Trigonometry – Question Set (Expanded)

Q1 Angles of Elevation and Depression

(a) A flagpole casts a 9m shadow when the sun's angle of elevation is 47°. Find the height of the pole.

(b) From the top of a 35m building the angle of depression to a car on the road is 18°. How far is the car from the base of the building?

(a) From a boat, the lighthouse top subtends an elevation of 12°. If the lighthouse is 24m tall, how far is the boat from its base?

(b) A drone hovers 60m above ground. At a point on level ground the elevation angle is 53°. How far horizontally is the observer from the point on the ground directly below the drone?

Q2 Bearings

(a) Convert the compass bearing $S28°E$ to a true bearing.

(b) Convert the true bearing 305° to a compass bearing.

A ranger walks 4km on a true bearing of 064° and then 5km on a true bearing of 152°.

a) Represent the journey on a scaled diagram.

b) Calculate the resultant displacement from the starting point (distance and true bearing).

Q3 3-Dimensional Right-Triangle Problems

(a) Find the space diagonal of a cuboid 4cm×7cm×10cm.

(b) A ladder rests against a wall forming a 70° angle with level ground. If the ladder foot is 1.5m from the wall, how high does it reach?

A kite string is 85m long and makes a 40° angle of elevation to the horizontal. If the flyer stands 12m above sea level on a cliff, how high above sea level is the kite?

Q4 Sine, Cosine and Area Rules

(a) In $\triangle ABC$, $A = 56°$, $B = 68°$, $a = 7.2$ cm. Find side b.

(b) In $\triangle DEF$, $d = 8$ cm, $e = 6$ cm, $\angle D = 42°$. Find side f.

(a) In $\triangle PQR$, $PQ = 6$ cm, $PR = 8$ cm, $QR = 11$ cm. Find $\angle P$.

(b) Given $\triangle XYZ$ with $XY = 14$ m, $YZ = 17$ m, $XZ = 12$ m, find $\angle Y$.

(a) Calculate the area of a triangle with sides 9cm and 12cm enclosing an angle of 65°.

(b) Calculate the area of a triangle with sides 15m and 18m enclosing 48°.

Q5 Unit Circle Identities & Graphs

(a) State $\cos(210°)$ using symmetry on the unit circle.

(b) Determine $\sin(135°)$ exactly.

A line on the Cartesian plane has gradient 1.2. Find its angle of inclination to the x-axis, correct to the nearest degree.

Q6 Exact Trigonometric Values

(a) Write exact values for $\sin 30°,\ \cos 45°,\ \tan 60°$.

(b) Show that $\cos 30° = \sin 60°$.

Find all angles $0° \leq \theta \leq 180°$ satisfying $\sin\theta = \frac{\sqrt{3}}{2}$.

Q7 Trigonometric Equations

(a) Solve $2\sin\theta - 1 = 0$ for $0° \leq \theta \leq 360°$.

(b) Solve $\cos 2\phi = -0.4$ for $0° \leq \phi \leq 360°$.

Solve $3\tan^2\alpha = 1$ for $-180° \leq \alpha \leq 180°$.

Q8 Ambiguous Case (Sine Rule)

In $\triangle LMN$, $l = 12$ cm, $m = 14$ cm, $\angle L = 28°$.

a) Determine the possible values of angle M.

b) For each possible M, find the corresponding side n.

Q9 Challenge Question

From point P the angle of elevation to the top of a tower is $35°$. After walking 40m directly toward the tower to point Q, the angle becomes $56°$.

a) Show, using two right-angled triangles, that the tower height h satisfies $\tan 35°(d) = h$ and $\tan 56°(d - 40) = h$, where d is the original horizontal distance.

b) Hence find h and d correct to the nearest metre.