Pythagoras
(c. 570 B.C.–c. 490 B.C.)

Pythagoras was a Greek mathematician and philosopher who discovered one of the most famous rules in mathematics. In mathematics, a rule is called a **theorem**. So, the rule that Pythagoras discovered is called the Pythagorean Theorem.

The Pythagorean Theorem
10.3
A tool for right triangle problems only

When do I need to use the Pythagorean Theorem ?

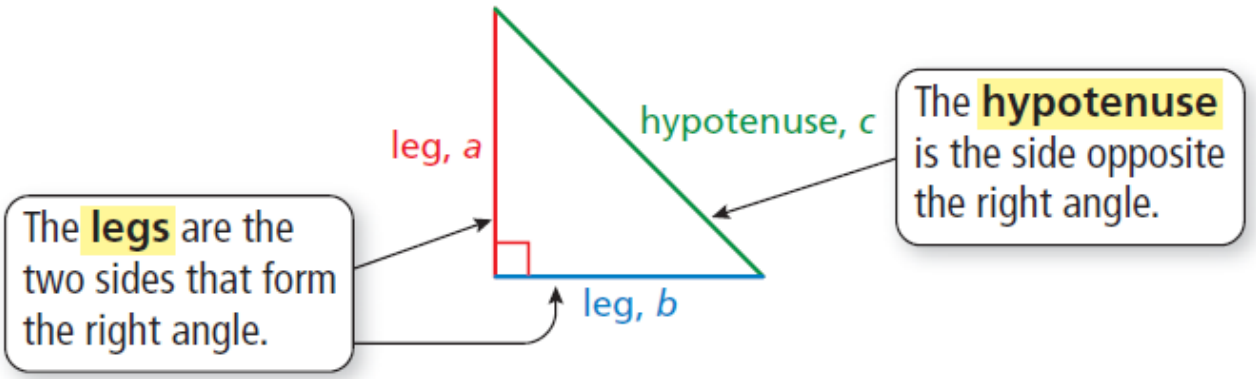
When I know the length of 2 sides

and

Need to know the length of the 3rd side

Sides of a Right Triangle

The sides of a right triangle have special names.

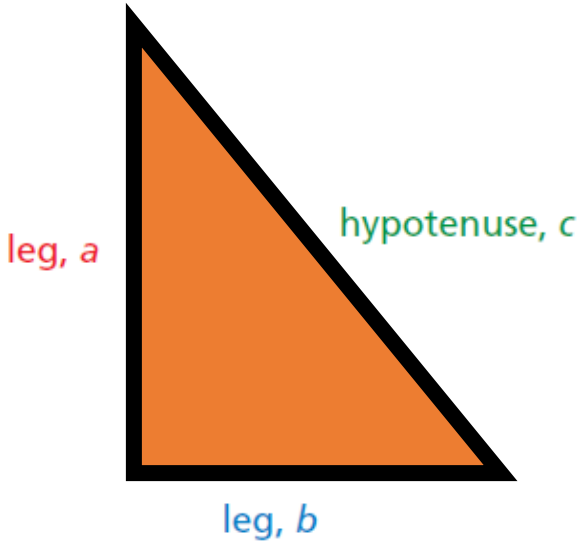


What is the Pythagorean Theorem?

The Pythagorean Theorem

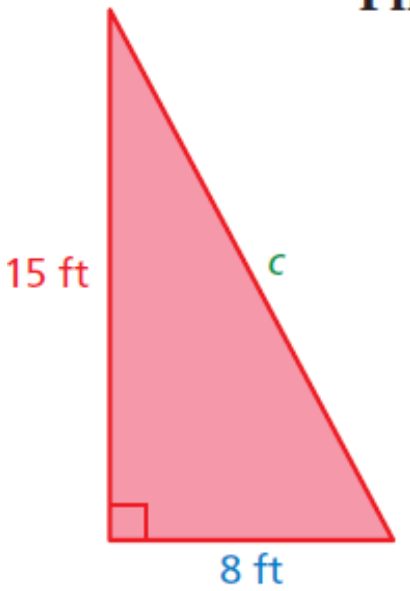
Words In any right triangle, the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse.

