Lesson 9.1 Pythagorean Theorem

Wednesday, March 29, 2023 8:56 PM

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Pythagor... Theorem

Pythagorean Theorem and Its Converse

Workbook pages 127-130

Content Objective

Students will solve problems using the Pythagorean Theorem and its converse.

Florida's B.E.S.T. Standards for Mathematics

MA.912.GR.3.2

Given a mathematical context, use coordinate geometry to classify or justify definitions, properties and theorems involving circles, triangles or quadrilaterals.

MA.912.T.1.2

Solve mathematical and real-world problems involving right triangles using trigonometric ratios and the Pythagorean Theorem.

Learn

The Pythagorean Theorem

The Pythagorean Theorem relates the lengths of the hypotenuse and legs of a right triangle.

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

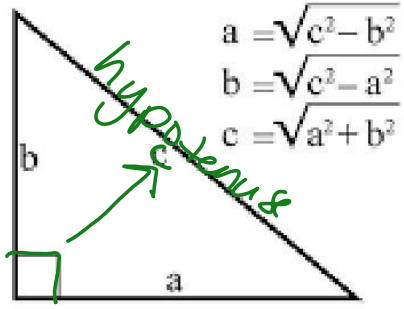
The Pythagorean Theorem

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

$a = \sqrt{c^2 - b^2}$

$b = \sqrt{c^2 - a^2}$

$c = \sqrt{a^2 + b^2}$



Learn

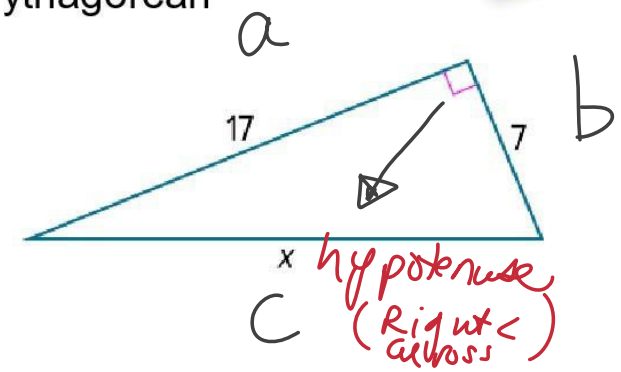
The Pythagorean Theorem

A **Pythagorean triple** is a set of three nonzero whole numbers *a*, *b*, and *c*, such that $a^2 + b^2 = c^2$. The most common Pythagorean triples are shown below in the first row. The triples below them are found by multiplying each number in the triple by the same factor.

Common Pythagorean Triples			
3, 4, 5	**5, 12, 13**	**8, 15, 17**	**7, 24, 25**
6, 8, 10	10, 24, 26	16, 30, 34	14, 48, 50
9, 12, 15	15, 36, 39	24, 45, 51	21, 72, 75
3*x*, 4*x*, 5*x*	5*x*, 12*x*, 13*x*	8*x*, 15*x*, 17*x*	7*x*, 24*x*, 25*x*

Find Missing Measures by Using the Pythagorean Theorem

Find the value of *x*.



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

$c^2 = 17^2 + 7^2$

$c^2 = 289 + 49$

$c^2 = 338$

$c^2 = 338$

$c = \sqrt{338}$

$c = 18.4$

Find Missing Measures by Using the Pythagorean Theorem

Find the value of *x*.

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

$17^2 = a^2 + 8^2$

$289 = a^2 + 64$

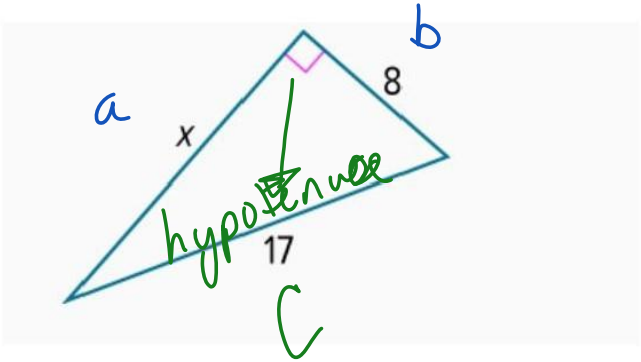
$-64 \quad -64$

$225 = a^2$

$a^2 = 225$

$a = \sqrt{225}$

$a = 15$



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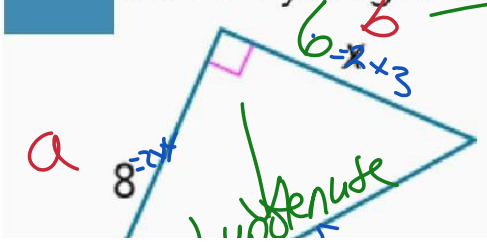
Find Missing Measures by Using the Pythagorean Theorem

