	19'2	14'3	20
30	55'7	52'8	49'4	45'8	41'9	37'7	33'2	28'7	23'9	19'1	14'2	30
40	55'6	52'6	49'3	45'7	41'7	37'5	33'1	28'5	23'8	18'9	14'0	40
50	55'5	52'5	49'2	45'5	41'6	37'4	32'9	28'3	23'6	18'7	13'8	50
00	37° 55'4	42° 52'4	47° 49'1	52° 45'4	57° 41'4	62° 37'2	67° 32'8	72° 28'2	77° 23'4	82° 18'6	87° 13'7	00
10	55'3	52'3	49'0	45'3	41'3	37'1	32'6	28'0	23'3	18'4	13'5	10
20	55'2	52'2	48'8	45'2	41'2	36'9	32'5	27'9	23'1	18'2	13'3	20
30	55'1	52'1	48'7	45'0	41'0	36'8	32'3	27'7	22'9	18'1	13'2	30
40	55'0	52'0	48'6	44'9	40'9	36'6	32'2	27'6	22'8	17'9	13'0	40
50	55'0	51'9	48'5	44'8	40'8	36'5	32'0	27'4	22'6	17'8	12'8	50
00	38° 54'9	43° 51'8	48° 48'4	53° 44'6	58° 40'6	63° 36'4	68° 31'9	73° 27'2	78° 22'5	83° 17'6	88° 12'7	00
10	54'8	51'7	48'3	44'5	40'5	36'2	31'7	27'1	22'3	17'4	12'5	10
20	54'7	51'6	48'1	44'4	40'3	36'1	31'6	26'9	22'1	17'3	12'3	20
30	54'6	51'5	48'0	44'2	40'2	35'9	31'4	26'8	22'0	17'1	12'2	30
40	54'5	51'4	47'9	44'1	40'1	35'8	31'3	26'6	21'8	16'9	12'0	40
50	54'4	51'2	47'8	44'0	39'9	35'6	31'1	26'5	21'7	16'8	11'8	50
00	39° 54'3	44° 51'1	49° 47'7	54° 43'9	59° 39'8	64° 35'5	69° 31'0	74° 26'3	79° 21'5	84° 16'6	89° 11'7	00
10	54'2	51'0	47'5	43'7	39'6	35'3	30'8	26'1	21'3	16'4	11'5	10
20	54'1	50'9	47'4	43'6	39'5	35'2	30'7	26'0	21'2	16'3	11'4	20
30	54'0	50'8	47'3	43'5	39'4	35'0	30'5	25'8	21'0	16'1	11'2	30
40	53'9	50'7	47'2	43'3	39'2	34'9	30'4	25'7	20'9	16'0	11'0	40
50	53'8	50'6	47'0	43'2	39'1	34'7	30'2	25'5	20'7	15'8	10'9	50
HP	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	HP
54°0	1'1 1'7	1'3 1'9	1'5 2'1	1'7 2'4	2'0 2'6	2'3 2'9	2'6 3'2	2'9 3'5	3'2 3'8	3'5 4'1	3'8 4'5	54°0
54°3	1'4 1'8	1'6 2'0	1'8 2'2	2'0 2'5	2'2 2'7	2'5 3'0	2'8 3'2	3'1 3'5	3'3 3'8	3'6 4'1	3'9 4'4	54°3
54°6	1'7 2'0	1'9 2'2	2'1 2'4	2'3 2'6	2'5 2'8	2'7 3'0	3'0 3'3	3'2 3'5	3'5 3'8	3'8 4'0	4'0 4'3	54°6
54°9	2'0 2'2	2'2 2'3	2'3 2'5	2'5 2'7	2'7 2'9	2'9 3'1	3'2 3'3	3'4 3'5	3'6 3'8	3'9 4'0	4'1 4'3	54°9
55°2	2'3 2'3	2'5 2'4	2'6 2'6	2'8 2'8	3'0 2'9	3'2 3'1	3'4 3'3	3'6 3'5	3'8 3'7	4'0 4'0	4'2 4'2	55°2
55°5	2'7 2'5	2'8 2'6	2'9 2'7	3'1 2'9	3'2 3'0	3'4 3'2	3'6 3'4	3'7 3'5	3'9 3'7	4'1 3'9	4'3 4'1	55°5
55°8	3'0 2'6	3'1 2'7	3'2 2'8	3'3 3'0	3'5 3'1	3'6 3'3	3'8 3'4	3'9 3'6	4'1 3'7	4'2 3'9	4'4 4'0	55°8
56°1	3'3 2'8	3'4 2'9	3'5 3'0	3'6 3'1	3'7 3'2	3'8 3'3	4'0 3'4	4'1 3'6	4'2 3'7	4'4 3'8	4'5 4'0	56°1
56°4	3'6 2'9	3'7 3'0	3'8 3'1	3'9 3'2	3'9 3'3	4'0 3'4	4'1 3'5	4'3 3'6	4'4 3'7	4'5 3'8	4'6 3'9	56°4
56°7	3'9 3'1	4'0 3'1	4'1 3'2	4'1 3'3	4'2 3'3	4'3 3'4	4'3 3'5	4'4 3'6	4'5 3'7	4'6 3'8	4'7 3'8	56°7
57°0	4'3 3'2	4'3 3'3	4'3 3'3	4'4 3'4	4'4 3'4	4'5 3'5	4'5 3'5	4'6 3'6	4'7 3'6	4'7 3'7	4'8 3'8	57°0
57°3	4'6 3'4	4'6 3'4	4'6 3'4	4'6 3'5	4'7 3'5	4'7 3'5	4'7 3'6	4'8 3'6	4'8 3'6	4'8 3'7	4'9 3'7	57°3
57°6	4'9 3'6	4'9 3'6	4'9 3'6	4'9 3'6	4'9 3'6	4'9 3'6	4'9 3'6	4'9 3'6	5'0 3'6	5'0 3'6	5'0 3'6	57°6
57°9	5'2 3'7	5'2 3'7	5'2 3'7	5'2 3'7	5'2 3'7	5'1 3'6	5'1 3'6	5'1 3'6	5'1 3'6	5'1 3'6	5'1 3'6	57°9
58°2	5'5 3'9	5'5 3'8	5'5 3'8	5'4 3'8	5'4 3'7	5'4 3'7	5'3 3'7	5'3 3'6	5'2 3'6	5'2 3'5	5'2 3'5	58°2
58°5	5'9 4'0	5'8 4'0	5'8 3'9	5'7 3'9	5'6 3'8	5'6 3'8	5'5 3'7	5'5 3'6	5'4 3'6	5'3 3'5	5'3 3'4	58°5
58°8	6'2 4'2	6'1 4'1	6'0 4'1	6'0 4'0	5'9 3'9	5'8 3'8	5'7 3'7	5'6 3'6	5'5 3'5	5'4 3'5	5'3 3'4	58°8
59°1	6'5 4'3	6'4 4'3	6'3 4'2	6'2 4'1	6'1 4'0	6'0 3'9	5'9 3'8	5'8 3'6	5'7 3'5	5'6 3'4	5'4 3'3	59°1
59°4	6'8 4'5	6'7 4'4	6'6 4'3	6'5 4'2	6'4 4'1	6'2 3'9	6'1 3'8	6'0 3'7	5'8 3'5	5'7 3'4	5'5 3'2	59°4
59°7	7'1 4'7	7'0 4'5	6'9 4'4	6'8 4'3	6'6 4'1	6'5 4'0	6'3 3'8	6'1 3'7	6'0 3'5	5'8 3'3	5'6 3'2	59°7
60°0	7'5 4'8	7'3 4'7	7'2 4'5	7'0 4'4	6'9 4'2	6'7 4'0	6'5 3'9	6'3 3'7	6'1 3'5	5'9 3'3	5'7 3'1	60°0
60°3	7'8 5'0	7'6 4'8	7'5 4'7	7'3 4'5	7'1 4'3	6'9 4'1	6'7 3'9	6'5 3'7	6'3 3'5	6'0 3'2	5'8 3'0	60°3
60°6	8'1 5'1	7'9 5'0	7'7 4'8	7'6 4'6	7'3 4'4	7'1 4'2	6'9 3'9	6'7 3'7	6'4 3'4	6'2 3'2	5'9 2'9	60°6
60°9	8'4 5'3	8'2 5'1	8'0 4'9	7'8 4'7	7'6 4'5	7'3 4'2	7'1 4'0	6'8 3'7	6'6 3'4	6'3 3'2	6'0 2'9	60°9
61°2	8'7 5'4	8'5 5'2	8'3 5'0	8'1 4'8	7'8 4'5	7'6 4'3	7'3 4'0	7'0 3'7	6'7 3'4	6'4 3'1	6'1 2'8	61°2
61°5	9'1 5'6	8'8 5'4	8'6 5'1	8'3 4'9	8'1 4'6	7'8 4'3	7'5 4'0	7'2 3'7	6'9 3'4	6'5 3'1	6'2 2'7	61°5

XXXV

Appendix D
H.O. 249 Vol. 1 Excerpts

LAT 40°N

LHA °	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn
	*CAPELLA	ALDEBARAN	*Diphda	FOMALHAUT	ALTAIR	*VEGA	Kochab							
0	34 20 056	26 36 090	31 06 168	18 49 194	26 41 259	29 50 297	27 43 348							
1	34 58 056	27 22 091	31 06 168	18 37 195	25 56 259	29 09 298	27 34 348							
2	35 36 056	28 07 092	31 23 170	18 24 196	25 11 260	28 29 298	27 24 348							
3	36 14 057	28 53 092	31 30 171	18 11 197	24 26 261	27 49 299	27 15 349							
4	36 53 057	29 39 093	31 37 172	17 57 198	23 40 261	27 08 299	27 06 349							
5	37 32 057	30 25 094	31 43 174	17 43 199	22 55 262	26 28 300	26 58 349							
6	38 10 058	31 11 094	31 47 175	17 28 200	22 09 263	25 49 300	26 49 349							
7	38 49 058	31 57 095	31 51 176	17 12 201	21 24 263	25 09 301	26 41 350							
8	39 28 058	32 43 096	31 54 177	16 55 201	20 38 264	24 29 301	26 33 350							
9	40 07 059	33 28 096	31 56 178	16 38 202	19 52 265	23 50 302	26 25 350							
10	40 47 059	34 14 097	31 57 179	16 21 203	19 06 266	23 11 302	26 17 351							
11	41 26 059	35 00 098	31 57 180	16 02 204	18 21 266	22 32 302	26 10 351							
12	42 06 060	35 45 098	31 57 181	15 43 205	17 35 267	21 53 303	26 03 351							
13	42 45 060	36 30 099	31 55 182	15 24 206	16 49 267	21 15 303	25 56 351							
14	43 25 060	37 16 100	31 53 184	15 03 206	16 03 268	20 37 304	25 49 352							
	*CAPELLA	BETELGEUSE	RIGEL	*Diphda	Enif	*DENEB	Kochab							
15	44 05 060	17 15 095	14 16 114	31 49 185	37 10 249	43 22 299	25 42 352							
16	44 45 061	18 01 096	14 57 115	31 45 186	36 27 250	42 42 299	25 36 352							
17	45 25 061	18 47 096	15 39 115	31 40 187	35 44 251	42 02 299	25 30 352							
18	46 05 061	19 32 097	16 21 116	31 34 188	35 00 252	41 22 300	25 24 353							
19	46 46 061	20 18 098	17 02 117	31 27 189	34 17 252	40 42 300	25 18 353							
20	47 26 062	21 04 098	17 42 118	31 19 190	33 33 253	40 02 300	25 13 353							
21	48 07 062	21 49 099	18 23 119	31 11 191	32 49 254	39 23 301	25 08 354							
22	48 47 062	22 34 100	19 03 119	31 01 192	32 04 255	38 43 301	25 03 354							
23	49 28 062	23 20 100	19 43 120	30 51 194	31 20 256	38 04 301	24 58 354							
24	50 09 063	24 05 101	20 23 121	30 40 195	30 35 257	37 25 302	24 53 354							
25	50 50 063	24 50 102	21 02 122	30 28 196	29 51 257	36 46 302	24 49 355							
26	51 31 063	25 35 102	21 41 122	30 15 197	29 06 258	36 07 302	24 45 355							
27	52 12 063	26 20 103	22 20 123	30 01 198	28 21 258	35 28 303	24 41 355							
28	52 53 063	27 04 104	22 58 124	29 47 199	27 36 259	34 50 303	24 38 356							
29	53 34 064	27 49 105	23 36 125	29 31 200	26 50 260	34 11 303	24 34 356							
	*CAPELLA	BETELGEUSE	RIGEL	*Diphda	Alpheratz	*DENEB	Kochab							
30	54 15 064	28 33 105	24 14 126	29 15 201	64 35 253	33 33 304	24 31 356							
31	54 56 064	29 17 106	24 51 126	28 58 202	63 51 254	32 55 304	24 28 357							
32	55 38 064	30 02 107	25 28 127	28 41 203	63 06 255	32 17 304	24 25 357							
33	56 19 064	30 45 108	26 04 128	28 22 204	62 22 256	31 39 305	24 23 357							
34	57 00 064	31 29 108	26 40 129	28 03 205	61 37 257	31 01 305	24 21 357							
35	57 42 065	32 13 109	27 16 130	27 43 206	60 52 258	30 24 306	24 19 358							
36	58 23 065	32 56 110	27 51 131	27 23 207	60 07 259	29 47 306	24 17 358							
37	59 05 065	33 39 111	28 25 132	27 01 208	59 22 260	29 10 306	24 16 358							
38	59 47 065	34 22 112	28 59 133	26 39 209	58 36 261	28 33 307	24 14 359							
39	60 28 065	35 04 113	29 33 134	26 17 210	57 51 262	27 56 307	24 13 359							
40	61 10 065	35 47 113	30 06 135	25 53 211	57 05 263	27 19 308	24 13 359							
41	61 52 065	36 29 114	30 38 136	25 29 212	56 20 263	26 43 308	24 12 359							
42	62 33 065	37 10 115	31 10 137	25 04 213	55 34 264	26 07 308	24 12 360							
43	63 15 065	37 52 116	31 41 137	24 39 214	54 48 265	25 31 309	24 12 360							
44	63 57 065	38 33 117	32 12 138	24 13 215	54 03 266	25 55 309	24 12 000							
	*Dubhe	POLLUX	SIRIUS	*RIGEL	Diphda	*Alpheratz	DENEB							
45	22 25 026	31 22 078	12 56 125	32 42 140	23 47 216	53 17 266	24 20 310							
46	22 45 026	32 07 079	13 33 126	33 12 141	23 19 217	52 31 267	23 45 310							
47	23 06 027	32 52 079	14 10 127	33 41 142	22 52 218	51 45 268	23 39 310							
48	23 27 027	33 37 080	14 46 128	34 09 143	22 23 218	50 59 268	23 35 311							
49	23 48 027	34 22 080	15 23 128	34 37 144	21 54 219	50 13 269	22 00 311							
50	24 09 028	35 07 081	15 59 129	35 03 145	21 25 220	49 27 270	21 26 312							
51	24 30 028	35 53 081	16 34 130	35 30 146	20 55 221	48 41 270	20 52 312							
52	24 52 028	36 38 082	17 09 131	35 55 147	20 25 222	47 55 271	20 18 313							
53	25 14 029	37 24 082	17 44 132	36 20 148	19 54 223	47 09 272	19 44 313							
54	25 37 029	38 09 083	18 18 132	36 44 149	19 22 224	46 23 272	19 11 314							
55	25 59 029	38 55 084	18 52 133	37 07 150	18 50 224	45 37 273	18 37 314							
56	26 22 030	39 41 084	19 25 134	37 29 151	18 18 225	44 51 273	18 04 315							
57	26 45 030	40 27 085	19 58 135	37 51 153	17 45 226	44 06 274	17 32 315							
58	27 08 030	41 12 085	20 30 136	38 11 154	17 11 227	43 20 275	16 59 315							
59	27 31 031	41 58 086	21 02 136	38 31 155	16 38 228	42 34 275	16 27 316							
	*Dubhe	POLLUX	PROCYON	*SIRIUS	RIGEL	*Hamal	Schedar							
60	27 55 031	42 44 087	29 59 110	21 34 137	38 50 156	60 56 244	53 52 314							
61	28 18 031	43 30 087	30 42 111	22 05 138	39 08 157	60 15 245	53 19 314							
62	28 42 032	44 16 088	31 25 112	22 35 139	39 26 159	59 33 246	52 46 314							
63	29 06 032	45 02 088	32 07 113	23 05 140	39 42 160	58 51 247	52 13 314							
64	29 31 032	45 48 089	32 49 114	23 34 141	39 57 161	58 08 248	51 40 314							
65	29 55 032	46 34 090	33 31 114	24 03 142	40 12 162	57 25 250	51 07 314							
66	30 20 033	47 20 090	34 13 115	24 31 143	40 25 164	56 42 251	50 34 314							
67	30 45 033	48 06 091	34 55 116	24 59 144	40 38 165	55 59 252	50 01 314							
68	31 10 033	48 52 092	35 36 117	25 26 145	40 49 166	55 15 253	49 28 314							
69	31 35 033	49 38 092	36 16 118	25 52 145	40 59 167	54 31 254	48 55 314							
70	32 01 034	50 23 093	36 57 119	26 18 146	41 09 169	53 47 254	48 21 314							
71	32 26 034	51 09 094	37 37 120	26 43 147	41 17 170	53 02 255	47 48 314							
72	32 52 034	51 55 094	38 17 121	27 07 148	41 25 171	52 18 256	47 15 314							
73	33 18 034	52 41 095	38 56 122	27 31 149	41 31 173	51 33 257	46 42 314							
74	33 44 035	53 27 096	39 35 123	27 54 150	41 36 174	50 48 258	46 09 314							
	*Dubhe	POLLUX	PROCYON	*SIRIUS	RIGEL	*Hamal	Schedar							
75	34 10 035	54 12 097	40 14 124	28 17 151	41 41 175	50 03 259	45 36 314							
76	34 36 035	54 58 097	40 52 125	28 38 152	41 44 177	49 18 260	45 04 314							
77	35 03 035	55 44 098	41 29 126	28 59 153	41 46 178	48 33 260	44 31 315							
78	35 29 035	56 29 099	42 06 127	29 20 154	41 47 179	47 47 261	43 58 315							
79	35 56 036	57 14 100	42 43 128	29 39 155	41 47 181	47 02 262	43 25 315							
80	36 23 036	58 00 101	43 19 129	29 58 156	41 46 182	46 16 263	42 53 315							
81	36 50 036	58 45 102	43 55 130	30 16 158	41 44 183	45 31 263	42 20 315							
82	37 17 036	59 30 102	44 29 131	30 33 159	41 41 185	44 45 264	41 48 315							
83	37 44 036	60 15 103	44 54 132	30 49 160	41 37 186	43 59 265	41 16 315							
84	38 11 037	60 59 104	45 38 133	31 05 161	41 31 187	43 13 266								

