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 $\mathbf{a^2 + b^2 = c^2}$, 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, $\mathbf{a^2 + b^2 = c^2}$.

- By using the **Pythagorean Theorem**, a triangle can be determined to be a right triangle. Also if either the legs or a leg and hypoter… theorem can be …

In order to … to know how to eva… of x^2, which mea… **eorem,** a number wi… ed for c. In order to … **square root** of a number is equal to a number that, when multiplied by itself, will produce the given number. The **Pythagorean Theorem** can be applied to any right triangle. Many everyday items can be evaluated using the **Pythagorean Theorem**.

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:

Ex. A right triangle has sides of 6 cm and 8 cm.

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The **Pythagorean Theorem** can also be used if one leg and the hypotenuse are given to get the missing leg. The **Pythagorean Theorem** is also used to prove that triangles are right triangles.

- 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 house16 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. $\mathbf{a^2 + b^2 = c^2}$

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

$a^2 + 256 = 324$

$a^2 = 68$

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

The ladder is approximately 8.3 ft away from the house.

Try This!

1. What is
2. What is
3. A triang n. What is the length of the **hypotenuse**?
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**?