

Pythagoras Theorem – GCSE Maths

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1. Introduction

- The Pythagorean Theorem is a simple rule that helps us figure out the length of one side in a right-angled triangle if we know the other two.
- It is one of the most fundamental and well-known principles in geometry.
- It is widely used in mathematics, physics, engineering, and everyday problem-solving to calculate distances or unknown side lengths.

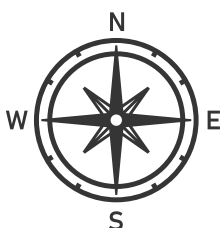
Real-life application:



Construction



Architecture



Navigation

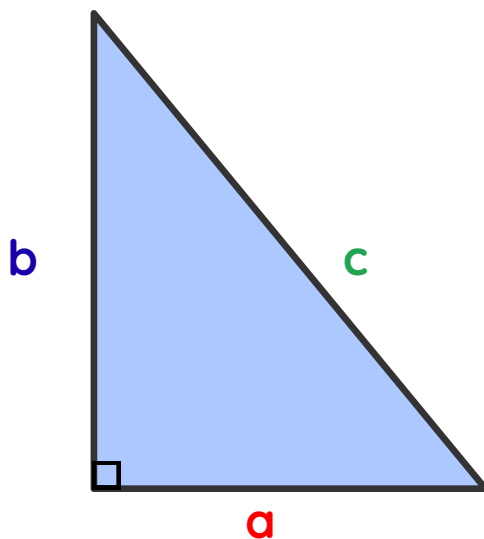


Air Traffic Control

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2. What is 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.
- Mathematically, if a right-angled triangle has sides of lengths a , b , and c (where c is the hypotenuse), then:

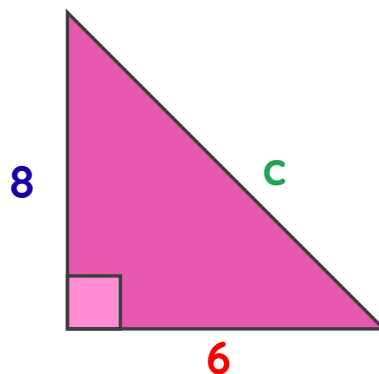


$$c^2 = a^2 + b^2$$

Key points:

- Applies Only to Right-Angled Triangles
- Hypotenuse is the Longest Side
- It helps to find the length of any side when the other two are known.

Example: A triangle has one side 6 cm long, another side 8 cm long, and a right angle between them. What is the length of the hypotenuse?



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Solution:

Given:

- **Base a = 6 cm**
- **Height b = 8 cm**

Using the formula,

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

Putting the values:

$$c^2 = 6^2 + 8^2$$

$$c^2 = 36 + 64$$

$$c^2 = 100$$

$$c = \sqrt{100}$$

$$c = 10$$

3. How to find the length of the missing side in a right-angled triangle?

- The Pythagorean Theorem helps find a missing side in a right-angled triangle when two sides are known.

Steps to find missing sides in a right-angled triangle:

Step#1: Identify the given sides

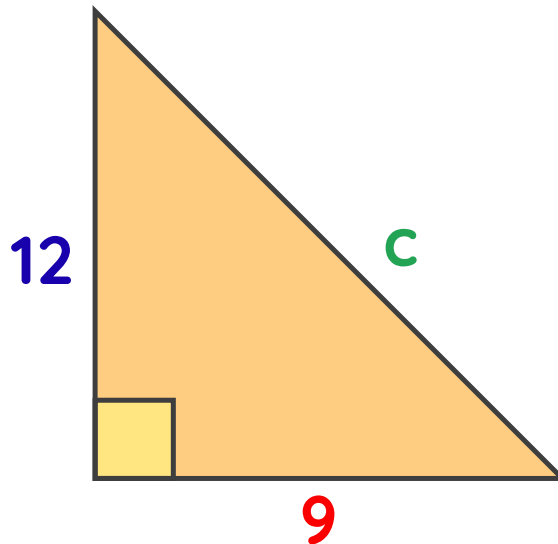
Step#2: Use the formula

Step#3: Plug the values

Step#4: Solve for the unknown side.

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Example: A right-angled triangle has one side 9 cm and another side 12 cm. What is the length of the hypotenuse?



Solution:

Step#1: Identify the given sides

Given:

- **Base a = 9 cm**
- **Height b = 12 cm**

Step#2: Use the formula

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

Step#3: Plug the values

$$c^2 = 9^2 + 12^2$$

Step#4: Solve for the unknown side.

$$c^2 = 81 + 144$$

$$c^2 = 225$$

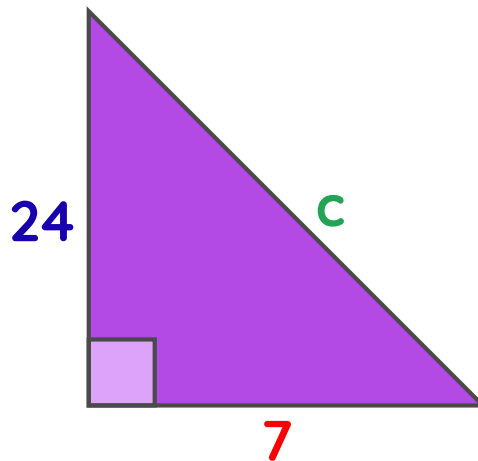
$$c = \sqrt{225}$$

$$c = 15$$

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4. Solved Examples

Problem1: In a right-angled triangle, the base is 7 cm and the height is 24 cm. Find the length of the hypotenuse.



Solution:

Step#1: Identify the given sides

Given:

- **Base a = 7 cm**
- **Height b = 24 cm**

Step#2: Use the formula

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

Step#3: Plug the values

$$c^2 = 7^2 + 24^2$$

Step#4: Solve for the unknown side.

$$c^2 = 49 + 576$$

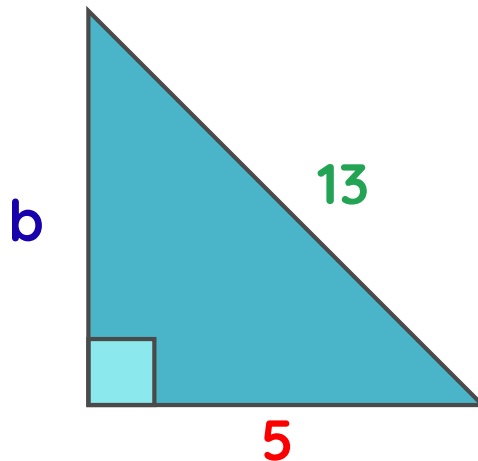
$$c^2 = 625$$

$$c = \sqrt{625}$$

$$c = 25$$

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Problem2: A right-angled triangle has a hypotenuse of 13 cm and one side of 5 cm. What is the length of the other side?



Solution:

Step#1: Identify the given sides

Given:

- **Base a = 5 cm**
- **Hypotenuse c = 13 cm**

Step#2: Use the formula

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

Rearrange it,

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

Step#3: Plug the values

$$b^2 = 13^2 - 5^2$$

Step#4: Solve for the unknown side.

$$b^2 = 169 - 25 = 144$$

$$b = \sqrt{144}$$

$$b = 12$$