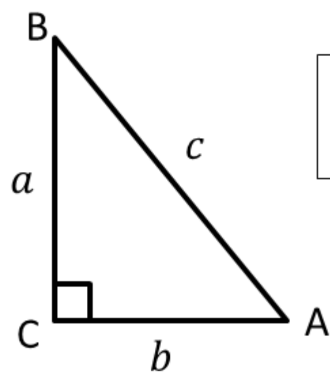
## Objective: Solve Right Triangle Problems Using the Pythagorean Theorem

### Concept

Given two sides of a right triangle, the third side is found using the Pythagorean Theorem.



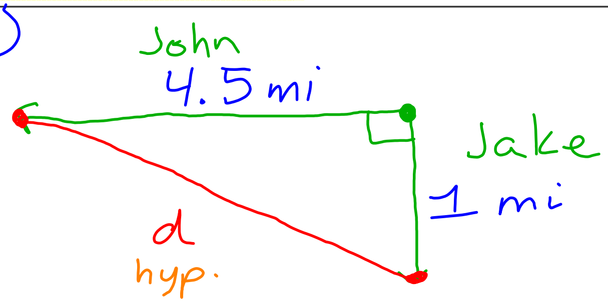

The Pythagorean Theorem

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

## Objective: Solve Right Triangle Problems Using the Pythagorean Theorem

Ex) From the corner of 5th Street and Elm Avenue, Jake walks due south at 2 miles per hour and John rides his bike due west at 9 miles per hour. How far apart are Jake and John after 30 minutes? Round to the nearest tenth of a mile.

(1)




(2) John's distance

$$\frac{9\,mi}{1\,hr} \cdot \frac{0.5\,hr}{1} = 4.5\,mi$$

(3) Jake's distance

$$\frac{2\,mi}{1\,hr} \cdot \frac{0.5\,hr}{1} = 1\,mi$$

(4) $d^2 = 4.5^2 + 1^2$

$$d = \sqrt{(4.5^2 + 1^2)}$$

$$\approx 4.6\ mi$$

(5) After 30 minutes, Jake and John are about 4.6 miles apart.

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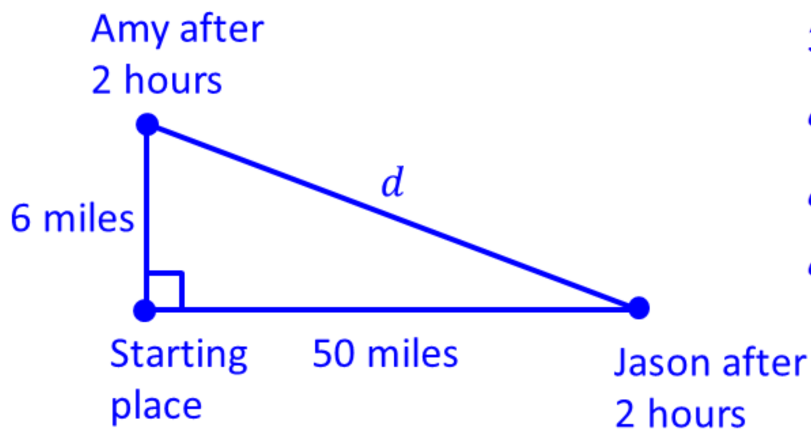
Practice) From the same intersection, Amy walks due north at 3 miles per hour and Jason drives due east at 25 miles per hour. How far apart are Amy and Jason after 2 hours? Round to the nearest tenth of a mile.




$$50^2 + 6^2 = d^2$$

$$d^2 = 2536$$

$$d = \sqrt{2536}$$

$$d \approx 50.4\, miles$$

After 2 hours, Amy and Jason are about 50.4 miles apart.

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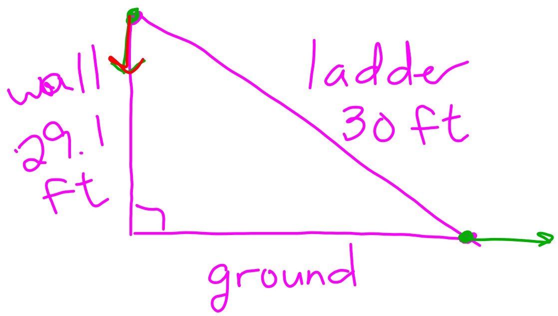
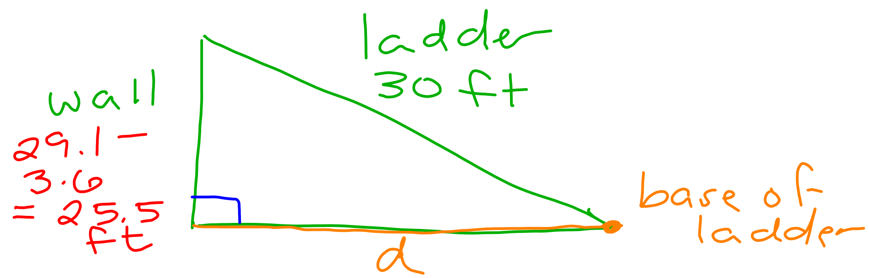
Practice) A 30-foot ladder leans against a wall at a height of 29.1 feet. The ladder then starts to slip down the wall at a constant speed of 1.2 feet per second. After 3 seconds, how far from the wall is the base of the ladder? Round to the nearest tenth.

