

C6.1 Pythagoras' theorem

Name: _____ Class: _____ Date: _____

Total: 20 marks

KEY WORDS triangle 三角形 • hypotenuse 斜边 • opposite 对边

Objective

Use pythagoras' theorem to solve Core IGCSE Mathematics problems.

You must be able to:

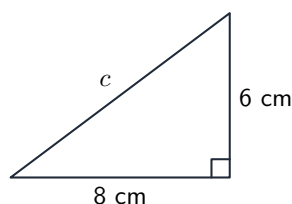
- Identify the hypotenuse opposite the right angle
- Use Pythagoras to find a longer or shorter missing side
- Interpret a calculated distance and check a triangle for a right angle

1 Key knowledge and worked examples

■ 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.

■ Worked example: Pythagoras' theorem



A right triangle has shorter sides 6 and 8 cm.

- Use $c^2 = a^2 + b^2$ because the included angle is 90° .
- $c = \sqrt{6^2 + 8^2} = \sqrt{100} = 10$ cm.
- If $c = 13$ cm and $a = 5$ cm, then $b^2 = c^2 - a^2$ and $b = \sqrt{13^2 - 5^2} = 12$ cm.

■ Method check

Pythagoras needs a right angle. For a shorter unknown side, subtract its known companion square from the hypotenuse square.

2 Practice

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

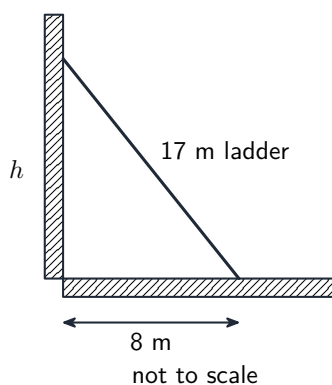
2.2 A right triangle has hypotenuse 10 cm and one leg 6 cm. Find the other leg. [2]

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

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

3 Exam-style questions

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

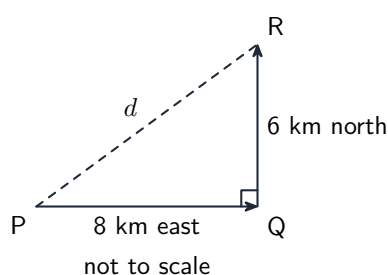


(a) A 17 m ladder has its foot 8 m from a vertical wall. Find the height it reaches. [2]

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

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

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]

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

Solutions

Award method and answer marks as indicated; accept equivalent correct methods.

2.1

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

2.2

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

2.3

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

2.4

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

3.1

(a)

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

(b)

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

(c)

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

3.2

(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.

(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**.