# Dutton's Navigation and Piloting

*TWELFTH EDITION BY*

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# The Complete Celestial Solution Using H.O.229

Chapter 27 dealt at length with sight reduction, using H.O. 214 and the *Nautical Almanac*. This appendix covers sight reduction using H.O. 229, *Sight Reduction Tables for Marine Navigation*, again with the *Nautical Almanac*. The H.O. 229 was described in article 2505.

*Introduction.*

Before proceeding, the student may find it desirable to review articles 2702 and 2703, which discuss the combined coordinate systems and the efficient use of the *Nautical Almanac*.

The arrangement of this appendix differs slightly from that of Chapter 27 in that the reduced celestial observations represent a single day's work for a navigator, and the resulting lines of position are plotted (see page 693). The hypothetical ship is a fleet tug, accompanying a damaged freighter; she is on C 288°.5, S 6.75 K. At 0400 (+1), on 1 August 1972, the tug's DR position is Lat. 41°02'.8 N, Long. 14°38'.0 W.

When observing a planet, the navigator measures the sextant altitude of the center of the body and records the time and date of the observation. He also checks the index error of the instrument.

*Complete solution for a planet observation.*

He then converts the time to GMT and Greenwich date, and enters the appropriate daily pages of the *Nautical Almanac* to obtain the GHA and declination at the whole hours of GMT, and the *v* and *d* values for the period, noting the sign of the *d* value by inspection. The *v* is always plus except for Venus when it can be either plus or minus. Turning to the appropriate "Increments and Corrections Table," he obtains the increments of GHA for minutes and seconds, and the corrections to GHA and declination for the *v* and *d* values, respectively. Applying these values to those obtained from the daily pages, he obtains the GHA and Dec. of the planet at the time of observation.

*The extract from the* Nautical *Almanac used in this Appendix starts on page 696.*

With the *Nautical Almanac* still open, the navigator notes the value of IC (as determined from the sextant), extracts the D and R (plus the "add'l" for Venus and Mars) corrections from the appropriate sections of the almanac, and combines them with hs to obtain ha and Ho.

The navigator then selects the AP, based on the best estimate of his position, and uses the a$\lambda$ to determine LHA in whole degrees.

Entering H.O. 229 with integral degrees of LHA, aL, and Dec., he obtains the tabulated altitude for the value of the entering arguments, *d*, and its sign, and Z. Z is corrected by visual interpolation for the actual value of the declination.

*The extract from H.O. 229 begins on page 703.*

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The correction to the tabulated altitude for Dec. Inc. and *d* is then taken from a multiplication table inside the cover of H. O. 229 and is applied to ht, as is the double second difference correction if *d* is printed in italic type, to obtain Hc.

Hc is then compared with Ho to determine (*a*). By converting Z to Zn, the navigator can use Zn and (*a*) to plot the LOP from the AP.

*Example:* On 1 August 1972 the 0447 DR position of the ship is Lat. 41°04'.5 N, Long. 14°44'.6 W. At 04-47-13 ZT the planet Venus is observed from a height of eye of 21 feet, with a sextant having an IC of (+) 0'.2. The sextant altitude is 31°13'.2.

*Required:* The (*a*), Zn, and AP, using H. O. 229 and the *Nautical Almanac.*

*Answer:* (Solution shown in column 1, page 689.)

| | |
|---|---|
| *a* | Away 23'.6 |
| Zn | 092°.2 |
| *a*L | 41°00'.0 N |
| *a*λ | 14°15'.7 W |

When observing the moon, the navigator measures the sextant altitude of either the upper or lower limb of the body, and records the time and date of the observation. He also checks the index error of the instrument.

He then converts the time to GMT and Greenwich date, and enters the appropriate daily pages of the *Nautical Almanac* to obtain the GHA, *v* value, which for the moon is always (+), declination, *d* value (noting the sign of the *d* value by inspection), and HP for the nearest whole hour of GMT. Turning to the appropriate "Increments and Corrections Table," he obtains the increments of GHA for minutes and seconds, and the corrections to GHA and declination for the *v* and *d* values, respectively. Applying these values to those obtained from the daily pages, he obtains the GHA and Dec. of the moon at the time of the observation.

With the *Nautical Almanac* still open, the navigator notes the value of IC (as determined from the sextant), and extracts the D correction and the corrections for altitude and HP from the "Altitude Correction Tables—Moon." The latter two corrections are always additive, but if the upper limb is observed, an additional correction of (−) 30' is made. These corrections are combined with hs to obtain ha and Ho.
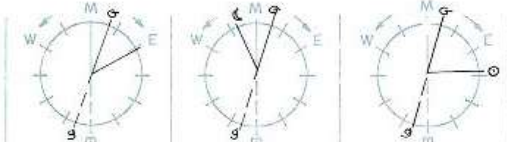
The navigator then selects the AP, based on the best estimate of his position, and uses the *a*λ to determine LHA in whole degrees.

Entering H. O. 229 with integral degrees of LHA, *a*L and Dec., he obtains the tabulated altitude for the value of the entering arguments, *d* and its sign, and Z. Z is corrected by visual interpolation for the actual value of the declination. The correction to the tabulated altitude for Dec. Inc. and *d* is then taken from a multiplication table inside the cover of H. O. 229 and applied to ht, as is the double second difference correction if *d* is printed in *italic* type, to obtain Hc.

Hc is then compared with Ho to determine (*a*). By converting Z to Zn, the navigator can then use Zn and (*a*) to plot the LOP from the AP.

*Example:* On 1 August 1972, the 0611 DR position of the ship is Lat. 41°07'.5 N, Long. 14°56'.3 W. At 06-11-03 ZT the lower limb of the moon is observed from

| | | | |
|---|---|---|---|
| Sight Reduction using H.O. 229 Cus: Spd: |  |  |  |
| Body | VENUS | ☾ | ☉ |
| IC | ° 0·2 − | ° 0·2 − | ° 0·2 − |
| Dip (Ht **21** ') | 4·4 | 4·4 | 4·4 |
| Sum | − 4·2 | − 4·2 | − 4·2 |
| hs | 31° 13·2 | 57° 06·5 | 12° 38·2 |
| ha | 31° 09′ | 57° 02·3 | 12° 34·0 |
| Alt. Corr | 1·6 | 41·4 | 0·1   4·3 |
| Add'l. | 0·3 | | 15·8 ∞ |
| H. P. ( **59·1** ) | | 6·1 | 0·5 TB |
| Corr. to ha | − 1·3 | +47·5 | +12·1 |
| Ho (Obs Alt) | 31° 07·7 | 57° 49·8 | 12° 46·1 |
| Date | 1 AUG 72 | 1 AUG 72 | 1 AUG 72 |
| DR Lat | 41° 04·5 N | 41° 07·5 N | 41° 07·5 N |
| DR Long | 14° 44·6 W | 14° 56·3 W | 14° 56·3 W. |
| Obs. Time | | | |
| WE (S+, F−) | | | |
| ZT | 04  47  13 | 06  11  03 | 06  11  56 |
| ZD (W+, E−) | + 1 | + 1 | + 1 |
| GMT | 05  47  13 | 07  11  03 | 07  11  56 |
| Date (GMT) | 1 AUG 72 | 1 AUG 72 | 1 AUG 72 |
| Tab GHA      v | 298 26·8   0·7 | 33 31·5   9·6 | 283 26·2 |
| GHA incr'mt. | 11 48·3 | 2 38·2 | 2 59·0 |
| SHA or V Corr. | 0·6 | 1·8 | |
| GHA | 310° 15·7 | 36° 11·5 | 286 25·2 |
| ± 360 if needed | | | |
| aλ (−W, +E) | 14° 15·7 W | 15° 11·5 W | 15° 25·2 W |
| LHA | 296° | 21° | 271° |
| Tab Dec      d | N 18°35·9  10·2 | N 14° 41·4  +13·1 | N 17° 58·8  −0·6 |
| d Corr (+ or −) | + 0·2 | + 2·5 | − 0·1 |
| True Dec | N 18° 36·1 | N 14° 43·6 | N 17° 58·7 |
| a Lat (N or S) | N 41  ⟨Sam⟩Cont | N 41  ⟨Sam⟩Cont | N 41  ⟨Sam⟩Cont. |
| Dec Inc      (±)d | 36·1    +36·4 | 43·6    +51·6 | 58·7    +38·1 |
| Hc (Tab. Alt.) | 31° 09·4 | 57° 23·5 | 11° 47·7 |
| tens      DS Diff. | 18·0 | 36·3 | 29·4 |
| units     DS Corr | 3·9  + | 1·2  + | 7·9  + |
| Tot. Corr. (+ or −) | + 21·9 | + 37·5 | 37·3 |
| Hc (Comp. Alt.) | 31° 31·3 | 58° 01·0 | 12° 25·0 |
| Ho (Obs. Alt.) | 31° 07·7 | 57° 49·8 | 12° 46·1 |
| a (Intercept) | 23·6  ⟲ | 11·2  ⟰ | 21·1  ⟲ |
| Z | 92·2 | 139·1 | 76·8 |
| Zn (°T) | 092°·2 | 220°·9 | 076°·8 |

H.O. 229 worksheet.