(1)




(2)




(3) $1.2 \frac{ft}{sec} \cdot \frac{3 sec}{1} = 3.6 ft$

(4)

$$25.5^2 + d^2 = 30^2$$

$$d^2 = 30^2 - 25.5^2$$

$$d = \sqrt{30^2 - 25.5^2}$$

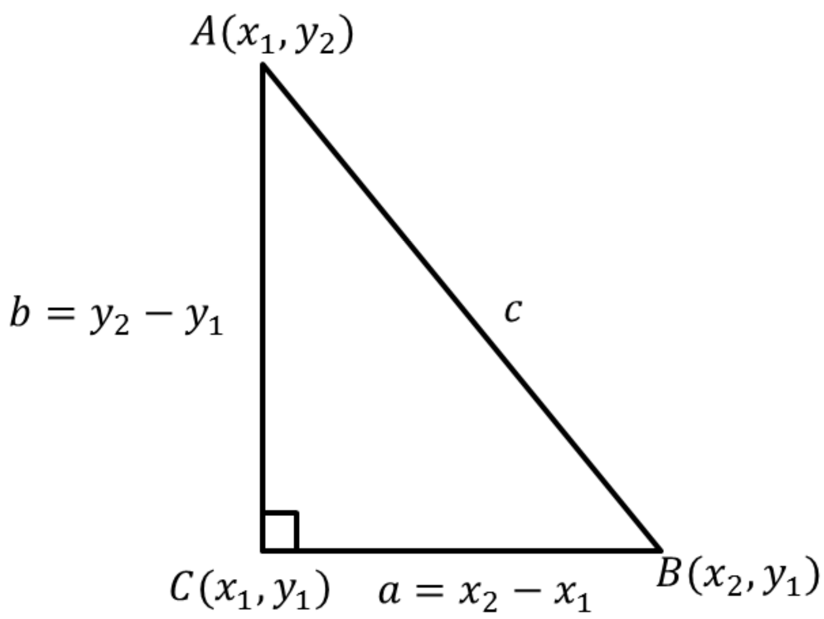
$$d \approx 15.8 \text{ feet}$$

(5) After 3 seconds the base of the ladder is about 15.8 feet from the wall.

## Objective: Solve Right Triangle Problems Using the Pythagorean Theorem

### Concept

**The Distance Formula**, which is used to find the distance, $d$, between any two points, is derived from the Pythagorean Theorem. The distance between any two non-vertical or non-horizontal points will correspond to the length of the hypotenuse of a right triangle when in context.




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

$$(x_2 - x_1)^2 + (y_2 - y_1)^2 = c^2$$

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

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

↓

**The Distance Formula**

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

# Objective: Solve Right Triangle Problems Using the Pythagorean Theorem

## Concept

Given two points $(x_1, y_1)$ and $(x_2, y_2)$, the distance between the points can be found using the Distance Formula. In context, the distance corresponds to length.

### The Distance Formula

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

## Objective: Solve Right Triangle Problems Using the Pythagorean Theorem

Practice) What is the length of a line segment, to the nearest tenth of a unit, if the endpoints are at $(-2, 7.5)$ and $(-3.1, 8.4)$?

$x_1$ $y_1$ $x_2$ $y_2$

$$\text{length} = \text{distance} = \sqrt{(-3.1 - -2)^2 + (8.4 - 7.5)^2}$$

$$= \sqrt{(-1.1)^2 + (0.9)^2}$$

$$\approx 1.4 \text{ units}$$

The length of the line segment is about 1.4 units.

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Practice) An object starts at $(6,14)$ and travels in a straight line for 7 minutes. At the end of the seven minutes the object is at $(-11,-3)$. How far, to the nearest tenth of a unit, did the object travel?

$$\text{distance} = \sqrt{(6-(-11))^2 + (14-(-3))^2}$$

$$\text{distance} = \sqrt{(17)^2 + (17)^2}$$

$$\text{distance} = \sqrt{578}$$

$$\text{distance} \approx 24.0\,units$$

The object traveled about 24.0 units in 7 minutes.

## Objective: Solve Right Triangle Problems Using the Pythagorean Theorem

### Closure

What relates the three sides of any right triangle?

The Pythagorean Theorem.