Non-right-triangle surveying/navigation problems

6 questions | 17 marks

Equivalent correct methods earn the corresponding marks.

1. A 40 m baseline AB has a point P to one side. Angle $PAB = 35^\circ$ and $PBA = 65^\circ$. Find AP. [3 marks]

Angle $P = 80^\circ$.

$AP = \frac{40\sin 65^\circ}{\sin 80^\circ}$.

Answer: 36.8 m

2. Routes from a depot have bearings 020° and 110°. Points 12 km and 16 km along them are joined. Find the joining distance. [2 marks]

The included angle is 90°.

$d = \sqrt{12^2 + 16^2} = 20\,\text{km}$.

Answer: 20 km

3. A triangular plot has sides 30 m and 42 m enclosing 55°. Find its area to one decimal place. [2 marks]

$K = \frac{1}{2} \times 30 \times 42 \sin 55^\circ$.

$K = 630\sin 55^\circ$ square metres.

Answer: $516.1\,\text{m}^2$

4. Two ground-level observers and the tower base lie on the same straight level line. Both observers are on one side of the tower, 20 m apart. The nearer elevation is 60° and the farther 30°. Find the tower height. [4 marks]

Let x be the nearer horizontal distance. $h = x\tan 60^\circ = (x+20)\tan 30^\circ$.

Solve to obtain $x = 10\,\text{m}$.

$h = 10\sqrt{3}\,\text{m}$.

Answer: 17.3 m

5. P is 20 km from O on bearing 350°. Q is 15 km from O on bearing 030°. Find the smaller angle POQ and PQ. [3 marks]

The angle crosses north: $10^\circ + 30^\circ = 40^\circ$.

$PQ^2 = 20^2 + 15^2 - 2\times 20\times 15\cos 40^\circ$.

Answer: 40°; $PQ \approx 12.9\,\text{km}$

6. A survey assumes level ground, but a measured baseline slopes up a hill. Explain why its sloping length cannot automatically replace a horizontal baseline. [3 marks]

A horizontal triangle uses horizontal distances.

Using an uncorrected sloping distance changes the geometry.

Answer: Its horizontal projection is shorter; the model needs a slope correction or additional height/angle information.