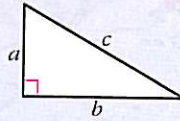


1 PYTHAGORAS' THEOREM AND ITS APPLICATIONS

Pythagoras' Theorem

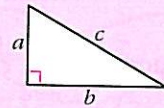
In a **right-angled** triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides:

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



REMEMBER

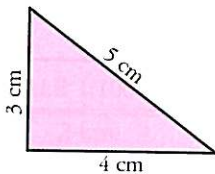
In this triangle,



c is the hypotenuse and a and b are the other sides, also known as the catheti.

1. Determine whether the following triangles are right-angled triangles by checking if the square of the longest side is equal to the sum of the squares of the other two sides.

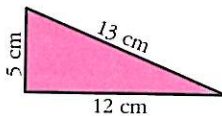
I



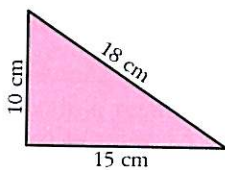
$$\left. \begin{array}{l} 5^2 = 25 \\ 3^2 + 4^2 = 9 + 16 = 25 \end{array} \right\} \text{Se cumple } 5^2 = 3^2 + 4^2$$

Therefore, the triangle is a right-angled triangle. The side measuring 5 cm is the hypotenuse and the other two sides are the catheti.

II



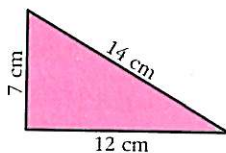
III



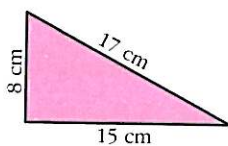
$$\left. \begin{array}{l} 18^2 = 324 \\ 10^2 + 15^2 = 100 + 225 = 325 \end{array} \right\} 18^2 \neq 10^2 + 15^2$$

The square of the longest side is not equal to the sum of the squares of the other two sides. Therefore, the triangle is not right-angled.

IV

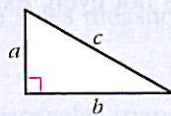


V



Applying Pythagoras' Theorem

Pythagoras' Theorem enables us to calculate one side of a right-angled triangle when the other two sides are known.



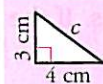
If the catheti are known, the hypotenuse can be calculated:

$$c^2 = a^2 + b^2 \rightarrow c = \sqrt{a^2 + b^2}$$

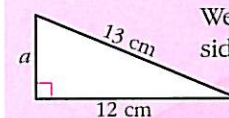
If the hypotenuse and one other side are known, the remaining side can be calculated:

$$c^2 = a^2 + b^2 \rightarrow a^2 = c^2 - b^2 \rightarrow a = \sqrt{c^2 - b^2}$$

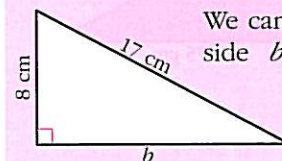
EXAMPLES



We can calculate the hypotenuse c .



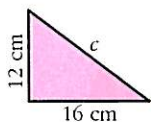
We can calculate side a .



We can calculate side b .

Sample problem

Calculate the hypotenuse of a right-angled triangle whose other sides measure 12 cm and 16 cm.



$$c = \sqrt{12^2 + 16^2} = \sqrt{144 + 256} = \sqrt{400} = 20$$

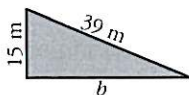
The hypotenuse measures 20 cm.

2. Calculate the hypotenuse of a right-angled triangle whose other sides measure 30 cm and 16 cm.

3. The catheti of a right-angled triangle measure 15 cm and 20 cm. Find the length of the hypotenuse.

Sample problem

The hypotenuse of a right-angled triangle measures 39 m and one of its catheti measures 15 m. Calculate the length of the unknown cathetus.



$$b = \sqrt{39^2 - 15^2} = \sqrt{1,521 - 225} = \sqrt{1,296} = 36$$

The unknown cathetus measures 36 m.

4. The hypotenuse of a right-angled triangle measures 34 dm and one of its catheti measures 30 dm. How long is the other cathetus?