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a height of eye of 21 feet with a sextant having an IC of (+) 0'.2. The sextant altitude is 57°06'.5.

*Required:* The (*a*), Zn, and AP, using H.O. 229 and the *Nautical Almanac.*

*Answer:* (Solution shown in column 2, page 689.)

> *a*      Away 11'.2
> Zn      220°.9
> *a*L     41°00'.0 N
> *a*λ     15°11'.5 W.

When observing the sun, the navigator measures the sextant altitude of either the upper or lower limb of the body, and records the time and date of the observation. He also records the index error of the sextant.

He then converts the time to GMT and Greenwich date, and enters the appropriate daily pages of the *Nautical Almanac* to obtain the GHA and declination at the whole hours of GMT, and the *d* value for the period (noting the sign of the *d* value by inspection). If maximum accuracy were desired, he would also note the SD of the sun from the daily pages. The values of I and IC, with their appropriate signs, would be entered in the form, as would the correction for D, obtained from the *Nautical Almanac.* These would be combined with hs to obtain ha.

Ordinarily, the ha is corrected by means of the sun altitude correction tables inside the front cover of the *Nautical Almanac,* which include corrections for an average value of semi-diameter, refraction, and parallax. Alternatively, the value of the semi-diameter found at the bottom of the sun column in the daily pages of the *Nautical Almanac* may be used together with the value of the refraction correction found under the heading "Stars and Planets," and an additional correction of (+)0'.1 for parallax to be used for altitudes of 65° and less.

Having entered the GHA and declination for the whole hours of GMT, the navigator now turns to the appropriate page of the "Increments and Corrections table," and obtains the increments of GHA for minutes and seconds and the correction to the declination for the *d* value. Applying these values to those obtained from the daily pages, he obtains the GHA and Dec. of the sun at the time of the observation.

With the *Nautical Almanac* still open, the navigator notes the value of IC (as determined from the sextant) and extracts the appropriate value of D. These are combined with hs to obtain ha. The appropriate correction for ☉, or ☉, taken from the Sun Table, is then applied to ha to obtain Ho.

The navigator then selects the AP, based on the best estimate of his position, and uses the *a*λ to determine LHA in whole degrees.

Entering H.O. 229 with integral degrees of LHA, *a*L, and Dec., he obtains the tabulated altitude for the value of the entering arguments, *d* and its sign, and Z. Z is corrected by visual interpolation for the actual value of the declination. The correction to the tabulated altitude for Dec. Inc. and *d* is then taken from a multiplication table inside the cover of H.O. 229 and is applied to ht, as is the double second difference correction if *d* is printed in *italic* type, to obtain Hc.

Hc is then compared with Ho to determine (*a*). By converting Z to Zn, the navigator can use Zn and (*a*) to plot the LOP from the AP.

*Example:* On 1 August 1972, the 0611 DR position of the ship is Lat. 41°07'.5 N, Long. 14°56'.3 W. At 06-11-56 ZT the lower limb of the sun is observed from a height of eye of 21 feet with a sextant having an IC of (+) 0'.2. The sextant altitude is 12°38'.2. The dry bulb temperature is 88° F, and the barometer reads 29.76 inches.

Because of the sun's comparatively low altitude, the individual corrections for refraction, semi-diameter and parallax, as well as the additional correction for nonstandard temperature and barometric pressure are to be applied to ha in this instance.

*Required:* The (a), Zn, and AP, using H. O. 229 and the *Nautical Almanac.*

*Answer:* (Solution shown in column 3, page 689.)

| | |
|---|---|
| a | T 21'.1 |
| Zn | 076°.8 |
| aL | 41°00'.0 N |
| aλ | 15°25'.2 W |

When observing a star, the navigator measures the sextant altitude of the body and records the time and date of the observation. He also checks the index error of the instrument.

*Complete solution for a star observation.*

He then converts the time to GMT and Greenwich date, and enters the appropriate daily pages of the Nautical Almanac to obtain the GHA of Aries at the whole hours of GMT, and the SHA and declination of the star for that period. Turning to the appropriate "Increments and Corrections" table, he obtains the increments of GHA of Aries for minutes and seconds. Adding this value to the GHA of Aries and SHA of the star obtained from the daily pages, he obtains the star's GHA at the time of the observation. The Dec. is the value tabulated on the daily page.

With the *Nautical Almanac* still open, the navigator notes the value of IC (as determined from the sextant), extracts the D and R corrections from the appropriate sections of the almanac, and applies them to hs to obtain ha and Ho.

The navigator then selects the AP, based on the best estimate of his position, and uses the aλ to determine LHA in whole degrees.

Entering H. O. 229 with integral degrees of LHA, aL, and Dec., he obtains the tabulated altitude for the value of the entering argument, *d* and its sign, and Z. The correction to tabulated altitude for *d* and Dec. Inc. is then taken from the multiplication table in H. O. 229, and applied to ht, as is the double second difference correction if *d* is printed in *italic* type, to obtain Hc. He corrects Z by visual interpolation for the actual value of the declination.

Hc is then compared with Ho to determine (a). By converting Z to Zn, the navigator can then use Zn and (a) to plot the LOP from the AP.

Two star observations are included in the following examples. The Vega reduction (Example 2) requires a double second difference correction, while Antares' declination is of contrary name to the observer's latitude.

In the Antares reduction (Example 1), note that the value of *d* as found in the tables is (−) 60'.0; this being the case, the full value of Dec. Diff. is applied to ht to obtain Hc.

| Sight Reduction using H.O. 229 | ANTARES | VEGA | |
|---|---|---|---|



Cus:
Spd:

| | ANTARES | VEGA | |
|---|---|---|---|
| Body | ANTARES | VEGA | |
| IC | + 0·2 − | + 0·2 − | + − |
| Dip (Ht 21 ') | 4·4 | 4·4 | |
| Sum | − 4·2 | − 4·2 | |
| hs | 22° 06'·5 | 64° 44'·5 | |
| ha | 22° 02'·3 | 64° 40·3 | |
| Alt. Corr | 2·4 | 0·5 | |
| Add'l. | | | |
| H. P. ( ) | | | |
| Corr. to ha | −2·4 | −0·5 | |
| Ho (Obs. Alt.) | 21° 59'·9 | 64 39'·8 | |
| Date | 1 AUG 72 | 1 AUG 72 | |
| DR Lat | 41° 36'·7 N | 41° 36'·7 N | |
| DR Long | 16° 52'·8 W | 16° 52'·8 W | |
| Obs. Time | | | |
| WE (S+, F−) | | | |
| ZT | 19 47 56 | 19 48 50 | |
| ZD (W+, E−) | +1 | +1 | |
| GMT | 20 47 56 | 20 48 50 | |
| Date (GMT) | 1 AUG 72 | 1 AUG 72 | |
| Tab GHA        V | 250° 31'·2 | 250° 31'·2 | |
| GHA incr'mt. | 12 01·0 | 12 14·5 | |
| SHA or V Corr. | 113 03·7 | 80 59·3 | |
| GHA | 375° 35'·9 | 343° 45'·0 | |
| ± 360 if needed | 15° 35'·9 | | |
| aλ (−W, +E) | W 16° 35'·9 | W 16° 45'·0 | |
| LHA | 359 | 327 | |
| Tab Dec        d | | | |
| d Corr· (+ or −) | | | |
| True Dec | S 26° 22'·5 | N 38 45'·6 | |
| a Lat (N or S) | N 42° Same (Cont) | N 42° (Same) Cont. | Same Cont. |
| Dec Inc        (±)d | 22·5    −60 | 45·6    +19·1 | |
| Hc (Tab. Alt.) | 21° 59'·6 | 64° 34'·0 | |
| tens        DS Diff. | | 7·6    4 | |
| units        DS Corr. | + | 6·9    +0·2 | + |
| Tot. Corr. (+ or −) | −22·5 | + 14·7 | |
| Hc (Comp. Alt.) | 21° 37'·1 | 64° 48'·7 | |
| Ho (Obs. Alt.) | 21 59·9 | 64 39·8 | |
| a (Intercept) | 22·8   ○ | 8·9   ○ | 4 |
| Z | N 179 E | N 86·3 E | |
| Zn (°T) | 179° | 086°·3 | |

H.O. 229 worksheet.

