

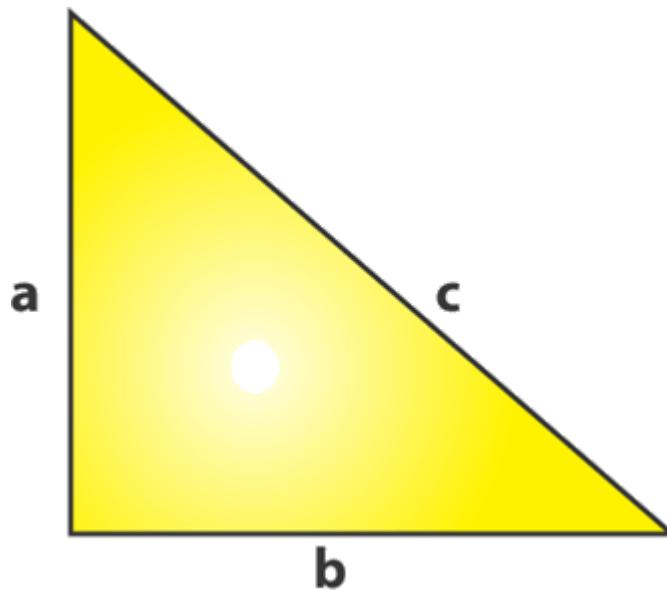
Pythagoras Theorem: Pythagoras Theorem Statement and Formula

Get unlimited access to the best preparation resource for NEST Mathematics: [fully solved questions with step-by-step explanation](#)- practice your way to success.

Pythagoras Theorem is an important topic in Maths, which explains the relation between the sides of a right-angled triangle. It is also sometimes called Pythagorean Theorem. The formula and proof of this theorem are explained here. This theorem is basically used for the right-angled triangle.

Pythagoras Theorem Statement

Pythagoras theorem states that “**In a right-angled triangle, the square of the hypotenuse side is equal to the sum of squares of the other two sides** “. The sides of this triangles have been named as Perpendicular, Base and Hypotenuse. Here, the **hypotenuse** is the longest side, as it is opposite to the angle 90° . The sides of a right triangle (say x , y and z) which has positive integer values, when squared are put into an equation, also called a Pythagorean triple.

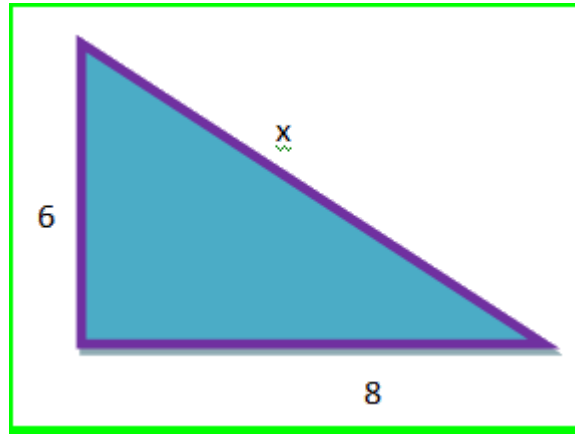


©FlexiPrep. Report @violations @<https://tips.fbi.gov/>

Example:

The examples of theorem based on the statement given for right triangles is given below:

Consider a right triangle, given below:



[©FlexiPrep, Report ©violations @https://tips.fbi.gov/](https://tips.fbi.gov/)

Find the value of x.

X is the side opposite to right angle; hence it is a hypotenuse.

Now, by the theorem we know;

$$\text{Hypotenuse}^2 = \text{Base}^2 + \text{Perpendicular}^2$$

$$x^2 = 8^2 + 6^2$$

$$x^2 = 64 + 36$$

$$= 100$$

$$x = \sqrt{100}$$

$$= 10$$

Therefore, we found the value of hypotenuse here.

Pythagoras Theorem Formula

Consider the triangle given above:

Where “a” is the perpendicular side

“b” is the base,

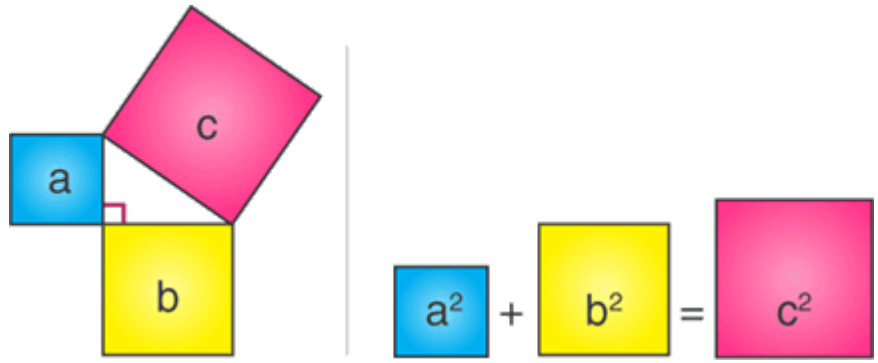
“c” is the hypotenuse side.