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



EXAMPLE 1 Finding the Length of a Hypotenuse

Find the length of the hypotenuse of the triangle.



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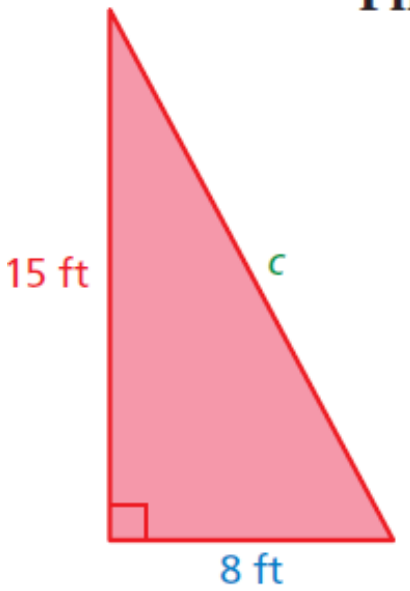

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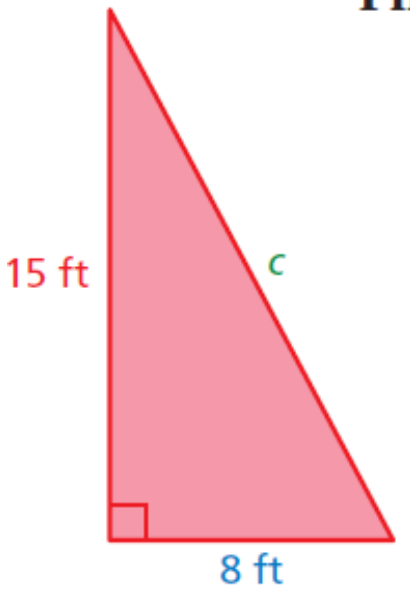

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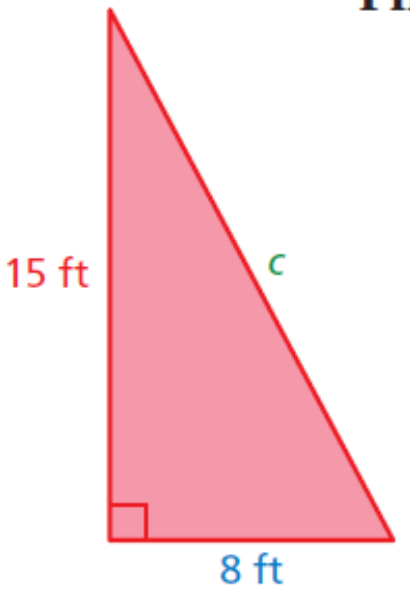

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$225 + 64 = c^2$ Evaluate powers.

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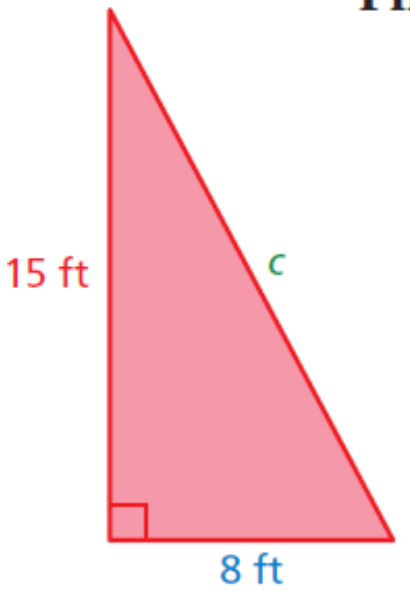