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42 N

1947
FIX

ANTARES
1947

0602

VEGA
1947

C 288°.5
S 6.75

0612
FIX

0400

0611

VENUS
0447

41 N

17 W    16 W    15 W    14 W
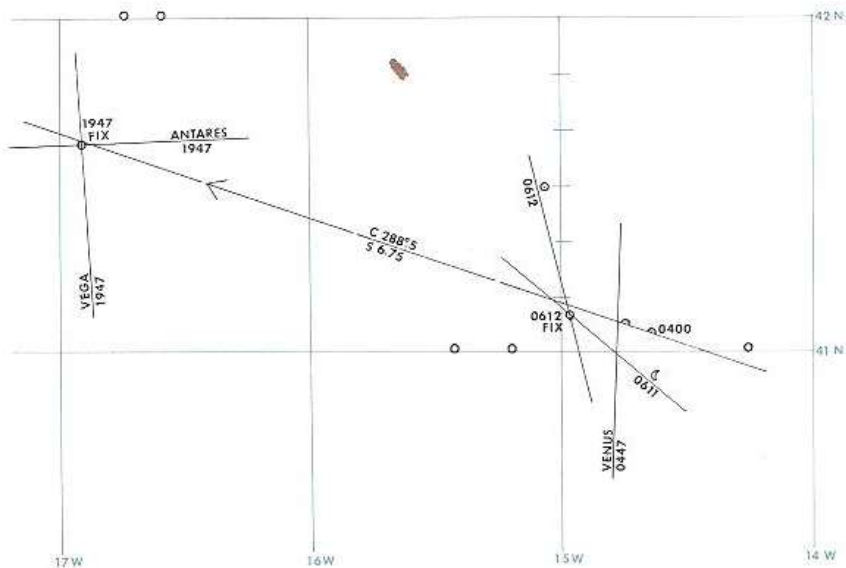
*Example 1:* On 1 August 1972, the 1947 DR position of the ship is Lat. 41°36'.7   *LOP plotting sheet.*
N, Long. 16°52'.8 W. At 19-47-56 the star Antares is observed from a height of
eye of 21 feet with a sextant having an IC of (+) 0'.2. The sextant altitude is
22°06'.5.

*Required:* The (a), Zn, and AP, using H. O. 229, and the *Nautical Almanac.*

*Answer:* (Solution shown in column 1, page 692.)

      a    Towards 22'.8
    Zn  179°.0
    aL  42°00'.0 N
    aλ  16°35'.9 W

*Example 2:* On 1 August 1972 the 1948 DR position of the ship is Lat. 41°36'.7
N, Long. 16°52'.8 W. At 19-48-50 ZT the star Vega is observed from a height of
eye of 21 feet with a sextant having an IC of (+) 0'.2. The sextant altitude is
64°44'.5.

*Required:* The (a), Zn, and AP, using H.O. 229, and the *Nautical Almanac.*

*Answer:* (Solution shown in column 2, page 692.)

      a    Away 8'.9
    Zn  086°.3
    aL  42°00'.0 N
    aλ  16°45'.0 W

The need for regular determination of compass error, and methods of making   *Exact azimuth*
azimuth observations at sea are described in detail in articles 2901 and 2902.   *H. O. 229.*
The method of calculating the azimuth by means of H. O. 229 is discussed next.   **693**

H.O. 229 makes an excellent azimuth table. When H.O. 229 is used to determine true azimuth for the purpose of checking the compass, triple linear interpolation usually must be made in order to obtain the required accuracy. The "d" values in H.O. 229 apply only to *altitude*, and should not be used when interpolating for azimuth.

*Example:* The azimuth of the sun is observed at 06-11-56 ZT on 1 August 1972. The 0612 DR position is Lat. 41°07'.5 N, Long. 14°56'.3 W. The azimuth obtained using a gyro repeater is 077°.5.

*Required:* Gyro error, using H.O. 229 to obtain true azimuth.

*Solution:* It is first necessary to determine the exact values of LHA, Dec., and L for the instant of observation of the azimuth. These values are determined as for working a sight, except that the *actual* position of the ship is used rather than an assumed position. Thus the DR longitude, 14°56'.3 W, is used to determine the exact value of LHA at the time of observation. The exact value of Dec. is found to be N 17°58'.7 by consulting the *Nautical Almanac* in the usual manner. The DR latitude is taken as the exact value of L at the time of observation.

With the exact values of LHA, Dec., and L determined, enter the appropriate section of H.O. 229, with the "tab." values, those tabulated entering arguments *nearest* to the exact values. In this case they are LHA 271°, Dec. N 18°, and L 41° N. With these "tab." values as entering arguments, enter the proper section (the "same name" section in this case), and extract and record the tabulated

H.O. 229 Azimuth worksheet.



| Body | ☉ | | | EXACT | | Z D/T I | CORR |
|---|---|---|---|---|---|---|---|
| | | | | Deg | Min | (+ or −) | (+ or −) |
| DR L | 41° 07'.5 N | | LAT | 41 | 07.5 | +0.3 | 0 |
| DR λ | 14° 56'.3 W | | LHA | 271 | 28.9 | +0.7 | +0.3 |
| Date (L) | 1 AUG. 72 | | DEC | 17 | 58.7 | +0.8 | 0 |
| ZT | 06 11 56 | | | | | Total (+) | +0.3 |
| ZD (+ or −) | +1 | | | | | | |
| GMT | 07 11 56 | | | | | Tab Z | 76.8 |
| Date (G) | 1 AUG 72 | | | | | Exact Z | N 77°.1 E |
| Tab GHA | 283° 26'.2 | | | | | Exact Zn | 077°.1 |
| Inc'mt | 2° 59'.0 | | | | | Gyro/Compass Brg | 077°.5 |
| GHA | 286° 25'.2 | | | | | Gyro/Compass Error | W 0°.4 |
| DR λ | 14° 56'.3 | | | | | | |
| LHA | 271° 28'.9 | | NORTH LAT | | | | |
| Tab Dec | N 17 58.8 | | LHA greater than 180° .......... Zn = Z | | | | |
| d corr | − 0'.1 | | LHA less than 180° .......... Zn = 360° − Z | | | | |
| Dec | N 17° 58'.7 | | SOUTH LAT | | | | |
| | | | LHA greater than 180° .......... Zn = 180° − Z | | | | |
| | | | LHA less than 180° .......... Zn = 180° + Z | | | | |

EXACT AZIMUTH USING H.O. 229

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azimuth angle, Z 76°.8. This value of Z is the *tabulated* ("tab.") value, to which the corrections resulting from the necessary interpolation are applied to obtain the azimuth angle for the exact values of LHA, Dec., and L at the moment of observation. Interpolation is made separately for the difference between each of the exact values and the corresponding "tab." values of LHA, Dec., and L; and the algebraic sum of the resulting corrections is applied to the value of tab. Z to obtain the exact azimuth angle at the moment of observation. It is normally considered sufficiently accurate to reduce these corrections to the nearest tenth of a degree.

The LHA is interpolated from 271° (Z 76°.8) to 272° (Z 77°.5), indicating a change of (+) 0°.7 for a change of 1° (60′) in the entering value of LHA known as the "LHA diff." Since the exact value of LHA is 271°28′.9, which is 28′.9 more than the "tab." value of LHA, the difference in the value of Z corresponding to this variation in LHA is 28′.9/60′ of the change for a 1° change in LHA. Thus, "LHA corr.", which is the correction to apply to the value of tab. Z for the variation of the exact value of LHA from the value of tab. LHA is equal to (+) 0°.7 × 28′.9/60′ which equals (+) 0°.3.

The Dec. is interpolated from 18° (Z 76°.8) to 17° (Z 77°.6), indicating a change of (+) 0°.8 for a change of 60′ in the entering value of Dec. This is known as the "Dec. diff." Since the exact value of Dec. is 17°58′.7 and is 1′.3 less than the "tab." value of Dec., the difference in the value of Z corresponding to this variation in Dec. is only 1′.3/60′ of the change for 60′ change in Dec. Thus the "Dec. corr.," which is the correction to apply to the value of tab. Z for the variation of the exact value of Dec. from the value of tab. Dec., is equal to (+) 0°.8 × 1′.3/60′, which, to the nearest tenth of a degree, equals 0°.0.

The L is interpolated from 41° (Z 76°.8) to 42° (Z 77°.1), indicating change of (+) 0°.3 in Z for a change of 1° (60′) in the entering value of L. This is known as the "L diff." Since the exact value of L (41°07′.5) is 7′.5 greater than the "tab." value of L (41°), the difference in the value of Z corresponding to this change in L is only 7′.5/60′ of the difference for a 1° change in L. Thus, "L corr.," which is the correction to apply to the value of Tab. Z for the variation of the exact value of L from the value of Tab. L, is equal to (+) 0°.3 × 7′.5/60′, which equals (+) 0°.0.

By applying the algebraic sum of the LHA, Dec., and L corrections, as determined above, to the tab. Z, the value of the exact azimuth angle at the moment of observation is found to be N 77°.1 E, which converts to a Zn of 077°.1. The gyro error is determined by comparing this exact azimuth with that obtained by observation, 077°.5.

*Answer:* Gyro error 0°.4 W

In solving problems for exact azimuth using H. O. 229, the multiplication of the fractional amount by the amount of the "diff." to obtain the appropriate correction can be accomplished most readily by establishing a proportion with dividers on a log scale of speed or distance, such as is found on some charts and on Maneuvering Board paper, and is discussed briefly in article 1304. In establishing the fractions involved, it is well to remember that the denominator of the fractional part of LHA, Dec., and L is always 60′, since the tabulated entering arguments of LHA, Dec., and L are always 1° apart.

