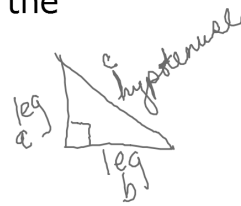Pythagorean Theorem - Day 2

I can use the Pythagorean Theorem to find missing measurements of triangles.

Gather your clicker and notebook. There are 4 clicker questions (a grade) and your assignment is awaiting you in gmail - an exit ticket.

We remember from yesterday, that the Pythagorean Theorem states:

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

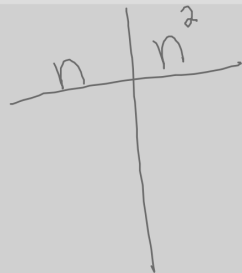leg a
hypotenuse c
leg b

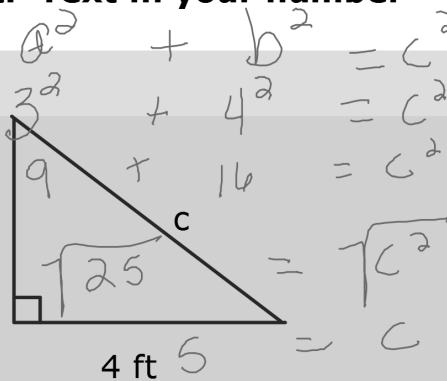Also, remember that this theorem only applies to right triangles.

In a right triangle, the hypotenuse is always opposite the right angle, and it is the longest side of a triangle. The remaining two sides are called legs.

Find the length of the hypotenuse in a right triangle with legs of 3 feet and 4 feet. __5__ feet. Text in your number response.

$n \quad \sqrt{n^2}$

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

$3^2 \qquad + \quad 4^2 \qquad = c^2$

$9 \qquad + \quad 16 \qquad = c^2$

3 ft   c

$\sqrt{25} \qquad = \sqrt{c^2}$

4 ft 5 $= c$

Using the Pythagorean Theorem

What You'll Learn

To use the Pythagorean Theorem to find missing measurements of triangles
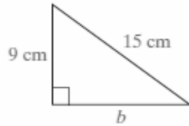
Why Learn This?

You can use the Pythagorean Theorem to find distances without measuring, including distances in space.

When you know the length of one leg and the hypotenuse of a right triangle, you can use the Pythagorean Theorem to find the length of the other leg.

EXAMPLE   Finding a Leg of a Right Triangle

1 Find the missing leg length of the triangle below.

9 cm, 15 cm, b

Handwritten: Subtract
$15^2 - 9^2 = b^2$
$225 - 81 = b^2$

Handwritten (right):
$\begin{array}{r} 225 \\ -\ 81 \\ \hline 144 \end{array}$

$a^2 + b^2 = c^2$ ← Use the Pythagorean Theorem.
$9^2 + b^2 = 15^2$ ← Substitute 9 for a and 15 for c.
$81 + b^2 = 225$ ← Simplify.
$b^2 = 144$ ← Subtract 81 from each side.
$\sqrt{b^2} = \sqrt{144}$ ← Find the positive square root of each side.
$b = 12$ ← Simplify.

The length of the other leg is 12 cm.

Handwritten: $\sqrt{144} = \sqrt{b^2}$ $12 = b$

1 EXAMPLE Find the missing leg length of the triangle.

$a^2 + b^2 = c^2$ ← Use the Pythagorean Theorem.

$a^2 + 12^2 = 13^2$ ← Substitute 12 for b and 13 for c.

$a^2 + 144 = 169$ ← Simplify.

$a^2 = 25$ ← Subtract.
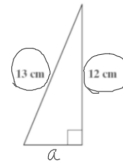
$\sqrt{a^2} = \sqrt{25}$ ← Find the positive square root of each side.
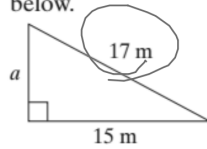
$a = 5$ ← Simplify.

The length of the other leg is 5 cm.

13 cm, 12 cm, a

Handwritten:
$\begin{array}{r} 169 \\ -144 \\ \hline 25 \end{array}$

$13^2 - 12^2 = a^2$
$169 - 144 = a^2$
$\sqrt{25} = \sqrt{a^2}$
$5 = a$

Example

① Finding a Leg of a Right Triangle Find the missing leg length of the triangle below.

