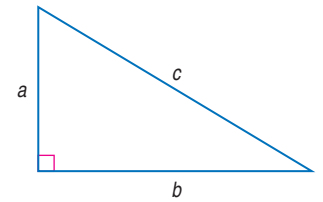


Pythagorean Theorem

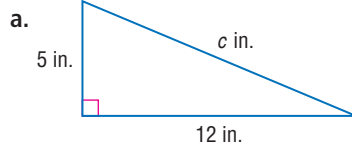
The **Pythagorean Theorem** states that in a right triangle, the square of the length of the hypotenuse c is equal to the sum of the squares of the lengths of the legs a and b .

That is, in any right triangle, $c^2 = a^2 + b^2$.



EXAMPLE

1 Find the length of the hypotenuse of each right triangle.



$$c^2 = a^2 + b^2 \quad \text{Pythagorean Theorem}$$

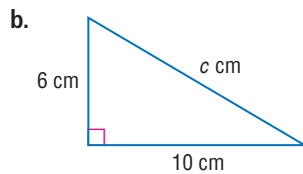
$$c^2 = 5^2 + 12^2 \quad \text{Replace } a \text{ with 5 and } b \text{ with 12.}$$

$$c^2 = 25 + 144 \quad \text{Simplify.}$$

$$c^2 = 169 \quad \text{Add.}$$

$$c = \sqrt{169} \quad \text{Take the square root of each side.}$$

$$c = 13 \quad \text{The length of the hypotenuse is 13 inches.}$$



$$c^2 = a^2 + b^2 \quad \text{Pythagorean Theorem}$$

$$c^2 = 6^2 + 10^2 \quad \text{Replace } a \text{ with 6 and } b \text{ with 10.}$$

$$c^2 = 36 + 100 \quad \text{Simplify.}$$

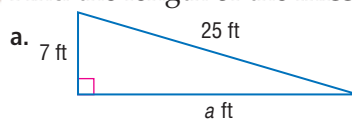
$$c^2 = 136 \quad \text{Add.}$$

$$c = \sqrt{136} \quad \text{Take the square root of each side.}$$

$$c \approx 11.7 \quad \text{Use a calculator. To the nearest tenth, the length of the hypotenuse is 11.7 centimeters.}$$

EXAMPLE

2 Find the length of the missing leg in each right triangle.



$$c^2 = a^2 + b^2 \quad \text{Pythagorean Theorem}$$

$$25^2 = a^2 + 7^2 \quad \text{Replace } c \text{ with 25 and } b \text{ with 7.}$$

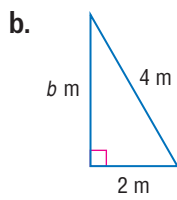
$$625 = a^2 + 49 \quad \text{Simplify.}$$

$$625 - 49 = a^2 + 49 - 49 \quad \text{Subtract 49 from each side.}$$

$$576 = a^2 \quad \text{Simplify.}$$

$$\sqrt{576} = a \quad \text{Take the square root of each side.}$$

$$24 = a \quad \text{The length of the leg is 24 feet.}$$



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

Pythagorean Theorem

$$4^2 = 2^2 + b^2$$

Replace c with 4 and a with 2.

$$16 = 4 + b^2$$

Simplify.

$$12 = b^2$$

Subtract 4 from each side.

$$\sqrt{12} = b$$

Take the square root of each side.

$$3.5 \approx b$$

Use a calculator to find the square root of 12.
Round to the nearest tenth.

To the nearest tenth, the length of the leg is 3.5 meters.

EXAMPLE

- 3** The lengths of the three sides of a triangle are 5, 7, and 9 inches. Determine whether this triangle is a right triangle.

Since the longest side is 9 inches, use 9 as c , the measure of the hypotenuse.

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

Pythagorean Theorem

$$9^2 \stackrel{?}{=} 5^2 + 7^2$$

Replace c with 9, a with 5, and b with 7.

$$81 \stackrel{?}{=} 25 + 49$$

Evaluate 9^2 , 5^2 , and 7^2 .

$$81 \neq 74$$

Simplify.

Since $c^2 \neq a^2 + b^2$, the triangle is *not* a right triangle.