# 1972 AUGUST 1, 2, 3 (TUES., WED., THURS.)

| G.M.T. | ARIES | VENUS -4.0 | | MARS -2.0 | | JUPITER -2.1 | | 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. |

Extract from the Nautical Almanac.

# 1972 AUGUST 1, 2, 3 (TUES., WED., THURS.)

*Extract from the Nautical Almanac.*

| OCT.—MAR. | SUN | APR.—SEPT. | | STARS AND PLANETS | | | DIP | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| App. Alt. | Lower Upper Limb Limb | App. Alt. | Lower Upper Limb Limb | App. Alt. | Corrⁿ | App. Alt. | Additional Corrⁿ | Ht. of Eye | Corrⁿ | Ht. of Eye Ht. of Eye Corrⁿ |

| OCT.—MAR. SUN Lower Limb/Upper Limb | APR.—SEPT. SUN Lower Limb/Upper Limb | STARS AND PLANETS | VENUS / MARS Additional Corrⁿ | DIP |
|---|---|---|---|---|
| 9 34 +10·8 −21·5 | 9 39 +10·6 −21·2 | 9 56 −5·3 | **1972** | m |
| 9 45 +10·9 −21·4 | 9 51 +10·7 −21·1 | 10 08 −5·2 | **VENUS** | 2·4 −2·8 |
| 9 56 +11·0 −21·3 | 10 03 +10·8 −21·0 | 10 20 −5·1 | Jan. 1–Feb. 29 | 2·6 −2·9 |
| 10 08 +11·1 −21·2 | 10 15 +10·9 −20·9 | 10 33 −5·0 | 0° | 2·8 −3·0 |
| 10 21 +11·2 −21·1 | 10 27 +11·0 −20·8 | 10 46 −4·9 | 42 +0·1 | 3·0 −3·1 |
| 10 34 +11·3 −21·0 | 10 40 +11·1 −20·7 | 11 00 −4·8 | Mar. 1–Apr. 15 | 3·2 −3·2 |
| 10 47 +11·4 −20·9 | 10 54 +11·2 −20·6 | 11 14 −4·7 | 0° | 3·4 −3·2 |
| 11 01 +11·5 −20·8 | 11 08 +11·3 −20·5 | 11 29 −4·6 | 47 +0·2 | 3·6 −3·3 |
| 11 15 +11·6 −20·7 | 11 23 +11·4 −20·4 | 11 45 −4·5 | Apr. 16–May 12 | 3·8 −3·4 |
| 11 30 +11·7 −20·6 | 11 38 +11·5 −20·3 | 12 01 −4·4 | 0° | 4·0 −3·5 |
| 11 46 +11·8 −20·5 | 11 54 +11·6 −20·2 | 12 18 −4·3 | 46 +0·3 | 4·3 −3·6 |
| 12 02 +11·9 −20·4 | 12 10 +11·7 −20·1 | 12 35 −4·2 | May 13–May 27 | 4·5 −3·7 |
| 12 19 +12·0 −20·3 | 12 28 +11·8 −20·0 | 12 54 −4·1 | 0° | 4·7 −3·8 |
| 12 37 +12·1 −20·2 | 12 46 +11·9 −19·9 | 13 13 −4·0 | 11 +0·4 | 5·0 −3·9 |
| 12 55 +12·2 −20·1 | 13 05 +12·0 −19·8 | 13 33 −3·9 | 41 +0·5 | 5·2 −4·0 |
| 13 14 +12·3 −20·0 | 13 24 +12·1 −19·7 | 13 54 −3·8 | May 28–June 5 | 5·5 −4·1 |
| 13 35 +12·4 −19·9 | 13 45 +12·2 −19·6 | 14 16 −3·7 | 0° | 5·8 −4·2 |
| 13 56 +12·5 −19·8 | 14 07 +12·3 −19·5 | 14 40 −3·6 | 6 +0·5 | 6·1 −4·3 |
| 14 18 +12·6 −19·7 | 14 30 +12·4 −19·4 | 15 04 −3·5 | 20 +0·6 | 6·3 −4·4 |
| 14 42 +12·7 −19·6 | 14 54 +12·5 −19·3 | 15 30 −3·4 | 31 +0·7 | 6·6 −4·5 |
| 15 06 +12·8 −19·5 | 15 19 +12·6 −19·2 | 15 57 −3·3 | June 6–June 29 | 6·9 −4·6 |
| 15 32 +12·9 −19·4 | 15 46 +12·7 −19·1 | 16 26 −3·2 | 0° | 7·2 −4·7 |
| 15 59 +13·0 −19·3 | 16 14 +12·8 −19·0 | 16 56 −3·1 | 4 +0·6 | 7·5 −4·8 |
| 16 28 +13·1 −19·2 | 16 44 +12·9 −18·9 | 17 28 −3·0 | 12 +0·7 | 7·9 −4·9 |
| 16 59 +13·2 −19·1 | 17 15 +13·0 −18·8 | 18 02 −2·9 | 22 +0·8 | 8·2 −5·0 |
| 17 32 +13·3 −19·0 | 17 48 +13·1 −18·7 | 18 38 −2·8 | June 30–July 8 | 8·5 −5·1 |
| 18 06 +13·4 −18·9 | 18 24 +13·2 −18·6 | 19 17 −2·7 | 0° | 8·8 −5·2 |
| 18 42 +13·5 −18·8 | 19 01 +13·3 −18·5 | 19 58 −2·6 | 6 +0·5 | 9·2 −5·3 |
| 19 21 +13·6 −18·7 | 19 42 +13·4 −18·4 | 20 42 −2·5 | 20 +0·6 | 9·5 −5·4 |
| 20 03 +13·7 −18·6 | 20 25 +13·5 −18·3 | 21 28 −2·4 | 31 +0·7 | 9·9 −5·5 |
| 20 48 +13·8 −18·5 | 21 11 +13·6 −18·2 | 22 19 −2·3 | July 9–July 24 | 10·3 −5·6 |
| 21 35 +13·9 −18·4 | 22 00 +13·7 −18·1 | 23 13 −2·2 | 0° | 10·6 −5·7 |
| 22 26 +14·0 −18·3 | 22 54 +13·8 −18·0 | 24 11 −2·1 | 11 −0·4 | 11·0 −5·8 |
| 23 22 +14·1 −18·2 | 23 51 +13·9 −17·9 | 25 14 −2·0 | 41 −0·5 | 11·4 −5·9 |
| 24 21 +14·2 −18·1 | 24 53 +14·0 −17·8 | 26 22 −1·9 | July 25–Aug. 19 | 11·8 −6·1 |
| 25 26 +14·3 −18·0 | 26 00 +14·1 −17·7 | 27 36 −1·8 | 0° | 12·2 −6·2 |
| 26 36 +14·4 −17·9 | 27 13 +14·2 −17·6 | 28 56 −1·7 | 46 +0·3 | 12·6 −6·3 |
| 27 52 +14·5 −17·8 | 28 33 +14·3 −17·5 | 30 24 −1·6 | Aug. 20–Oct. 3 | 13·0 −6·4 |
| 29 15 +14·6 −17·7 | 30 00 +14·4 −17·4 | 32 00 −1·5 | 0° | 13·4 −6·5 |
| 30 46 +14·7 −17·6 | 31 35 +14·5 −17·3 | 33 45 −1·4 | 47 +0·2 | 13·8 −6·6 |
| 32 26 +14·8 −17·5 | 33 20 +14·6 −17·2 | 35 40 −1·3 | Oct. 6–Dec. 31 | 14·2 −6·7 |
| 34 17 +14·9 −17·4 | 35 17 +14·7 −17·1 | 37 48 −1·2 | 0° | 14·7 −6·8 |
| 36 20 +15·0 −17·3 | 37 26 +14·8 −17·0 | 40 08 −1·1 | 42 +0·1 | 15·1 −6·9 |
| 38 36 +15·1 −17·2 | 39 50 +14·9 −16·9 | 42 44 −1·0 | | 15·5 −7·0 |
| 41 08 +15·2 −17·1 | 42 31 +15·0 −16·8 | 45 36 −0·9 | | 16·0 −7·1 |
| 43 59 +15·3 −17·0 | 45 31 +15·1 −16·7 | 48 47 −0·8 | **MARS** | 16·5 −7·2 |
| 47 10 +15·4 −16·9 | 48 55 +15·2 −16·6 | 52 18 −0·7 | Jan. 1–Dec. 31 | 16·9 −7·3 |
| 50 46 +15·5 −16·8 | 52 44 +15·3 −16·5 | 56 11 −0·6 | 0° | 17·4 −7·4 |
| 54 49 +15·6 −16·7 | 57 02 +15·4 −16·4 | 60 28 −0·5 | 60 +0·1 | 17·9 −7·5 |
| 59 23 +15·7 −16·6 | 61 51 +15·5 −16·3 | 65 08 −0·4 | | 18·4 −7·6 |
| 64 30 +15·8 −16·5 | 67 17 +15·6 −16·2 | 70 11 −0·3 | | 18·8 −7·7 |
| 70 12 +15·9 −16·4 | 73 16 +15·7 −16·1 | 75 34 −0·2 | | 19·3 −7·8 |
| 76 26 +16·0 −16·3 | 79 43 +15·8 −16·0 | 81 13 −0·1 | | 19·8 −7·9 |
| 83 05 +16·1 −16·2 | 86 32 +15·9 −15·9 | 87 03 0·0 | | 20·4 −8·0 |
| 90 00 | 90 00 | 90 00 | | 20·9 −8·1 |
| | | | | 21·4 −8·1 |