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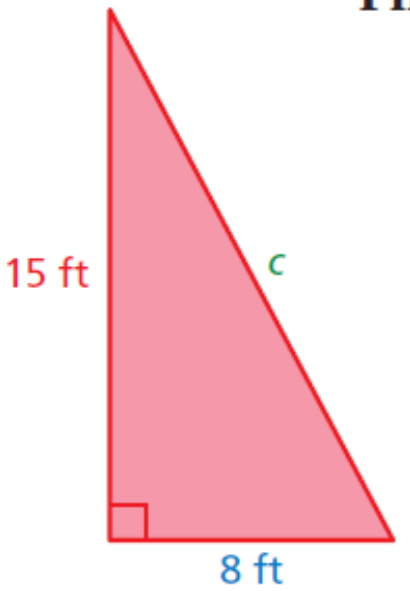

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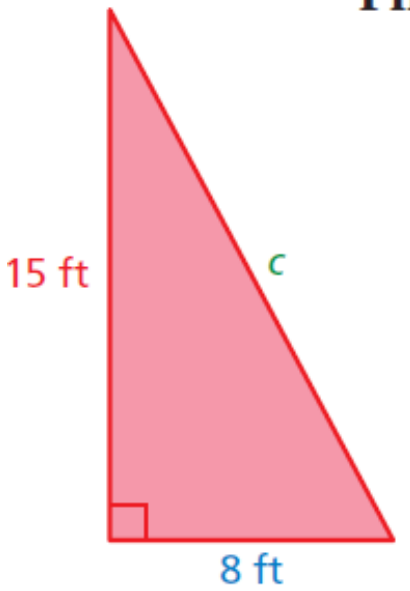

$a^2 + b^2 = c^2$	Write the Pythagorean Theorem.
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$289 = c^2$	Add.
$\sqrt{289} = \sqrt{c^2}$	Take positive square root of each side.
$17 = c$	Simplify.

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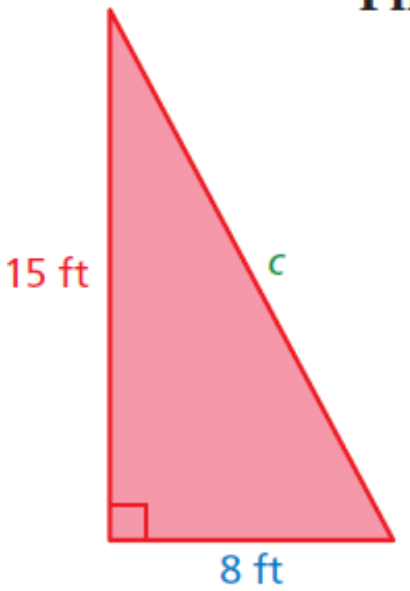

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$289 = c^2$ Add.

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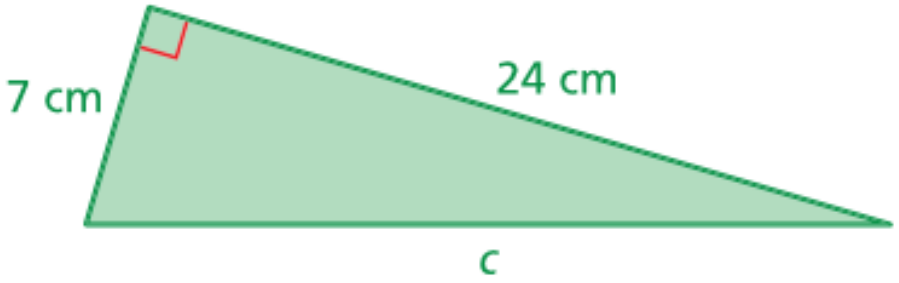
The length of the hypotenuse is 17 feet.

