Pythagoras' Theorem

Understanding Pythagoras' Theorem

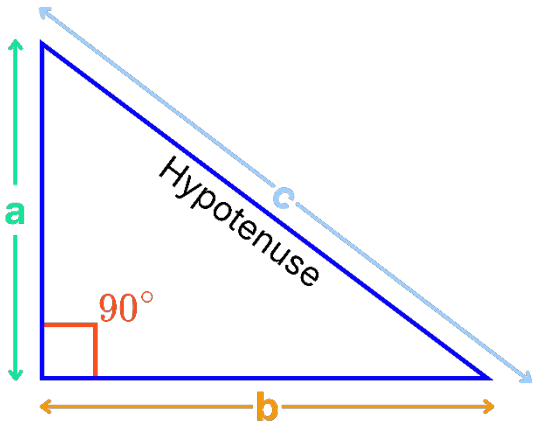
Pythagoras' Theorem is used to find a missing side length in a right-angled triangle. It states that:

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

where:

- a and b are the two shorter sides
- c is the hypotenuse

(the longest side, opposite the right angle)



How is Pythagoras' Theorem formed?

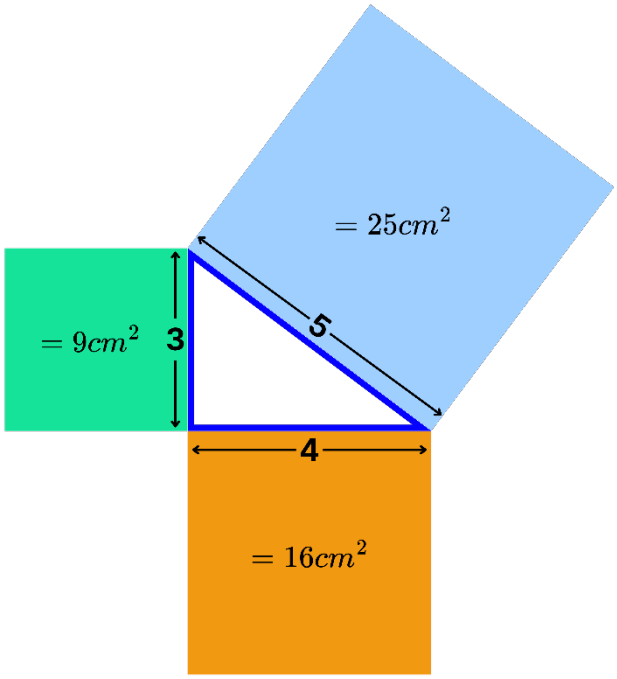
Pythagoras' theorem describes the relationship between the three sides of a right-angled triangle. It is based on the areas of the squares drawn on each side.

Using the diagram below:

1. Calculate the area of each smaller square:
   - ■: $3 \times 3 = 9cm^2$
   - ■: $4 \times 4 = 16cm^2$

2. Add the two smaller areas together:
   $9 + 16 = 25cm^2$

3. Find the length of the hypotenuse:
   $\therefore$ ■ $= 25cm^2$
   $\therefore c^2 = 25cm^2$
   $c = \sqrt{25}$
   $c = 5cm$



This means:

The square of the longest side (c) equals the sum of the squares of the other two sides (a + b).

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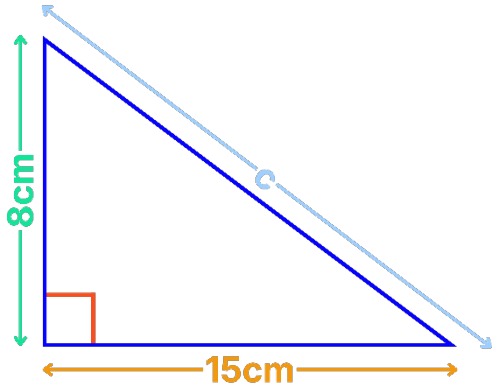
Finding the hypotenuse

A right-angled triangle has:

- One short side = 8 cm
- The other short side = 15 cm
- Hypotenuse = c

Use Pythagoras' Theorem:

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



Steps	Example
1. Substitute the values	$a = 8$ $b = 15$ $8^2 + 15^2 = c^2$
2. Square the numbers	$64 + 225 = c^2$
3. Add together	$289 = c^2$
4. Find the square root	$c = \sqrt{289}$ $c = 17cm$

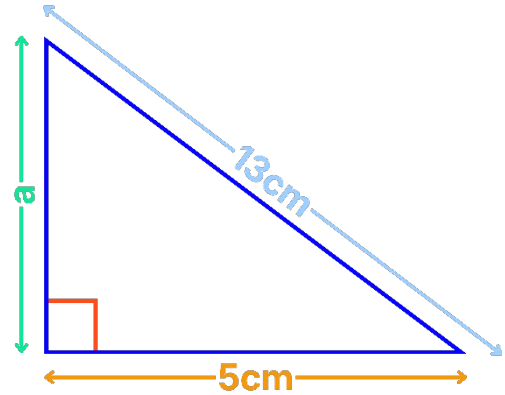
Finding a shorter side

A right-angled triangle has:

- One short side = a
- The other short side = 5 cm
- Hypotenuse = 13 cm

Use Pythagoras' Theorem:

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



Steps	Example
1. Substitute the values	$b = 5$ $c = 13$ $a^2 + 5^2 = 13^2$
2. Square the numbers	$a^2 + 25 = 169$
3. Rearrange to find the unknown	$a^2 = 169 - 25$
4. Find the square root	$a = \sqrt{144}$ $a = 12cm$

Related helpsheet

- Understanding Trigonometry

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