| Ht. of Eye | Corrⁿ | Ht. of Eye | Corrⁿ |
|---|---|---|---|
| ft. | | m | |
| 8·0 | 1·0 − 1·8 | | |
| 8·6 | 1·5 − 2·2 | | |
| 9·2 | 2·0 − 2·5 | | |
| 9·8 | 2·5 − 2·8 | | |
| 10·5 | 3·0 − 3·0 | | |
| 11·2 | See table ← | | |
| 11·9 | | | |
| 12·6 | m | | |
| 13·3 | 20 − 7·9 | | |
| 14·1 | 22 − 8·3 | | |
| 14·9 | 24 − 8·6 | | |
| 15·7 | 26 − 9·0 | | |
| 16·5 | 28 − 9·3 | | |
| 17·4 | | | |
| 18·3 | 30 − 9·6 | | |
| 19·1 | 32 − 10·0 | | |
| 20·1 | 34 − 10·3 | | |
| 21·0 | 36 − 10·6 | | |
| 22·0 | 38 − 10·8 | | |
| 22·9 | | | |
| 23·9 | 40 − 11·1 | | |
| 24·9 | 42 − 11·4 | | |
| 26·0 | 44 − 11·7 | | |
| 27·1 | 46 − 11·9 | | |
| 28·1 | 48 − 12·2 | | |
| 29·2 | | | |
| 30·4 | ft. | | |
| 31·5 | 2 − 1·4 | | |
| 32·7 | 4 − 1·9 | | |
| 33·9 | 6 − 2·4 | | |
| 35·1 | 8 − 2·7 | | |
| 36·3 | 10 − 3·1 | | |
| 37·6 | See table ← | | |
| 38·9 | | | |
| 40·1 | ft. | | |
| 41·5 | 70 − 8·1 | | |
| 42·8 | 75 − 8·4 | | |
| 44·2 | 80 − 8·7 | | |
| 45·5 | 85 − 8·9 | | |
| 46·9 | 90 − 9·2 | | |
| 48·4 | 95 − 9·5 | | |
| 49·8 | | | |
| 51·3 | 100 − 9·7 | | |
| 52·8 | 105 − 9·9 | | |
| 54·3 | 110 − 10·2 | | |
| 55·8 | 115 − 10·4 | | |
| 57·4 | 120 − 10·6 | | |
| 58·9 | 125 − 10·8 | | |
| 60·5 | | | |
| 62·1 | 130 − 11·1 | | |
| 63·8 | 135 − 11·3 | | |
| 65·4 | 140 − 11·5 | | |
| 67·1 | 145 − 11·7 | | |
| 68·8 | 150 − 11·9 | | |
| 70·5 | 155 − 12·1 | | |

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.
For daylight observations of Venus, see page 260.

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# A4 ALTITUDE CORRECTION TABLES—ADDITIONAL CORRECTIONS

## ADDITIONAL REFRACTION CORRECTIONS FOR NON-STANDARD CONDITIONS
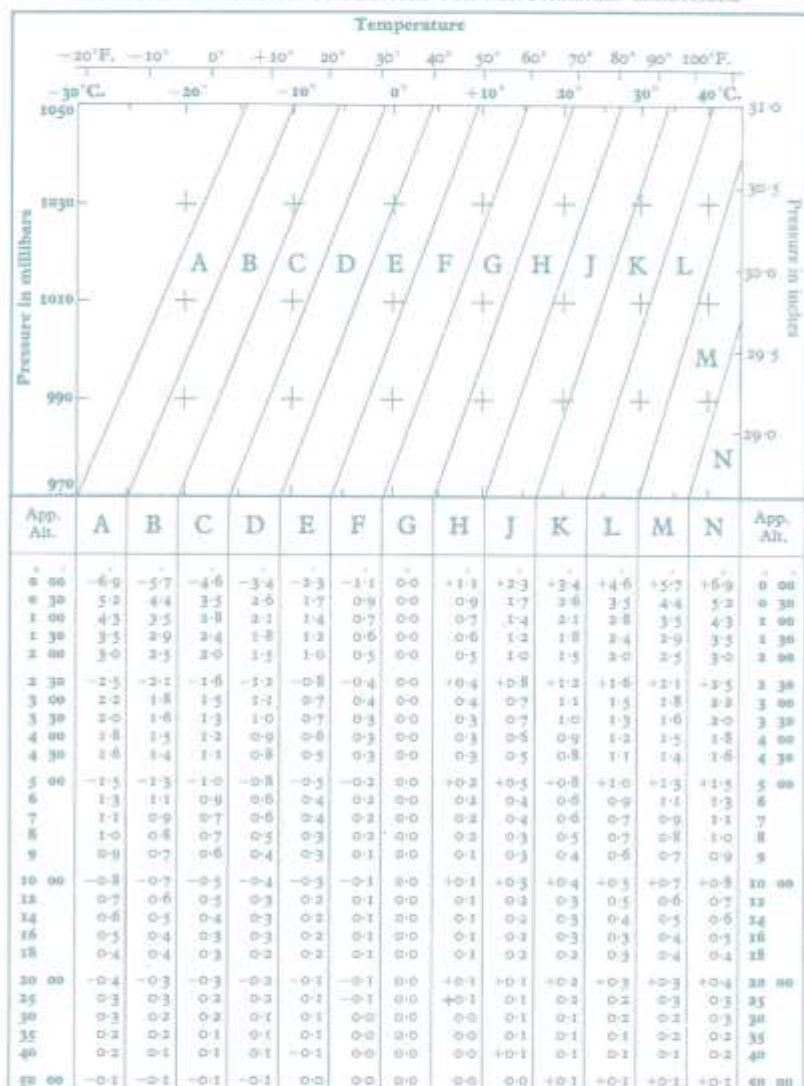


The graph is entered with arguments temperature and pressure to find a zone letter; using as arguments this zone letter and apparent altitude (sextant altitude corrected for dip), a correction is taken from the table. This correction is to be applied to the sextant altitude in addition to the corrections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