According to the definition, the Pythagoras Theorem formula is given as:

$$\text{Hypotenuse}^2 = \text{Perpendicular}^2 + \text{Base}^2$$

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

The side opposite to the right angle (90°) is the longest side (known as Hypotenuse) because the side opposite to the greatest angle is the longest.



©FlexiPrep. Report @violations @https://tips.fbi.gov/

Consider three squares of sides a, b, c mounted on the three sides of a triangle having the same sides as shown.

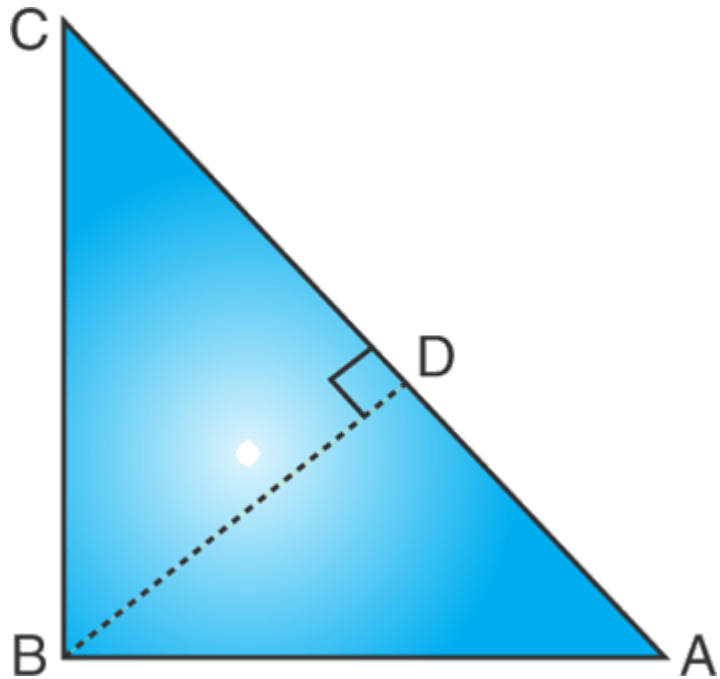
By Pythagoras Theorem –

$$\text{Area of square } A + \text{Area of square } B = \text{Area of square } C$$

Pythagoras Theorem Proof

Given: A right-angled triangle ABC.

To Prove- $AC^2 = AB^2 + BC^2$



©FlexiPrep. Report @violations @https://tips.fbi.gov/

Proof: First, we have to drop a perpendicular BD onto the side AC

We know, $\triangle ADB \sim \triangle ABC$

Therefore, $\frac{AD}{AB} = \frac{AB}{AC}$ (Condition for similarity)

Or, $AB^2 = AD \times AC \dots \dots \dots (1)$

Also, $\triangle BDC \sim \triangle ABC$

Therefore, $\frac{CD}{BC} = \frac{BC}{AC}$ (Condition for similarity)

Or, $BC^2 = CD \times AC \dots \dots \dots (2)$

Adding the equations (1) and (2) we get,

$$AB^2 + BC^2 = AD \times AC + CD \times AC$$

$$AB^2 + BC^2 = AC (AD + CD)$$

Since, $AD + CD = AC$

Therefore, $AC^2 = AB^2 + BC^2$

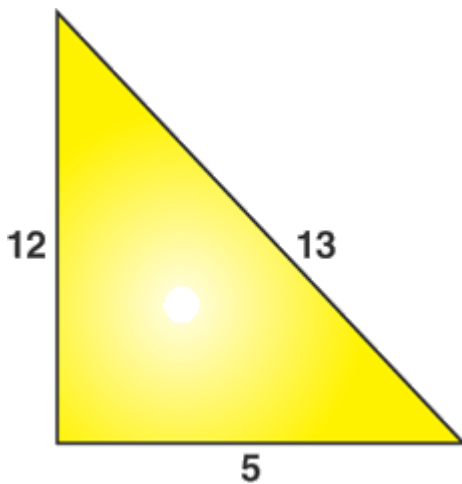
Hence, the Pythagorean theorem is proved.

Applications of Pythagoras Theorem

- To know if the triangle is a right-angled triangle or not.
- In a right-angled triangle, we can calculate the length of any side if the other two sides are given.
- To find the diagonal of a square.

