

Pythagoras' Theorem

Pythagoras' Theorem allows us to find the length of a missing side in right-angled triangle if we know the lengths of the other two sides.

Check that you can:

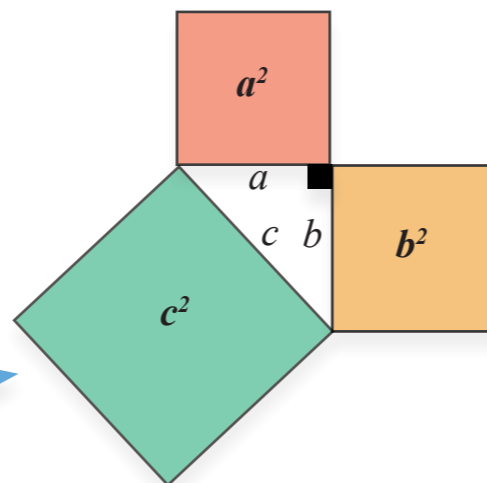
- recognise right-angled triangles
- find square numbers (2) with a calculator
- find the square root ($\sqrt{\quad}$) of a number using a calculator.



Pythagoras of Samos

570 BC – 495 BC

Pythagoras was a Greek philosopher and mathematician. He discovered that if you were to draw squares on each of the sides of a right-angled triangle the sum of the area of the two smaller squares would equal the area of the largest square.



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

Where c is the hypotenuse, the longest side that lies opposite the right-angle, and a and b are either of the shorter sides.

Remember to label the sides of your triangle. It's important that the hypotenuse is labelled c but it doesn't matter which of the shorter sides is labelled a or b .

Finding the hypotenuse

1) Find the length of x

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

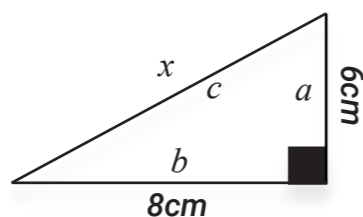
$$6^2 + 8^2 = x^2$$

$$36 + 64 = x^2$$

$$100 = x^2$$

$$\sqrt{100} = x$$

$$10 \text{ cm} = x$$



2) Find the length of y

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

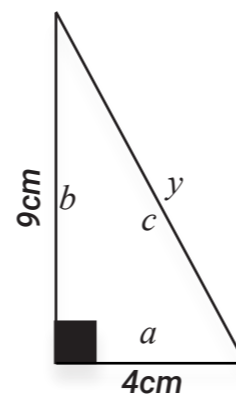
$$4^2 + 9^2 = y^2$$

$$16 + 81 = y^2$$

$$97 = y^2$$

$$\sqrt{97} = y$$

$$9.8 \text{ m (to 1 d.p.)} = y$$



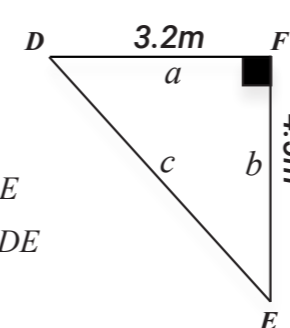
3) Find the length of DE

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

$$3.2^2 + 4.5^2 = DE^2$$

$$\sqrt{(3.2^2 + 4.5^2)} = DE$$

$$5.5 \text{ m (to 1 d.p.)} = DE$$



In e.g. 1) you don't actually need a calculator, just use your knowledge of square numbers and square roots. This is an example of a Pythagorean triple where the sides are all whole numbers. Can you think of any other Pythagorean triples?

Finding a short side

To find the length of a or b

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

can be re-arranged to give either:

$$c^2 - b^2 = a^2 \quad \text{or} \quad c^2 - a^2 = b^2$$

Examples

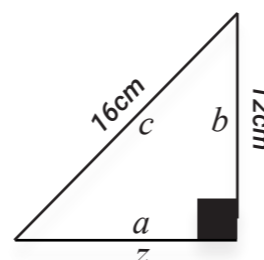
1) Find the length of z .

$$c^2 - b^2 = a^2$$

$$16^2 - 12^2 = z^2$$

$$\sqrt{(16^2 - 12^2)} = z$$

$$10.6 \text{ cm (to 1 d.p.)} = z$$



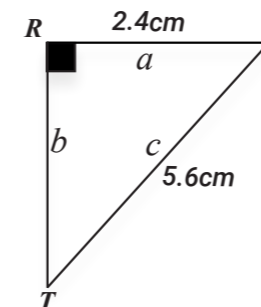
2) Find the length of RT .

$$c^2 - b^2 = a^2$$

$$5.6^2 - 2.4^2 = RT^2$$

$$\sqrt{(5.6^2 - 2.4^2)} = RT$$

$$5.1 \text{ m (to 1 d.p.)} = RT$$



Remember

- To check what side you are trying to find. When it's the longest side c , you need to **ADD** the squares and when it's one of the shorter sides a or b , you need to **SUBTRACT** the squares.
- Pythagoras' theorem can only be used to find length of sides, take care to not confuse it with a trigonometry question which involves length of sides and angle size in right-angled triangles.