Altitude-Intercept Worksheet

LoP = _____

Section 0 - "Estimated Position"

EstLat N/S _____° _____′__

EstLon E/W _____° _____′__

Section 1 - "Time of Observation"

Date _____ _____ _____

Chronometer _____h _____m _____s

Error ± _____m _____s

Local Time _____h _____m _____s

Time Zone ± _____h

UTo _____h _____m _____s

Section 2 - "Observed Altitude"

Hs _____° _____′__ cel.obj. _____

IE ± _____′__ app.dir. _____

Dip − _____′__

Ha _____° _____′__

Refr − _____′__

_____° _____′__

Prllx +_____° _____′__ HP _____° _____′__

SD ± _____′__ upper limb: −
lower limb: +

Ho _____° _____′__

Section 3 - "Nautical Almanac"

SHA (NA) _____° _____′__ Add SHA and Aries GHA (GHAa next line) to obtain stars GHA

GHAa(NA) _____° _____′__

GHA (NA) _____° _____′__ ddGHA ± _____′__ p(ddGHA) _____

dHA + _____° _____′__ <-- fMin _____m _____s p(fMin) _____

Interp ± _____′__ <-- (sign of ddGHA) <-- s( ) _____

GHA _____° _____ __ at UTo

Dec (NA) N/S _____° _____′__ dDec ± _____′__ p(dDec) _____

fMin _____m _____s p(fMin) _____

Interp ± _____′__ <-- (sign of dDec) <-- s( ) _____

Dec N/S _____° _____ __ at UTo

Remark: if the result for Declination at the time of observation (UTo) is negative, the N/S declaration must be swapped.

Section 4 - "Sight Reduction"

Sight-Reduction is done on a separate worksheet. The trigonometric equations are:

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Hc = asin( sin(LatAP)*sin(Dec) + cos(LatAP)*cos(Dec)*cos(GHA+LonAP) )
Zc = atan( cos(Dec)*sin(GHA+LonAP) / (cos(LatAP)*sin(Dec)-sin(LatAP)*cos(Dec)*cos(GHA+LonAP)) )
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Section 5 - "Line of Position"

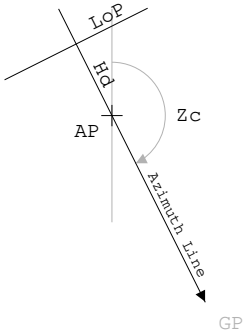
LatAP N/S _____° _____′__

LonAP E/W _____° _____′__

Hc _____° _____′__ **Zc** _____° __

Ho − _____° _____′__

Hd ± _____′__ Hd > 0 draw LoP Hd miles away from GP
Hd < 0 draw LoP Hd miles towards GP



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Sight-Reduction Worksheet for precompiled Tables

LoP = _____

Section 4 - "Sight Reduction"

GHA _____° ____′__ Lat/Dec: SAME - CONTRARY

LonAP ± _____° ____′__ LatAP ± ____°

LHA _____° Dec ± ____° ____′__ p(mDec) _____

H _____° ____′__ dH ± ____′__ p(dH) _____

Interp ± _____° ____′__ <-- (sign of dH) <-- s( ) _____

Hc _____° ____′__

_____° __

Z _____° __

N-Lat LHA < 180°: Zc=360°-Z
LHA > 180°: Zc=000°+Z
S-Lat LHA < 180°: Zc=180°+Z
LHA > 180°: Zc=180°-Z

Zc _____° __

Remarks and Instructions

Choose an appropriate Assumed Position (AP) close to the Estimated Position, but such that both "LatAP" and "LHA" are integral numbers. This Assumed Position will be the reference location for drawing the Azimuth Line, Altitude Difference and the Line-of-Position.

The "LHA" is the angular distance measured westward from the local celestial Meridian to the postition of the celestial object. It is obtained by adding the "GHA" and the "LonAP" using it's correct sign (positive for Easter Longitudes; negative for Western Longitudes).

The following parts are used to enter the Sight-Redution tables:
- the integral value of the Latitude of the Assumed Position ("LatAP")
- the integral value of the Local-Hour Angle ("LHA") and
- the integral part of the Declination ("Dec")

The table evaluation gives the following results:
- the Altitude in the Assumed Position ("H") for the integral Declination value
- the variation of "Hc" for one degree increment of Declination ("dH") and
- the Azimuth angle ("Z")

Use the minutes part of the Declination and the "dH" value to obtain the interpolated altitude correction ("Interp") from the interpolation tables. Adding this correction to "H" eventually yields the Calculated Altitude "Hc".

Finally, use the correct calculation scheme to obtain the true Azimuth "Zc" from the tabulated value "Z". Select the scheme according to the Latitude of the Assumed Position (North or South) and the value of "LHA".

