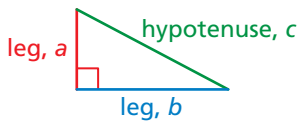
Name _____ Date _____

The Pythagorean Theorem

In a right triangle, the **hypotenuse** is the side opposite the right angle. The **legs** are the two sides that form the right angle.

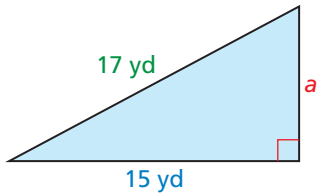
The **Pythagorean Theorem** states that in any right triangle, the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse.

Pythagorean Theorem



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

Example 1 **Find the missing length of the triangle.**

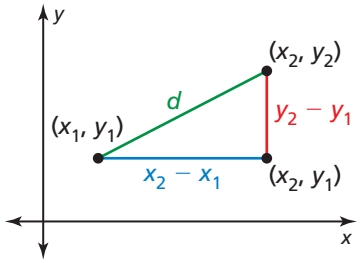


$a^2 + b^2 = c^2$	Write the Pythagorean Theorem.
$a^2 + 15^2 = 17^2$	Substitute 15 for b and 17 for c.
$a^2 + 225 = 289$	Evaluate powers.
$a^2 = 64$	Subtract 225 from each side.
$a = 8$	Take positive square root of each side.

▶ The missing length is 8 yards.

You can use the Pythagorean Theorem to develop the *Distance Formula*. You can use the **Distance Formula** to find the distance d between any two points (x_1, y_1) and (x_2, y_2) in a coordinate plane.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$



Example 2 **Find the distance between the two points.**

a. $(3, 6), (-2, 4)$

Let $(x_1, y_1) = (3, 6)$ and $(x_2, y_2) = (-2, 4)$.

$$\begin{aligned} d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(-2 - 3)^2 + (4 - 6)^2} \\ &= \sqrt{25 + 4} \\ &= \sqrt{29} \end{aligned}$$

b. $(0, 5), (4, -1)$

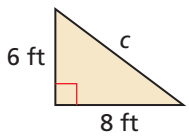
Let $(x_1, y_1) = (0, 5)$ and $(x_2, y_2) = (4, -1)$.

$$\begin{aligned} d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(4 - 0)^2 + (-1 - 5)^2} \\ &= \sqrt{16 + 36} \\ &= 2\sqrt{13} \end{aligned}$$

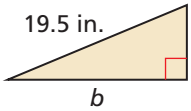
Practice

Check your answers at BigIdeasMath.com.

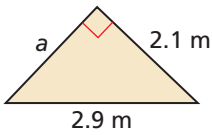
Find the missing length of the triangle.

1. 

10 ft

2. 

18 in.

3. 

2 m

Find the distance between the two points.

4. $(0, 0), (4, 3)$ 5

5. $(0, -7), (5, 5)$ 13

6. $(4, 2), (-1, 5)$ $\sqrt{34}$

7. $(-5, 6), (-7, -2)$ $2\sqrt{17}$

8. $(-1, -3), (9, 0)$ $\sqrt{109}$

9. $(-4, -4), (-1, -1)$ $3\sqrt{2}$