LHA °	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	LHA °	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	
	*VEGA	Alphecca	ARCTURUS	*SPICA	REGULUS	*POLLUX	CAPELLA		*Alpheratz	ALTAIR	Nunki	*ANTARES	ARCTURUS	*Alkaid	Kochab											
180	17 55 054	44 04 090	54 22 116	35 15 154	52 40 229	36 54 278	21 08 313	270	16 48 066	50 20 134	22 29 167	20 17 202	37 53 264	45 27 304	49 27 342											
181	18 32 054	44 50 090	55 03 117	35 34 155	52 05 231	36 09 278	20 35 313	271	17 30 066	50 53 136	22 39 168	19 59 203	37 08 264	44 49 304	49 13 342											
182	19 10 055	45 36 091	55 44 118	35 53 157	51 29 232	35 23 279	20 02 314	272	18 12 067	51 24 137	22 48 169	19 41 204	36 22 265	44 11 304	48 59 342											
183	19 47 055	46 22 092	56 25 119	36 11 158	50 53 233	34 38 280	19 29 314	273	18 54 068	51 55 138	22 57 170	19 23 204	35 36 266	43 33 305	48 44 341											
184	20 25 056	47 08 092	57 05 120	36 28 159	50 16 234	33 53 280	18 56 315	274	19 37 068	52 26 140	23 05 171	19 03 205	34 50 267	42 55 305	48 30 341											
185	21 04 056	47 54 093	57 44 122	36 44 160	49 38 235	33 08 281	18 23 315	275	20 20 069	52 55 141	23 12 172	18 43 206	34 04 267	42 18 305	48 15 341											
186	21 42 057	48 40 094	58 23 123	36 59 161	49 00 237	32 22 281	17 51 316	276	21 03 069	53 23 142	23 18 173	18 23 207	33 18 268	41 40 305	48 00 341											
187	22 21 057	49 26 094	59 01 124	37 14 162	48 21 238	31 37 282	17 19 316	277	21 46 070	53 51 144	23 24 173	18 02 208	32 32 269	41 03 306	47 45 341											
188	22 59 058	50 12 095	59 39 126	37 27 164	47 42 239	30 52 282	16 48 317	278	22 29 070	54 17 145	23 29 174	17 40 209	31 46 269	40 25 306	47 30 341											
189	23 38 058	50 57 096	60 16 127	37 40 165	47 03 240	30 08 283	16 16 317	279	23 12 071	54 43 147	23 33 175	17 17 210	31 00 270	39 48 306	47 14 341											
190	24 18 059	51 43 097	60 52 128	37 51 166	46 23 241	29 23 283	15 45 318	280	23 56 071	55 08 149	23 36 176	16 54 210	30 14 270	39 11 306	46 59 340											
191	24 57 059	52 29 097	61 28 130	38 02 167	45 42 242	28 38 284	15 14 318	281	24 39 072	55 31 150	23 39 177	16 31 211	29 29 271	38 34 307	46 43 340											
192	25 37 060	53 14 098	62 03 132	38 11 169	45 02 243	27 54 285	14 44 319	282	25 23 072	55 53 152	23 40 178	16 07 212	28 43 272	37 58 307	46 28 340											
193	26 16 060	54 00 099	62 37 133	38 20 170	44 21 244	27 09 285	14 13 319	283	26 07 073	56 14 153	23 41 179	15 42 213	27 57 272	37 21 307	46 12 340											
194	26 56 061	54 45 100	63 10 135	38 28 171	43 39 245	26 25 286	13 43 320	284	26 51 073	56 34 155	23 41 180	15 17 214	27 11 273	36 44 308	45 56 340											
195	DENE	*VEGA	ARCTURUS	*SPICA	REGULUS	*POLLUX	Dubhe	285	*Alpheratz	Enif	ALTAIR	*Rasalhague	ARCTURUS	*Alkaid	*Kochab											
196	13 04 041	27 36 061	63 42 137	38 34 172	42 57 246	25 41 286	61 56 331	286	27 35 074	42 51 118	56 53 157	56 44 220	26 25 274	36 08 308	45 41 340											
197	13 35 041	28 17 062	64 13 138	38 40 174	42 15 247	24 57 287	61 33 330	287	28 19 074	43 31 119	57 11 159	56 13 220	25 39 274	35 32 308	45 25 341											
198	14 05 042	28 57 062	64 43 140	38 45 175	41 33 248	24 13 287	61 10 329	288	29 03 075	44 11 120	57 27 160	55 42 223	24 53 275	34 56 308	45 09 340											
199	14 36 042	29 38 062	65 11 142	38 48 176	40 50 249	23 29 288	60 47 329	289	29 48 076	44 50 121	57 42 162	55 10 225	24 07 275	34 20 309	44 53 340											
200	15 07 043	30 19 063	65 39 144	38 51 177	40 07 249	22 45 288	60 23 328	290	30 32 076	45 29 122	57 55 164	54 37 226	23 22 276	33 44 309	44 37 339											
201	15 38 043	31 00 063	66 05 146	38 53 179	39 24 250	22 01 289	59 58 328	291	31 17 077	46 08 123	58 07 166	54 04 228	22 36 277	33 09 309	44 21 339											
202	16 10 044	31 41 064	66 30 148	38 53 180	38 41 251	21 18 289	59 34 327	292	32 02 077	46 46 125	58 18 168	53 30 229	21 50 277	32 33 310	44 04 339											
203	16 42 044	32 22 064	66 53 151	38 53 181	37 57 252	20 35 290	59 09 327	293	32 47 078	47 24 126	58 27 169	52 55 230	21 05 278	31 58 310	43 48 339											
204	17 14 045	33 04 065	67 15 153	38 52 182	37 13 253	19 52 290	58 44 327	294	33 32 078	48 01 127	58 35 171	52 19 232	20 19 279	31 23 310	43 32 339											
205	17 47 045	33 45 065	67 35 155	38 49 184	36 29 254	19 09 291	58 18 326	295	34 17 079	48 37 128	58 41 173	51 43 233	19 34 279	30 48 311	43 16 339											
206	18 19 046	34 27 066	67 54 157	38 46 185	35 45 254	18 26 292	57 53 326	296	35 02 079	49 13 129	58 45 175	51 06 234	18 49 280	30 13 311	42 59 339											
207	18 52 046	35 09 066	68 11 160	38 42 186	35 01 255	17 43 292	57 27 325	297	35 47 080	49 49 130	58 49 177	50 28 235	18 03 280	29 39 311	42 43 339											
208	19 26 047	35 51 066	68 26 162	38 36 187	34 16 256	17 01 293	57 01 325	298	36 32 080	50 23 132	58 50 179	49 50 236	17 18 281	29 04 312	42 27 339											
209	19 59 047	36 33 067	68 39 165	38 30 189	33 32 257	16 18 293	56 34 325	299	37 18 081	50 57 133	58 50 181	49 12 238	16 33 281	28 30 312	42 10 339											
210	20 33 048	37 15 067	68 50 167	38 23 190	32 47 257	15 36 294	56 08 325	300	38 03 082	51 31 134	58 49 183	48 33 239	15 48 282	27 56 313	41 54 339											
211	DENE	*VEGA	Rasalhague	ANTARES	*SPICA	REGULUS	*Dubhe	301	*Mirfak	Alpheratz	*Enif	ALTAIR	Rasalhague	*Alphecca	Kochab											
212	21 07 048	37 58 068	69 41 169	15 06 146	38 14 191	32 02 258	55 41 324	302	18 21 039	38 49 082	52 03 136	58 46 185	47 53 240	34 15 278	41 38 339											
213	21 41 048	38 40 068	70 22 170	15 32 147	38 05 192	31 17 259	55 14 324	303	18 50 040	39 34 083	52 35 137	58 42 187	47 13 241	33 29 279	41 21 339											
214	22 16 049	39 23 068	71 03 171	15 57 148	37 55 194	30 22 260	54 47 324	304	19 20 040	40 20 083	53 06 138	58 36 188	46 33 242	32 44 279	41 05 339											
215	22 50 049	40 06 069	71 44 172	16 21 148	37 43 195	29 47 260	54 19 324	305	19 50 041	41 05 084	53 36 140	58 28 190	45 52 243	31 59 280	40 49 339											
216	23 25 050	40 48 069	72 25 173	16 45 149	37 31 196	29 01 261	53 52 323	306	20 20 041	41 51 084	54 05 141	58 19 192	45 11 244	31 13 280	40 32 339											
217	24 01 050	41 31 070	73 01 174	17 08 150	37 18 197	28 16 262	53 25 323	307	20 50 042	42 37 085	54 34 143	58 09 194	44 30 245	30 28 281	40 16 339											
218	24 36 051	42 15 070	73 42 175	17 31 151	37 04 198	27 30 263	52 57 323	308	21 21 042	43 23 085	55 01 144	57 57 196	43 48 246	29 43 281	40 00 339											
219	25 12 051	42 58 070	74 23 176	17 53 152	36 49 200	26 45 263	52 29 323	309	21 52 042	44 09 086	55 28 146	57 44 198	43 06 247	28 58 282	39 44 339											
220	25 47 051	43 41 071	75 04 177	18 14 153	36 33 201	25 59 264	52 01 323	310	22 23 043	44 54 087	55 53 147	57 29 199	42 24 248	28 13 283	39 28 339											
221	26 23 052	44 25 071	75 44 178	18 35 153	36 17 202	25 13 265	51 33 323	311	22 54 043	45 40 087	56 17 149	57 13 201	41 41 248	27 28 283	39 11 339											
222	27 00 052	45 08 072	76 25 179	18 55 154	35 59 203	24 27 265	51 05 322	312	23 26 044	46 26 088	56 40 151	56 56 203	40 58 249	26 44 284	38 55 340											
223	27 36 053	45 52 072	77 06 180	19 15 155	35 41 204	23 42 266	50 37 322	313	23 58 044	47 12 088	57 03 152	56 37 205	40 15 250	25 59 284	38 39 340											
224	28 13 053	46 36 072	77 47 181	19 34 156	35 21 205	22 56 267	50 09 322	314	24 30 044	47 58 089	57 23 154	56 17 206	39 32 251	25 15 285	38 23 340											
225	28 49 053	47 20 073	78 28 182	19 52 157	35 01 206	22 10 267	49 41 322	315	25 02 045	48 44 090	57 43 156	55 57 208	38 48 252	24 30 285	38 07 340											
226	29 26 054	48 03 073	79 09 183	20 10 158	34 41 208	21 24 268	49 13 322	316	25 35 045	49 30 090	58 01 157	55 34 210	38 04 253	23 46 286	37 51 340											
227	DENE	*ALTAIR	Rasalhague	ANTARES	*SPICA																					

