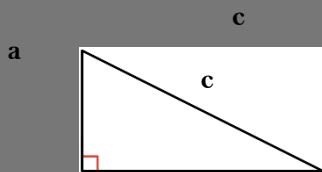


PYTHAGOREAN THEOREM

THE PYTHAGOREAN THEOREM

In any right triangle, if a and b are the lengths of the legs and c is the length of the hypotenuse,

$$a^2 + b^2 = c^2$$
$$(\text{Leg})^2 + (\text{Other Leg})^2 = (\text{Hypotenuse})^2$$



The equation $a^2 + b^2 = c^2$ is called the Pythagorean equation.

Example: One leg of a right triangle is 8 ft. If the hypotenuse is 17 ft, find the length of the other leg.

$$x^2 + 8^2 = 17^2$$
$$x^2 + 64 = 289$$
$$x^2 - 225 = 0$$
$$(x + 15)(x - 15) = 0$$
$$x = 15 \text{ or } x = -15$$

$x = -15$ is not a valid since the length of a side of a triangle cannot be negative.
The length of the other leg is 15 ft.

Example: One leg of a right triangle is 1 cm more than the other leg. If the hypotenuse is 5 cm, find the length of the legs.

$$x^2 + (x + 1)^2 = 5^2$$
$$x^2 + (x + 1)(x + 1) = 25$$
$$x^2 + x^2 + x + x + 1 = 25$$
$$2x^2 + 2x - 24 = 0$$
$$2(x^2 + x - 12) = 0$$
$$2(x + 4)(x - 3) = 0$$
$$2 \neq 0, \quad x + 4 = 0, \quad x - 3 = 0$$
$$x = -4 \text{ or } x = 3$$

$x = -4$ is not a valid answer, so the only valid answer is $x = 3$.
If one of the legs is $x = 3$, the other leg is $x + 1 = 3 + 1 = 4$.
The lengths of the other legs are 3 cm and 4 cm.

EXERCISES:

- (1) One leg of a right triangle is 24 inches. If the hypotenuse is 25 inches, find the length of the other leg.

- (2) One leg of a right triangles is 2 meters less than the other leg. If the hypotenuse is 10 meters, find the length of the legs.

- (3) One leg of a right triangle is 5 feet. If the other leg is 1 ft. less than the hypotenuse, find that that leg and the hypotenuse.

Answers

- 1.) 7 in
- 2.) 6 m, 8 m
- 3.) 12 ft, 13 ft