

Pythagoras Theorem

1. Find the value of x using Pythagorean theorem:

Ans. Identify the sides and the hypotenuse of the right angle triangle.

The one sides length = 8 m and the other side length = 15.

' x ' is the length of hypotenuse because it is opposite side of the right angle.

Substitute the values into the Pythagorean formula (here ' x ' is the hypotenuse)

$$(h)^2 = p^2 + b^2$$

[Here $h \rightarrow$ hypotenuse, $p \rightarrow$ perpendicular, $b \rightarrow$ base]

$$x^2 = 8^2 + 15^2$$

Solve to find the known value of ' x '

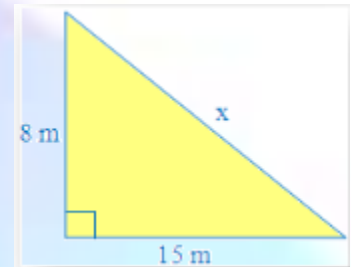
$$x^2 = 64 + 225$$

$$x^2 = 289$$

$$x = \sqrt{289}$$

$$x = 17$$

Therefore, value of x (hypotenuse) = 17 m



2. Use the formula of Pythagorean theorem to determine the length of ' a '.

Ans. Identify the perpendicular, base and the hypotenuse of the right angle triangle.

Length of perpendicular = 24 cm and the length of base = a .

Length of hypotenuse = 25 cm. Since hypotenuse is the opposite side of the right angle.

Substitute the values into the Pythagorean formula (here ' a ' is the base)

$$(h)^2 = p^2 + b^2$$

[Here $h \rightarrow$ hypotenuse, $p \rightarrow$ perpendicular, $b \rightarrow$ base]

$$25^2 = 24^2 + a^2$$

Solve to find the known value of ' a '

$$625 = 576 + a^2$$

$$625 - 576 = 576 - 576 + a^2$$

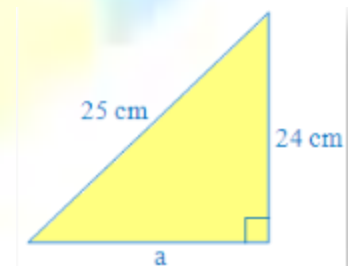
$$49 = a^2$$

$$a^2 = 49$$

$$a = \sqrt{49}$$

$$a = 7$$

Therefore, length of ' a ' (base) = 7 cm



3. Solve to find the missing value of the triangle using the formula of Pythagorean Theorem:

Ans. Identify the perpendicular, base and the hypotenuse of the right angle triangle.

Perpendicular = k and Base = 7.5

Hypotenuse = 8.5, since hypotenuse is the opposite side of the right angle.

Substitute the values into the Pythagorean formula (here 'k' is the perpendicular)

$$(h)^2 = p^2 + b^2$$

[Here h → hypotenuse, p → perpendicular, b → base]

$$8.5^2 = k^2 + 7.5^2$$

Solve to find the known value of 'k'

$$72.25 = k^2 + 56.25$$

$$72.25 - 56.25 = k^2 + 56.25 - 56.25$$

$$16 = k^2$$

$$k^2 = 16$$

$$k = \sqrt{16}$$

$$k = 4$$

Therefore, missing value of the triangle 'k' (perpendicular) = 4

4. The side of a triangle are of length 4.5 cm, 7.5 cm and 6 cm. Is this triangle a right triangle? If so, which side is the hypotenuse?

Ans. We know that hypotenuse is the longest side. If 4.5 cm, 7.5 cm and 6 cm are the lengths of angled triangle, then 7.5 cm will be the hypotenuse.

Using the converse of Pythagoras theorem, we get

$$(7.5)^2 = (6)^2 + (4.5)^2$$

$$\Rightarrow 56.25 = 36 + 20.25$$

$$\Rightarrow 56.25 = 56.25$$

Since, both the sides are equal therefore, 4.5 cm, 7.5 cm and 6 cm are the side of the right angled triangle having hypotenuse 7.5 cm.

5. The side of a triangle are of length 8 cm, 15 cm and 17 cm. Is this triangle a right triangle? If so, which side is the hypotenuse?

Ans. We know that hypotenuse is the longest side. If 8 cm, 15 cm and 17 cm are the lengths of angled triangle, then 17 cm will be the hypotenuse.

Using the converse of Pythagoras theorem, we get

$$(17)^2 = (15)^2 + (8)^2$$

$$\Rightarrow 289 = 225 + 64$$

$$\Rightarrow 289 = 289$$

Since, both the sides are equal therefore, 8 cm, 15 cm and 17 cm are the side of the right angled triangle having hypotenuse 17 cm.

6. The side of a triangle are of length 9 cm, 11 cm and 6 cm. Is this triangle a right triangle? If so, which side is the hypotenuse?

Ans. We know that hypotenuse is the longest side. If 9 cm, 11 cm and 6 cm are the lengths of angled triangle, then 11 cm will be the hypotenuse.

Using the converse of Pythagoras theorem, we get

$$(11)^2 = (9)^2 + (6)^2$$

$$\Rightarrow 121 = 81 + 36$$

$$\Rightarrow 121 \neq 117$$

Since, both the sides are not equal therefore 9 cm, 11 cm and 6 cm are not the side of the right angled triangle. The above examples of the converse of Pythagorean Theorem will help us to determine the right triangle when the sides of the triangles will be given in the questions.