LAT 40°S

LHA	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn
0	Alpheratz	*Hamal	RIGEL	*CANOPUS	Peacock	*Munki	Enif							
0	20 56 002	20 03 031	14 03 089	27 36 137	51 47 226	26 33 257	31 02 320							
1	20 56 001	20 20 030	14 49 088	28 07 137	51 14 226	25 49 256	30 32 319							
2	20 56 000	20 49 029	15 35 088	28 39 136	50 41 226	25 04 256	30 01 318							
3	20 57 359	21 11 028	16 21 087	29 11 136	50 09 226	24 20 255	29 30 317							
4	20 56 358	21 33 027	17 07 086	29 43 136	49 36 226	23 35 255	28 59 316							
5	20 54 357	21 53 026	17 53 086	30 15 135	49 03 226	22 51 254	28 26 315							
6	20 52 356	22 13 025	18 38 085	30 47 135	48 30 226	22 07 254	27 54 314							
7	20 48 355	22 33 024	19 24 084	31 20 135	47 57 226	21 23 253	27 20 313							
8	20 44 354	22 52 024	20 10 084	31 52 134	47 24 226	20 39 252	26 47 312							
9	20 39 353	23 10 023	20 56 083	32 25 134	46 51 225	19 55 252	26 12 311							
10	20 34 352	23 27 022	21 41 082	32 58 134	46 19 225	19 12 251	25 38 310							
11	20 27 352	23 43 021	22 27 082	33 31 134	45 46 225	18 28 251	25 03 310							
12	20 20 351	23 59 020	23 12 081	34 05 133	45 13 225	17 45 250	24 27 309							
13	20 12 350	24 15 019	23 57 080	34 38 133	44 41 225	17 02 250	23 51 308							
14	20 04 349	24 29 018	24 43 080	35 12 133	44 08 225	16 19 249	23 14 307							
15	*Hamal	ALDEBARAN	RIGEL	*CANOPUS	Peacock	*FOMALHAUT	Alpheratz							
15	24 43 017	14 32 053	25 28 079	35 46 132	43 36 225	62 55 283	19 55 348							
16	24 56 016	15 09 052	26 13 078	36 20 132	43 03 225	62 10 282	19 45 347							
17	25 08 015	15 45 052	26 58 077	36 54 132	42 31 225	61 25 281	19 34 346							
18	25 19 014	16 21 051	27 43 077	37 28 132	41 59 224	60 40 280	19 22 345							
19	25 30 013	16 56 050	28 27 076	38 02 131	41 27 224	59 55 279	19 10 344							
20	25 40 012	17 31 049	29 12 075	38 37 131	40 55 224	59 09 278	18 58 343							
21	25 49 011	18 06 048	29 56 074	39 12 131	40 23 224	58 24 277	18 44 342							
22	25 57 010	18 40 048	30 40 074	39 46 131	39 51 224	57 38 277	18 30 342							
23	26 04 009	19 14 047	31 24 073	40 21 131	39 19 224	56 53 276	18 15 341							
24	26 11 008	19 47 046	32 08 072	40 56 130	38 48 223	56 07 275	18 00 340							
25	26 17 007	20 20 045	32 52 071	41 31 130	38 16 223	55 21 274	17 43 339							
26	26 22 006	20 52 044	33 35 071	42 07 130	37 45 223	54 35 274	17 26 338							
27	26 26 005	21 24 043	34 19 070	42 42 130	37 13 223	53 49 273	17 09 337							
28	26 30 004	21 55 043	35 02 069	43 17 129	36 42 223	53 03 272	16 51 336							
29	26 32 003	22 26 042	35 44 068	43 53 129	36 11 222	52 17 272	16 32 336							
30	Hamal	*ALDEBARAN	RIGEL	*SIRIUS	*CANOPUS	Peacock	*FOMALHAUT							
30	26 34 002	22 56 041	36 27 067	24 56 091	44 29 129	50 40 222	51 31 271							
31	26 35 001	23 26 040	37 09 066	25 42 091	45 04 129	50 09 222	50 46 270							
32	26 35 000	23 55 039	37 51 065	26 28 090	45 40 129	50 39 222	50 00 270							
33	26 34 359	24 24 038	38 33 065	27 14 089	46 16 129	50 08 221	49 14 269							
34	26 33 358	24 52 037	39 14 064	27 59 089	46 52 129	49 38 221	48 28 268							
35	26 30 357	25 19 036	39 55 063	28 45 088	47 28 128	48 08 221	47 42 268							
36	26 27 356	25 46 035	40 36 062	29 31 087	48 04 128	47 38 221	46 56 267							
37	26 23 355	26 12 034	41 16 061	30 17 087	48 40 128	47 08 221	46 10 267							
38	26 19 354	26 38 033	41 56 060	31 03 086	49 16 128	46 31 220	45 24 266							
39	26 13 352	27 03 032	42 35 059	31 49 085	49 52 128	45 08 220	44 38 265							
40	26 06 351	27 27 031	43 14 058	32 35 085	50 29 128	44 30 219	43 52 265							
41	25 59 350	27 51 030	43 53 057	33 21 084	51 05 128	43 51 219	43 07 264							
42	25 51 349	28 14 029	44 31 056	34 06 083	51 41 128	42 59 219	42 21 264							
43	25 42 348	28 36 028	45 09 054	34 52 083	52 17 128	42 13 219	41 35 263							
44	25 33 347	28 57 027	45 46 055	35 37 082	52 54 128	41 48 218	40 50 263							
45	*ALDEBARAN	RIGEL	*SIRIUS	*CANOPUS	ACHERNAR	*FOMALHAUT	Hamal							
45	29 18 026	46 23 052	36 23 081	53 30 128	68 09 211	40 40 262	25 22 346							
46	29 38 025	46 59 051	37 08 081	54 07 128	67 45 212	39 19 261	25 11 345							
47	29 58 024	47 35 050	37 54 080	54 43 128	67 21 213	38 33 261	24 59 344							
48	30 16 023	48 10 049	38 39 079	55 19 128	66 56 214	37 48 260	24 47 343							
49	30 34 022	48 44 048	39 24 078	55 56 128	66 30 214	37 03 260	24 33 342							
50	30 51 021	49 18 046	40 09 077	56 32 128	66 04 215	36 17 259	24 19 342							
51	31 07 020	49 50 045	40 53 077	57 08 128	65 37 216	35 32 259	24 04 341							
52	31 22 019	50 23 044	41 38 076	57 44 128	65 10 217	34 47 258	23 48 340							
53	31 37 018	50 54 043	42 23 075	58 21 128	64 42 217	34 02 258	23 32 339							
54	31 51 017	51 25 041	43 07 074	58 57 128	64 14 218	33 17 257	23 15 338							
55	32 03 016	51 55 040	43 51 073	59 33 128	63 46 219	32 33 257	22 57 337							
56	32 15 015	52 24 038	44 35 073	60 09 129	63 17 219	31 48 256	22 39 336							
57	32 27 013	52 52 037	45 19 072	60 45 129	62 48 220	31 03 256	22 19 335							
58	32 37 012	53 19 035	46 02 071	61 20 129	62 18 220	30 19 255	22 00 334							
59	32 46 011	53 45 034	46 46 070	61 56 129	61 48 221	29 35 255	21 39 333							
60	ALDEBARAN	*BETELGEUSE	*SIRIUS	*ACRUX	ACHERNAR	*FOMALHAUT	Hamal							
60	32 55 010	35 43 036	47 29 069	21 29 157	61 18 221	28 50 254	21 18 332							
61	33 02 009	36 09 035	48 11 068	21 48 157	60 48 221	28 06 253	20 56 331							
62	33 09 008	36 35 034	48 54 067	22 06 156	60 17 222	27 22 253	20 34 330							
63	33 15 007	37 00 033	49 36 066	22 25 156	59 47 222	26 38 252	20 11 329							
64	33 20 006	37 25 031	50 18 065	22 44 156	59 16 222	25 55 252	19 47 329							
65	33 24 004	37 48 030	50 59 064	23 03 155	58 45 223	25 11 251	19 23 328							
66	33 27 003	38 11 029	51 40 063	23 22 155	58 13 223	24 27 251	18 58 327							
67	33 29 002	38 33 028	52 21 062	23 42 154	57 42 223	23 44 250	18 32 326							
68	33 30 001	38 54 027	53 01 061	24 02 154	57 10 223	23 01 250	18 06 325							
69	33 31 000	39 14 026	53 41 059	24 22 154	56 39 224	22 18 249	17 40 324							
70	33 30 359	39 34 024	54 20 058	24 42 153	56 07 224	21 35 249	17 13 323							
71	33 28 358	39 52 023	54 59 057	25 03 153	55 35 224	20 52 248	16 45 323							
72	33 26 356	40 10 022	55 38 056	25 24 153	55 03 224	20 10 248	16 17 322							
73	33 23 355	40 26 021	56 15 055	25 45 153	54 31 224	19 27 247	15 48 321							
74	33 18 354	40 42 019	56 52 053	26 06 152	53 59 224	18 45 247	15 19 320							
75	BETELGEUSE	*SIRIUS	Suhail	*ACRUX	ACHERNAR	*Diphda	ALDEBARAN							
75	40 57 018	57 09 052	44 44 116	26 28 152	53 27 225	31 03 272	33 13 353							
76	41 10 017	58 25 050	45 25 115	26 50 152	52 54 225	30 17 271	33 07 352							
77	41 23 015	58 40 049	46 07 115	27 12 151	52 22 225	29 31 271	33 00 351							
78	41 35 014	59 14 047	46 48 115	27 34 151	51 50 225	28 45 270	32 52 350							
79	41 46 013	59 47 046	47 30 114	27 56 151	51 17 225	27 59 269	32 43 348							
80	41 55 012	60 20 044	48 12 114	28 19 150	50 45 225	27 13 269	32 34 347							
81	42 04 010	60 52 043	48 54 114	28 41 150	50 12 225	26 27 268	32 23 346							
82	42 12 009	61 22 041	49 36 113	29 04 150	49 40 225	25 41 267	32 12 345							
83	42 18 008	61 52 039	50 19 113	29 28 150	49 07 225	24 55 267	31 59 344							
84	42 24 006	62 21 038	51 01 113	29 51										

LAT 40°S

LHA °	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn
ARCUTURUS	*ANTARES	RIGIL KENT.	ACRUX	*CANOPUS	Alphard	*REGULUS										
180	22 55 035	33 29 098	58 03 144	66 38 173	34 00 227	43 44 302	31 50 327									
181	23 20 034	34 15 098	58 30 144	66 38 173	33 27 226	43 05 301	31 25 326									
182	23 46 033	35 01 097	58 57 145	66 48 175	32 54 226	42 25 300	30 59 325									
183	24 10 032	35 46 096	59 23 145	66 52 176	32 21 226	41 45 299	30 32 324									
184	24 34 031	36 32 096	59 50 145	66 54 177	31 48 225	41 05 298	30 05 323									
185	24 58 030	37 18 095	60 15 146	66 56 178	31 15 225	40 24 297	29 37 322									
186	25 21 029	38 03 095	60 41 146	66 57 179	30 43 225	39 43 296	29 09 321									
187	25 43 028	38 49 094	61 06 147	66 57 181	30 10 225	39 02 295	28 40 320									
188	26 04 027	39 35 093	61 31 147	66 56 182	29 38 224	38 20 294	28 10 319									
189	26 25 026	40 21 093	61 56 148	66 55 183	29 06 224	37 38 294	27 40 318									
190	26 45 025	41 07 092	62 20 149	66 52 184	28 35 224	36 56 293	27 09 317									
191	27 04 024	41 53 092	62 44 149	66 48 185	28 03 223	36 13 292	26 37 316									
192	27 22 023	42 39 091	63 07 150	66 43 186	27 32 223	35 31 291	26 05 315									
193	27 40 022	43 25 090	63 30 151	66 38 187	27 01 222	34 48 290	25 33 315									
194	27 57 021	44 11 090	63 52 151	66 32 189	26 30 222	34 04 289	25 00 314									
ARCUTURUS	*ANTARES	RIGIL KENT.	ACRUX	*CANOPUS	Alphard	*REGULUS	Denebola									
195	28 14 020	44 57 089	64 14 152	66 24 190	27 23 246	24 27 313	32 54 339									
196	28 29 019	45 43 088	64 35 153	66 16 191	26 41 245	23 53 312	32 27 338									
197	28 44 018	46 29 088	64 56 154	66 07 192	25 59 244	23 18 311	32 00 337									
198	28 58 017	47 15 087	65 16 154	65 57 193	25 17 243	22 43 310	32 01 336									
199	29 11 016	48 00 086	65 36 155	65 47 194	24 35 242	22 08 309	31 42 335									
200	29 23 015	48 46 086	65 55 156	65 36 195	23 53 241	21 32 308	31 23 334									
201	29 34 014	49 32 085	66 13 157	65 25 196	23 23 240	20 56 308	31 02 333									
202	29 45 013	50 18 084	66 30 158	65 10 197	22 52 239	20 20 307	30 41 332									
203	29 55 012	51 04 083	66 47 159	64 57 198	22 21 238	19 43 306	30 18 331									
204	30 04 011	51 49 083	66 63 160	64 43 199	21 50 237	19 05 305	29 56 330									
205	30 12 010	52 35 082	67 18 161	64 28 200	21 19 236	18 28 304	29 32 329									
206	30 19 009	53 20 081	67 33 162	64 12 200	20 49 235	17 50 303	29 08 328									
207	30 26 008	54 06 080	67 46 163	63 56 201	20 18 234	17 11 302	28 43 327									
208	30 31 006	54 51 079	67 59 164	63 39 202	20 00 233	16 33 301	28 17 326									
209	30 36 005	55 36 078	68 11 166	63 21 203	20 00 233	15 53 301	27 51 325									
ARCUTURUS	*ANTARES	Peacock	RIGIL KENT.	ACRUX	Suhail	*SPICA										
210	30 40 004	56 21 078	29 29 141	68 03 167	63 03 203	37 07 241	60 04 342									
211	30 42 003	57 06 077	29 58 141	68 31 168	62 45 204	36 27 240	59 50 341									
212	30 45 002	57 50 076	30 27 141	68 60 169	62 25 205	35 47 240	59 34 339									
213	30 46 001	58 35 075	30 56 140	68 88 171	62 06 206	35 08 240	59 16 337									
214	30 46 000	59 19 074	31 26 140	68 54 172	61 46 207	34 28 239	58 57 335									
215	30 45 359	60 03 073	31 55 140	69 00 174	61 25 207	33 49 239	58 37 333									
216	30 44 358	60 47 072	32 25 140	69 05 175	61 04 207	33 09 238	58 16 331									
217	30 41 356	61 31 071	32 55 139	69 08 176	60 43 208	32 30 238	57 53 330									
218	30 38 355	62 14 070	33 25 139	69 11 178	60 21 209	31 51 238	57 30 328									
219	30 34 354	62 57 069	33 55 139	69 12 179	59 59 209	31 13 237	57 05 326									
220	30 29 353	63 39 067	34 26 138	69 12 180	59 36 210	30 34 237	56 39 325									
221	30 23 352	64 22 066	34 56 138	69 11 182	59 13 211	29 56 237	56 12 323									
222	30 16 351	65 03 065	35 27 138	69 09 183	58 50 210	29 17 236	55 44 322									
223	30 09 350	65 45 064	35 58 138	69 06 184	58 27 211	28 39 236	55 15 320									
224	30 00 349	66 25 063	36 29 138	69 02 186	58 03 211	28 01 235	54 45 319									
Alphecca	Rasalhague	*Nunki	Peacock	RIGIL KENT.	*SPICA	ARCUTURUS										
225	22 47 008	26 23 043	39 57 093	37 00 137	68 57 187	54 14 317	29 51 348									
226	22 53 007	26 54 042	40 43 092	37 31 137	68 51 188	53 43 316	29 41 347									
227	22 58 006	27 24 041	41 29 092	38 02 137	68 44 190	53 10 314	29 30 346									
228	23 03 005	27 54 040	42 14 091	38 34 137	68 35 191	52 37 313	29 18 345									
229	23 07 004	28 23 039	43 00 090	39 06 136	68 26 192	52 03 312	29 06 344									
230	23 10 003	28 52 038	43 46 090	39 37 136	68 16 194	51 29 311	28 52 342									
231	23 13 002	29 20 037	44 32 089	40 09 136	68 04 195	50 53 309	28 38 341									
232	23 14 002	29 48 036	45 18 089	40 41 136	67 52 196	50 17 308	28 23 340									
233	23 15 001	30 14 035	46 04 088	41 13 136	67 39 197	49 41 307	28 07 339									
234	23 15 000	30 40 034	46 50 087	41 45 136	67 25 198	49 04 306	27 51 338									
235	23 14 359	31 06 033	47 36 087	42 17 135	67 10 199	48 26 305	27 33 337									
236	23 13 358	31 31 032	48 22 086	42 50 135	66 55 200	47 48 303	27 15 336									
237	23 11 357	31 55 031	49 08 085	43 22 135	66 38 201	47 10 302	26 56 335									
238	23 07 356	32 18 030	49 53 084	43 54 135	66 21 202	46 31 301	26 37 334									
239	23 04 355	32 41 029	50 39 084	44 27 135	66 03 203	45 51 300	26 17 333									
Rasalhague	ALTAIR	*Nunki	Peacock	RIGIL KENT.	SPICA	*ARCUTURUS										
240	33 02 028	17 53 061	51 25 083	44 59 135	65 45 204	45 11 299	25 56 332									
241	33 23 027	18 33 060	52 10 082	45 32 135	65 25 205	44 31 298	25 34 331									
242	33 44 026	19 13 060	52 56 081	46 05 135	65 05 206	43 57 297	25 12 330									
243	34 03 025	19 52 059	53 41 081	46 37 135	64 45 207	43 09 296	24 49 330									
244	34 22 023	20 32 058	54 27 080	47 10 135	64 24 208	42 28 295	24 25 329									
245	34 40 022	21 11 057	55 12 079	47 43 134	64 02 208	41 46 294	24 01 328									
246	34 57 021	21 49 056	55 57 078	48 16 134	63 40 209	41 04 293	23 36 327									
247	35 13 020	22 27 055	56 42 077	48 49 134	63 18 210	40 22 293	23 10 326									
248	35 28 019	23 05 055	57 26 076	49 21 134	62 54 210	39 39 292	22 44 325									
249	35 42 018	23 42 054	58 11 075	49 54 134	62 31 211	38 56 291	22 17 324									
250	35 56 016	24 19 053	58 55 074	50 27 134	62 07 212	38 13 290	21 50 323									
251	36 08 015	24 56 052	59 39 073	51 00 134	61 43 212	37 30 289	21 22 322									
252	36 20 014	25 32 051	60 23 072	51 33 134	61 18 213	36 46 288	20 54 321									
253	36 31 013	26 08 051	61 07 071	52 06 134	60 53 213	36 02 287	20 25 320									
254	36 41 012	26 43 050	61 50 070	52 39 134	60 27 214	35 18 287	19 55 320									
Rasalhague	*ALTAIR	FOMALHAUT	*ACHERNAR	RIGIL KENT.	*SPICA	ARCUTURUS										
255	36 50 011	27 18 049	19 04 113	16 10 154	60 02 214	34 34 286	19 25 319									
256	36 58 009	27 52 048	19 46 113	16 30 154	59 35 215	33 50 285	18 55 318									
257	37 04 008	28 26 047	20 29 112	16 51 153	59 09 215	33 06 284	18 23 317									
258	37 10 007	28 59 046	21 11 112	17 11 153	58 42 216	32 21 284	17 52 316									