| App. Alt. | A | B | C | D | E | F | G | H | J | K | L | M | N | App. Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 00 | −6·9 | −5·7 | −4·6 | −3·4 | −2·3 | −1·1 | 0·0 | +1·1 | +2·3 | +3·4 | +4·6 | +5·7 | +6·9 | 8 00 |
| 8 30 | 5·2 | 4·4 | 3·5 | 2·6 | 1·7 | 0·9 | 0·0 | 0·9 | 1·7 | 2·6 | 3·5 | 4·4 | 5·2 | 8 30 |
| 9 00 | 4·3 | 3·5 | 2·8 | 2·1 | 1·4 | 0·7 | 0·0 | 0·7 | 1·4 | 2·1 | 2·8 | 3·5 | 4·3 | 9 00 |
| 9 30 | 3·5 | 2·9 | 2·4 | 1·8 | 1·2 | 0·6 | 0·0 | 0·6 | 1·2 | 1·8 | 2·4 | 2·9 | 3·5 | 9 30 |
| 10 00 | 3·0 | 2·5 | 2·0 | 1·5 | 1·0 | 0·5 | 0·0 | 0·5 | 1·0 | 1·5 | 2·0 | 2·5 | 3·0 | 10 00 |
| 10 30 | −2·5 | −2·1 | −1·6 | −1·2 | −0·8 | −0·4 | 0·0 | +0·4 | +0·8 | +1·2 | +1·6 | +2·1 | +2·5 | 10 30 |
| 11 00 | 2·2 | 1·8 | 1·5 | 1·1 | 0·7 | 0·4 | 0·0 | 0·4 | 0·7 | 1·1 | 1·5 | 1·8 | 2·2 | 11 00 |
| 11 30 | 2·0 | 1·6 | 1·3 | 1·0 | 0·7 | 0·3 | 0·0 | 0·3 | 0·7 | 1·0 | 1·3 | 1·6 | 2·0 | 11 30 |
| 12 00 | 1·8 | 1·5 | 1·2 | 0·9 | 0·6 | 0·3 | 0·0 | 0·3 | 0·6 | 0·9 | 1·2 | 1·5 | 1·8 | 12 00 |
| 12 30 | 1·6 | 1·4 | 1·1 | 0·8 | 0·5 | 0·3 | 0·0 | 0·3 | 0·5 | 0·8 | 1·1 | 1·4 | 1·6 | 12 30 |
| 13 00 | −1·5 | −1·3 | −1·0 | −0·8 | −0·5 | −0·2 | 0·0 | +0·2 | +0·5 | +0·8 | +1·0 | +1·3 | +1·5 | 13 00 |
| 14 | 1·3 | 1·1 | 0·9 | 0·6 | 0·4 | 0·2 | 0·0 | 0·2 | 0·4 | 0·6 | 0·9 | 1·1 | 1·3 | 14 |
| 15 | 1·1 | 0·9 | 0·7 | 0·6 | 0·4 | 0·2 | 0·0 | 0·2 | 0·4 | 0·6 | 0·7 | 0·9 | 1·1 | 15 |
| 16 | 1·0 | 0·8 | 0·7 | 0·5 | 0·3 | 0·2 | 0·0 | 0·2 | 0·3 | 0·5 | 0·7 | 0·8 | 1·0 | 16 |
| 17 | 0·9 | 0·7 | 0·6 | 0·4 | 0·3 | 0·1 | 0·0 | 0·1 | 0·3 | 0·4 | 0·6 | 0·7 | 0·9 | 17 |
| 18 00 | −0·8 | −0·7 | −0·5 | −0·4 | −0·3 | −0·1 | 0·0 | +0·1 | +0·3 | +0·4 | +0·5 | +0·7 | +0·8 | 18 00 |
| 20 | 0·7 | 0·6 | 0·5 | 0·3 | 0·2 | 0·1 | 0·0 | 0·1 | 0·2 | 0·3 | 0·5 | 0·6 | 0·7 | 20 |
| 25 | 0·6 | 0·5 | 0·4 | 0·3 | 0·2 | 0·1 | 0·0 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·6 | 25 |
| 30 | 0·5 | 0·4 | 0·3 | 0·3 | 0·2 | 0·1 | 0·0 | 0·1 | 0·2 | 0·3 | 0·4 | 0·5 | 0·5 | 30 |
| 35 | 0·4 | 0·4 | 0·3 | 0·2 | 0·2 | 0·1 | 0·0 | 0·1 | 0·2 | 0·2 | 0·3 | 0·4 | 0·4 | 35 |
| 40 00 | −0·4 | −0·3 | −0·3 | −0·2 | −0·1 | −0·1 | 0·0 | +0·1 | +0·1 | +0·2 | +0·3 | +0·3 | +0·4 | 40 00 |
| 45 | 0·3 | 0·3 | 0·2 | 0·2 | 0·1 | −0·1 | 0·0 | +0·1 | 0·1 | 0·2 | 0·2 | 0·3 | 0·3 | 45 |
| 50 | 0·3 | 0·2 | 0·2 | 0·1 | 0·1 | 0·0 | 0·0 | 0·0 | 0·1 | 0·2 | 0·2 | 0·3 | 0·3 | 50 |
| 55 | 0·2 | 0·2 | 0·1 | 0·1 | 0·1 | 0·0 | 0·0 | 0·0 | 0·1 | 0·1 | 0·1 | 0·2 | 0·2 | 55 |
| 60 | 0·2 | 0·1 | 0·1 | 0·1 | −0·1 | 0·0 | 0·0 | 0·0 | +0·1 | 0·1 | 0·1 | 0·1 | 0·2 | 60 |
| 80 00 | −0·1 | −0·1 | −0·1 | −0·1 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | +0·1 | +0·1 | +0·1 | +0·1 | 80 00 |

# ALTITUDE CORRECTION TABLES 35°-90°—MOON

| App. Alt. | 35°-39° Corr | 40°-44° Corr | 45°-49° Corr | 50°-54° Corr | 55°-59° Corr | 60°-64° Corr | 65°-69° Corr | 70°-74° Corr | 75°-79° Corr | 80°-84° Corr | 85°-89° Corr | App. Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HP | L U | L U | L U | L U | L U | L U | L U | L U | L U | L U | L U | HP |

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

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

| 47 | SUN PLANETS | ARIES | MOON | or Corr | or Corr | or Corr | 48 | SUN PLANETS | ARIES | MOON | or Corr | or Corr | or Corr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Dec. | 38° Hc | 38° d | 38° Z | 39° Hc | 39° d | 39° Z | 40° Hc | 40° d | 40° Z | 41° Hc | 41° d | 41° Z | 42° Hc | 42° d | 42° Z | 43° Hc | 43° d | 43° Z | 44° Hc | 44° d | 44° Z | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 0 |
| 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 1 |
| 2 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 2 |
| 3 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 3 |
| 4 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 4 |
| 5 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 5 |
| 6 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 6 |
| 7 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 7 |
| 8 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 8 |
| 9 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 9 |
| 10 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 10 |
| 11 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 11 |
| 12 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 12 |
| 13 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 13 |
| 14 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 14 |
| 15 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 15 |
| 16 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 16 |
| 17 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 17 |
| 18 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 18 |
| 19 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 19 |
| 20 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 20 |
| 21 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 21 |
| 22 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 22 |
| 23 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 23 |
| 24 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 24 |
| 25 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 25 |
| 26 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 26 |
| 27 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 27 |
| 28 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 28 |
| 29 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 29 |
| 30 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 30 |
| 31 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 31 |
| 32 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 32 |
| 33 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 33 |
| 34 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 34 |
| 35 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 35 |
| 36 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 36 |
| 37 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 37 |
| 38 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 38 |
| 39 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 39 |
| 40 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 40 |
| 41 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 41 |
| 42 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 42 |
| 43 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 43 |
| 44 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 44 |
| 45 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 45 |
| 46 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 46 |
| 47 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 47 |
| 48 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 48 |
| 49 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 49 |
| 50 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 50 |
| 51 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 51 |
| 52 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 52 |
| 53 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 53 |
| 54 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 54 |
| 55 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 55 |
| 56 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 56 |
| 57 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 57 |
| 58 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 58 |
| 59 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 59 |
| 60 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 60 |
| 61 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 61 |
| 62 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 62 |
| 63 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 63 |
| 64 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 64 |
| 65 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 65 |
| 66 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 66 |
| 67 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 67 |
| 68 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 68 |
| 69 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 69 |
| 70 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 70 |
| 71 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 71 |
| 72 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 72 |
| 73 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 73 |
| 74 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 74 |
| 75 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 75 |
| 76 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 76 |
| 77 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 77 |
| 78 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 78 |
| 79 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 79 |
| 80 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 80 |
| 81 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 81 |
| 82 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 82 |
| 83 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 83 |
| 84 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 84 |
| 85 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 85 |
| 86 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 86 |
| 87 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 87 |
| 88 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 |
| 89 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 89 |
| 90 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 90 |
|  | 38° |  |  | 39° |  |  | 40° |  |  | 41° |  |  | 42° |  |  | 43° |  |  | 44° |  |  |  |

*Extract from H.O. 229.*

| Dec. | 38° | | | 39° | | | 40° | | | 41° | | | 42° | | | 43° | | | 44° | | | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | |

| Dec. | 38° | | | 39° | | | 40° | | | 41° | | | 42° | | | 43° | | | 44° | | | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | |

| Dec. | 39° | | | 40° | | | 41° | | | 42° | | | 43° | | | 44° | | | 45° | | | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | |

| Dec. | 38° |  |  | 39° |  |  | 40° |  |  | 41° |  |  | 42° |  |  | 43° |  |  | 44° |  |  | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z | Hc | d | Z |  |
| ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° ′ | ′ | ° | ° |
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| 1 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 1 |
| 2 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 2 |
| 3 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 3 |
| 4 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 4 |
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| 10 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 10 |
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| 12 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 12 |
| 13 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 13 |
| 14 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 14 |
| 15 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 15 |
| 16 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 16 |
| 17 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 17 |
| 18 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 18 |
| 19 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 19 |
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| 27 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 27 |
| 28 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 28 |
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| 30 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 30 |
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| 36 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 36 |
| 37 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 37 |
| 38 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 38 |
| 39 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 39 |
| 40 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 40 |
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| 42 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 42 |
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| 44 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 44 |
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| 47 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 47 |
| 48 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 48 |
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| 51 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 51 |
| 52 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 52 |
| 53 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 53 |
| 54 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 54 |
| 55 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 55 |
| 56 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 56 |
| 57 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 57 |
| 58 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 58 |
| 59 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 59 |
| 60 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 60 |
| 61 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 61 |
| 62 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 62 |
| 63 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 63 |
| 64 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 64 |
| 65 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 65 |
| 66 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 66 |
| 67 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 67 |
| 68 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 68 |
| 69 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 69 |
| 70 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 70 |
| 71 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 71 |
| 72 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 72 |
| 73 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 73 |
| 74 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 74 |
| 75 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 75 |
| 76 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 76 |
| 77 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 77 |
| 78 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 78 |
| 79 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 79 |
| 80 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 80 |
| 81 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 81 |
| 82 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 82 |
| 83 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 83 |
| 84 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 84 |
| 85 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 85 |
| 86 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 86 |
| 87 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 87 |
| 88 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 88 |
| 89 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 89 |
| 90 | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 90 |
|  | 38° |  |  | 39° |  |  | 40° |  |  | 41° |  |  | 42° |  |  | 43° |  |  | 44° |  |  |  |