7. A person has to walk 100 m to go from position X in the north of east direction to the position B and then to the west of Y to reach finally at position Z. The position Z is situated at the north of X and at a distance of 60 m from X. Find the distance between X and Y.

Ans. Let $XY = x$ m

Therefore, $YZ = (100 - x)$ m

In ΔXYZ , $\angle Z = 90^\circ$

Therefore, by Pythagoras theorem

$$XY^2 = YZ^2 + XZ^2$$

$$\Rightarrow x^2 = (100 - x)^2 + 60^2$$

$$\Rightarrow x^2 = 10000 - 200x + x^2 + 3600$$

Pythagorean Theorem Word Problem

$$\Rightarrow 200x = 10000 + 3600$$

$$\Rightarrow 200x = 13600$$

$$\Rightarrow x = \frac{13600}{200}$$

$$\Rightarrow x = 68$$

Therefore, distance between X and Y = 68 meters.



8. If the square of the hypotenuse of an isosceles right triangle is 128 cm^2 , find the length of each side.

Ans. Let the two equal side of right angled isosceles triangle, right angled at Q be $k \text{ cm}$.

Given: $h^2 = 128$

So, we get

$$PR^2 = PQ^2 + QR^2$$

$$h^2 = k^2 + k^2$$

$$\Rightarrow 128 = 2k^2$$

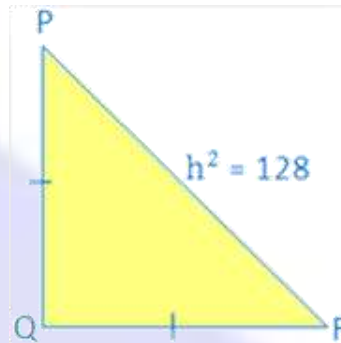
$$\Rightarrow \frac{128}{2} = k^2$$

$$\Rightarrow 64 = k^2$$

$$\Rightarrow \sqrt{64} = k$$

$$\Rightarrow 8 = k$$

Therefore, length of each side is 8 cm .



9. Find the perimeter of a rectangle whose length is 150 m and the diagonal is 170 m .

Ans. In a rectangle, each angle measures 90° .

Therefore PSR is right angled at S

Using Pythagoras theorem, we get

$$\Rightarrow PS^2 + SR^2 = PR^2$$

$$\Rightarrow PS^2 + 150^2 = 170^2$$

$$\Rightarrow PS^2 = 170^2 - 150^2$$

$$\Rightarrow PS^2 = (170 + 150)(170 - 150), \text{ [using the formula of } a^2 - b^2 = (a + b)(a - b)\text{]}$$

$$\Rightarrow PS^2 = 320 \times 20$$

$$\Rightarrow PS^2 = 6400$$

$$\Rightarrow PS = \sqrt{6400}$$

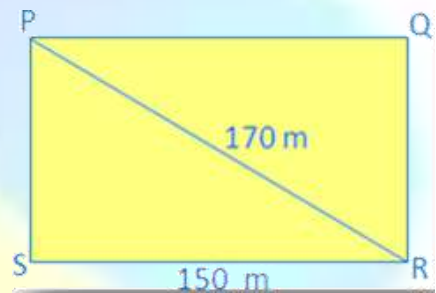
$$\Rightarrow PS = 80$$

Therefore perimeter of the rectangle PQRS = $2(\text{length} + \text{width})$

$$= 2(150 + 80) \text{ m}$$

$$= 2(230) \text{ m}$$

$$= 460 \text{ m}$$



10. A ladder 13 m long is placed on the ground in such a way that it touches the top of a vertical wall 12 m high. Find the distance of the foot of the ladder from the bottom of the wall.

Ans. Let the required distance be $x \text{ meters}$. Here, the ladder, the wall and the ground form a right-angled triangle.

The ladder is the hypotenuse of that triangle.

According to Pythagorean Theorem,

$$x^2 + 12^2 = 13^2$$

$$\Rightarrow x^2 = 13^2 - 12^2$$

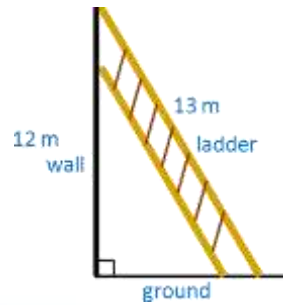
$$\Rightarrow x^2 = (13 + 12)(13 - 12)$$

$$\Rightarrow x^2 = (25)(1)$$

$$\Rightarrow x^2 = 25$$

$$\Rightarrow x = \sqrt{25}$$

$$\Rightarrow x = 5$$



Therefore, distance of the foot of the ladder from the bottom of the wall = 5 meters.

11. The height of two building is 34 m and 29 m respectively. If the distance between the two building is 12 m, find the distance between their tops.

Ans. The vertical buildings AB and CD are 34 m and 29 m respectively.

Draw $DE \perp AB$

Then $AE = AB - EB$ but $EB = BC$

Therefore $AE = 34 \text{ m} - 29 \text{ m} = 5 \text{ m}$

Now, AED is right angled triangle and right angled at E.

Therefore,

$$AD^2 = AE^2 + ED^2$$

$$\Rightarrow AD^2 = 5^2 + 12^2$$

$$\Rightarrow AD^2 = 25 + 144$$

$$\Rightarrow AD^2 = 169$$

$$\Rightarrow AD = \sqrt{169}$$

$$\Rightarrow AD = 13$$

Therefore the distance between their tops = 13 m.