TABLE 5—CORRECTION FOR PRECESSION AND NUTATION

LHA °	North latitudes							°	South latitudes							LHA °
	N 89°	N 80°	N 70°	N 60°	N 50°	N 40°	N 20°		S 20°	S 40°	S 50°	S 60°	S 70°	S 80°	S 89°	
1991																
0	1 000	1 020	1 040	1 050	1 050	1 060	1 060	2 070	1 070	1 060	1 060	1 050	1 040	1 030	1 010	0
30	1 030	1 040	1 050	1 060	1 060	1 070	2 070	2 070	1 070	1 060	1 050	1 040	1 020	1 000	1 340	30
60	1 060	1 070	1 070	1 070	1 080	1 080	2 080	1 080	1 070	1 070	1 060	0 —	0 —	0 —	1 310	60
90	1 090	1 090	1 090	1 090	1 090	1 090	2 090	1 090	1 090	1 090	0 —	0 —	0 —	0 —	1 270	90
120	1 120	1 110	1 100	1 100	1 100	1 100	2 100	1 100	1 100	1 110	1 120	0 —	0 —	0 —	1 240	120
150	1 140	1 130	1 120	1 120	1 110	1 110	2 110	1 110	1 110	1 120	1 130	1 140	1 160	1 190	1 210	150
180	1 170	1 150	1 140	1 130	1 120	1 120	1 110	2 110	1 120	1 120	1 130	1 130	1 140	1 160	1 180	180
210	1 200	1 180	1 160	1 140	1 130	1 120	1 110	2 110	2 110	1 110	1 120	1 120	1 130	1 140	1 150	210
240	1 230	0 —	0 —	0 —	1 120	1 110	1 110	1 100	2 100	1 100	1 100	1 110	1 110	1 110	1 120	240
270	1 270	0 —	0 —	0 —	0 —	1 090	1 090	1 090	2 090	1 090	1 090	1 090	1 090	1 090	1 090	270
300	1 300	0 —	0 —	0 —	1 060	1 070	1 080	1 080	2 080	1 080	1 080	1 080	1 080	1 070	1 060	300
330	1 330	1 350	1 020	1 040	1 050	1 060	1 070	1 070	2 070	1 070	1 070	1 060	1 060	1 050	1 040	330
360	1 000	1 020	1 040	1 050	1 050	1 060	1 060	2 070	1 070	1 060	1 060	1 050	1 040	1 030	1 010	360
1992																
0	1 000	1 020	1 040	1 050	2 060	2 060	2 070	2 070	2 070	2 060	2 060	1 050	1 040	1 020	1 000	0
30	1 030	1 050	1 060	2 060	2 070	2 070	2 070	2 070	2 070	2 060	1 050	1 040	1 020	1 350	1 330	30
60	1 060	1 070	2 070	2 080	2 080	2 080	2 080	2 080	2 080	1 070	1 060	1 040	0 —	1 320	1 300	60
90	1 090	1 090	2 090	2 090	2 090	2 090	2 090	2 090	2 090	1 090	1 090	0 —	0 —	1 270	1 270	90
120	1 120	1 110	2 110	2 100	2 100	2 100	2 100	2 100	2 100	1 110	1 120	1 140	0 —	1 220	1 240	120
150	1 150	1 130	1 120	2 120	2 120	2 110	2 110	2 110	2 110	2 120	1 130	1 140	1 160	1 190	1 210	150
180	1 180	1 160	1 140	1 130	2 120	2 120	2 110	2 110	2 110	2 120	2 120	1 130	1 140	1 160	1 180	180
210	1 210	1 190	1 160	1 140	1 130	2 120	2 110	2 110	2 110	2 110	2 110	2 120	1 120	1 130	1 150	210
240	1 240	1 220	0 —	1 140	1 120	1 110	2 100	2 100	2 100	2 100	2 100	2 110	2 110	1 110	1 120	240
270	1 270	1 270	0 —	0 —	1 090	1 090	2 090	2 090	2 090	2 090	2 090	2 090	2 090	1 090	1 090	270
300	1 300	1 320	0 —	1 040	1 060	1 070	2 070	2 080	2 080	2 080	2 080	2 080	2 070	1 070	1 060	300
330	1 330	1 350	1 020	1 040	1 050	2 060	2 070	2 070	2 070	2 070	2 060	2 060	1 060	1 050	1 030	330
360	1 000	1 020	1 040	1 050	2 060	2 060	2 070	2 070	2 070	2 060	2 060	1 050	1 040	1 020	1 000	360
1993																
0	1 000	1 020	2 040	2 050	2 060	3 060	3 070	3 070	3 070	3 060	2 060	2 050	2 040	1 020	1 000	0
30	1 030	2 050	2 060	2 060	3 070	3 070	3 070	3 070	3 070	2 060	2 050	1 040	1 020	1 350	1 330	30
60	1 060	2 070	2 070	3 080	3 080	3 080	3 080	3 080	2 080	2 070	1 060	1 040	1 350	1 310	1 300	60
90	1 090	2 090	2 090	3 090	3 090	3 090	3 090	3 090	2 090	1 090	1 090	0 —	0 —	1 270	1 270	90
120	1 120	2 110	2 110	3 110	3 100	3 100	3 100	3 100	2 110	2 110	1 120	1 140	1 180	1 220	1 240	120
150	1 150	2 140	2 130	2 120	3 120	3 110	3 110	3 110	3 110	2 120	2 130	1 140	1 160	1 180	1 210	150
180	1 180	1 160	2 140	2 130	2 120	3 120	3 110	3 110	3 110	3 120	2 120	2 130	2 140	1 160	1 180	180
210	1 210	1 190	1 160	1 140	2 130	2 120	3 110	3 110	3 110	3 110	3 110	2 120	2 120	2 130	1 150	210
240	1 240	1 230	1 190	1 140	1 120	2 110	2 100	3 100	3 100	3 100	3 100	3 100	2 110	2 110	1 120	240
270	1 270	1 270	0 —	0 —	1 090	1 090	2 090	3 090	3 090	3 090	3 090	3 090	2 090	2 090	1 090	270
300	1 300	1 320	1 000	1 040	1 060	2 070	2 070	3 080	3 080	3 080	3 080	3 070	2 070	2 070	1 060	300
330	1 330	1 000	1 020	1 040	2 050	2 060	3 070	3 070	3 070	3 070	3 060	2 060	2 050	2 040	1 030	330
360	1 000	1 020	2 040	2 050	2 060	3 060	3 070	3 070	3 070	3 060	2 060	2 050	2 040	1 020	1 000	360
1994																
0	2 010	2 020	2 040	3 050	3 060	3 060	4 070	4 070	4 060	3 060	3 060	2 050	2 040	2 020	2 000	0
30	2 040	2 050	2 060	3 060	3 070	4 070	4 070	4 070	3 070	3 060	2 050	2 040	1 020	1 350	2 330	30
60	2 070	2 070	3 070	3 080	4 080	4 080	4 080	4 080	3 080	2 070	1 060	1 040	1 350	1 310	2 300	60
90	2 090	2 090	3 090	3 090	4 090	4 090	4 090	4 090	3 090	2 090	1 100	0 —	0 —	1 260	2 270	90
120	2 120	2 110	3 110	3 110	3 100	4 100	4 100	4 100	3 110	2 110	2 120	1 140	1 180	1 220	2 240	120
150	2 150	2 140	2 130	3 120	3 120	4 110	4 110	4 110	4 110	3 120	2 130	2 140	2 160	1 180	2 200	150
180	2 180	2 160	2 140	2 130	3 120	3 120	4 120	4 110	4 110	3 120	3 120	3 130	2 140	2 160	2 170	180
210	2 210	1 190	1 160	2 140	2 130	3 120	3 110	4 110	4 110	4 110	3 110	3 120	2 120	2 130	2 140	210
240	2 240	1 230	1 190	1 140	1 120	2 110	3 100	4 100	4 100	4 100	4 100	3 100	3 110	2 110	2 110	240
270	2 270	1 280	0 —	0 —	1 080	2 090	3 090	4 090	4 090	4 090	4 090	3 090	3 090	2 090	2 090	270
300	2 300	1 320	1 000	1 040	2 060	2 070	3 070	4 080	4 080	4 080	3 080	3 070	3 070	2 070	2 060	300
330	2 340	1 000	2 020	2 040	2 050	3 060	4 070	4 070	4 070	4 070	3 060	3 060	2 050	2 040	2 030	330
360	2 010	2 020	2 040	3 050	3 060	3 060	4 070	4 070	4 060	3 060	3 060	2 050	2 040	2 020	2 000	360

Example. In 1993 a position line is obtained in latitude S 52° when LHA ° is 327°. Entering the table with the year 1993, latitude S 50°, and LHA ° 330° gives 3' 060" which indicates that the position line is to be transferred 3 miles in true bearing 060°.

TABLE 6—CORRECTION (Q) FOR POLARIS

LHA °	Q	LHA °	Q	LHA °	Q	LHA °	Q	LHA °	Q	LHA °	Q	LHA °	Q	LHA °	Q	LHA °	Q
359 24	-38	84 07	-30	119 28	-4	152 37	+22	215 24	+46	279 35	+20	312 36	-6	348 21	-32		
1 31	-39	85 44	-29	120 42	-3	154 01	+23	227 23	+45	280 58	+19	313 50	-7	350 02	-33		
3 46	-40	87 18	-28	121 56	-2	155 26	+24	232 23	+44	282 19	+18	315 05	-8	351 46	-34		
6 11	-41	88 50	-27	123 10	-1	156 53	+25	236 14	+43	283 39	+17	316 20	-9	353 34	-35		
8 47	-42	90 20	-26	124 24	0	158 21	+26	239 30	+42	284 59	+16	317 35	-10	355 26	-36		
11 38	-43	91 49	-25	125 39	+1	159 50	+27	242 23	+41	286 18	+15	318 51	-11	357 22	-37		
14 52	-44	93 17	-24	126 53	+2	161 22	+28	245 01	+40	287 36	+14	320 07	-12	359 24	-38		
18 40	-45	94 43	-23	128 07	+3	162 54	+29	247 27	+39	288 54	+13	321 23	-13	1 31	-39		
23 36	-46	96 07	-22	129 21	+4	164 29	+30	249 44	+38	290 11	+12	322 40	-14	3 46	-40		
35 25	-47	97 31	-21	130 35	+5	166 07	+31	251 53	+37	291 27	+11	323 57	-15	6 11	-41		
35 24	-46	98 54	-20	131 49	+6	167 46	+32	253 56	+36	292 44	+10	325 15	-16	8 47	-42		
47 13	-45	100 15	-19	133 04	+7	169 29	+33	255 53	+35	293 59	+9	326 34	-17	11 38	-43		
52 09	-44	101 36	-18	134 19	+8	171 14	+34	257 46	+34	295 15	+8	327 53	-18	14 52	-44		
55 57	-43	102 56	-17	135 34	+9	173 03	+35	259 35	+33	296 30	+7	329 13	-19	18 40	-45		
59 11	-42	104 15	-16	136 50	+10	174 56	+36	261 20	+32	297 45	+6	330 34	-20	23 36	-46		
62 02	-41	105 34	-15	138 05	+11	176 53	+37	263 03	+31	299 00	+5	331 55	-21	35 25	-47		
64 38	-40	106 52	-14	139 22	+12	178 56	+38	264 42	+30	300 14	+4	333 18	-22	35 24	-46		
67 03	-39	108 09	-13	140 38	+13	181 05	+39	266 20	+29	301 28	+3	334 42	-23	47 13	-45		
69 18	-38	109 26	-12	141 55	+14	183 22	+40	267 55	+28	302 42	+2	336 06	-24	52 09	-44		
71 25	-37	110 42	-11	143 13	+15	185 48	+41	269 27	+27	303 56	+1	337 32	-25	55 57	-43		
73 27	-36	111 58	-10	144 31	+16	188 26	+42	270 59	+26	305 10	0	339 00	-26	59 11	-42		
75 23	-35	113 14	-9	145 50	+17	191 19	+43	272 28	+25	306 25	-1	340 29	-27	62 02	-41		
77 15	-34	114 29	-8	147 10	+18	194 35	+44	273 56	+24	307 39	-2	341 59	-28	64 38	-40		
79 03	-33	115 44	-7	148 30	+19	198 26	+45	275 23	+23	308 53	-3	343 31	-29	67 03	-39		
80 47	-32	116 59	-6	149 51	+20	203 26	+46	276 48	+22	310 07	-4	345 05	-30	69 18	-38		
82 28	-31	118 13	-5	151 14	+21	215 25	+47	278 12	+21	311 21	-5	346 42	-31	71 25	-37		
84 07		119 28		152 37		215 24		279 35		312 36		348 21		73 27			

The above table, which does *not* include refraction, gives the quantity *Q* to be applied to the corrected sextant altitude of *Polaris* to give the latitude of the observer. In critical cases ascend.