# INTERPOLATION TABLE

| Dec. Inc. | 10' | 20' | 30' | 40' | 50' | Dec. | 0' | 1' | 2' | 3' | 4' | 5' | 6' | 7' | 8' | 9' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Tens | | | Decimals | | | | | Units | | | | | |
| 36.0 | 6.0 | 12.0 | 18.0 | 24.0 | 30.0 | .0 | 0.0 | 0.6 | 1.2 | 1.8 | 2.4 | 3.0 | 3.6 | 4.3 | 4.9 | 5.5 |
| 36.1 | 6.0 | 12.0 | 18.0 | 24.0 | 30.1 | .1 | 0.1 | 0.7 | 1.3 | 1.9 | 2.5 | 3.1 | 3.7 | 4.3 | 4.9 | 5.5 |
| 36.2 | 6.0 | 12.0 | 18.1 | 24.1 | 30.1 | .2 | 0.1 | 0.7 | 1.3 | 1.9 | 2.6 | 3.2 | 3.8 | 4.4 | 5.0 | 5.6 |
| 36.3 | 6.0 | 12.1 | 18.1 | 24.2 | 30.2 | .3 | 0.2 | 0.8 | 1.4 | 2.0 | 2.6 | 3.2 | 3.8 | 4.4 | 5.0 | 5.7 |
| 36.4 | 6.1 | 12.1 | 18.2 | 24.3 | 30.3 | .4 | 0.2 | 0.9 | 1.5 | 2.1 | 2.7 | 3.3 | 3.9 | 4.5 | 5.1 | 5.7 |
| 36.5 | 6.1 | 12.2 | 18.3 | 24.3 | 30.4 | .5 | 0.3 | 0.9 | 1.5 | 2.1 | 2.7 | 3.3 | 4.0 | 4.6 | 5.2 | 5.8 |
| 36.6 | 6.1 | 12.2 | 18.3 | 24.4 | 30.5 | .6 | 0.4 | 1.0 | 1.6 | 2.2 | 2.8 | 3.4 | 4.0 | 4.6 | 5.2 | 5.8 |
| 36.7 | 6.1 | 12.3 | 18.4 | 24.5 | 30.6 | .7 | 0.4 | 1.0 | 1.6 | 2.3 | 2.9 | 3.5 | 4.1 | 4.7 | 5.3 | 5.9 |
| 36.8 | 6.2 | 12.3 | 18.4 | 24.6 | 30.7 | .8 | 0.5 | 1.1 | 1.7 | 2.3 | 2.9 | 3.5 | 4.1 | 4.7 | 5.4 | 6.0 |
| 36.9 | 6.2 | 12.3 | 18.5 | 24.6 | 30.8 | .9 | 0.5 | 1.2 | 1.8 | 2.4 | 3.0 | 3.6 | 4.2 | 4.8 | 5.4 | 6.0 |

Double Second Diff. and Corr.: 0.8 / 0.1 ; 2.5 / 0.2 ; 4.2 / 0.3 ; 5.9 ; 7.6 / 0.4 ; 9.3 / 0.5 ; 11.0 / 0.6 ; 12.7 / 0.7 ; 14.4 / 0.8 ; 16.1 / 0.9 ; 1.0

| Dec. Inc. | 10' | 20' | 30' | 40' | 50' | Dec. | 0' | 1' | 2' | 3' | 4' | 5' | 6' | 7' | 8' | 9' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 43.0 | 7.1 | 14.3 | 21.5 | 28.6 | 35.8 | .0 | 0.0 | 0.7 | 1.4 | 2.2 | 2.9 | 3.6 | 4.3 | 5.1 | 5.8 | 6.5 |
| 43.1 | 7.2 | 14.3 | 21.5 | 28.7 | 35.9 | .1 | 0.1 | 0.8 | 1.5 | 2.2 | 3.0 | 3.7 | 4.4 | 5.1 | 5.9 | 6.6 |
| 43.2 | 7.2 | 14.4 | 21.6 | 28.8 | 36.0 | .2 | 0.1 | 0.9 | 1.6 | 2.3 | 3.0 | 3.8 | 4.5 | 5.2 | 5.9 | 6.7 |
| 43.3 | 7.2 | 14.4 | 21.6 | 28.9 | 36.1 | .3 | 0.2 | 0.9 | 1.7 | 2.4 | 3.1 | 3.8 | 4.6 | 5.3 | 6.0 | 6.7 |
| 43.4 | 7.2 | 14.5 | 21.7 | 28.9 | 36.2 | .4 | 0.3 | 1.0 | 1.7 | 2.5 | 3.2 | 3.9 | 4.6 | 5.4 | 6.1 | 6.8 |
| 43.5 | 7.3 | 14.5 | 21.8 | 29.0 | 36.2 | .5 | 0.4 | 1.1 | 1.8 | 2.5 | 3.3 | 4.0 | 4.7 | 5.4 | 6.2 | 6.9 |
| 43.6 | 7.3 | 14.5 | 21.8 | 29.1 | 36.3 | .6 | 0.4 | 1.2 | 1.9 | 2.6 | 3.3 | 4.1 | 4.8 | 5.5 | 6.2 | 7.0 |
| 43.7 | 7.3 | 14.6 | 21.9 | 29.2 | 36.4 | .7 | 0.5 | 1.2 | 2.0 | 2.7 | 3.4 | 4.1 | 4.9 | 5.6 | 6.3 | 7.0 |
| 43.8 | 7.3 | 14.6 | 21.9 | 29.2 | 36.5 | .8 | 0.6 | 1.3 | 2.0 | 2.8 | 3.5 | 4.2 | 4.9 | 5.7 | 6.4 | 7.1 |
| 43.9 | 7.4 | 14.7 | 22.0 | 29.3 | 36.6 | .9 | 0.7 | 1.4 | 2.1 | 2.8 | 3.6 | 4.3 | 5.0 | 5.7 | 6.5 | 7.2 |

Double Second Diff. and Corr.: 18.7 / 0.9 ; 20.7 / 1.0 ; 22.7 / 1.1 ; 24.6 / 1.2 ; 26.6 / 1.3 ; 28.6 / 1.4 ; 30.5 / 1.5 ; 32.5 / 1.6 ; 34.5 / 1.7

| Dec. Inc. | 10' | 20' | 30' | 40' | 50' | Dec. | 0' | 1' | 2' | 3' | 4' | 5' | 6' | 7' | 8' | 9' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 44.0 | 7.3 | 14.6 | 22.0 | 29.3 | 36.6 | .0 | 0.0 | 0.7 | 1.5 | 2.2 | 3.0 | 3.7 | 4.4 | 5.2 | 5.9 | 6.7 |
| 44.1 | 7.3 | 14.7 | 22.0 | 29.4 | 36.7 | .1 | 0.1 | 0.8 | 1.6 | 2.3 | 3.0 | 3.8 | 4.5 | 5.3 | 6.0 | 6.7 |
| 44.2 | 7.3 | 14.7 | 22.1 | 29.4 | 36.8 | .2 | 0.1 | 0.9 | 1.6 | 2.4 | 3.1 | 3.9 | 4.6 | 5.3 | 6.1 | 6.8 |
| 44.3 | 7.4 | 14.8 | 22.1 | 29.5 | 36.9 | .3 | 0.2 | 1.0 | 1.7 | 2.4 | 3.2 | 3.9 | 4.7 | 5.4 | 6.2 | 6.9 |
| 44.4 | 7.4 | 14.8 | 22.2 | 29.6 | 37.0 | .4 | 0.3 | 1.0 | 1.8 | 2.5 | 3.3 | 4.0 | 4.7 | 5.5 | 6.2 | 7.0 |
| 44.5 | 7.4 | 14.8 | 22.3 | 29.7 | 37.1 | .5 | 0.4 | 1.1 | 1.9 | 2.6 | 3.3 | 4.1 | 4.8 | 5.6 | 6.3 | 7.0 |
| 44.6 | 7.4 | 14.9 | 22.3 | 29.7 | 37.2 | .6 | 0.4 | 1.2 | 1.9 | 2.7 | 3.4 | 4.2 | 4.9 | 5.6 | 6.4 | 7.1 |
| 44.7 | 7.5 | 14.9 | 22.4 | 29.8 | 37.3 | .7 | 0.5 | 1.3 | 2.0 | 2.7 | 3.5 | 4.2 | 5.0 | 5.7 | 6.5 | 7.2 |
| 44.8 | 7.5 | 15.0 | 22.4 | 29.9 | 37.4 | .8 | 0.6 | 1.3 | 2.1 | 2.8 | 3.6 | 4.3 | 5.0 | 5.8 | 6.5 | 7.3 |
| 44.9 | 7.5 | 15.0 | 22.5 | 30.0 | 37.5 | .9 | 0.7 | 1.4 | 2.2 | 2.9 | 3.6 | 4.4 | 5.1 | 5.9 | 6.6 | 7.3 |