Sight-Reduction Worksheet for Ageton's Method

LoP = _____

Section 4 - "Sight Reduction"

AP: LatAP = ±____°____ (N/S) GP: Dec = ±____°____ (N/S) (0)

LonAP = ±____°____ (E/W) GHA = _____°____

1. LHA = GHA + LonAP = _____°_____ ± _____°_____ = _____°_____

t = - LHA = ±_____°_____ if(LHA < 180°) (1)

t = 360°- LHA = ±_____°_____ if(LHA > 180°)

A(t) = _____

2. A(Dec) = _____ B(Dec) = _____

3. A(R) = A(t) + B(Dec) = _____ + _____ = _____

R = ____°____ B(R) = _____

4. A(LatQ)= A(Dec) - B(R) = _____ - _____ = _____

LatQ = ±____°____ (N/S) (4)

5. dLat = LatAP - LatQ = ±_____°____ - ±_____°____ = ±_____°____ (5)

B(dLat)= _____

6. A(Hc) = B(R) + B(dLat) = _____ + _____ = _____

Hc = ____°___ B(Hc) = _____

7. A(Z) = A(R) - B(Hc) = _____ - _____ = _____

Z = ____°____ (7)

8. Zc = ____°____ (8)

Remarks and Instructions

(0) Use the appropriate signs for Latitude, Longitude and Declination:
positive for N and E, negative for S and W.

(1) The meridian angle "t" is calculated from "LHA" according to the following rule:
if LHA < 180° t = - LHA (GP is WEST of AP)
if LHA > 180° t = 360° - LHA (GP is EAST of AP)

(4) The sign of the Latitude of "Q" (N/S) depends on the values of "t" and "Dec":
if |t| < 90° LatQ has the same sign as Dec
if |t| > 90° LatQ has the contrary sign of Dec
Where |t| is the absolute value of "t"

(5) The value of "dLat" must be calculated taking the correct signs for "LatAP" and "LatQ" into account. The resulting sign of "dLat" should be recorded correcly (see remark 7).

(7) Select one out of four cases, depending on the value of "|t|" and the sign of "dLat" to determine how to select the value of "Z" from the Tables:

|t|	|t| < 90°		|t| > 90°	
dLat	-	+	-	+
Z	< 90°	> 90°	> 90°	< 90°

if Z < 90° select Z from the top line - left column of the Table
if Z > 90° select Z from the bottom line - right column of the Table

(8) The true Azimuth "Zc" is obtained from "Z" depending on the sign of "t":
if t > 0 Zc = Z (GP is East of AP)
if t < 0 Zc = 360° - Z (GP is West of AP)

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Sight-Reduction Worksheet for Bygrave's Method

LoP = _____

Section 4 - "Sight Reduction"

AP: LatAP = ±____°____ (N/S) GP: Dec = ±____°____ (N/S) (0)

LonAP = ±____°____ (E/W) GHA = _____°____

1. LHA = GHA + LonAP = _____°_____ ± _____°_____ = _____°_____

   t = − LHA = ±_____°_____ if(LHA < 180°) (1)

   t = 360°− LHA = ±_____°_____ if(LHA > 180°)

2. calculator: TAN Dec / COS t = shift TAN = _____ (LatQ)

   LatQ = ±_____

3. dLat = LatAP − LatQ = ±_____ − ±_____ = ±_____ (3)

4. Y = 90° − dLat = 90° − ±_____ = ±_____

5. calculator: COS LatQ * TAN t / COS Y = shift TAN = _____ (Z)

   Z = _____

6. calculator: COS Z * TAN Y = shift TAN = _____ (Hc)

   Hc = _____

7. Zc = Z = _____ (scheme 1) (7)

   Zc = 180° + Z = _____ (scheme 2)

   Zc = 180° − Z = _____ (scheme 3)

   Zc = 360° − Z = _____ (scheme 4)

Remarks and Instructions

(0) Use the appropriate signs for Latitude, Longitude and Declination: positive for N and E, negative for S and W. For usage with an electronic calculator, angle values are used in decimal format instead of degree and minutes notation.

(1) The meridian angle "t" is calculated from "LHA" according to the following rule:
if LHA < 180° t = − LHA (GP is WEST of AP)
if LHA > 180° t = 360° − LHA (GP is EAST of AP)

(3) The value of "dLat" must be calculated taking the correct signs for "LatAP" and "LatQ" into account. The resulting sign of "dLat" should be recorded correcly (see remark 0) and correctly used in step4 to calculate the complementary angle Y.

(7) The true Azimuth "Zc" is obtained from "Z" according to one of the following cases: first select in which range the value of t is, then, depending on the sign of LatAP or dLat, select the correct calculations scheme for Zc:

[−180°: −90°]	if LatAP is positive:	use Zc = 360° − Z	(scheme 4)
	if LatAP is negative:	use Zc = 180° + Z	(scheme 2)
[−90°: 0°]	if dLat is positive:	use Zc = 180° + Z	(scheme 2)
	if dLat is negative:	use Zc = 360° − Z	(scheme 4)
[0°: +90°]	if dLat is positive:	use Zc = 180° − Z	(scheme 3)
	if dLat is negative:	use Zc = Z	(scheme 1)
[+90°:+180°]	if dLat is positive:	use Zc = Z	(scheme 1)
	if dLat is negative:	use Zc = 180° − Z	(scheme 3)

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