

Pythagoras' theorem

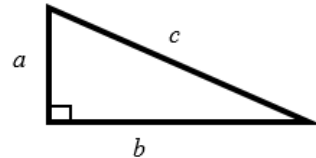
A LEVEL LINKS

Scheme of work: 2a. Straight-line graphs, parallel/perpendicular, length and area problems

Key points

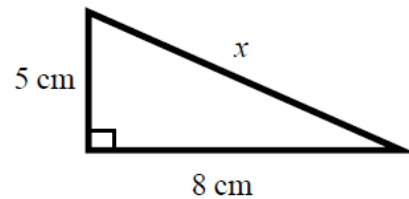
- In a right-angled triangle the longest side is called the hypotenuse.
- Pythagoras' theorem states that for a right-angled triangle the square of the hypotenuse is equal to the sum of the squares of the other two sides.

$$c^2 = a^2 + b^2$$

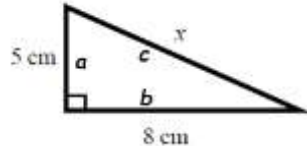


Examples

Example 1 Calculate the length of the hypotenuse.
Give your answer to 3 significant figures.



$$c^2 = a^2 + b^2$$



$$x^2 = 5^2 + 8^2$$

$$x^2 = 25 + 64$$

$$x^2 = 89$$

$$x = \sqrt{89}$$

$$x = 9.433\ 981\ 13\dots$$

$$x = 9.43\text{ cm}$$

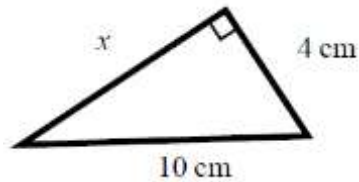
1 Always start by stating the formula for Pythagoras' theorem and labelling the hypotenuse c and the other two sides a and b .

2 Substitute the values of a , b and c into the formula for Pythagoras' theorem.

3 Use a calculator to find the square root.

4 Round your answer to 3 significant figures and write the units with your answer.

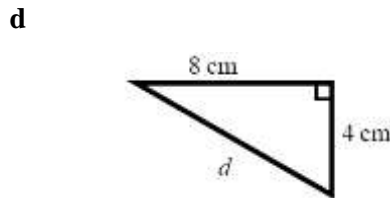
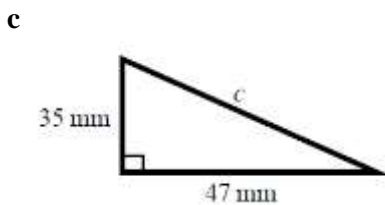
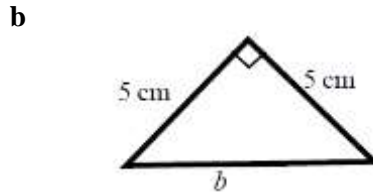
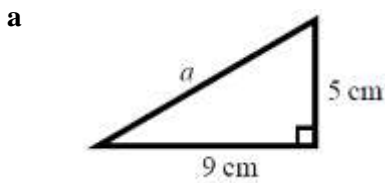
Example 2 Calculate the length x .
Give your answer in surd form.



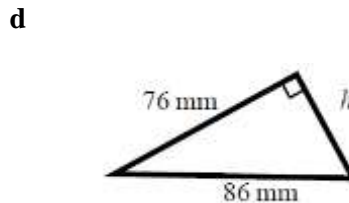
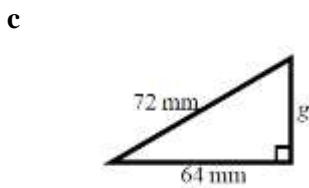
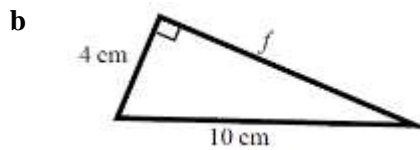
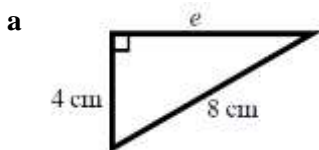
$c^2 = a^2 + b^2$ $10^2 = x^2 + 4^2$ $100 = x^2 + 16$ $x^2 = 84$ $x = \sqrt{84}$ $x = 2\sqrt{21} \text{ cm}$	<ol style="list-style-type: none"> 1 Always start by stating the formula for Pythagoras' theorem. 2 Substitute the values of a, b and c into the formula for Pythagoras' theorem. 3 Simplify the surd where possible and write the units in your answer.
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Practice

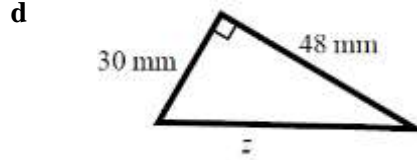
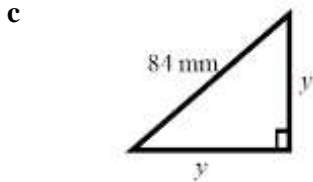
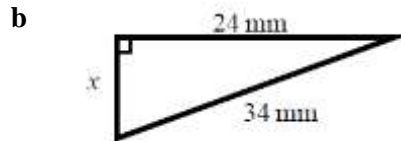
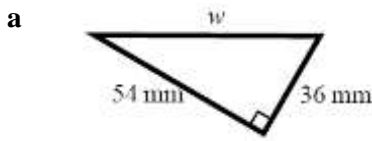
1 Work out the length of the unknown side in each triangle.
Give your answers correct to 3 significant figures.



2 Work out the length of the unknown side in each triangle.
Give your answers in surd form.



- 3 Work out the length of the unknown side in each triangle. Give your answers in surd form.



- 4 A rectangle has length 84 mm and width 45 mm . Calculate the length of the diagonal of the rectangle. Give your answer correct to 3 significant figures.

Hint

Draw a sketch of the rectangle.

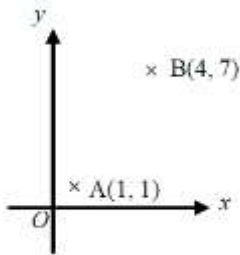
Extend

- 5 A yacht is 40 km due North of a lighthouse. A rescue boat is 50 km due East of the same lighthouse. Work out the distance between the yacht and the rescue boat. Give your answer correct to 3 significant figures.

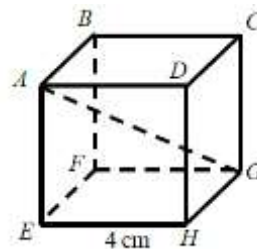
Hint

Draw a diagram using the information given in the question.

- 6 Points A and B are shown on the diagram. Work out the length of the line AB. Give your answer in surd form.



- 7 A cube has length 4 cm . Work out the length of the diagonal AG . Give your answer in surd form.



Answers

- 1** **a** 10.3 cm **b** 7.07 cm
 c 58.6 mm **d** 8.94 cm
- 2** **a** $4\sqrt{3}$ cm **b** $2\sqrt{21}$ cm
 c $8\sqrt{17}$ mm **d** $18\sqrt{5}$ mm
- 3** **a** $18\sqrt{13}$ mm **b** $2\sqrt{145}$ mm
 c $42\sqrt{2}$ mm **d** $6\sqrt{89}$ mm
- 4** 95.3 mm
- 5** 64.0 km
- 6** $3\sqrt{5}$ units
- 7** $4\sqrt{3}$ cm