

## THE PYTHAGOREAN THEOREM

### What Is the Pythagorean Theorem?

The **Pythagorean Theorem** is a theorem that states the sum of the squares of the legs of a right triangle equals the square of the length of the hypotenuse.

- In mathematical terms, this is represented by  $a^2 + b^2 = c^2$ , where  $a$  and  $b$  are the length of the legs and  $c$  is the length of the **hypotenuse** of a **right triangle**.
- A **Pythagorean triple** is a set of numbers that always satisfy the equation,  $a^2 + b^2 = c^2$ .

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using the **Pythagorean theorem**.



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## How to use the Pythagorean Theorem

In order to use the **Pythagorean Theorem**, **powers and roots** should be looked at first.

For example, what is  $7^2$  and the square root of 225?

**Ex.  $7^2 = 7 \cdot 7 = 49$**

The square root of 225 =  $\sqrt{225} = 15$  because  $15 \cdot 15 = 225$ .

The **Pythagorean Theorem** can only be used if a triangle is a **right triangle**. This would have to be stated in order to use the **Pythagorean Theorem**. If a triangle is a right triangle and the sides are given, the hypotenuse can be found as follows:



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- For example if a triangle has legs that are 5 cm and 10 cm and a hypotenuse of 15, is the triangle a right triangle?

**Ex.  $a^2 + b^2 = c^2$**

$$5^2 + 10^2 = 15^2$$

$$25 + 100 = 225$$

$125 \neq 225$  so the triangle is not a right triangle.

Objects in every day life can be used with the **Pythagorean Theorem** also.

- For example, if an 18 ft ladder leans against a house and rests on the house 16 ft above the ground, how far away is the ladder from the house given that the house and the ground make a right angle?

**Ex.  $a^2 + b^2 = c^2$**

$$a^2 + 16^2 = 18^2$$

$$a^2 + 256 = 324$$

$$a^2 = 68$$

$$a = \sqrt{68} \approx 8.25 \approx 8.3 \text{ ft.}$$

The ladder is approximately 8.3 ft away from the house.

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4. A right triangle has a hypotenuse of 26 ft and a leg that is 24 ft. What is the length of the **missing leg**?

5. A triangle has sides of 5 cm and 8 cm. The hypotenuse is 13. Is the triangle a **right triangle**?

6. A square is cut into two triangles by a diagonal. If a side of the square measures 10 m, what is the length of the **diagonal**?