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° and PBA=65°. Find AP. [3 marks]

Angle P=80°.

AP=40sin65°/sin80°.

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°.

$d=\sqrt{(12^2+16^2)}=20$ 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]

$K=\frac{1}{2}\times30\times42\sin55°$.

K=630sin55° square metres.

Answer: 516.1 m²

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. $h=x\tan60°=(x+20)\tan30°$.

Solve to obtain $x=10$ m.

$h=10\sqrt{3}$ 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: $10°+30°=40°$.

$PQ^2=20^2+15^2-2\times20\times15\cos40°$.

Answer: 40°; PQ≈12.9 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.