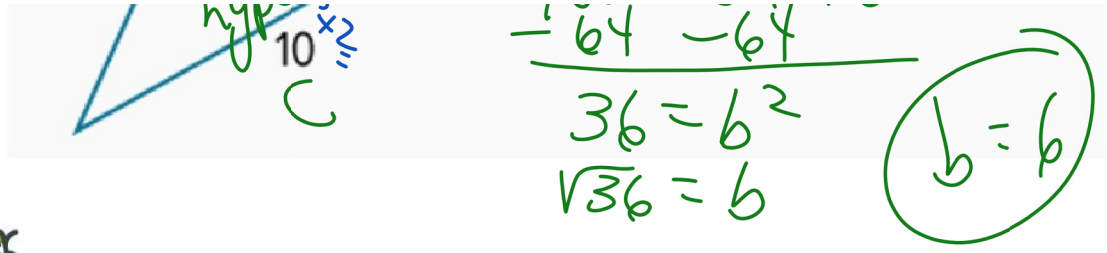
Use a Pythagorean Triple to find the value of x.



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

$10^2 = 8^2 + b^2$

$100 = 64 + b^2$



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Example 3
Use the Pythagorean Theorem

ZIP LINING A summer camp is building a new zip lining course. The designer of the course wants the last zip line to start at a platform 450 meters above the ground and end 775 meters away from the base of the platform. How long must the zip line be to meet the designer's specifications?

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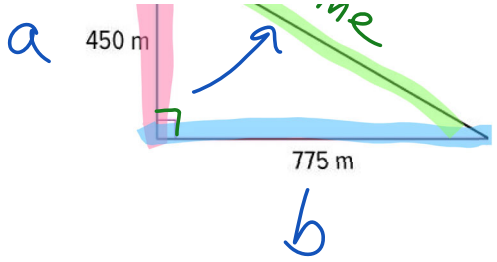
Example 3
Use the Pythagorean Theorem

Step 1 **Visualize and describe the situation.**

The base of the platform and the ground should be approximately perpendicular. We need to find the length of the zip line, which is the hypotenuse of a right triangle. Draw a diagram that models the situation.



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Example 3

Use the Pythagorean Theorem

Step 2 Find the length of the zip line.

Use the Pythagorean Theorem to find the length x of the zip line.

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

$450^2 + 775^2 = x^2$

$202{,}500 + 600{,}625 = x^2$

$803{,}125 = x^2$

$x = \sqrt{803{,}125}$

$x = 896.17$

$x = 896.2$

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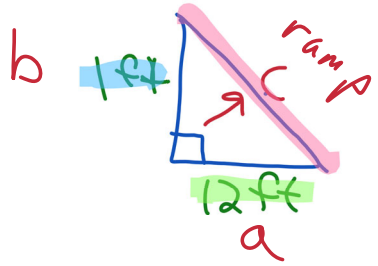
Example 3

Use the Pythagorean Theorem

Check

Check

RAMPS Lincoln High School is installing more wheelchair ramps around the school. One of the new ramps needs to have a base that is 12 feet long and reaches a height of 1 foot. If the side of the ramp forms a right triangle, how long should the inclined surface of the ramp be? Find the exact length of the inclined surface of the ramp.