Pythagorean Theorem Problems

Problem 1: The sides of a triangle are 5,12 and 13 units . Check if it has a right angle or not.



©FlexiPrep. Report ©violations @<https://tips.fbi.gov/>

Solution: From Pythagoras Theorem, we have,

$$Perpendicular^2 + Base^2 = Hypotenuse^2$$

Perpendicular = 12 units

Base = 5 units

Hypotenuse = 13 units

$$12^2 + 5^2 = 13^2$$

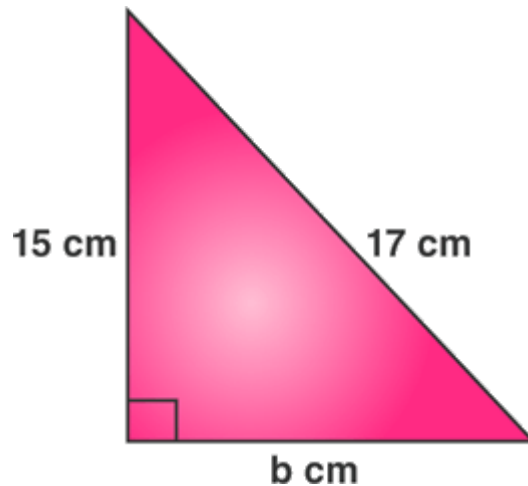
$$144 + 25 = 169$$

$$169 = 169$$

$$L. H. S. = R. H. S.$$

Therefore, the angles opposite to the 13-unit side will be at a right angle.

Problem 2: The two sides of a right-angled as shown in the figure. Find the third side.



©FlexiPrep, Report @violations @<https://tips.fbi.gov/>

Solution: Given,

Perpendicular = 15 cm

Base = b cm

Hypotenuse = 17 cm

As per the Pythagorean Theorem, we have;

$$\text{Perpendicular}^2 + \text{Base}^2 = \text{Hypotenuse}^2$$

$$15^2 + b^2 = 17^2$$

$$225 + b^2 = 289$$

$$b^2 = 289 - 225$$

$$b^2 = 64$$

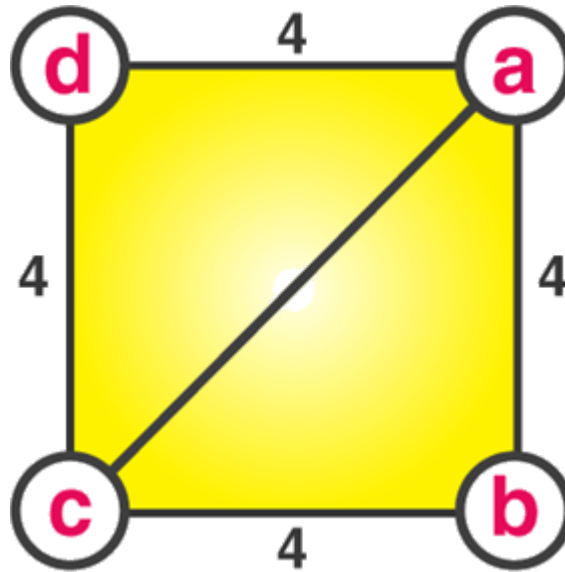
$$b = \sqrt{64}$$

Therefore, $b = 8$

Problem 3: Given the side of a square to be 4 cm. Find the length of the diagonal.

Solution- Given;

Sides of a square = 4 cm



[©FlexiPrep, Report @violations @https://tips.fbi.gov/](https://tips.fbi.gov/)

To Find- The length of diagonal ac .

Consider triangle abc (or can also be acd)

$$(ab)^2 + (bc)^2 = (ac)^2$$

$$(4)^2 + (4)^2 = (ac)^2$$

$$16 + 16 = (ac)^2$$

$$32 = (ac)^2$$

$$(ac)^2 = 32$$

or $ac = 4\sqrt{2}$.

Thus, the length of the diagonal is $4\sqrt{2}$.

Frequently Asked Questions on Pythagoras Theorem

What is the Formula for Pythagorean Theorem?

The formula for Pythagoras, for a right-angled triangle, is given by; $c^2 = a^2 + b^2$

What is the Formula for Hypotenuse?

The hypotenuse is the longest side of the right-angled triangle, opposite to right angle, which is adjacent to base and perpendicular. Let base, perpendicular and hypotenuse are a , b and c respectively. Then the hypotenuse formula, from the Pythagoras statement, will be;

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

Can We Apply the Pythagoras Theorem for Any Triangle?

No, this theorem is applicable only for the right-angled triangle.

Developed by: [Mindsprite Solutions](#)