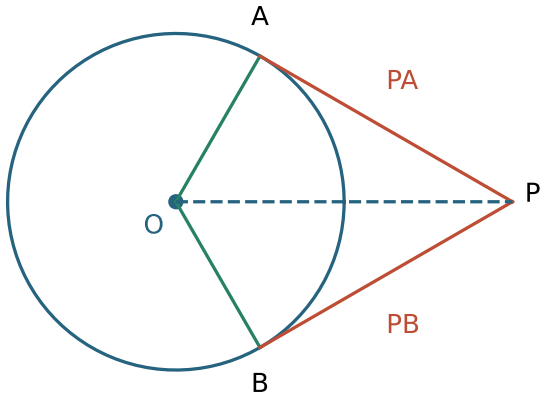
Exercise walk-through

4.3.2
Trig Basic

AQA · GCSE · Mathematics

Figure: Congruence, similarity and circles (4)

Shared OP and equal radii → RHS → PA = PB



- Equal radii, shared OP and right angles give congruent triangles (RHS), so PA = PB
- Match each part of the diagram to the text.

Pythagoras and trigonometry

- **Pythagoras' theorem.** In a right-angled triangle, $a^2 + b^2 = c^2$, where c is the **hypotenuse**, the longest side, opposite the right angle.
- A ladder whose foot is 3 m from a wall and whose top is 4 m up the wall is $\sqrt{9+16} = 5$ m long.
- **Trigonometric ratios.** Label the sides from the angle θ: opposite, **adjacent** (next to the angle) and **hypotenuse**.
- **Worked example 12.** In a right-angled triangle the hypotenuse is 23.7 cm and x is the side **adjacent** to an angle of $52°$.

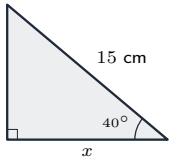
$$\sin\theta = \frac{\text{opp}}{\text{hyp}} \qquad \cos\theta = \frac{\text{adj}}{\text{hyp}} \qquad \tan\theta = \frac{\text{opp}}{\text{adj}}$$

Sources for this lesson

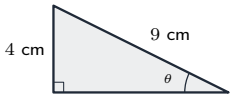
- AQA, *GCSE Mathematics (8300) specification*, subject content section 3.4 (Geometry and measures), and the GCSE formulae sheet.
- Cleomedes, *On the Circular Motions of the Celestial Bodies*, book 1, chapter 7, which records Eratosthenes' method.
- AQA, *GCSE Mathematics* Higher Papers 1 and 2 (June 2024), the trigonometry and vector questions, adapted.

Exercises 2.1·2.2

2.1 Work out the length x. [2]

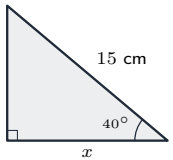


2.2 Work out the angle θ. [2]



Exercises 2.1·2.2

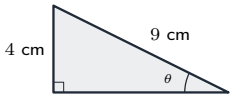
2.1 Work out the length x. [2]



2.1

- $x = 15\cos 40°$
- **11.5** cm

2.2 Work out the angle θ. [2]

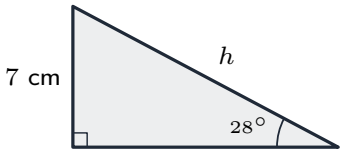


2.2

- $\sin\theta = \frac{4}{9}$
- **26.4**°

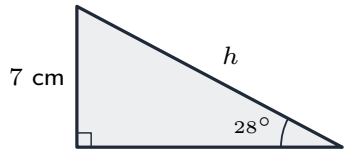
Exercise 3.1

3.1 Work out the length of the hypotenuse h. [3]



Exercise 3.1

3.1 Work out the length of the hypotenuse h. [3]



3.1

- $\sin 28° = \dfrac{7}{h}$
- $h = \dfrac{7}{\sin 28°}$
- **14.9** cm

Exercise 3.2 (a)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

(a) Work out the height of the top of the tower above Zara's eyes. [2]

