

Exercise walk-through

C6.2

Right-angled triangles

IGCSE Mathematics

You must be able to

- Choose sine, cosine or tangent from the labelled sides
- Rearrange for a side or use an inverse trig function for an angle
- Interpret elevation and keep full intermediate precision

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The method

Method — Key knowledge: Right-angled triangles

For an acute angle θ in a right triangle, $\sin \theta = O/H$, $\cos \theta = A/H$ and $\tan \theta = O/A$. Opposite and adjacent depend on the chosen angle; hypotenuse always faces the right angle. Choose the ratio containing the known and wanted sides, rearrange before substituting. Use inverse trig for an angle and degree mode. Bearings measure clockwise from north; draw the right triangle before calculating.

Exercises 2.1·2.3

2.1 Find the side opposite 30° in a right triangle with hypotenuse 12 cm. [2]

2.2 Find the adjacent side for angle 60° and hypotenuse 14 cm. [2]

2.3 Find an acute angle with opposite 5 cm and adjacent 12 cm, to one decimal place.[2]

Exercises 2.1·2.3

2.1 Find the side opposite 30° in a right triangle with hypotenuse 12 cm. [2]

2.1

- $O = H \sin \theta = 12 \sin 30^\circ = \mathbf{6}$ cm.

2.2 Find the adjacent side for angle 60° and hypotenuse 14 cm. [2]

2.2

- $A = H \cos \theta = 14 \cos 60^\circ = \mathbf{7}$ cm.

2.3 Find an acute angle with opposite 5 cm and adjacent 12 cm, to one decimal place.[2]

2.3

- $\theta = \tan^{-1}(O/A) = \tan^{-1}(5/12) = \mathbf{22.6^\circ}$.

Exercise 2.4

2.4 A ramp rises 3 m over a horizontal run of 7 m. Find its angle to the horizontal. [2]

3 Exam-style questions

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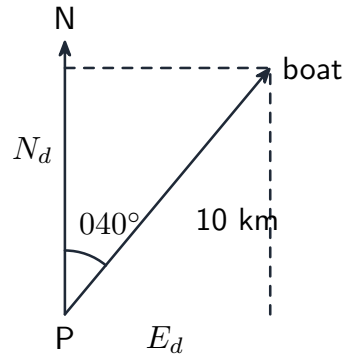
3 Exam-style questions

2.4

- $\theta = \tan^{-1}(3/7) = \mathbf{23.2^\circ}$ to one decimal place.

Setup for exercise 3.1

3.1 Apply the right-angled triangles methods below. Show working and include units where appropriate.



Exercise 3.1 (a)

(a) A boat travels 10 km from P on bearing 040° . Find how far north of P it is, to three significant figures. [2]

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(a)

- Angle is from north, so north is adjacent: $N = 10 \cos 40^\circ = \mathbf{7.66}$ km.

Exercise 3.1 (b)

(b) Find how far east of P it is, to three significant figures.

[2]

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(b) Find how far east of P it is, to three significant figures.

[2]

(b)

- East is opposite: $E = 10 \sin 40^\circ = \mathbf{6.43}$ km.

Exercise 3.1 (c)

(c) Find the bearing of P from the boat.

[2]

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(c) Find the bearing of P from the boat.

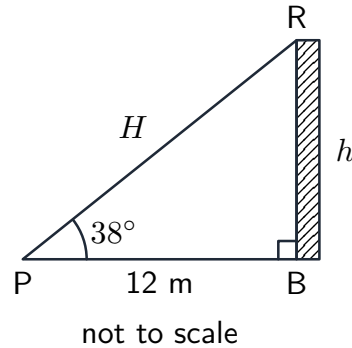
[2]

(c)

- Reverse bearing: $b = 40 + 180 = \mathbf{220^\circ}$.

Setup for exercise 3.2

3.2 A point P is 12 m horizontally from the foot B of a vertical building. The angle of elevation from P to the roof R is 38° .



Exercise 3.2 (a)

(a) Find the building height to three significant figures.

[3]

Exercise 3.2 (a)

(a) Find the building height to three significant figures. [3]

(a)

- Height is opposite and 12 m is adjacent, so $\tan \theta = h/d$.
- Rearrange $h = d \tan \theta$.
- $h = 12 \tan 38^\circ \approx \mathbf{9.38}$ m.

Exercise 3.2 (b)

(b) Find the line-of-sight distance PR to three significant figures. Explain why using $12 \sin 38^\circ$ for the height is incorrect. [3]

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(b)

- Use $\cos \theta = d/H$, so $H = d/\cos \theta$.
- $H = 12/\cos 38^\circ \approx \mathbf{15.2}$ m.
- Sine requires the hypotenuse as its denominator; 12 m is adjacent, not hypotenuse.