2D & 3D TRIGONOMETRY

Checklist

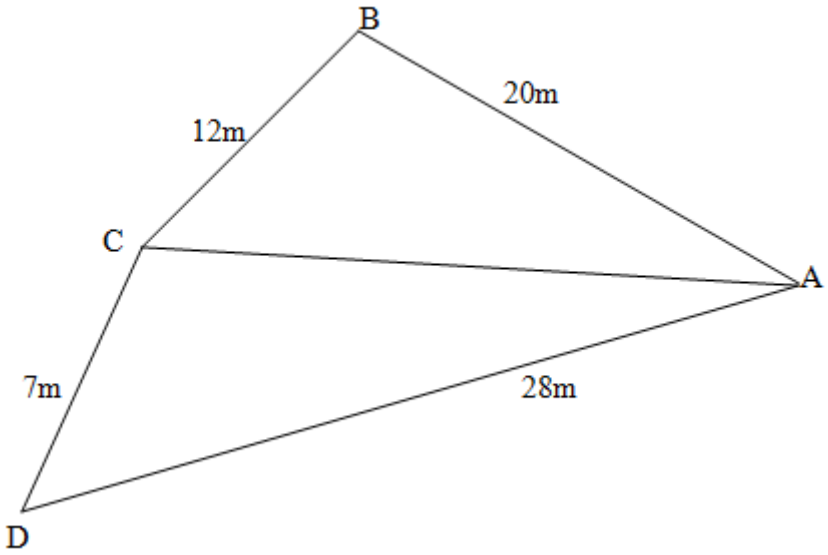
Make sure you ….

- can use the sine rule and cosine rule to find:
  - the length of an unknown side
  - the size of an unknown angle
- are able to calculate the area of various shapes
- can work with diagrams showing measurements in 3D.

Exam Questions

Question 1

A piece of land has the form of a quadrilateral ABCD with AB = 20m, BC = 12m, CD = 7m and AD = 28m. $\hat{B} = 110^\circ$. The owner decides to divide the land into two plots by erecting a fence from A to C.



1.1 Calculate the length of the fence AC correct to one decimal place. (2)

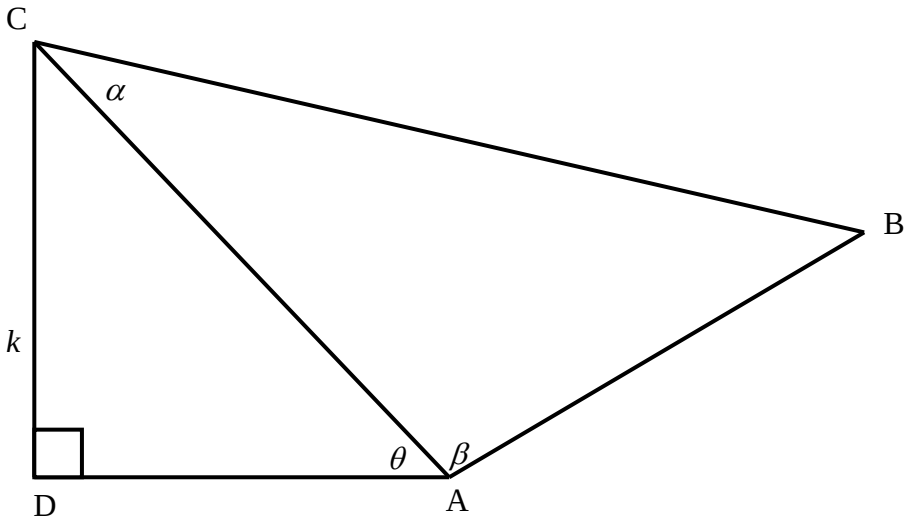
1.2 Calculate the size of $B\hat{A}C$ correct to the nearest degree. (2)

1.3 Calculate the size of $\hat{D}$ correct to the nearest degree. (3)

1.4 Calculate the area of the entire piece of land ABCD, correct to one decimal place. (5)

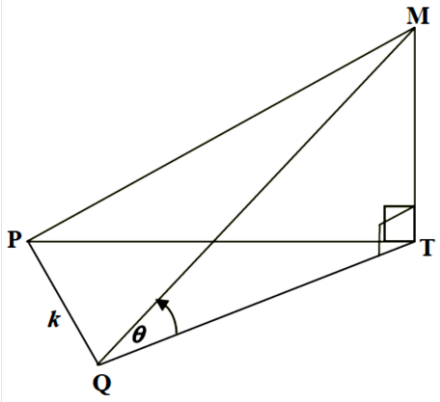
Question 2

Prove that $AB = \dfrac{k\sin\alpha}{\sin\theta\sin(\alpha+\beta)}$



Question 3

In the diagram alongside, MT is a vertical structure. P, Q and T are three points in the same horizontal plabe. The angle of elevation of M from Q is θ. PQ = *k* meters, $PM = 2PQ$ and $area\ \Delta MPQ = 2k^2.\sin\theta.\cos\theta.$