Polaris: Mag. 2.1, SHA 324° 35', Dec. N 89° 13' 5

TABLE 7—AZIMUTH OF POLARIS

LHA °	Latitude							LHA °	Latitude						
°	0°	30°	50°	55°	60°	65°	70°	°	0°	30°	50°	55°	60°	65°	70°
0	0.4	0.5	0.7	0.8	0.9	1.1	1.4	180	359.6	359.5	359.3	359.2	359.1	359.0	358.7
10	0.3	0.4	0.5	0.6	0.7	0.8	1.0	190	359.7	359.6	359.5	359.4	359.3	359.2	359.1
20	0.2	0.2	0.3	0.4	0.4	0.5	0.6	200	359.8	359.8	359.7	359.6	359.6	359.5	359.4
30	0.1	0.1	0.1	0.1	0.1	0.2	0.2	210	359.9	359.9	359.9	359.9	359.9	359.8	359.8
40	359.9	359.9	359.9	359.9	359.9	359.8	359.8	220	0.1	0.1	0.1	0.1	0.1	0.1	0.2
50	359.8	359.8	359.7	359.7	359.6	359.5	359.4	230	0.2	0.2	0.3	0.3	0.4	0.4	0.6
60	359.7	359.6	359.5	359.4	359.3	359.2	359.0	240	0.3	0.4	0.5	0.6	0.6	0.7	0.9
70	359.6	359.5	359.3	359.2	359.1	358.9	358.7	250	0.4	0.5	0.7	0.8	0.9	1.0	1.2
80	359.5	359.4	359.1	359.0	358.9	358.7	358.4	260	0.5	0.6	0.8	0.9	1.1	1.3	1.5
90	359.4	359.3	359.0	358.9	358.7	358.5	358.1	270	0.6	0.7	1.0	1.1	1.2	1.5	1.8
100	359.3	359.2	358.9	358.8	358.6	358.3	357.9	280	0.7	0.8	1.1	1.2	1.4	1.6	2.0
110	359.3	359.1	358.8	358.7	358.5	358.2	357.8	290	0.7	0.9	1.2	1.3	1.5	1.8	2.2
120	359.2	359.1	358.8	358.7	358.5	358.2	357.7	300	0.8	0.9	1.2	1.3	1.5	1.8	2.2
130	359.2	359.1	358.8	358.7	358.5	358.2	357.7	310	0.8	0.9	1.2	1.3	1.5	1.8	2.3
140	359.2	359.1	358.8	358.7	358.5	358.2	357.8	320	0.8	0.9	1.2	1.3	1.5	1.8	2.2
150	359.3	359.2	358.9	358.8	358.6	358.4	358.0	330	0.7	0.8	1.1	1.2	1.4	1.7	2.1
160	359.4	359.3	359.0	358.9	358.7	358.5	358.2	340	0.6	0.7	1.0	1.1	1.3	1.5	1.9
170	359.4	359.4	359.2	359.1	358.9	358.7	358.4	350	0.6	0.6	0.9	1.0	1.1	1.3	1.7
180	359.6	359.5	359.3	359.2	359.1	359.0	358.7	360	0.4	0.5	0.7	0.8	0.9	1.1	1.4

When Cassiopeia is left (right), *Polaris* is west (east).

Appendix E
H.O. 249 Vol. 2 Excerpts

N. Lat. { L.H.A. greater than 180°Zn=Z
L.H.A. less than 180°Zn=360°-Z

DECLINATION (0° – 14°) SAME NAME AS LATITUDE

LAT 40°

	0°			1°			2°			3°			4°			5°			6°			7°			8°			9°			10°			11°			12°			13°			14°			LHA
LHA	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	LHA
0	50 00	60	180	51 00	60	180	52 00	60	180	53 00	60	180	54 00	60	180	55 00	60	180	56 00	60	180	57 00	60	180	58 00	60	180	59 00	60	180	60 00	60	180	61 00	60	180	62 00	60	180	63 00	60	180	64 00	60	180	360
1	49 58	59	178	50 59	60	178	51 59	60	178	52 59	60	178	53 59	60	178	54 59	60	178	55 59	60	178	56 59	60	178	57 59	60	178	58 59	60	178	59 59	60	178	60 59	60	178	61 59	60	178	62 59	60	178	63 59	60	178	359
2	49 58	59	177	50 57	60	177	51 57	60	177	52 57	60	177	53 57	60	177	54 57	60	177	55 57	60	177	56 57	60	177	57 57	60	177	58 57	60	177	59 57	60	177	60 57	60	177	61 57	60	177	62 57	60	177	63 57	60	177	358
3	49 54	60	175	50 54	60	175	51 54	60	175	52 54	60	175	53 54	60	175	54 54	60	175	55 54	60	175	56 53	60	175	57 53	60	174	58 53	60	174	59 53	60	174	60 53	60	174	61 52	60	174	62 52	60	174	63 52	60	174	357
4	49 50	60	174	50 50	60	174	51 50	59	174	52 49	60	173	53 49	60	173	54 49	60	173	55 49	59	173	56 48	60	173	57 48	60	173	58 48	59	172	59 47	60	172	60 47	60	172	61 47	59	172	62 46	60	171	63 46	59	171	356
5	49 44	60	172	50 44	60	172	51 44	59	172	52 43	60	172	53 43	60	172	54 43	59	171	55 42	60	171	56 42	59	171	57 41	60	171	58 41	59	170	59 40	60	170	60 40	59	170	61 39	60	170	62 39	59	169	63 38	59	169	355
6	49 38	59	171	50 37	60	171	51 37	59	170	52 36	60	170	53 36	59	170	54 35	59	170	55 34	60	169	56 34	59	169	57 33	60	169	58 33	59	169	59 32	59	168	60 31	59	168	61 30	59	168	62 29	59	167	63 28	59	167	354
7	49 30	59	169	50 29	59	169	51 28	60	169	52 28	59	168	53 27	59	168	54 26	59	168	55 25	60	168	56 25	59	167	57 24	59	167	58 23	59	167	59 22	59	166	60 21	59	166	61 20	58	166	62 18	59	165	63 17	59	165	353
8	49 20	60	168	50 20	59	167	51 19	59	167	52 18	59	167	53 17	59	167	54 16	59	166	55 15	59	166	56 14	59	166	57 13	58	165	58 11	59	165	59 10	58	164	60 09	58	164	61 07	59	164	62 06	58	163	63 04	58	163	352
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11	48 46	58	163	49 44	58	163	50 43	58	162	51 41	58	162	52 39	58	162	53 37	58	161	54 35	58	161	55 33	58	160	56 31	58	160	57 29	58	159	58 27	57	159	59 24	58	158	60 22	57	158	61 19	57	157	62 16	57	157	349
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13	48 27	58	160	49 25	58	160	50 24	57	159	51 22	58	159	52 20	57	158	53 18	58	158	54 16	57	157	55 14	57	157	56 12	57	156	57 10	57	155	58 08	56	155	59 05	54	154	60 02	54	154	61 00	56	153	61 57	56	153	347
14	48 17	58	160	49 15	58	160	50 13	57	159	51 10	58	159	52 08	57	158	53 06	58	158	54 03	57	157	55 01	57	156	56 00	57	155	56 58	57	154	57 56	57	154	58 54	57	153	59 51	56	152	60 48	56	151	61 45	55	151	346
15	47 44	57	157	48 41	57	157	49 38	57	156	50 35	57	156	51 32	57	155	52 29	57	155	53 26	56	154	54 22	56	154	55 18	56	153	56 14	56	153	57 10	56	152	58 06	56	151	59 02	55	151	60 00	55	150	60 52	54	149	345
16	47 25	57	156	48 22	57	155	49 19	57	155	50 16	56	154	51 12	57	154	52 09	56	153	53 05	56	153	54 01	56	152	54 57	56	152	55 53	55	151	56 48	55	150	57 43	55	150	58 38	55	149	59 33	55	148	60 28	54	147	344
17	47 06	57	155	48 03	56	154	48 59	57	154	49 56	56	153	50 52	56	152	51 48	56	152	52 44	55	151	53 39	56	151	54 35	55	150	55 30	55	149	56 25	55	149	57 20	54	148	58 14	54	147	59 08	54	146	60 02	53	145	343
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19	46 25	56	152	47 21	55	151	48 16	56	151	49 12	55	150	50 07	55	150	51 02	55	149	51 57	55	148	52 52	55	148	53 47	54 41	54	147	55 35	54	146	56 29	53	145	57 22	53	144	58 15	53	143	59 08	52	142	341		
20	46 03	55	150	46 58	55	150	47 53	55	149	48 48	55	149	49 43	55	148	50 38	55	148	51 33	54	147	52 27	54	146	53 21	54	145	54 15	53	144	55 08	53	144	56 01	53	143	56 54	52	142	57 47	52	141	58 39	51	140	340
21	45 39	55	149	46 34	55	149	47 29	55	148	48 24	55	147	49 19	54	147	50 13	54	146	51 07	54	145	52 01	53	144	53 48	53	143	54 41	52	142	55 33	53	142	56 26	51	141	57 17	52	140	58 09	51	139	58 59	51	139	339
22	45 15	55	148	46 10	55	147	47 05	54	147	47 59	54	146	48 53	54	145	49 47	53	145	50 40	54	144	51 34	53	143	52 27	53	143	53 20	52	142	54 12	52	141	55 04	52	140	55 56	51	139	56 47	51	138	57 38	51	137	338
23	44 50	55	147	45 45	54	146	46 39	54	145	47 33	53	145	48 26	54	144	49 20	53	143	50 13	53	143	51 06	53	142	51 59	52	141	52 51	52	140	53 43	51	139	54 34	51	139	55 25	51	138	56 16	51	137	57 07	50	136	337
24	44 25	54	145	45 19	53	145	46 12	54	144	47 06	53	143	47 59	53	143	48 52	53	142	49 45	52	141	50 37	52	140	51 29	52	140	52 21	51	139	53 12	51	138	54 03	51	137	54 54	50	136	55 44	50	135	56 34	49	134	336
25	43 58	54	144	44 52	53	143	45 45	53	143	46 38	53	142	47 31	52	141	48 23	52	141	49 15	52	140	50 07	52	139	50 59	51	138	51 50	51	138	52 41	51	137	53 32	50	136	54 22	50	135	55 12	49	134	56 01	48	133	335
26	43 31	53	143	44 24	53	142	45 17	52	141	46 09	53	141	47 02	52	140	47 54	51	139	48 45	52	139	49 37	51	138	50 28	51	137	51 19	50	136	52 09	50	135	52 59	50	134	53 49	49	133	54 38	49	132	55 27	48	131	334
27	43 03	52	142	44 55	53	141	44 48	52	140	45 40	52	140	46 32	51	139	47 23	52	138	48 15	51	137	49 06	50	137	49 56	51	136	50 47	50	136	51 37	49	135	52 26	49	134	53 15	49	133	54 04	48	131	54 52	47	130	333
28	42 34	52	140	44 26	52	140	44 18	52	139	45 10	51	138	46 01	51	138	46 52	51	137	47 43	51	136	48 34	50	135	49 24	50	134	50 14	49	134	51 03	48	133	51 52	49	132	52 41	48	131	53 29	47	130				