Exercise 3.2 (a)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

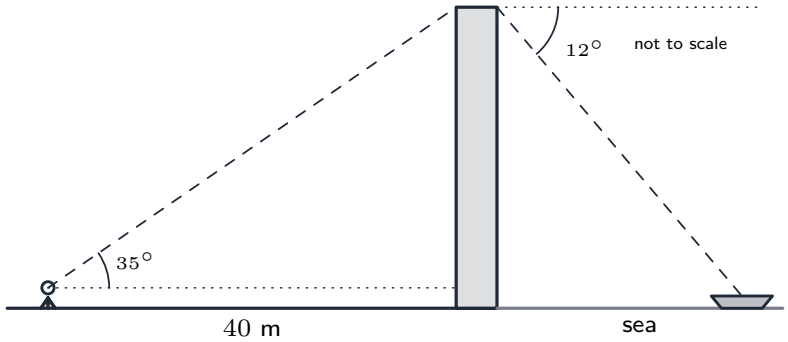
(a) Work out the height of the top of the tower above Zara's eyes. [2]

(a) $40 \tan 35° = \mathbf{28.0}$ m

Exercise 3.2 (b)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

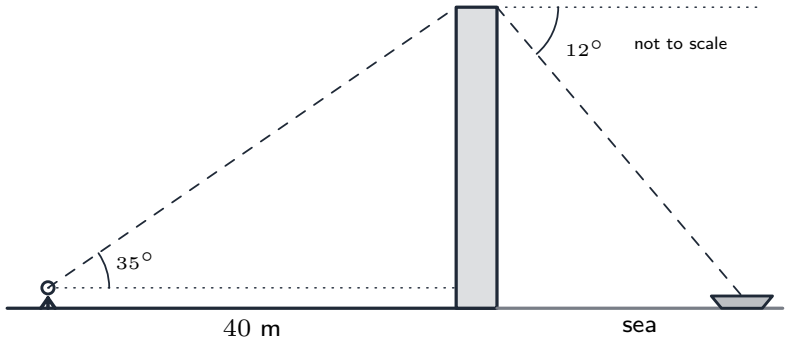
(b) Work out the height of the tower. Work out the distance from Zara's eyes to the top of the tower. [3]



Exercise 3.2 (b)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

(b) Work out the height of the tower. Work out the distance from Zara's eyes to the top of the tower. [3]



(b) $28.0 + 1.5 = \mathbf{29.5}$ m; $\dfrac{40}{\cos 35°} = \mathbf{48.8}$ m

Exercise 3.2 (c)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

(c) Zara walks towards the tower until the angle of elevation is 50°. How far is she from the tower now? How far did she walk? [4]

Exercise 3.2 (c)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

(c) Zara walks towards the tower until the angle of elevation is 50°. How far is she from the tower now? How far did she walk? [4]

(c) $\dfrac{28.0}{\tan 50^\circ} = \mathbf{23.5}$ m; $40 - 23.5 = \mathbf{16.5}$ m

Exercise 3.2 (d)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

(d) From the top of the tower, the angle of depression of a boat is 12°. 30 seconds later it is 20°. The boat sails straight towards the tower. Use the height of the tower to work out the speed of the boat. [5]

Exercise 3.2 (d)

3.2 Zara stands 40 m from a tower on flat ground. Her eyes are 1.5 m above the ground. The angle of elevation from her eyes to the top of the tower is 35°.

(d) From the top of the tower, the angle of depression of a boat is 12°. 30 seconds later it is 20°. The boat sails straight towards the tower. Use the height of the tower to work out the speed of the boat. [5]

(d) $\dfrac{29.5}{\tan 12°} = 138.8$ m; $\dfrac{29.5}{\tan 20°} = 81.1$ m; $(138.8 - 81.1) \div 30 = \mathbf{1.92}$ m/s