Using Pythagoras’ Theorem

Handy maths study tips

Pythagoras’ Theorem is used to find the lengths of unknown sides in triangles. It can be used in the following conditions:

1. The triangle is a right-angled triangle, i.e. contains an angle of 90 degrees.
2. Two of the three sides are already known.

The rule is: \( a^2 + b^2 = c^2 \)

In words: The square of the hypotenuse is equal to the sum of the squares of the other two sides.

Note that this is sometimes expressed as \( a^2 + b^2 = h^2 \).

Here \( a \) and \( b \) are the two shorter sides of the triangle-the ones which are attached to the right-angle.

\( c \) or \( h \) is the hypotenuse, the longest side, the side that lies opposite the right-angle.

Examples

1 Finding the hypotenuse
If \( a = 3 \), \( b = 7 \) find \( c \).

Substitute the known values into Pythagoras’ Theorem: \( 3^2 + 7^2 = c^2 \)

Evaluate the Left Hand Side (LHS) \( 9 + 49 = c^2 \Rightarrow 58 = c^2 \)

Take the square root (positive as we are looking for a length) of both sides: \( \sqrt{58} = c \)

You can now either leave it as \( \sqrt{58} = c \) or use you calculator to find \( \sqrt{58} = 7.616 \) to 3 d.p.

2 Finding a shorter side
If \( a = 5 \), \( c = 13 \) find \( b \).

Substitute the known values into Pythagoras’ Theorem: \( 5^2 + b^2 = 13^2 \)

This becomes \( 25 + b^2 = 169 \).

Rearrange to get \( b^2 \) on its own: \( b^2 = 169 - 25 = 144 \)

Take the positive square root of both sides:

\( b = \sqrt{144} = 12 \)

So \( b = 12 \)