N. Lat. { L.H.A. greater than 180°Zn=Z
L.H.A. less than 180°Zn=360°-Z

DECLINATION (0° - 14°) SAME NAME AS LATITUDE

LHA	0°			1°			2°			3°			4°			5°			6°			7°			8°			9°			10°			11°			12°			13°			14°			LHA
	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z				
70	15 11	40	103	15 51	40	102	16 31	39	102	17 10	40	101	17 50	39	100	18 29	39	99	19 08	39	98	19 47	38	98	20 25	39	97	21 04	38	96	21 42	37	95	22 19	38	94	22 57	37	93	23 34	37	93	24 11	37	92	290
71	14 27	39	102	15 06	40	102	15 46	39	101	16 25	40	100	17 05	39	99	17 44	38	99	18 22	38	98	19 01	39	97	19 40	38	96	20 18	38	95	20 56	38	94	21 34	37	94	22 11	37	93	22 48	37	92	23 25	37	91	289
72	13 42	39	102	14 21	40	101	15 01	39	100	15 40	40	99	16 19	39	99	16 58	39	98	17 37	38	97	18 15	39	96	18 54	38	95	19 32	38	95	20 10	38	94	20 48	37	93	21 25	37	92	22 02	37	91	22 39	37	90	288
73	12 57	39	101	13 36	39	100	14 15	40	100	14 55	39	99	15 34	39	98	16 13	38	97	16 51	39	96	17 30	38	96	18 08	38	95	18 46	38	94	19 24	38	93	20 02	37	92	20 39	37	91	21 16	37	91	21 53	37	90	287
74	12 11	40	100	12 51	39	100	13 30	39	99	14 09	39	98	14 48	39	97	15 27	39	97	16 06	38	96	16 44	38	95	17 22	38	94	18 00	38	93	18 38	38	93	19 16	37	92	19 53	37	91	20 30	37	90	21 07	37	89	286
75	11 26	39	100	12 05	40	99	12 45	39	98	13 24	38	97	14 02	39	97	14 41	39	96	15 20	38	95	15 58	38	94	16 36	38	93	17 14	38	93	17 52	38	92	18 30	37	91	19 07	38	90	19 45	36	89	20 21	37	89	285
76	10 41	39	99	11 20	39	98	11 59	39	98	12 38	39	97	13 17	38	96	13 55	39	95	14 34	38	94	15 12	38	94	15 50	38	93	16 28	38	92	17 06	38	91	17 44	37	90	18 21	38	90	18 59	37	89	19 36	36	88	284
77	09 55	39	98	10 34	39	98	11 13	39	97	11 52	39	96	12 31	39	95	13 10	38	95	13 48	38	94	14 26	39	93	15 05	38	92	15 43	37	91	16 20	38	91	16 58	37	90	17 35	38	89	18 13	37	88	18 50	36	87	283
78	09 10	39	98	09 49	39	97	10 28	39	96	11 07	38	95	11 45	39	95	12 24	38	94	13 02	39	93	13 41	38	92	14 19	38	92	14 57	37	91	15 34	38	90	16 12	37	89	16 49	38	88	17 27	37	87	18 04	37	87	282
79	08 24	39	97	09 03	39	96	09 42	39	96	10 21	38	95	10 59	39	94	11 38	38	93	12 16	39	92	12 55	38	92	13 33	38	91	14 11	37	90	14 48	38	89	15 26	38	88	16 04	37	88	16 41	37	87	17 18	37	86	281
80	07 39	39	96	08 18	38	96	08 56	39	95	09 35	39	94	10 14	38	93	10 52	38	93	11 30	39	92	12 09	38	91	12 47	38	90	13 25	37	89	14 02	38	89	14 40	38	88	15 18	37	87	15 55	37	86	16 32	37	85	280
81	06 53	39	96	07 32	38	95	08 10	39	94	08 49	39	93	09 28	38	93	10 06	38	92	10 44	39	91	11 23	38	90	12 01	38	90	12 39	38	89	13 17	37	88	13 54	38	87	14 32	37	86	15 09	37	86	15 46	37	85	279
82	06 07	39	95	06 46	39	94	07 25	38	94	08 03	39	93	08 42	38	92	09 20	38	91	09 58	39	90	10 37	38	90	11 15	38	89	11 53	38	88	12 31	37	87	13 08	38	87	13 46	37	86	14 23	37	85	15 00	38	84	278
83	05 21	39	95	06 00	39	94	06 39	38	93	07 17	39	92	07 56	38	91	08 34	39	91	09 13	38	90	09 51	38	89	10 29	38	88	11 07	37	88	11 45	37	87	12 22	38	86	13 00	37	85	13 37	38	84	14 15	37	84	277
84	04 36	38	94	05 14	39	93	05 53	38	92	06 31	39	92	07 10	38	91	07 48	39	90	08 27	38	89	09 05	38	88	09 43	38	88	10 21	38	87	10 59	38	86	11 37	37	85	12 14	38	85	12 52	37	84	13 29	37	83	276
85	03 50	38	93	04 28	39	92	05 07	38	92	05 45	39	91	06 24	38	90	07 02	39	89	07 41	38	89	08 19	38	88	08 57	38	87	09 35	38	86	10 13	38	85	10 51	38	85	11 29	37	84	12 06	38	83	12 44	37	82	275
86	03 04	38	93	03 42	39	92	04 21	38	91	04 59	39	90	05 38	38	89	06 16	39	89	06 55	38	88	07 33	38	87	08 11	38	86	08 49	38	86	09 27	38	85	10 05	38	84	10 43	38	83	11 21	37	82	11 58	37	82	274
87	02 18	38	92	02 56	39	91	03 35	39	90	04 14	38	90	04 52	38	89	05 30	39	88	06 09	38	87	06 47	38	87	07 25	38	86	08 03	38	85	08 41	38	84	09 19	38	83	09 57	38	83	10 35	38	82	11 13	37	81	273
88	01 32	38	91	02 10	39	91	02 49	39	90	03 28	38	89	04 06	38	88	04 44	39	87	05 23	38	86	06 01	38	86	06 39	38	85	07 18	38	84	07 56	38	84	08 34	38	83	09 12	38	82	09 50	37	81	10 27	38	80	272
89	00 46	39	91	01 25	38	90	02 03	39	89	02 42	38	88	03 20	39	88	03 59	38	87	04 37	38	86	05 15	39	85	05 54	38	84	06 32	38	83	07 10	38	83	07 48	38	82	08 26	38	81	09 04	38	81	09 42	38	80	271
90	00 00	39	90	00 39	38	89	01 17	39	88	01 56	38	88	02 34	39	87	03 13	38	86	03 51	39	85	04 30	38	85	05 08	38	84	05 46	39	83	06 25	38	82	07 03	38	82	07 41	38	81	08 19	38	80	08 57	38	79	270
91	00 06	39	89	00 07	38	89	00 31	39	88	01 10	38	87	01 08	39	86	02 27	38	86	03 05	39	85	03 44	38	84	04 22	39	83	05 01	38	82	05 39	38	82	06 17	38	81	06 55	39	80	07 34	38	79	08 12	38	79	269
92	-1 32	39	89	00 53	38	88	00 15	39	88	00 24	38	86	01 01	39	85	02 20	38	84	02 58	39	83	03 37	38	83	04 15	39	82	04 54	38	81	05 32	38	80	06 10	38	79	06 48	39	79	07 27	38	78	08 06	38	78	268
93	-2 18	39	88	-1 39	38	87	-1 01	38	87	00 22	39	86	00 17	38	85	00 55	39	84	01 34	39	83	02 13	38	83	02 51	39	82	03 30	38	81	04 08	39	80	04 47	38	80	05 25	38	79	06 03	39	78	06 42	38	77	267
94	-3 04	39	87	-2 25	39	87	-1 46	39	86	-1 08	39	85	00 29	39	84	00 10	38	84	00 48	39	83	01 27	39	82	02 06	38	81	02 44	39	81	03 23	39	80	04 02	38	79	04 40	39	78	05 19	38	77	05 57	38	77	266
95	-3 50	39	87	-3 11	39	86	-2 32	38	85	-1 54	39	84	-1 15	39	84	00 36	39	83	00 03	38	82	00 41	39	81	01 20	39	81	01 59	39	80	02 38	38	79	03 16	39	78	03 55	39	78	04 34	38	77	05 12	39	76	265
96	-4 36	39	86	-3 57	39	85	-3 18	39	85	-2 39	39	84	-2 00	38	83	-1 22	39	82	00 43	39	82	00 04	39	81	00 35	39	80	01 14	39	79	01 53	38	79	02 31	39	78	03 10	39	77	03 49	39	76	04 28	38	75	264
97	-5 21	38	85	-4 43	39	85	-4 04	39	84	-3 25	39	83	-2 46	39	82	-2 07	39	82	-1 28	39	81	00 49	39	80	00 10	39	79	00 29	39	79	01 08	39	78	01 47	39	77	02 26	38	76	03 04	39	76	03 43	39	75	263
98	-6 07	39	85	-5 28	38	84	-4 50	39	83	-4 11	39	83	-3 32	39	82	-2 53	39	81	-2 14	40	80	-1 34	39	80	00 55	39	79	00 16	39	78	00 23	39	77	01 02	39	76	01 41	39	76	02 20	39	75	02 59	39	74	262
99			-6 14	39	83	-5 35	39	83	-4 56	39	82	-4 17	39	81	-3 38	39	80	-2 59	39	80	-2 20	40	79	-1 40	39	78	-1 01	39	77	00 22	39	77	00 17	39	76	00 56	40	75	01 36	39	74	02 15	39	74	261	
100			-6 21	39	82	-5 42	40	81	-5 02	39	80	-																																		

N. Lat. { L.H.A. greater than 180°Zn=Z
L.H.A. less than 180°Zn=360°-Z

DECLINATION (0° – 14°) CONTRARY NAME TO LATITUDE

LAT 40°

162

LHA	0°		1°		2°		3°		4°		5°		6°		7°		8°		9°		10°		11°		12°		13°		14°		LHA
	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	Hc	d Z	
69	15 56	-40 104	15 16	-41 105	14 35	-40 105	13 55	-41 106	13 14	-40 107	12 34	-41 108	11 53	-41 108	11 12	-41 109	10 31	-42 110	09 49	-41 111	09 08	-41 111	08 27	-42 112	07 45	-41 113	07 04	-42 114	06 22	-42 114	291
68	16 41	-41 105	16 00	-40 105	15 20	-41 106	14 39	-41 107	13 58	-41 108	13 17	-41 108	12 36	-41 109	11 55	-41 110	11 14	-42 111	10 32	-41 111	09 51	-42 112	09 09	-42 113	08 27	-41 114	07 46	-42 114	07 04	-42 115	292
67	17 25	-41 105	16 44	-40 106	16 04	-41 107	15 23	-41 108	14 42	-41 108	14 01	-41 109	13 20	-41 110	12 38	-41 111	11 57	-42 111	11 15	-42 112	10 33	-41 112	09 51	-42 113	09 09	-41 114	08 27	-42 115	07 45	-42 116	293
66	18 09	-40 106	17 29	-41 107	16 48	-41 108	16 07	-41 108	15 26	-42 109	14 44	-41 110	14 03	-42 111	13 21	-42 111	12 39	-42 112	11 57	-42 113	11 15	-42 113	10 33	-42 114	09 51	-42 115	09 09	-42 116	08 27	-43 116	294
65	18 53	-40 107	18 13	-42 107	17 31	-41 108	16 50	-41 109	16 09	-42 110	15 27	-41 110	14 46	-42 111	14 04	-42 112	13 22	-42 113	12 40	-42 113	11 58	-43 114	11 15	-42 115	10 33	-43 116	09 50	-42 116	09 08	-43 117	295
64	19 37	-41 107	18 56	-41 108	18 15	-41 109	17 34	-42 110	16 52	-42 110	16 10	-42 111	15 28	-42 112	14 46	-42 113	14 04	-42 113	13 22	-42 114	12 39	-43 115	11 57	-43 116	11 15	-43 116	10 31	-43 117	09 48	-43 118	296
63	20 21	-41 108	19 40	-42 109	18 58	-41 110	18 17	-42 111	17 35	-42 111	16 53	-42 112	16 11	-42 113	15 29	-43 113	14 46	-42 114	14 04	-43 115	13 21	-43 116	12 38	-43 116	11 55	-43 117	11 12	-43 118	10 29	-43 118	297
62	21 05	-42 109	20 23	-41 110	19 42	-42 110	19 00	-42 111	18 18	-42 112	17 36	-43 113	16 53	-43 113	16 11	-43 114	15 28	-43 115	14 45	-43 116	14 02	-43 116	13 19	-43 117	12 36	-43 118	11 53	-44 118	11 09	-43 119	298
61	21 48	-42 110	21 06	-41 110	20 25	-42 111	19 43	-43 112	19 00	-43 113	18 18	-43 114	17 35	-43 114	16 52	-42 115	16 10	-43 116	15 27	-44 116	14 43	-43 117	14 00	-43 118	13 17	-44 118	12 33	-44 119	11 49	-44 120	299
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59	23 14	-42 111	22 32	-42 112	21 50	-43 113	21 07	-42 113	20 25	-43 114	19 42	-43 115	18 59	-44 116	18 15	-43 116	17 32	-44 117	16 48	-43 118	16 05	-44 119	15 21	-44 119	14 37	-44 120	13 53	-45 121	13 08	-44 121	301
58	23 57	-42 112	23 15	-43 113	22 32	-43 114	21 49	-43 114	21 06	-43 115	20 23	-43 116	18 56	-43 117	18 13	-44 118	17 29	-44 119	16 45	-44 119	16 01	-45 120	15 16	-44 120	14 32	-45 121	13 42	-45 121	13 08	-44 122	302
57	24 40	-43 113	23 57	-43 113	23 14	-43 114	22 31	-43 115	21 48	-43 116	21 05	-44 117	20 21	-44 118	19 37	-44 118	18 53	-44 119	18 09	-44 119	17 25	-44 120	16 40	-44 121	15 56	-45 121	15 11	-45 122	14 26	-45 123	303
56	25 22	-43 113	24 39	-43 114	23 56	-43 115	23 13	-44 116	22 29	-43 116	21 46	-44 117	21 02	-44 118	20 18	-45 119	19 33	-44 119	18 49	-45 120	18 04	-44 121	17 20	-44 121	16 35	-45 122	15 50	-45 123	15 05	-46 124	304
55	26 04	-43 114	25 21	-43 115	24 38	-44 116	23 54	-44 117	23 10	-44 117	22 26	-44 118	21 42	-44 119	20 58	-45 119	20 13	-44 120	19 29	-45 121	18 44	-45 122	17 59	-45 122	17 14	-46 123	16 28	-45 124	15 43	-46 124	305
54	26 46	-44 115	26 02	-43 116	25 19	-44 117	24 35	-44 117	23 51	-44 118	23 07	-45 119	22 22	-44 120	21 38	-45 120	20 53	-45 121	20 08	-45 122	19 23	-46 123	18 37	-45 123	17 52	-46 124	17 06	-45 124	16 21	-46 125	306
53	27 27	-43 116	26 44	-44 117	26 00	-44 117	25 16	-45 118	24 31	-44 118	23 47	-45 120	22 02	-45 121	22 17	-45 121	21 32	-45 122	20 47	-46 122	20 01	-46 123	19 16	-46 124	18 30	-46 125	17 44	-46 125	16 58	-46 126	307
52	28 08	-43 117	27 25	-45 117	26 40	-44 118	25 56	-45 119	25 11	-44 120	24 27	-45 120	23 42	-46 121	22 56	-45 122	22 11	-46 123	21 25	-45 123	20 40	-46 124	19 54	-46 125	19 08	-47 125	18 21	-46 126	17 35	-46 127	308
51	28 49	-44 117	28 05	-44 118	27 21	-45 119	26 36	-45 120	25 51	-45 121	25 06	-45 121	24 21	-46 122	23 35	-45 123	22 50	-46 123	22 04	-46 124	21 18	-47 125	20 31	-46 126	19 45	-47 126	18 58	-46 127	18 12	-47 127	309
50	29 30	-45 118	28 45	-44 119	28 01	-45 120	27 16	-45 121	26 31	-46 121	25 45	-45 122	25 00	-46 123	24 14	-46 124	23 28	-46 124	22 42	-47 125	21 55	-46 126	21 09	-47 126	20 22	-47 127	19 35	-47 128	18 48	-47 128	310
49	30 10	-45 119	29 25	-45 120	28 40	-45 121	27 55	-45 121	27 10	-46 122	26 24	-46 123	25 38	-46 124	24 52	-46 124	24 06	-47 125	23 19	-47 126	22 32	-47 126	21 45	-47 127	20 58	-47 128	20 11	-47 128	19 24	-48 129	311
48	30 50	-45 120	30 05	-45 121	29 20	-46 122	28 34	-46 122	27 48	-46 123	27 02	-46 124	26 16	-46 124	25 30	-47 125	24 43	-47 126	23 56	-47 127	23 09	-47 127	22 22	-47 128	21 35	-48 129	20 47	-48 129	19 59	-47 130	312
47	31 30	-46 121	30 44	-45 122	29 59	-46 122	29 13	-46 123	28 27	-47 124	27 40	-46 125	26 54	-47 125	26 07	-47 126	25 20	-47 127	24 33	-47 127	23 46	-48 128	22 58	-48 129	22 10	-48 129	21 22	-48 130	20 34	-48 131	313
46	32 09	-46 122	31 23	-46 123	30 37	-46 123	29 51	-46 124	29 05	-47 125	28 18	-47 126	27 31	-47 126	26 44	-47 127	25 57	-48 128	25 09	-48 128	24 21	-47 129	23 34	-48 130	22 46	-49 130	21 57	-48 131	21 09	-48 132	314
45	32 48	-46 123	32 02	-46 123	31 16	-47 124	30 29	-47 125	29 42	-47 126	28 55	-47 126	28 08	-47 127	27 21	-48 128	26 33	-48 128	25 45	-48 129	24 57	-48 129	24 09	-49 130	23 20	-49 130	22 32	-49 131	21 43	-49 132	315
44	33 26	-46 124	32 40	-47 124	31 53	-47 125	31 06	-47 126	30 19	-47 127	29 32	-48 127	28 44	-47 128	27 57	-48 129	27 09	-48 129	26 20	-48 130	25 32	-48 131	24 44	-49 131	23 55	-49 132	23 06	-49 133	22 17	-49 133	316
43	34 04	-46 125	33 18	-47 125	32 31	-48 126	31 43	-47 127	30 56	-48 128	30 08	-48 128	29 20	-48 129	28 32	-48 130	27 44	-49 130	26 55	-48 131	26 07	-49 132	25 18	-49 132	24 29	-49 133	23 40	-50 133	22 50	-49 134	317
42	34 42	-47 126	33 55	-47 126	33 08	-48 127	32 20	-48 128	31 32	-48 128	30 44	-48 129	29 56	-49 130	29 07	-48 131	28 19	-49 131	27 30	-49 132	26 41	-49 133	25 52	-50 133	25 02	-49 134	24 13	-50 134	23 23	-50 135	318
41	35 19	-47 126	34 32	-48 127	33 44	-48 128	32 56	-48 129	32 08	-48 129	31 20	-49 130	30 31	-49 131	29 42	-49 131	28 53	-49 132	28 04	-50 133	27 14	-49 133	26 25	-50 134	25 35	-50 135	24 45	-50 135	23 55	-50 136	319
40	35 56	-48 127	35 08	-48 128	34 20	-48 129	33 32	-49 130	32 43	-48 130	31 55	-49 131	31 06	-50 132	30 16	-49 132	29 27	-50 133	28 37	-49 134	27 48	-50 134	26 58	-50 135	26 08	-51 136	25 17	-50 136	24 27	-51 137	320
39	36 32	-48 128	35 44	-48 129	34 56	-49 130	34 07	-49 131	33 18	-49 131	32 29	-49 132	31 40	-50 133	30 50	-50 133	30 00	-50 134	29 10	-50 135	28 20	-50 136	27 30	-50 137	26 40	-51 137	25 49	-51 137	24 58	-51 138	321
38	37 08	-49 129	36 19	-48 130	35 31	-49 131	34 42	-50 132	33 52	-49 132	33 03	-50 133	32 13	-50 134	31 23	-50 134	30 33	-50 135	29 43	-51 136	28 52	-50 137	28 02	-51 137	27 11	-51 137	26 20	-51 138	25 29	-51 139	322
37	37 43	-49 130	36 54	-49 131	36 05	-49 132	35 16	-50 133	34 26	-50 133	33 36	-50 134	32 46	-50 135	31 56	-51 136	31 05	-50 136	30 15	-51 137	29 24	-51 137	28 33	-51 138	27 42	-52 138	26 50	-51 139	25 59	-52 139	323
36	38 18	-49 131	37 29	-50 132	36 39	-50 133	35 49	-50 134	34 59	-50 134	34 09	-50 135	33 19	-51 136	32 28	-51 136	31 37	-51 137	30 46	-51 137	29 55	-51 138	29 04	-52 139	28 12	-52 139	27 20	-51 140	26 29	-52 140	324
35	38 52	-50 133	38 02	-50 133	37 12	-50 134	36 22	-50 135	35 32	-51 135	34 41	-51 136	33 50	-51 137	32 59	-51 137	32 08	-51													