17 m

a

15 m

$289 - 225$

$\begin{array}{r} -225 \\ \hline 64 \end{array}$ $\sqrt{64} = \sqrt{a^2}$

$a^2 + b^2 = c^2$	← Use the Pythagorean Theorem.
$a^2 + 15^2 = 17^2$	← Substitute 15 for b and 17 for c.
$a^2 + 225 = 289$	← Simplify.
$a^2 = 64$	← Subtract.
$\sqrt{a^2} = \sqrt{64}$	← Find the positive square root of each side.
$a = 8$	← Simplify.

The length of the other leg is 8 m.

✓ **Quick Check**

1. The hypotenuse of a right triangle is 20.2 ft long. One leg is 12.6 ft long. Find the length of the other leg to the nearest tenth. █████

12.6 ft

20.2 ft

b
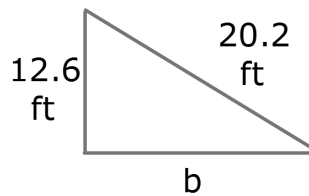
True or false?

c squared **minus** a squared **equals** b squared.

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

$3 + 4 = 7$
$7 - 4 = 3$
$7 - 3 = 4$

(A) True

(B) False

Find the missing leg length of a triangle whose hypotenuse is 13 cm and a leg is 12 cm. _____ cm

Text in your number response.

$13^2 - 12^2$

$169 - 144 = 25$

$\sqrt{25} = 5$

$$\begin{array}{r} 169 \\ -\,144 \\ \hline 25 \end{array}$$
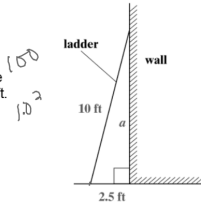
12 cm   13 cm

a

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2 **EXAMPLE** The bottom of a 10-foot ladder is 2.5 ft from the side of a wall. How far, to the nearest tenth, is the top of the ladder from the ground?

$100 - 6.25 = \sqrt{93.75}$

$$\begin{array}{r} 81 \\ \overline{6}^2 \end{array}$$

The diagram shows a right triangle with hypotenuse 10 ft and leg 2.5 ft. The distance from the top of the ladder to the ground is a.

100

1.0 ²

ladder

wall

10 ft a

2.5 ft

$a^2 + b^2 = c^2$ ← Use the Pythagorean Theorem.

$a^2 + (2.5)^2 = 10^2$ ← Substitute $b = 2.5$ and $c = 10$.

$a^2 + 6.25 = 100$ ← Multiply.

$a^2 = 93.75$ ← Subtract 6.25 from each side.

$a = \sqrt{93.75}$ ← Find the positive square root.

$\sqrt{}$ 93.75 ENTER 9.6824584 ← Use a calculator.

$a \approx 9.7$ ← Round to the nearest tenth.

The distance from the top of the ladder to the ground is about 9.7 ft.

✓ Quick Check

2. Construction The bottom of an 18-ft ladder is 5 ft from the side of a house. Find the distance from the top of the ladder to the ground. Round to the nearest tenth of a foot. ▮

18 ft

|←5 ft→|

The bottom of a ten foot ladder is 2.5 feet from the side of a wall. How far, to the nearest tenth, is the top of the ladder from the ground?
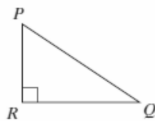
(A) 10.3 feet

(B) 9.5 feet

(C) 9.9 feet

(D) 10.1 feet

(E) 9.7 feet

Check Your Understanding

1. **Vocabulary** Name the two legs and the hypotenuse of the triangle at the left.
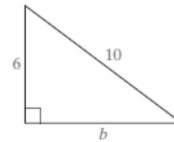
2. Fill in the blanks for each step to find the missing leg length of the triangle below.

   a. $6^2 + b^2 = \blacksquare^2$

   b. $\blacksquare + b^2 = 100$

   c. $b^2 = \blacksquare$

   d. $b = \blacksquare$

Power down your clickers and put them away.

Go to your email and find the email from me called Exit Ticket. Reply to me on this: Explain the difference of how to find the length of the hypotenuse when you know the measurements of both legs, and how to find a missing leg length when you know the length of the hypotenuse and one leg.

This is due before the bell rings. Please use complete sentences and punctuation.