On Your Own

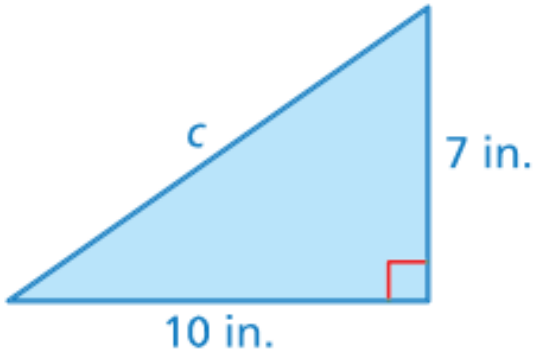
Find the length of the hypotenuse of the triangle.

1.



$c = 25\ cm$

2.

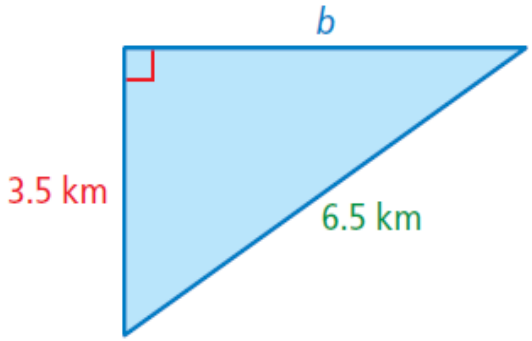


$c = \sqrt{149}\ in$

$c \approx 12.2\ in$

EXAMPLE 2 Finding the Length of a Leg

Find the missing length of the triangle.



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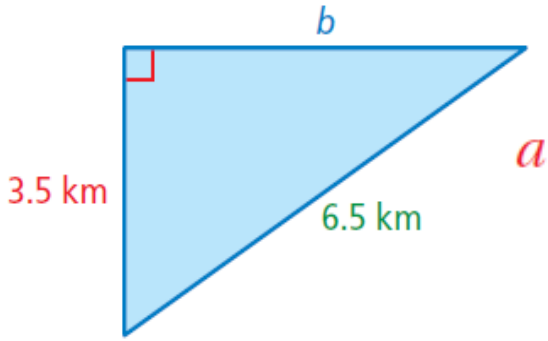

$a^2 + b^2 = c^2$

Write the Pythagorean Theorem.

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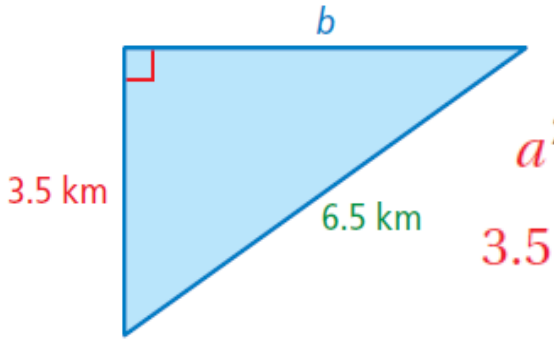

$a^2 + b^2 = c^2$ Write the Pythagorean Theorem.

$3.5^2 + b^2 = 6.5^2$ Substitute 3.5 for *a* and 6.5 for *c*.

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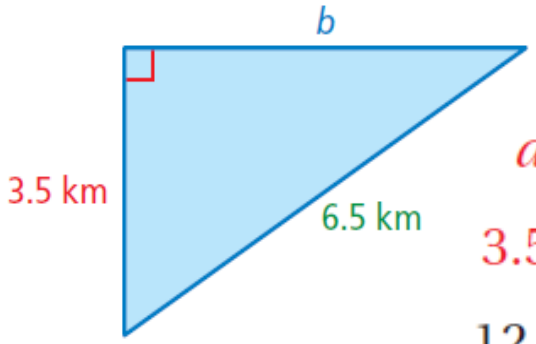

$a^2 + b^2 = c^2$ Write the Pythagorean Theorem.

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$12.25 + b^2 = 42.25$ Evaluate powers.

