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Pythagoras' Theorem

IGCSE Mathematics

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1 Introduction to Pythagoras' Theorem

Note

Pythagoras' Theorem is one of the most important and widely used results in all of mathematics. It describes the relationship between the three sides of a right-angled triangle and allows us to calculate unknown lengths. This theorem appears frequently in IGCSE examinations and forms the basis for trigonometry and coordinate geometry.

In this chapter, we will explore:

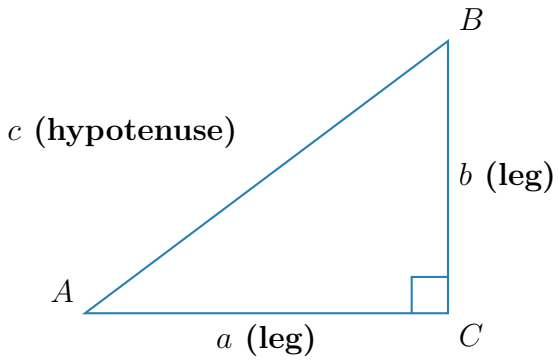
- Understanding right-angled triangles and the hypotenuse
- Pythagoras' Theorem and its formula
- Finding the hypotenuse
- Finding a shorter side
- Pythagorean triples
- Determining whether a triangle is right-angled
- Applications in 2D shapes
- Pythagoras' Theorem in 3D

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2 Right-Angled Triangles

Definition

A **right-angled triangle** is a triangle that contains exactly one angle of 90.
The **hypotenuse** is the longest side of a right-angled triangle. It is always the side directly opposite the right angle.
The other two sides are called the **legs** (or shorter sides) of the triangle.



Note

How to identify the hypotenuse:

- It is always **opposite** the right angle
- It is always the **longest** side of the triangle
- In diagrams, the right angle is usually marked with a small square

3 Pythagoras' Theorem

Pythagoras' Theorem

In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.
If c is the hypotenuse and a and b are the two shorter sides, then:

$$\boxed{a^2 + b^2 = c^2}$$

The area of the square on the hypotenuse equals the sum of the areas of the squares on the other two sides.

Note

Key Point: Pythagoras' Theorem ONLY works for right-angled triangles. Before applying the theorem, always check that the triangle has a 90 angle.

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