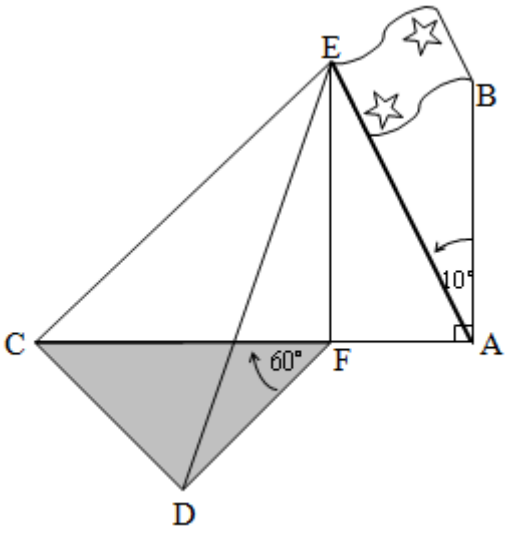


3.1 Prove that $M\hat{P}Q = 2\theta$ (5)

3.2 Hence, prove that $MQ = k\sqrt{1+8\sin^2\theta}$ (4)

Question 4

A flag pole AE of length 5 metres is leaning at 10° to the vertical AB. EF, drawn parallel to BA, meets CA at F. An observer at C notes that the angle of elevation of E, the top of the flag pole is 25°, while another observer at D, in the same horizontal plane as C, F and A, finds that the angle of elevation of E is 35°. $C\hat{F}D = 60^\circ$

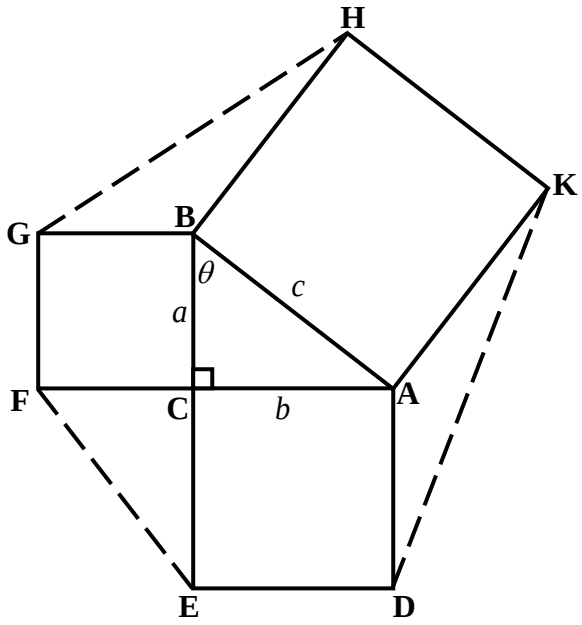


4.1 Show that the distance for C to F is 11m (rounded off to the nearest whole number) (4)

4.2 Calculate the distance between the two observers at C and D, rounding off to the nearest whole number. (6)

Question 5

Refer to the figure below, which represents the Pythagorean Theorem, with squares drawn on the 3 sides of the right-angled ΔABC, $C\hat{B}A = \theta$. A rubber band (DEFGHK) is stretched around this figure.



5.1 Write $\sin\theta$ and $\cos\theta$ in terms of *a, b* and *c*. (2)

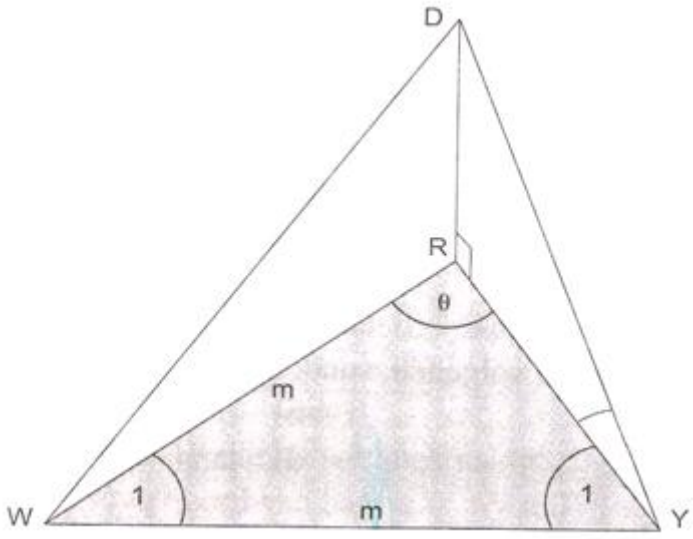
5.2 Write down (without reasons) the sizes of $G\hat{B}H$ and $K\hat{A}D$ in terms of θ. (3)

5.3 Using your answers from (a) and (b) above, show that the area of the whole region enclosed by the rubber band is:

$$2(ab + c^2)$$ (6)

Additional Question

From point Y the angle of elevation to the top of the vertical tower RD is equal to α The point W is in the same horizontal plane and equidistant from R and Y. The distance is m units. $W\hat{R}Y$ is θ.



a) Express DR, the height of the tower, in terms of RY and α. (2)

b) Express the size of $\hat{W}_1$ in terms of θ. (2)

c) In ΔRWY, show that $RY = \dfrac{m.\sin 2\theta}{\sin\theta}$. (3)

d) Prove that $RY = 2m.\cos\theta$. (2)

e) Write the height of the tower, RD in terms of m, θ and α. (1)

f) If it is given that $\theta = 75°$, $\alpha = 30°$ and $m = \sqrt{2}$ units.

Determine RD without using a calculator. (5)