N. Lat. { L.H.A. greater than 180°Zn=Z
L.H.A. less than 180°Zn=360°-Z

DECLINATION (15° - 29°) SAME NAME AS LATITUDE

	15°			16°			17°			18°			19°			20°			21°			22°			23°			24°			25°			26°			27°			28°			29°			
LHA	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	LHA			
0	65 00	60 180	66 00	60 180	67 00	60 180	68 00	60 180	69 00	60 180	70 00	60 180	71 00	60 180	72 00	60 180	73 00	60 180	74 00	60 180	75 00	60 180	76 00	60 180	77 00	60 180	78 00	60 180	79 00	60 180	80 00	60 180	81 00	60 180	82 00	60 180	83 00	60 180	84 00	60 180	85 00	60 180	360			
1	64 59	60 178	65 59	60 178	66 59	60 178	67 59	60 177	68 59	60 177	69 59	60 177	70 59	60 177	71 59	60 177	72 59	60 177	73 59	60 177	74 59	60 177	75 59	60 176	76 59	60 176	77 59	60 176	78 59	60 176	79 59	60 176	80 59	60 176	81 59	60 176	82 59	60 176	83 59	60 176	84 59	60 175	359			
2	64 56	60 175	65 56	60 175	66 56	60 175	67 56	60 175	68 56	60 175	69 56	60 175	70 56	60 174	71 55	60 174	72 55	60 174	73 55	60 174	74 54	60 173	75 54	60 173	76 54	60 173	77 53	60 172	78 53	60 172	79 53	60 172	80 53	60 172	81 53	60 172	82 53	60 172	83 53	60 171	358					
3	64 52	60 173	65 51	60 173	66 51	60 173	67 51	60 172	68 51	60 172	69 50	60 172	70 50	60 171	71 49	60 171	72 49	60 171	73 48	60 171	74 48	60 170	75 47	60 169	76 46	60 169	77 45	60 168	78 44	60 168	79 43	60 168	80 42	60 168	81 41	60 168	82 40	60 168	83 40	60 167	357					
4	64 45	60 171	65 45	60 171	66 44	60 170	67 44	60 170	68 43	60 170	69 42	60 169	70 42	60 169	71 41	60 169	72 40	60 168	73 39	60 168	74 38	60 167	75 36	60 166	76 35	60 166	77 34	60 165	78 33	60 165	79 32	60 165	80 31	60 165	81 30	60 165	82 29	60 165	83 28	60 164	356					
5	64 37	60 169	65 36	60 168	66 36	60 168	67 35	60 167	68 34	60 167	69 33	60 166	70 32	60 166	71 30	60 165	72 29	60 165	73 27	60 164	74 26	60 163	75 24	60 162	76 21	60 161	77 19	60 160	78 16	60 159	79 15	60 159	80 14	60 159	81 13	60 159	82 12	60 159	83 11	60 158	355					
6	64 27	60 166	65 26	60 166	66 25	60 166	67 24	60 165	68 22	60 164	69 21	60 164	70 19	60 163	71 18	60 162	72 16	60 162	73 13	60 161	74 11	60 160	75 08	60 159	76 05	60 157	77 01	60 156	78 00	60 156	79 00	60 156	80 00	60 156	81 00	60 156	82 00	60 155	354							
7	64 16	60 164	65 14	60 164	66 13	60 163	67 11	60 163	68 09	60 162	69 07	60 161	70 05	60 160	71 03	60 159	72 00	60 159	73 00	60 158	74 00	60 157	75 00	60 156	76 00	60 155	77 00	60 154	78 00	60 154	79 00	60 154	80 00	60 154	81 00	60 154	82 00	60 154	83 00	60 153	353					
8	64 02	60 162	65 01	60 162	65 59	60 162	66 57	60 161	67 56	60 160	68 54	60 159	69 51	60 158	70 46	60 157	71 42	60 156	72 38	60 156	73 34	60 155	74 30	60 154	75 24	60 154	76 18	60 153	77 11	60 152	78 04	60 151	79 00	60 150	80 00	60 149	81 00	60 148	352							
9	63 48	60 160	64 45	60 158	65 43	60 157	66 40	60 157	67 37	60 156	68 34	60 156	69 30	60 155	70 27	60 154	71 22	60 153	72 18	60 153	73 13	60 152	74 08	60 151	75 04	60 150	76 00	60 149	77 00	60 149	78 00	60 149	79 00	60 149	80 00	60 149	81 00	60 148	351							
10	63 31	60 158	64 28	60 157	65 25	60 156	66 22	60 156	67 18	60 155	68 15	60 154	69 10	60 153	70 06	60 152	71 01	60 151	71 55	60 150	72 49	60 149	73 42	60 148	74 35	60 147	75 26	60 146	76 17	60 145	77 08	60 144	78 00	60 144	79 00	60 144	80 00	60 144	81 00	60 143	350					
11	63 13	60 156	64 10	60 155	65 06	60 154	66 02	60 153	66 58	60 153	67 53	60 152	68 49	60 151	69 43	60 150	70 37	60 149	71 31	60 148	72 24	60 147	73 16	60 146	74 07	60 145	75 00	60 144	76 00	60 144	77 00	60 144	78 00	60 144	79 00	60 144	80 00	60 143	349							
12	62 53	60 154	63 50	60 153	64 45	60 152	65 41	60 151	66 36	60 150	67 31	60 149	68 25	60 148	69 19	60 147	70 12	60 146	71 05	60 145	72 00	60 144	73 00	60 143	74 00	60 142	75 00	60 141	76 00	60 141	77 00	60 141	78 00	60 141	79 00	60 141	80 00	60 140	348							
13	62 32	60 152	63 28	60 151	64 23	60 150	65 18	60 149	66 12	60 148	67 07	60 147	68 00	60 146	68 53	60 145	69 45	60 144	70 37	60 143	71 28	60 142	72 18	60 141	73 08	60 140	74 00	60 139	75 00	60 139	76 00	60 139	77 00	60 139	78 00	60 139	79 00	60 138	347							
14	62 10	60 150	63 05	60 149	64 00	60 148	64 54	60 147	65 48	60 146	66 41	60 145	67 34	60 144	68 26	60 143	69 17	60 142	70 08	60 141	71 00	60 140	72 00	60 139	73 00	60 138	74 00	60 137	75 00	60 137	76 00	60 137	77 00	60 137	78 00	60 137	79 00	60 136	346							
15	61 46	60 148	62 41	60 147	63 35	60 146	64 28	60 145	65 21	60 144	66 14	60 143	67 06	60 142	67 57	60 141	68 48	60 140	69 39	60 139	70 26	60 138	71 14	60 137	72 06	60 136	73 00	60 135	74 00	60 135	75 00	60 135	76 00	60 135	77 00	60 135	78 00	60 134	345							
16	61 22	60 146	62 15	60 145	63 08	60 144	64 01	60 143	64 54	60 142	65 45	60 141	66 37	60 140	67 27	60 139	68 17	60 138	69 05	60 137	69 53	60 136	70 40	60 135	71 26	60 134	72 10	60 133	73 00	60 133	74 00	60 133	75 00	60 133	76 00	60 133	77 00	60 132	344							
17	60 55	60 144	61 48	60 143	62 41	60 142	63 33	60 141	64 25	60 140	65 16	60 139	66 06	60 138	66 56	60 137	67 45	60 136	68 32	60 135	69 19	60 134	70 05	60 133	70 50	60 132	71 33	60 131	72 10	60 130	73 00	60 130	74 00	60 130	75 00	60 130	76 00	60 130	77 00	60 129	343					
18	60 28	60 143	61 21	60 142	62 13	60 141	63 04	60 140	63 55	60 139	64 45	60 138	65 35	60 137	66 23	60 136	67 11	60 135	67 58	60 134	68 44	60 133	69 29	60 132	70 13	60 131	71 00	60 130	72 00	60 130	73 00	60 130	74 00	60 130	75 00	60 130	76 00	60 129	342							
19	60 00	60 141	60 52	60 140	61 43	60 139	62 34	60 138	63 24	60 137	64 13	60 136	65 02	60 135	65 50	60 134	66 37	60 133	67 23	60 132	68 08	60 131	68 52	60 130	69 35	60 129	70 16	60 128	71 00	60 128	72 00	60 128	73 00	60 128	74 00	60 128	75 00	60 127	341							
20	59 30	60 139	60 22	60 138	61 12	60 137	62 02	60 136	62 52	60 135	63 40	60 134	64 28	60 133	65 16	60 132	66 02	60 131	66 46	60 130	67 32	60 129	68 15	60 128	68 56	60 127	69 37	60 126	70 15	60 125	71 00	60 125	72 00	60 125	73 00	60 125	74 00	60 125	75 00	60 124	340					
21	59 00	60 138	59 50	60 137	60 40	60 136	61 30	60 135	62 19	60 134	63 07	60 133	63 54	60 132	64 40	60 131	65 26	60 130	66 10	60 129	66 54	60 128	67 36	60 127	68 17	60 126	68 57	60 125	69 37	60 124	70 15	60 124	71 00	60 124	72 00	60 124	73 00	60 124	74 00	60 123	339					
22	58 29	60 136	59 18	60 135	60 08	60 134	60 57	60 133	61 45	60 132	62 32	60 131	63 19	60 130	64 04	60 129	64 49	60 128	65 33	60 127	66 16	60 126	66 57	60 125	67 37	60 124	68 17	60 123	68 57	60 122	69 37	60 121	70 15	60 121	71 00	60 121	72 00	60 121								

$$\text{N. Lat. } \begin{cases} \text{L.H.A. greater than } 180^\circ \dots \text{Zn} = \text{Z} \\ \text{L.H.A. less than } 180^\circ \dots \text{Zn} = 360^\circ - \text{Z} \end{cases}$$

