

NAUTICAL SCIENCE
GRADE 12
ASTRO NAVIGATION

1. At 1445 D on 20 June 1981, in DR position $24^{\circ} 30' N$ $61^{\circ} 31.1' E$, a sextant altitude of the sun's lower limb was taken to the south of the observer. The sextant reading was $30^{\circ} 45.4'$.

Index error was $4.1'$ off the arc
Height of eye was 9 metres

Determine:

- a. The intercept and bearing of the sun; and
- b. By means of a sketch show how you would plot the resultant position line.

2. At sunrise on 19 January 1981 a compass bearing of the sun was taken in Dr position $33^{\circ} 15' S$ $72^{\circ} 40' E$. The bearing was $132\frac{1}{2}^{\circ}$ (C). At the time the ship's head was 315° (C) and the variation for the area was $21^{\circ} W$.

Determine:

- a. The GMT and zone time of sunrise.
- b. The compass error and deviation for the ship's head.
- c. The ship's true course.

ANSWERS TO THE ASTRO NAVIGATION PROBLEMS

1. Zone time = 1445 D
 Zone (-4) = 0400
 GMT = 1045 Z

GHA = 327° 13.9' Dec = S 20° 05.6'
 Incre = 11° 15.0' 'd' = 00.5' (0.6')
 GHA = 338° 28.9' Dec = S20° 05.1'
 Long (E)= 61° 31.1'
 LHA = 400° 00.0'
 = 360° 00.0'
 = 40° 00'

Sin cal alt = $\cos 40^\circ \cdot \cos 24^\circ 30' \cdot \cos 20^\circ 05' 06'' - \sin 24^\circ 30' \cdot \sin 20^\circ 05' 06''$
 = 0.512266456

Cal alt = 30° 48.9'

Sextant alt = 30° 45.4'

IE = 04.1'

Obs alt = 30° 49.5'

Dip = 05.3'

App alt = 30° 44.2'

Total correct = 14.7'

True alt = 30° 58.9'

Cal alt = 30° 48.9'

Intercept = 10' Towards

Sin Z = $\cos dx \sin LHA / \cos Hc = \cos 20^\circ 05' 06'' \times \sin 40^\circ / \cos 30^\circ 58' 54''$
 = 0.704156523

Z = S 44.8° W

True brg = 224.8° = 225° (T)

2. LMT SR (35° S) = 0507 {30° S 0518}
 Lat cor (1° 45' N)= 0004 5{33° 15' S}1.75° } 11
 LMT SR (33° 15' S)= 0511 {35° } 0507}
 Long (72° 40' S)= 0451 1.75/5 x 11 = 3.85 = 4 min
 GMT = 0020 Z
 Zone (-5) = 0500
 Zone time = 0520 E

Dec = S 20° 23.7'
 "d" = 00.2' (0.6')
 Dec = S 20° 23.5'

Sin Amp = Sin dec/cos lat = Sin 20° 23' 30"/cos 33° 15'
 = 0.416646525
 True brg = E 24.6° S
 = 114.6° (T)
 = 114½° (T)
 Comp brg = 132½° (C)
 Comp error = 18° W
 Variation = 21° W
 Deviation = 3° E

Comp heading = 315° (C)
 Comp error = 18° W
 True heading = 297° (T)