Exercise walk-through

4.6
Three-dimensional trigonometry

Pearson Edexcel · International GCSE · Mathematics A

Angles, polygons and symmetry (2)

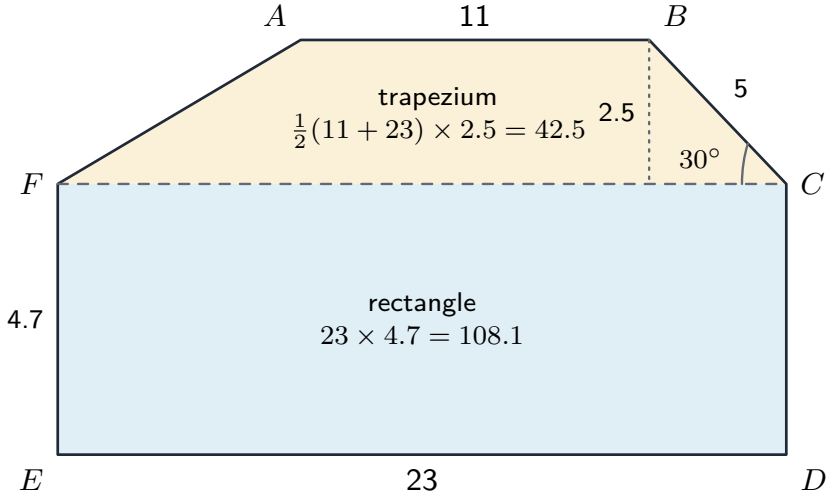
- The angles in a triangle add up to $180°$. The exterior angle of a triangle equals the sum of the two opposite interior angles.
- An isosceles triangle has two equal sides and two equal base angles. An equilateral triangle has three $60°$ angles.
- parallelogram: opposite sides parallel and equal, opposite angles equal, diagonals bisect each other

Pythagoras and trigonometry in 2D

- $\tan 62° = \frac{h}{50}$, so $h = 50 \tan 62° = 94.0$ m (3 s.f.).
- The **sine rule** , $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, works when you know a side and its opposite angle.
- The **cosine rule** , $a^2 = b^2 + c^2 - 2bc\cos A$, works when you know two sides and the angle between them, or all three sides.

$$\sin\theta = \frac{\text{opp}}{\text{hyp}}, \quad \cos\theta = \frac{\text{adj}}{\text{hyp}}, \quad \tan\theta = \frac{\text{opp}}{\text{adj}}$$

Figure: Mensuration: perimeter, area, surface and volume

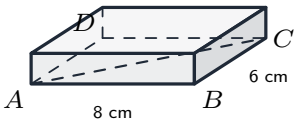


total area $108.1 + 42.5 = 150.6$ cm^2

- Rectangle 108.1 + trapezium 42.5 = 150.6 cm^2
- Trapezium height = 5 sin 30° = 2.5

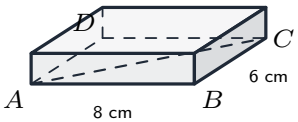
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2.1 A tray is a cuboid with a base 6 cm by 8 cm. Find the length of the diagonal AC of the base. [2]



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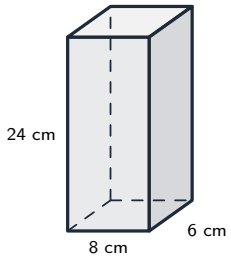


2.1

- $AC^2 = 6^2 + 8^2$
- $AC = \mathbf{10}$ cm

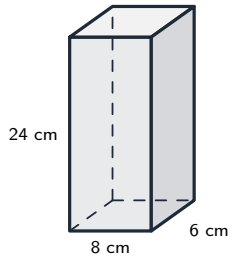
Exercise 2.2

2.2 A box is a cuboid 6 cm by 8 cm by 24 cm. Find the length of the longest straight rod that fits inside the box. [2]



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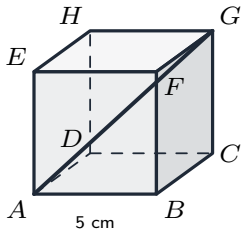


2.2

- $\sqrt{6^2 + 8^2 + 24^2} = \sqrt{676}$
- **26** cm

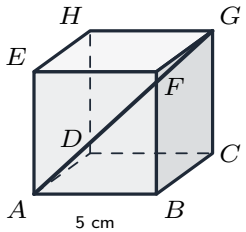
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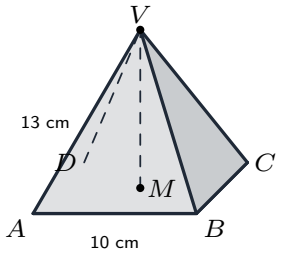


2.3

- $AC = \sqrt{50} = 7.07$ cm, and $\tan\theta = \frac{5}{7.07}$
- $\theta = \mathbf{35.3}°$

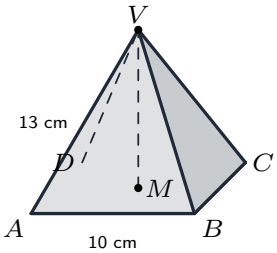
Exercise 3.1

3.1 A pyramid has a square base $ABCD$ with sides of 10 cm. Its top V is directly above the centre M of the base. $VA = 13$ cm. Find the height VM. [3]



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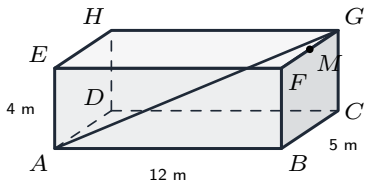
3.1

- $AM = \frac{1}{2}\sqrt{10^2 + 10^2} = 7.07$ cm
- $VM^2 = 13^2 - 7.07^2 = 119$
- $VM = \mathbf{10.9}$ cm

Setup for exercise 3.2

3.2 A room is a cuboid $ABCDEFGH$. The floor $ABCD$ is 12 m by 5 m and the room is 4 m high. M is the midpoint of the edge FG on the ceiling.

(a) Find the length AC. [2]



(b) Find the length of the diagonal AG. [3]

Exercise 3.2

(c) Find the angle between AG and the floor $ABCD$. [4]

(d) A light hangs at M. A cable runs straight from A to M. Find the length of the cable and the angle it makes with the floor. Is this angle larger or smaller than the angle in (c)? [5]

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3.2

(a) $AC^2 = 12^2 + 5^2$; $AC = \mathbf{13}$ m

Full solution on next slide

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Full solution 3.2

3.2

(a) $AC^2 = 12^2 + 5^2$; $AC = \mathbf{13}$ m

(b) $AG^2 = 13^2 + 4^2 = 185$; $AG = \mathbf{13.6}$ m

(c) the angle is GAC, with a right angle at C; $\tan GAC = \frac{4}{13}$; $\tan^{-1} \frac{4}{13} = \mathbf{17.1}°$

(d) the point below M is the midpoint of BC; distance from $A = \sqrt{12^2 + 2.5^2} = 12.26$ m; $AM = \sqrt{12.26^2 + 4^2} = \mathbf{12.9}$ m; $\tan\theta = \frac{4}{12.26}$, $\theta = 18.1°$, which is **larger**