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

$12^2+1^2=c^2$

$144+1=c$

$145=c^2$

$\sqrt{145}=c$

$12=c$

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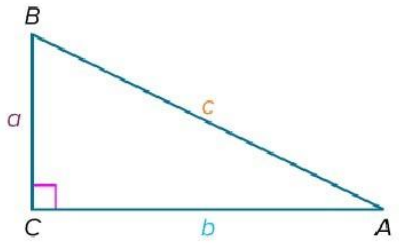
Learn

Converse of the Pythagorean Theorem

Converse of the Pythagorean Theorem

If the sum of the squares of the lengths of the shortest sides of a triangle is equal to the square of the length of the longest side, then the triangle is a right triangle.



Example

If $a^2 + b^2 = c^2$, then $\triangle ABC$ is a right triangle.

You can also use side lengths to classify a triangle as acute or obtus

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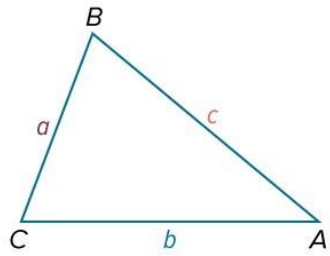
Learn

Converse of the Pythagorean Theorem

If the square of the length of the longest side of a triangle is less than the sum of the squares of the lengths of the other two sides, then the triangle is an acute triangle.

Example

If $c^2 < a^2 + b^2$, then $\triangle ABC$ is acute.



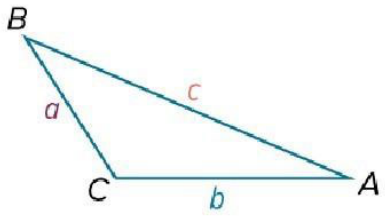
Learn

Converse of the Pythagorean Theorem

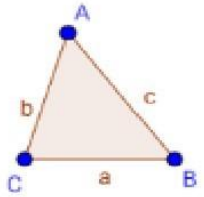
If the square of the length of the longest side of a triangle is greater than the sum of the squares of the lengths of the other two sides, then the triangle is an obtuse triangle.

Example

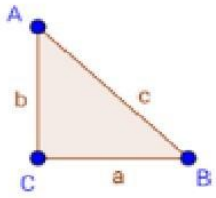
If $c^2 > a^2 + b^2$, then $\triangle ABC$ is obtuse.



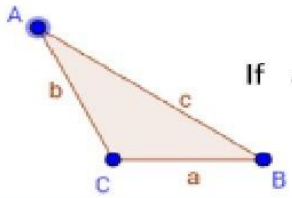
Converse of Pythagorean Theorem



If $c^2 < a^2 + b^2$ then ABC is an acute triangle



If $c^2 = a^2 + b^2$ then ABC is right triangle



If $c^2 > a^2 + b^2$ then ABC is an obtuse triangle

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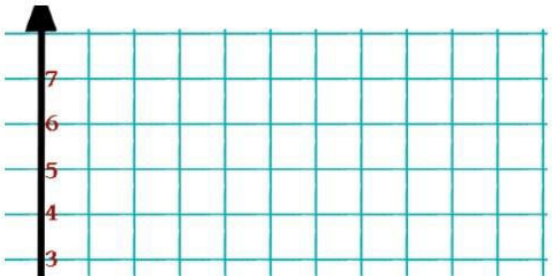
Example 4

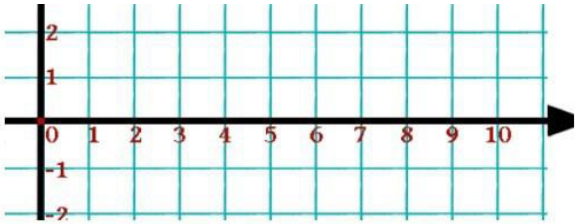
Classify Triangles

Determine whether the points *A*(2, 2), *B*(5, 7), and *C*(10, 6) can be the vertices of a triangle.

If so, classify the triangle as *acute*, *right*, or *obtuse*.

Justify your answer.





Example 4
Classify Triangles

Step 1 Calculate the measures of the sides.

Use the Distance Formula to calculate the measures of $\overline{AB}$, $\overline{BC}$ and $\overline{AC}$.

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Example 4
Classify Triangles

Step 3 Classify the triangle.

Classify the triangle by comparing the square of the longest

side to the sum of the squares of the other two sides.

$c^2 \stackrel{?}{=} a^2 + b^2$

Compare c^2 and $a^2 + b^2$.