DECLINATION ($15^{\circ} - 29^{\circ}$) SAME NAME AS LATITUDE

LAT 40°

	15°				16°				17°				18°				19°				20°				21°				22°				23°				24°				25°				26°				27°				28°				29°				
LHA	Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		Hc	d	Z		LHA												
70	24	48	36	91	25	24	36	90	26	00	36	89	26	36	36	88	27	12	35	87	27	47	34	86	28	21	35	85	28	56	34	85	29	30	33	84	30	03	33	83	30	36	33	82	31	09	32	81	31	41	32	80	32	13	31	79	32	44	31	78	290
71	24	02	36	90	24	38	36	89	25	14	36	88	25	50	36	88	26	26	35	87	27	01	35	86	27	36	34	85	28	10	34	84	28	44	34	83	29	18	33	82	29	51	33	81	30	24	32	80	30	56	32	79	31	28	31	78	31	59	31	77	289
72	23	16	36	90	23	52	37	89	24	29	35	88	25	04	36	87	25	40	35	86	26	15	35	86	26	50	34	84	27	24	34	83	27	58	34	82	28	32	33	81	29	05	33	81	29	38	33	80	30	11	32	79	31	43	32	78	31	15	31	77	288
73	22	30	36	89	23	06	37	88	23	43	35	87	24	18	36	86	24	54	35	85	25	29	35	85	26	04	35	84	26	39	34	83	27	13	34	82	27	47	33	81	28	20	33	80	28	53	33	79	29	26	32	78	29	58	32	77	30	30	31	76	287
74	21	44	37	88	22	21	36	87	22	57	36	87	23	33	35	86	24	08	35	85	24	43	35	85	25	18	35	84	25	53	34	82	26	27	34	81	27	01	34	80	27	35	33	79	28	08	33	78	28	41	32	77	29	45	32	76	286				
75	20	58	37	88	21	35	36	87	22	11	36	86	22	47	35	85	23	22	35	84	23	58	35	83	24	33	35	82	25	08	34	82	25	42	34	81	26	16	34	80	26	50	33	79	27	23	33	78	27	56	33	77	28	29	32	76	29	01	32	75	285
76	20	12	37	87	20	49	36	86	21	25	36	85	22	01	36	85	22	37	35	84	23	12	35	83	23	47	35	82	24	22	35	81	24	57	34	80	25	31	34	79	26	05	33	78	26	38	33	77	27	11	33	76	27	44	33	75	28	17	32	74	284
77	19	26	37	86	20	03	37	86	20	39	36	85	21	15	36	84	21	51	35	83	22	27	35	82	23	02	35	81	23	37	34	80	24	11	35	80	24	46	34	79	25	20	33	78	25	53	34	77	26	27	33	76	27	00	32	75	27	32	73	74	283
78	18	41	36	86	19	17	37	85	19	54	36	84	20	30	36	83	21	06	35	82	21	41	35	82	22	16	36	81	22	52	34	80	23	26	35	79	24	01	34	78	24	35	34	77	25	09	33	76	25	42	33	75	26	15	33	74	26	48	33	73	282
79	17	55	36	85	18	31	37	84	19	08	36	84	19	44	36	83	20	20	36	82	20	56	35	81	21	31	35	80	22	06	35	79	22	41	35	78	23	16	34	77	23	50	34	77	24	24	34	76	24	58	33	75	25	31	33	74	26	04	33	73	281
80	17	09	37	85	17	46	36	84	18	22	36	83	18	58	37	82	19	35	35	81	20	10	36	80	20	46	35	80	21	21	35	79	21	56	35	78	22	31	35	77	23	06	34	76	23	40	34	75	24	14	33	74	24	47	33	73	25	20	33	72	280
81	16	23	37	84	17	00	37	83	17	37	36	82	18	13	36	81	18	49	36	81	19	25	36	80	20	01	35	79	20	36	35	78	21	11	35	77	21	46	35	76	22	21	34	75	22	55	34	75	23	29	34	74	24	03	34	73	24	37	33	72	279
82	15	38	36	83	16	14	37	82	16	51	37	82	17	28	36	81	18	04	36	80	18	40	36	79	19	16	35	78	19	51	36	77	20	27	35	77	21	02	35	76	21	37	34	75	22	11	34	74	22	45	34	73	23	19	34	72	23	53	33	71	278
83	14	52	37	83	15	29	37	82	16	06	36	81	17	42	37	80	17	19	36	79	17	55	36	79	18	31	35	78	19	06	36	77	19	42	35	76	20	17	35	75	20	52	35	74	21	27	34	73	22	41	33	72	23	10	33	71	277				
84	14	06	37	82	14	43	37	81	15	20	37	80	15	57	36	80	16	33	37	79	17	10	36	78	17	46	36	77	18	22	35	76	18	57	36	75	19	35	75	20	08	35	74	20	43	35	73	21	18	34	72	21	52	34	71	22	26	34	70	276	
85	13	21	37	81	13	58	37	81	14	35	37	80	15	12	36	79	15	48	37	78	16	25	36	77	17	01	36	77	17	37	36	76	18	13	35	75	18	49	35	74	19	24	35	73	19	59	35	72	20	34	35	71	21	09	34	71	21	43	34	70	275
86	12	35	38	81	13	13	37	80	13	50	37	79	14	27	36	78	15	03	37	78	15	40	36	77	16	16	37	76	16	53	36	75	17	29	36	74	18	05	35	73	18	40	35	73	19	15	36	72	19	51	34	71	20	25	35	70	21	00	34	69	274
87	11	50	37	80	12	27	38	79	13	05	37	79	13	42	37	78	14	19	36	77	14	55	37	76	15	32	36	75	16	08	37	75	16	45	36	74	17	21	35	73	17	56	36	72	18	32	35	71	19	07	35	70	19	42	35	69	20	17	35	69	273
88	11	05	37	80	11	42	38	79	12	20	37	78	12	57	37	77	13	34	37	76	14	11	37	76	14	48	36	75	15	24	36	74	16	00	37	73	16	37	36	72	17	13	35	71	17	48	36	71	18	24	35	70	18	59	35	69	19	34	68	272	
89	10	20	37	79	10	57	38	78	11	35	37	77	12	12	37	77	12	49	37	76	13	26	37	75	14	03	37	74	14	40	37	73	15	17	36	73	15	53	36	72	16	39	36	71	17	05	36	70	17	41	35	69	18	16	36	68	18	52	35	68	271
90	09	35	37	78	10	12	38	78	10	50	37	77	11	27	38	76	12	05	37	75	12	42	37	74	13	19	37	74	13	56	37	73	14	33	36	72	15	09	37	71	15	46	36	70	16	22	36	70	16	58	36	69	17	34	35	68	18	09	36	67	270
91	08	50	37	78	09	27	38	77	10	05	38	76	10	43	37	75	11	20	38	75	11	58	37	74	12	35	37	73	13	12	37	72	13	49	37	71	14	26	37	71	15	03	36	70	15	39	36	69	16	15	36	68	16	51	36	67	17	27	36	66	269
92	08	05	38	77	08	43	38	76	09	21	37	76	09	58	38	75	10	36	38	74	11	14	37	73	11	51	37	72	12	28	38	72	13	06	37	71	13	43	37	70	14	20	36	69	14	56	37	68	15	33	36	68	16	09	36	67	16	45	36	66	268
93	07	20	38	77	07	58	38	76	08	36	38	75	09	14	38	74	09	52	38	73	10	30	37	73	11	07	38	72	11	45	37	71	12	22	38	70	13	00	37	69	13	37	69	14	14	36	68	14	50	37	67	15	27	36	66	16	03	37	65	267	
94	06	35	39	76	07	14	38	75	07	52	38	74	08	30	38	74	09	08	38	73	09	46	38	72	10	24	38	71	11	02	37	70	11	39	38	70	12	17	37	69	12	54	37	68	13	31	37	67	14	08	37	66	14	45	37	66	15	12	36	65	266
95	05	51	38	75	06	29	39	75	07	08	38	74	07	46	38	73	08	24	38	72	09	02	38	71	09	40	38	71	10	18	38	70	10	56	38	69	11	34	38	68	12	11	38	67	12	49	37	67	13	26	37	66	14	03	37	65	14	40	37	64	265
96	05	06	39	75	05	45	39	74	06	24	38	73	07	02	39	72	07	41	38	72	08	19	38	71	08	57	38	70	09	35	38	69	10	13	38	68	11	51	38	68	11	29	38	67	12	07	37	66	12	44	38	65	13	22	37	64	13	59	37	64	264
97	04	22	38	74	05	01	39	73	05	40	38	73	06	18	39	72	06	57	39	71	07	36	39	7																																					

S. Lat. $\begin{cases} \text{L.H.A. greater than } 180^\circ \dots \text{Zn} = 180^\circ - Z \\ \text{L.H.A. less than } 180^\circ \dots \text{Zn} = 180^\circ + Z \end{cases}$

DECLINATION ($15^{\circ} - 29^{\circ}$) CONTRARY NAME TO LATITUDE

LAT 40°

N. Lat. { L.H.A. greater than 180°Zn=Z
L.H.A. less than 180°Zn=360°-Z

DECLINATION (15° – 29°) CONTRARY NAME TO LATITUDE

	15°			16°			17°			18°			19°			20°			21°			22°			23°			24°			25°			26°			27°			28°			29°			
LHA	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	Hc	d	Z	LHA			
69	05 40	-42	115	04 58	-41	116	04 17	-42	116	03 35	-42	117	02 53	-42	118	02 11	-42	119	01 29	-42	119	00 47	-42	120	00 05	-42	121	0-37	-42	121	-- 19	-41	122	- 00	-42	123	-- 42	-42	124	-- 24	-42	124	-- 06	-42	125	291
68	06 22	-42	116	05 40	-42	116	04 58	-42	117	04 16	-43	118	03 33	-42	119	02 51	-42	119	02 09	-42	120	01 27	-42	121	00 45	-43	121	00 02	-42	122	0-40	-42	123	-- 22	-42	124	-- 04	-42	124	-- 46	-43	125	-- 29	-42	126	292
67	07 03	-42	116	06 21	-43	117	05 38	-42	118	04 56	-42	119	04 14	-43	119	03 31	-42	120	02 49	-43	121	02 06	-42	121	01 24	-43	122	00 41	-42	123	0-01	-43	123	0-44	-42	124	-- 26	-43	125	-- 09	-43	126	-- 51	-43	126	293
66	07 44	-42	117	07 02	-43	118	06 19	-43	118	05 36	-42	119	04 54	-43	120	04 11	-43	121	03 28	-43	121	02 45	-42	122	02 03	-43	123	01 20	-43	123	00 37	-43	124	0-06	-43	125	0-49	-43	126	-- 32	-43	126	-- 15	-42	127	294
65	08 25	-43	118	07 42	-43	118	06 59	-43	119	06 16	-43	120	05 33	-43	121	04 50	-43	121	04 07	-43	122	03 24	-43	123	02 41	-43	123	01 58	-43	124	01 15	-43	125	00 32	-44	125	0-12	-43	126	0-55	-43	127	-- 38	-43	128	295
64	09 05	-43	118	08 22	-43	119	07 39	-43	120	06 56	-43	121	06 13	-43	121	05 30	-44	122	04 46	-43	123	04 03	-44	123	03 19	-43	124	02 36	-44	125	01 52	-43	125	01 09	-44	126	00 25	-43	127	0-18	-44	127	-- 02	-43	128	296
63	09 46	-44	119	09 02	-43	120	08 19	-43	121	07 36	-44	122	06 52	-44	122	06 08	-43	123	05 25	-44	123	04 41	-44	124	03 57	-43	125	03 14	-44	125	02 30	-44	126	01 46	-44	127	01 02	-44	127	00 18	-44	128	0-26	-43	129	297
62	10 26	-44	120	09 42	-44	121	08 58	-43	121	08 15	-44	122	07 31	-44	123	06 47	-44	123	06 03	-44	124	05 19	-44	125	04 35	-44	126	03 51	-44	126	03 07	-44	127	02 23	-45	127	01 38	-44	128	00 54	-44	129	00 10	-44	129	298
61	11 05	-43	121	10 22	-44	121	09 38	-44	122	08 54	-45	123	08 09	-44	123	07 25	-44	124	06 41	-44	125	05 57	-45	125	05 12	-44	126	04 28	-45	127	03 43	-44	127	02 59	-45	128	02 14	-44	129	01 30	-45	129	00 45	-44	130	299
60	11 45	-44	121	11 01	-45	122	10 16	-44	123	09 32	-44	123	08 48	-45	124	08 03	-44	125	07 19	-45	125	06 34	-45	126	05 49	-44	127	05 05	-45	127	04 20	-45	128	03 35	-45	129	02 50	-45	129	02 05	-45	130	01 20	-45	131	300
59	12 24	-44	122	11 40	-45	123	10 55	-45	123	10 10	-44	124	09 26	-45	125	08 41	-45	125	07 56	-45	126	07 11	-45	127	06 26	-45	127	05 41	-45	128	04 56	-45	129	04 11	-46	129	03 25	-45	130	02 40	-45	131	01 55	-45	131	301
58	13 03	-45	123	12 18	-45	123	11 33	-45	124	10 48	-45	125	10 03	-45	125	09 18	-45	126	08 33	-45	127	07 48	-46	127	07 02	-45	128	06 17	-46	128	05 31	-45	129	04 46	-46	130	04 00	-45	131	03 15	-46	131	02 29	-45	132	302
57	13 41	-45	124	12 56	-45	124	12 11	-45	125	11 26	-46	126	10 40	-45	126	09 55	-46	127	09 09	-45	128	08 24	-46	128	07 38	-46	129	06 52	-45	129	06 07	-46	130	05 21	-46	131	04 35	-46	131	03 49	-46	132	03 03	-46	133	303
56	14 19	-45	124	13 34	-45	125	12 49	-46	126	12 03	-46	126	11 17	-45	127	10 32	-46	128	09 46	-46	128	09 00	-46	129	08 14	-46	130	07 28	-46	130	06 42	-46	131	05 56	-47	131	05 09	-46	132	04 23	-46	133	03 37	-46	133	304
55	14 57	-45	125	14 12	-46	126	13 26	-46	126	12 40	-46	127	11 54	-46	128	11 08	-46	128	10 22	-47	129	09 35	-46	130	08 49	-46	130	08 03	-47	131	07 16	-46	132	06 30	-47	132	05 43	-46	133	04 57	-47	133	04 10	-47	134	305
54	15 35	-46	126	14 49	-46	126	14 03	-47	127	13 16	-46	128	12 30	-46	128	11 44	-47	129	10 57	-46	130	10 11	-47	130	09 24	-47	131	08 37	-47	132	07 50	-46	132	07 04	-47	133	06 17	-47	134	05 30	-47	134	04 43	-47	135	306
53	16 12	-46	127	15 26	-47	127	14 39	-46	128	13 53	-47	129	13 06	-47	129	12 19	-47	130	11 32	-47	130	10 45	-47	131	09 58	-47	132	09 11	-47	132	08 24	-47	133	07 37	-47	134	06 50	-47	134	06 03	-48	135	05 15	-47	135	307
52	16 49	-47	127	16 02	-47	128	15 15	-47	128	14 28	-47	129	13 41	-47	130	12 54	-47	131	12 07	-47	131	11 20	-47	132	10 33	-48	132	09 45	-47	133	08 58	-48	134	08 10	-47	134	07 23	-48	135	06 35	-48	136	05 47	-47	136	308
51	17 25	-47	128	16 38	-47	129	15 51	-47	129	15 04	-48	130	14 16	-47	131	13 29	-47	131	12 42	-48	132	11 54	-48	133	11 06	-47	133	10 19	-48	134	09 31	-48	134	08 43	-48	135	07 55	-48	136	07 07	-48	136	06 19	-48	137	309
50	18 01	-47	129	17 14	-48	130	16 26	-47	130	15 39	-48	131	14 51	-48	131	14 03	-47	132	13 16	-48	133	12 28	-48	133	11 40	-48	134	10 52	-49	135	10 03	-48	135	09 15	-48	136	08 27	-48	136	07 39	-49	137	06 50	-48	138	310
49	18 36	-47	130	17 49	-48	130	17 01	-48	131	16 13	-48	132	15 25	-48	132	14 37	-48	133	13 49	-48	133	13 01	-49	134	12 12	-48	135	11 24	-48	135	10 36	-49	136	09 47	-49	137	08 58	-48	137	08 10	-49	138	07 21	-49	138	311
48	19 12	-48	131	18 24	-48	131	17 36	-49	132	16 47	-48	132	15 59	-48	133	15 11	-49	134	14 22	-48	134	13 34	-49	135	12 45	-49	135	11 56	-49	136	11 07	-49	137	10 18	-49	137	09 29	-49	138	08 40	-49	138	07 51	-49	139	312
47	19 46	-48	131	18 58	-48	132	18 10	-49	133	17 21	-49	133	16 32	-48	134	15 44	-49	134	14 55	-49	135	14 06	-49	136	13 17	-49	136	12 28	-49	137	11 39	-50	137	10 49	-49	138	10 00	-49	139	09 11	-50	139	08 21	-49	140	313
46	20 21	-49	132	19 32	-49	133	18 43	-49	133	17 54	-49	134	17 05	-49	135	16 16	-49	135	15 27	-49	136	14 38	-49	136	13 49	-50	137	12 59	-49	138	12 10	-50	138	11 20	-50	139	10 30	-49	139	09 41	-50	140	08 51	-50	140	314
45	20 54	-49	133	20 05	-49	134	19 16	-49	134	18 27	-49	135	17 38	-50	135	16 48	-49	136	15 59	-50	137	15 09	-49	137	14 20	-50	138	13 30	-50	138	12 40	-50	139	11 50	-50	140	11 00	-50	140	10 10	-50	141	09 20	-50	141	315
44	21 28	-49	134	20 39	-50																																									

TABLE 5.—Correction to Tabulated Altitude for Minutes of Declination

[illegible]

Appendix F
Sight Reduction Form

Sight Reduction by H.O. 249 or H.O. 229

Course _____ Date _____ Assumed Lat. ° N S LMT _____ GMT _____

Speed _____ DR pos. _____ at _____ GMT _____

Height of eye _____ ft. LHA γ _____° at _____ LMT _____

Civil twil. _____

Body						
GMT						
Hs						
I.C (+or-)						
Dip (-)						
R LL UL						
Ho						
GHA (hr.) / v	/	/	/	/	/	/
SHA ★						
GHA (m & s)						
v corr (moon, plan.)						
GHA (total)						
Long. -W +E						
LHA						
Dec. /d	/	/	/	/	/	/
d corr						
Dec. (tot.)						
Alt. /d	/	/	/	/	/	/
d corr.						
Hc						
Ho						
Intercept						
Z						
Zn						

Advance AP (mi.) _____ toward _____°

H.O. 249 Vol. 1: Move fix _____ mi. toward _____°.