

Y9H U8 Pythagoras' Theorem – Knowledge Organiser

Squares and square roots R



This can also be written as 6^2

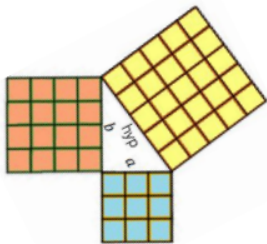
$\sqrt{\quad}$ is the square root symbol

eg $\sqrt{64} = 8$
Because $8 \times 8 = 64$

1 × 1	2 × 2	3 × 3	4 × 4	5 × 5	6 × 6	7 × 7	8 × 8	9 × 9	10 × 10
1	4	9	16	25	36	49	64	81	100

Square numbers

Determine if a triangle is right-angled



If a triangle is right-angled, the sum of the squares of the shorter sides will equal the square of the hypotenuse.

$$a^2 + b^2 = \text{hypotenuse}^2$$

eg $a^2 + b^2 = \text{hypotenuse}^2$

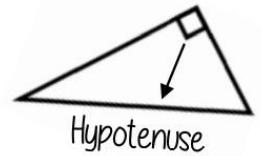
$$3^2 + 4^2 = 5^2$$

$$9 + 16 = 25$$

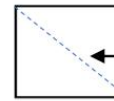
Substituting the numbers into the theorem shows that this is a right-angled triangle

$a = 3$ $b = 4$ $c = 5$

Identify the hypotenuse

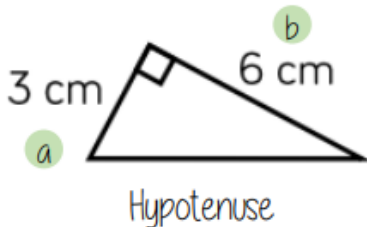


The hypotenuse is always the longest side on a triangle because it is opposite the biggest angle.



Polygons can still have a hypotenuse if it is split up in triangles and opposite a right angle

Calculate the hypotenuse



Either of the short sides can be labelled a or b

$$a^2 + b^2 = \text{hypotenuse}^2$$

Work out the hypotenuse to 1 d.p.:

$$a = 3$$

$$b = 6$$

$$a^2 + b^2 = \text{hypotenuse}^2$$

$$3^2 + 6^2 = \text{hypotenuse}^2$$

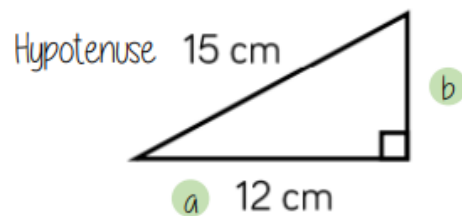
$$9 + 36 = \text{hypotenuse}^2$$

$$45 = \text{hypotenuse}^2$$

$$\sqrt{45} = \text{hypotenuse}$$

$$6.7 \text{ cm} = \text{hypotenuse}$$

Calculate one of the short sides



Either of the short sides can be labelled a or b

$$b^2 = \text{hypotenuse}^2 - a^2$$

Work out the short side:

$$\text{Hypotenuse} = 15$$

$$a = 12$$

$$\text{hypotenuse}^2 - a^2 = b^2$$

$$15^2 - 12^2 = b^2$$

$$225 - 144 = b^2$$

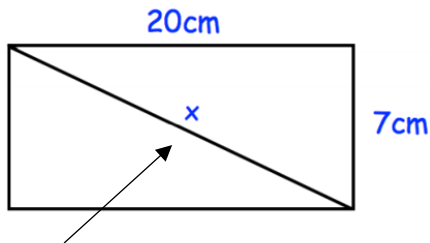
$$81 = b^2$$

$$\sqrt{81} = b$$

$$9 \text{ cm} = b$$

Creating right-angled triangles

Find the length of the diagonal, x .



The diagonal x is also the hypotenuse of a right-angled triangle

Work out the hypotenuse to 2 d.p.:

$$a = 20$$

$$b = 7$$

$$a^2 + b^2 = \text{hypotenuse}^2$$

$$20^2 + 7^2 = \text{hypotenuse}^2$$

$$400 + 49 = \text{hypotenuse}^2$$

$$449 = \text{hypotenuse}^2$$

$$\sqrt{449} = \text{hypotenuse}$$

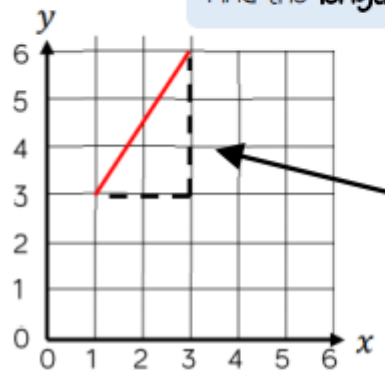
$$21.19 \text{ cm} = \text{hypotenuse}$$

Sparx

- Calculating with roots and powers M135
- Finding missing lengths M677
- Pythagoras and 3-D problems M147

Pythagoras' theorem on a coordinate axis

Find the length of the line segment



The segment can be made into a right-angled triangle by adding the sides on the diagram

The line segment is the hypotenuse

$$a^2 + b^2 = \text{hypotenuse}^2$$

The lengths of a and b are the sides of the triangle.

Be careful to check the scale on the axes

Work out the hypotenuse to 3 s.f.:

$$a = 2$$

$$b = 3$$

$$a^2 + b^2 = \text{hypotenuse}^2$$

$$2^2 + 3^2 = \text{hypotenuse}^2$$

$$4 + 9 = \text{hypotenuse}^2$$

$$13 = \text{hypotenuse}^2$$

$$\sqrt{13} = \text{hypotenuse}$$

$$3.61 \text{ cm} = \text{hypotenuse}$$