SHRINE ASSIGNMENT 2010

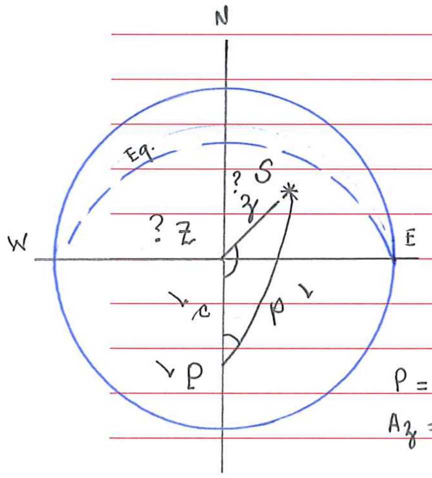
SHRINE OF REMEMBRANCE ϕ: $-37°\,49'\,55''$ $(c = 52°\,10'\,05'')$

λ: $144°\,58'\,20''$ $(\;9^h\,39^m\,53.3^s)$

1. Azimuth & zenith distance of sun at 11 am Eastern Australian Standard Time (10^h E of UT)

		h	m	s	DECLINATION
Zone Time	11 Nov 2010	11	00	00	
$-\lambda_E$ (zone)		-10			
= UT	11-Nov-2010	1	00	00	
+ E @ 0^h UT		+ 12	16	01.6	S, $17°\,19.7'$
± ΔE for 1^h		−		0.3	+ 0.7
= GHA sun		13	16	01.3	S $17°\,20.4'$
+ λ_E (obs)		+ 9	39	53.3	
= LHA sun		22	55	54.6	$p = 72°\,39'\,36''$

P_E $= 16°\,01'\,21.0''$



$P = 24^h - \text{LHA}$

$Az = 180 - Z$

$c = 52°\,10'\,05''$

$p = 72\;39\;36$

$P = 16\;01\;21$

Cosine rule

$\cos z = \cos c \cos p + \sin c \sin p \cos P$

$z = 24°\,50'\,49''$

Four parts rule

cos(inner side) cos(inner angle)

= sin(inner side) cot(outer side)

− sin(inner angle) cot(outer angle)

or $\cos c \cos P = \sin c \cot p - \sin P \cot Z$

$$\tan Z = \frac{\sin P}{\dfrac{\sin c}{\tan p} - \cos c \cos P}$$

$Z = 141°\,10'\,09''$

$Az = 38°\,49'\,51''$

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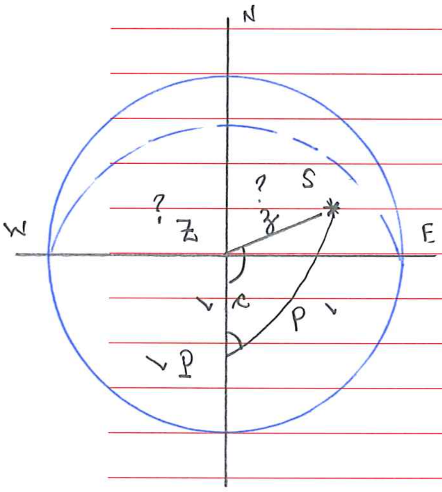
2. Azimuth & zenith distance of Sun at 11 am Daylight Saving Time (11^h E of UT)

Zone Time	11-Nov-2010	11^h	00^m	00^s	
$-\lambda_E$ (zone)		-11			
= UT	11-Nov-2010	0	00	00	DECLINATION
+ E @ 0^h UT		12	16	01.6	S 17° 19.7′
= GHA sun		12	16	01.6	
+ λ_E (obs)		9	39	53.3	$p = 72°\ 40'\ 18''$
= LHA sun		21	55	54.9	

$P_E \qquad = 31°\ 01'\ 16.5''$



$c = 52°\ 10'\ 05''$

$p = 72\ \ 40\ \ 18$

$P = 31\ \ 01\ \ 16.5$

$z = 34°\ 01'\ 22''$

$Z = 118°\ 26'\ 48.5''$

$Az = 61°\ 33'\ 11''$

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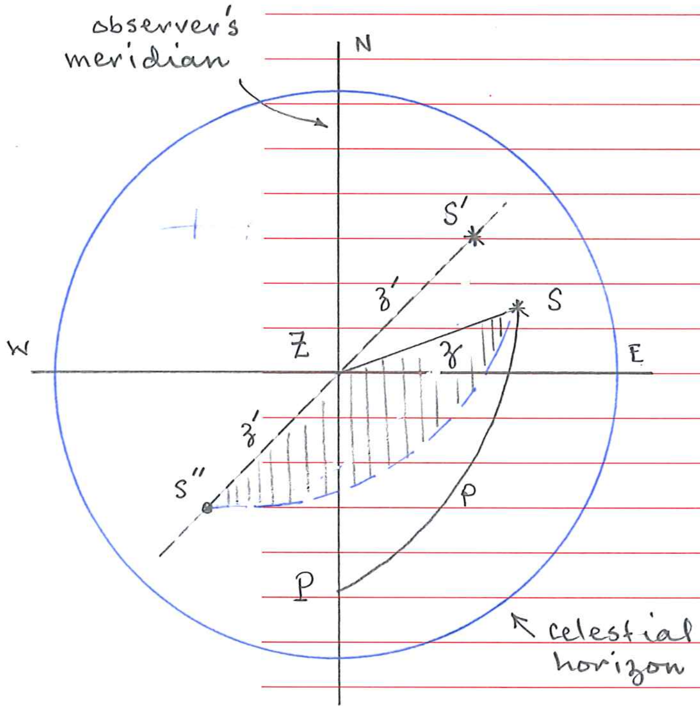
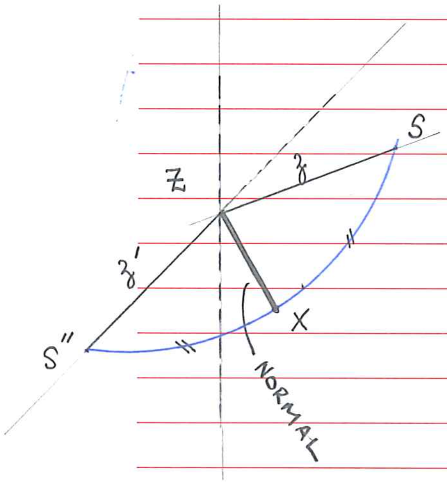


