

Exercise walk-through

C6.1

Pythagoras' theorem

IGCSE Mathematics

You must be able to

- Identify the hypotenuse opposite the right angle
- Use Pythagoras to find a longer or shorter missing side
- Interpret a calculated distance and check a triangle for a right angle

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The method

Method — Key knowledge: Pythagoras' theorem

For a right triangle, $c^2 = a^2 + b^2$, where c is the hypotenuse opposite the right angle. To find the hypotenuse, add squares and take a square root. To find a shorter side, subtract its partner's square from the hypotenuse's square. A rectangle's diagonal makes a right triangle. Check the hypotenuse is longest and round only at the end.

Exercises 2.1·2.3

2.1 Find the hypotenuse of a right triangle with shorter sides 5 and 12 cm. [2]

2.2 A right triangle has hypotenuse 10 cm and one leg 6 cm. Find the other leg. [2]

2.3 Find the diagonal of a 9×12 cm rectangle. [2]

Exercises 2.1·2.3

2.1 Find the hypotenuse of a right triangle with shorter sides 5 and 12 cm. [2]

2.1

- $c = \sqrt{5^2 + 12^2} = \sqrt{169} = \mathbf{13}$ cm.

2.2 A right triangle has hypotenuse 10 cm and one leg 6 cm. Find the other leg. [2]

2.2

- $b = \sqrt{10^2 - 6^2} = \sqrt{64} = \mathbf{8}$ cm.

2.3 Find the diagonal of a 9×12 cm rectangle. [2]

2.3

- $d = \sqrt{9^2 + 12^2} = \sqrt{225} = \mathbf{15}$ cm.

Exercise 2.4

2.4 Find the hypotenuse with shorter sides 7 and 9 cm to one decimal place. [2]

Exercise 2.4

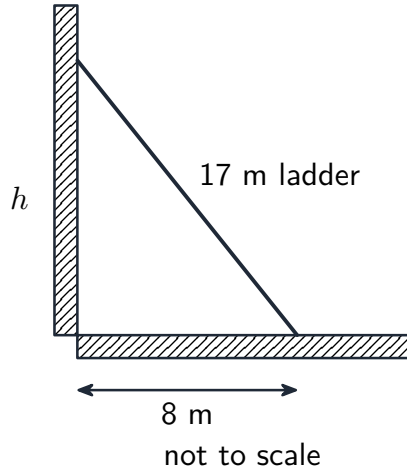
2.4 Find the hypotenuse with shorter sides 7 and 9 cm to one decimal place. [2]

2.4

- $c = \sqrt{7^2 + 9^2} = \sqrt{130} = 11.4017\dots = \mathbf{11.4}$ cm.

Setup for exercise 3.1

3.1 Apply the pythagoras' theorem methods below. Show working and include units where appropriate.



Exercise 3.1 (a)

- (a) A 17 m ladder has its foot 8 m from a vertical wall. Find the height it reaches. [2]

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(a)

- $h = \sqrt{17^2 - 8^2} = \sqrt{225} = \mathbf{15}$ m.

Exercise 3.1 (b)

(b) The foot moves to 10 m from the wall. Find the new height to one decimal place. [2]

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(b)

- $h_2 = \sqrt{17^2 - 10^2} = \sqrt{189} = \mathbf{13.7}$ m to one decimal place.

Exercise 3.1 (c)

(c) How far does the top move down the wall? Give your answer to one decimal place.[2]

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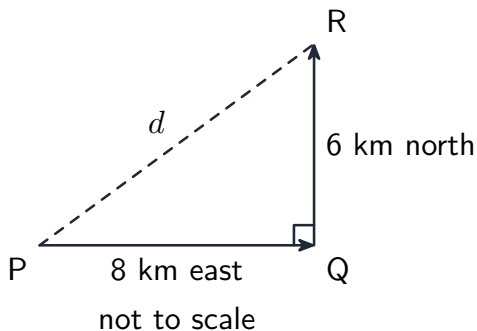
(c) How far does the top move down the wall? Give your answer to one decimal place.[2]

(c)

- Use the unrounded value: $\Delta h = 15 - \sqrt{189} = 1.2522\dots = \mathbf{1.3}$ m.

Exercise 3.2 (a)

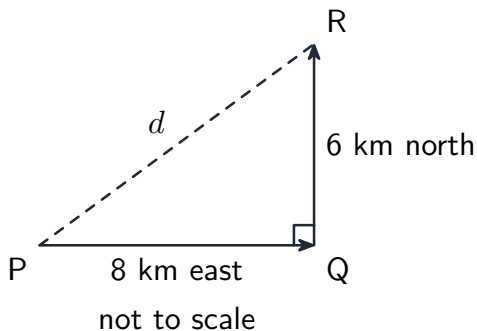
3.2 A walker travels 8 km east from P to Q, then 6 km north from Q to R.



(a) Find the direct distance PR and how much shorter it is than the route through Q . [3]

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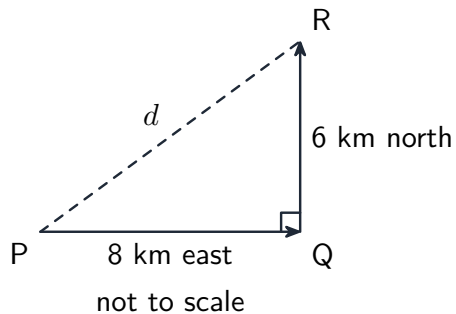
(a) Find the direct distance PR and how much shorter it is than the route through Q. [3]

(a)

- The east and north directions are perpendicular, so use $d^2 = 8^2 + 6^2$.
- $d = \mathbf{10}$ km.
- Saving $s = 8 + 6 - 10 = \mathbf{4}$ km.

Exercise 3.2 (b)

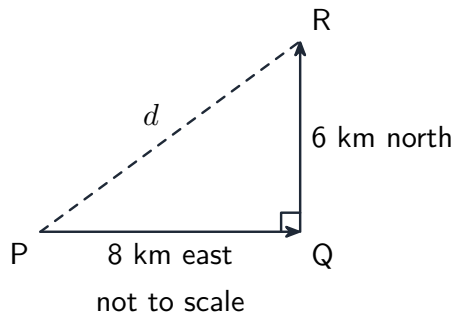
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(b) A different triangle has sides 6 km, 8 km and 11 km. Decide whether it is right-angled, showing the square comparison. [3]

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(b)

- The longest side would be the hypotenuse, so compare 11^2 with $6^2 + 8^2$.
- These give **121 and 100**.
- They are unequal, so the triangle is **not right-angled**.