Double Second Diff. and Corr.: 1.1 ; 3.2 / 0.1 ; 5.3 / 0.2 ; 7.5 / 0.3 ; 9.6 / 0.4 ; 11.7 / 0.5 ; 13.9 / 0.6 ; 16.0 / 0.7 ; 18.1 / 0.8

| Dec. Inc. | 10' | 20' | 30' | 40' | 50' | Dec. | 0' | 1' | 2' | 3' | 4' | 5' | 6' | 7' | 8' | 9' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45.0 | 7.5 | 15.0 | 22.5 | 30.0 | 37.5 | .0 | 0.0 | 0.8 | 1.5 | 2.3 | 3.0 | 3.8 | 4.5 | 5.3 | 6.1 | 6.8 |
| 45.1 | 7.5 | 15.0 | 22.5 | 30.0 | 37.6 | .1 | 0.1 | 0.8 | 1.6 | 2.4 | 3.1 | 3.9 | 4.6 | 5.4 | 6.1 | 6.9 |
| 45.2 | 7.5 | 15.0 | 22.6 | 30.1 | 37.6 | .2 | 0.2 | 0.9 | 1.7 | 2.4 | 3.2 | 3.9 | 4.7 | 5.5 | 6.2 | 7.0 |
| 45.3 | 7.5 | 15.1 | 22.6 | 30.2 | 37.7 | .3 | 0.2 | 1.0 | 1.7 | 2.5 | 3.3 | 4.0 | 4.8 | 5.5 | 6.3 | 7.1 |
| 45.4 | 7.6 | 15.1 | 22.7 | 30.3 | 37.8 | .4 | 0.3 | 1.1 | 1.8 | 2.6 | 3.3 | 4.1 | 4.9 | 5.6 | 6.4 | 7.1 |
| 45.5 | 7.6 | 15.2 | 22.8 | 30.3 | 37.9 | .5 | 0.4 | 1.1 | 1.9 | 2.7 | 3.4 | 4.2 | 4.9 | 5.7 | 6.4 | 7.2 |
| 45.6 | 7.6 | 15.2 | 22.8 | 30.4 | 38.0 | .6 | 0.5 | 1.2 | 2.0 | 2.7 | 3.5 | 4.2 | 5.0 | 5.8 | 6.5 | 7.3 |
| 45.7 | 7.6 | 15.3 | 22.9 | 30.5 | 38.1 | .7 | 0.5 | 1.3 | 2.0 | 2.8 | 3.6 | 4.3 | 5.1 | 5.8 | 6.6 | 7.4 |
| 45.8 | 7.7 | 15.3 | 22.9 | 30.6 | 38.2 | .8 | 0.6 | 1.4 | 2.1 | 2.9 | 3.6 | 4.4 | 5.2 | 5.9 | 6.7 | 7.4 |
| 45.9 | 7.7 | 15.3 | 23.0 | 30.6 | 38.3 | .9 | 0.7 | 1.4 | 2.2 | 3.0 | 3.7 | 4.5 | 5.2 | 6.0 | 6.7 | 7.5 |

Double Second Diff. and Corr.: 20.3 / 0.9 ; 22.4 / 1.0 ; 24.5 / 1.1 ; 26.7 / 1.2 ; 28.8 / 1.3 ; 30.9 / 1.4 ; 33.1 / 1.5 ; 35.2 / 1.6

| Dec. Inc. | 10' | 20' | 30' | 40' | 50' | Dec. | 0' | 1' | 2' | 3' | 4' | 5' | 6' | 7' | 8' | 9' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 58.0 | 9.6 | 19.3 | 29.0 | 38.6 | 48.3 | .0 | 0.0 | 1.0 | 1.9 | 2.9 | 3.9 | 4.9 | 5.8 | 6.8 | 7.8 | 8.8 |
| 58.1 | 9.7 | 19.3 | 29.0 | 38.7 | 48.4 | .1 | 0.1 | 1.1 | 2.0 | 3.0 | 4.0 | 5.0 | 5.9 | 6.9 | 7.9 | 8.9 |
| 58.2 | 9.7 | 19.4 | 29.1 | 38.8 | 48.5 | .2 | 0.2 | 1.2 | 2.1 | 3.1 | 4.1 | 5.1 | 6.0 | 7.0 | 8.0 | 9.0 |
| 58.3 | 9.7 | 19.4 | 29.1 | 38.9 | 48.6 | .3 | 0.3 | 1.3 | 2.2 | 3.2 | 4.2 | 5.2 | 6.1 | 7.1 | 8.1 | 9.1 |
| 58.4 | 9.7 | 19.5 | 29.2 | 38.9 | 48.7 | .4 | 0.4 | 1.4 | 2.3 | 3.3 | 4.3 | 5.3 | 6.2 | 7.2 | 8.2 | 9.2 |
| 58.5 | 9.8 | 19.5 | 29.3 | 39.0 | 48.8 | .5 | 0.5 | 1.5 | 2.4 | 3.4 | 4.4 | 5.4 | 6.3 | 7.3 | 8.3 | 9.3 |
| 58.6 | 9.8 | 19.5 | 29.3 | 39.1 | 48.8 | .6 | 0.6 | 1.6 | 2.5 | 3.5 | 4.5 | 5.5 | 6.4 | 7.4 | 8.4 | 9.4 |
| 58.7 | 9.8 | 19.6 | 29.4 | 39.2 | 48.9 | .7 | 0.7 | 1.7 | 2.6 | 3.6 | 4.6 | 5.6 | 6.5 | 7.5 | 8.5 | 9.5 |
| 58.8 | 9.8 | 19.6 | 29.4 | 39.2 | 49.0 | .8 | 0.8 | 1.8 | 2.7 | 3.7 | 4.7 | 5.7 | 6.6 | 7.6 | 8.6 | 9.6 |
| 58.9 | 9.9 | 19.7 | 29.5 | 39.3 | 49.1 | .9 | 0.9 | 1.9 | 2.8 | 3.8 | 4.8 | 5.8 | 6.7 | 7.7 | 8.7 | 9.7 |

Double Second Diff. and Corr.: 8.2 / 0.1 ; 24.6 / 0.1 ; 41.0 / 0.2

| Dec. Inc. | 10' | 20' | 30' | 40' | 50' | Dec. | 0' | 1' | 2' | 3' | 4' | 5' | 6' | 7' | 8' | 9' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 59.0 | 9.8 | 19.6 | 29.5 | 39.3 | 49.1 | .0 | 0.0 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 5.9 | 6.9 | 7.9 | 8.9 |
| 59.1 | 9.8 | 19.7 | 29.5 | 39.4 | 49.2 | .1 | 0.1 | 1.1 | 2.1 | 3.1 | 4.1 | 5.1 | 6.0 | 7.0 | 8.0 | 9.0 |
| 59.2 | 9.8 | 19.7 | 29.6 | 39.4 | 49.3 | .2 | 0.2 | 1.2 | 2.2 | 3.2 | 4.2 | 5.2 | 6.1 | 7.1 | 8.1 | 9.1 |
| 59.3 | 9.9 | 19.8 | 29.6 | 39.5 | 49.4 | .3 | 0.3 | 1.3 | 2.3 | 3.3 | 4.3 | 5.3 | 6.2 | 7.2 | 8.2 | 9.2 |
| 59.4 | 9.9 | 19.8 | 29.7 | 39.6 | 49.5 | .4 | 0.4 | 1.4 | 2.4 | 3.4 | 4.4 | 5.4 | 6.3 | 7.3 | 8.3 | 9.3 |
| 59.5 | 9.9 | 19.8 | 29.8 | 39.7 | 49.6 | .5 | 0.5 | 1.5 | 2.5 | 3.5 | 4.5 | 5.5 | 6.4 | 7.4 | 8.4 | 9.4 |
| 59.6 | 9.9 | 19.9 | 29.8 | 39.7 | 49.7 | .6 | 0.6 | 1.6 | 2.6 | 3.6 | 4.6 | 5.6 | 6.5 | 7.5 | 8.5 | 9.5 |
| 59.7 | 10.0 | 19.9 | 29.9 | 39.8 | 49.8 | .7 | 0.7 | 1.7 | 2.7 | 3.7 | 4.7 | 5.7 | 6.6 | 7.6 | 8.6 | 9.6 |
| 59.8 | 10.0 | 20.0 | 29.9 | 39.9 | 49.9 | .8 | 0.8 | 1.8 | 2.8 | 3.8 | 4.8 | 5.8 | 6.7 | 7.7 | 8.7 | 9.7 |
| 59.9 | 10.0 | 20.0 | 30.0 | 40.0 | 50.0 | .9 | 0.9 | 1.9 | 2.9 | 3.9 | 4.9 | 5.9 | 6.8 | 7.8 | 8.8 | 9.8 |

Double Second Diff. and Corr.: 16.2 / 0.1 ; 48.6 / 0.1 ; 0.0 / 0.0 ; 48.2 / 0.0

| | 10' | 20' | 30' | 40' | 50' | | 0' | 1' | 2' | 3' | 4' | 5' | 6' | 7' | 8' | 9' |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

The Double-Second-Difference correction (Corr.) is always to be added to the tabulated altitude.