11 am DAYLIGHT SAVING TIME

The Sun is at S, but needs to be reflected into plane S'Z S'' by oblique mirror at Z (observer's zenith)

NOTE The reflection of S' is at S''; and since the angle of incidence is equal to angle of reflection, the zenith distances will be equal. (ZS' and ZS'')



The great circle arc S→S'' is the intersection of the plane containing the NORMAL to the oblique mirror and the celestial sphere.

And as the angle of incidence is equal to angle of reflection, the mid-point X of the arc is the intersection of the normal and the celestial sphere

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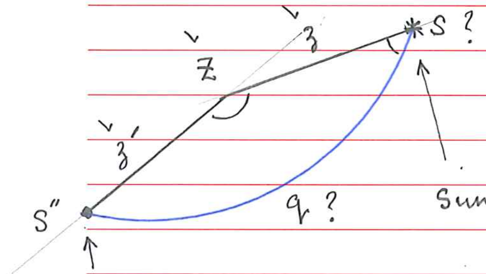
3. Compute S and q in triangle Z S S"



$z = 34° 01' 22"$

$z' = 24\ 50\ 49$

$Z = 157\ 16\ 40$

Sun @ 11 am Daylight Saving Time

reflected Sun @ 11am East. Aust. St. Time

$$\cos q = \cos z \cos z' + \sin z \sin z' \cos Z$$

$$q = \underline{57° 38' 25.0"}$$

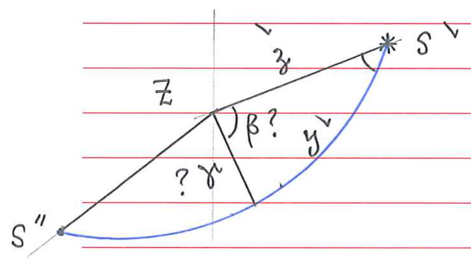
$$\cos z \cos Z = \sin z \cot z' - \sin Z \cot S$$

or

$$\tan S = \frac{\sin Z}{\frac{\sin z}{\tan z'} - \cos z \cos Z}$$

$$S = \underline{11° 04' 40.9"}$$

4. Compute γ and β



$z = 34° 01' 22"$

$y = q/2 = 28° 49' 12.5"$

$S = 11° 04' 40.9"$

$$\cos \gamma = \cos z \cos y + \sin z \sin y \cos S$$

$$\gamma = \underline{7° 45' 18"}$$

$$\cos z \cos S = \sin z \cot y - \sin S \cot \beta$$

$$\tan \beta = \frac{\sin S}{\frac{\sin z}{\tan y} - \cos z \cos S}$$

$$\beta = \underline{43° 20' 57"}$$

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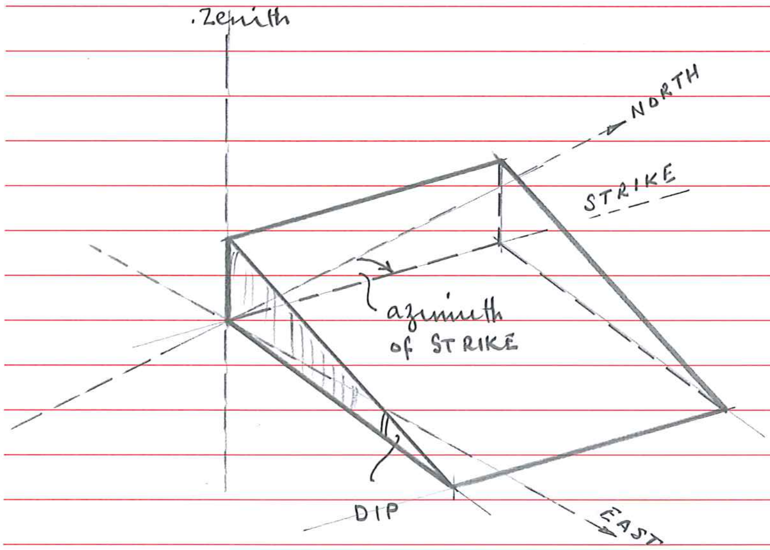
5. Normal to oblique mirror

Azimuth of normal = 61° 33′ 11″
+ 43 20 57
104° 54′ 08″

Zenith distance of normal = 7° 45′ 18″

DIP of mirror = 7° 45′ 18″

Azimuth of STRIKE = 14° 53′ 36″



OBLIQUE MIRROR.

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