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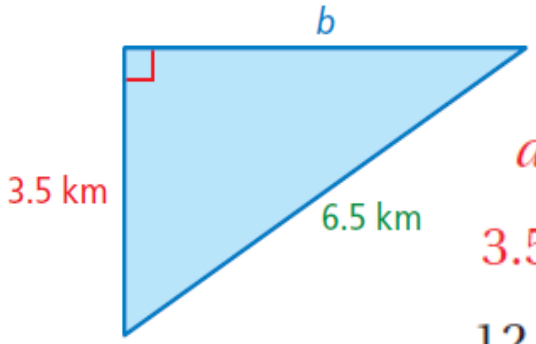

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$b^2 = 30$ Subtract 12.25 from each side.

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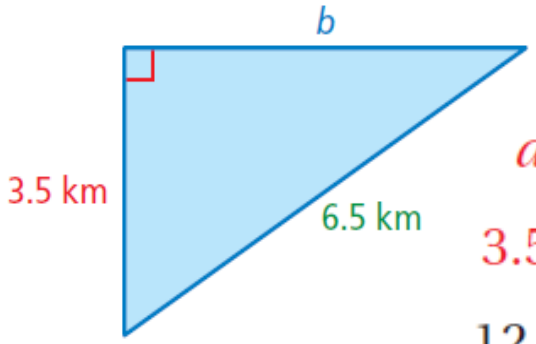

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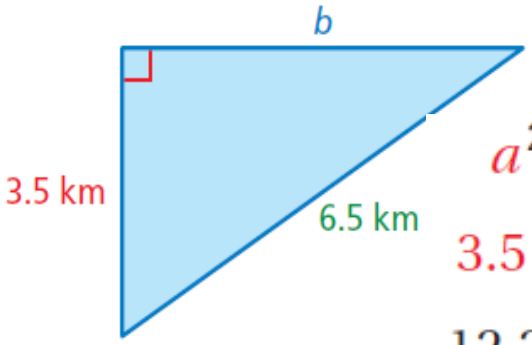

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$$12.25 + b^2 = 42.25$$ Evaluate powers.

$$b^2 = 30$$ Subtract 12.25 from each side.

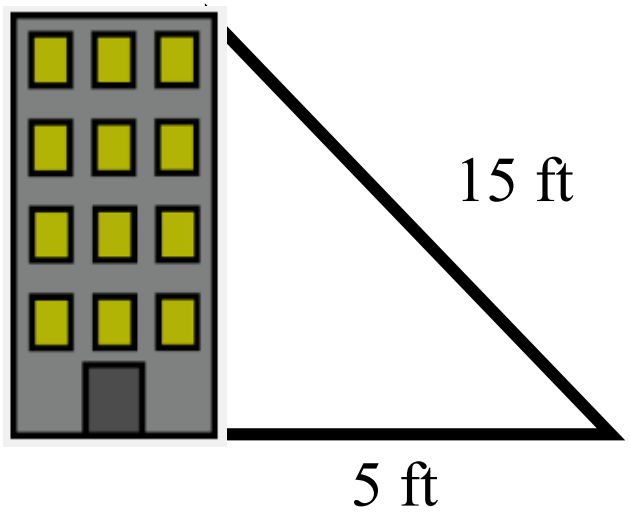
$$b = \sqrt{30}$$ Take positive square root of each side.

The length of the leg is $\sqrt{30} \approx 5.5$ kilometers.

EXAMPLE 3 Real-Life Application

A 15 foot ladder leans up against a building. The foot of the ladder is 5 feet from the base of the building. How high up the wall, to the nearest foot does the ladder reach?

Draw a picture:



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

$$a^2 + 5^2 = 15^2$$

$$a^2 + 25 = 225$$

$$a^2 = 200$$

$$\sqrt{a^2} = \sqrt{200}$$

$$a = \sqrt{200}\ \text{ft}$$

$$a = 14.14\ ft$$

The ladder reaches about 14 feet up the wall.