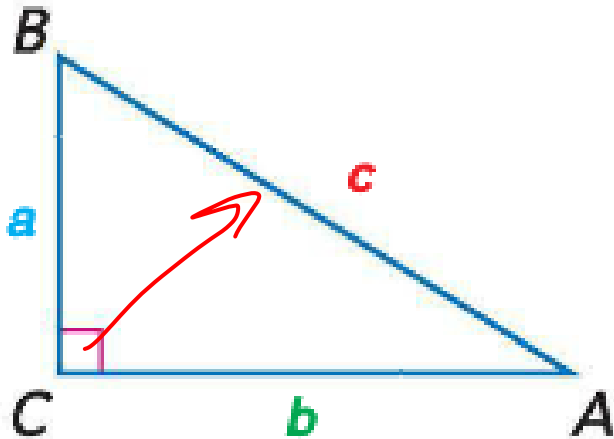




# Pythagorean Theorem

# Pythagorean Theorem

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

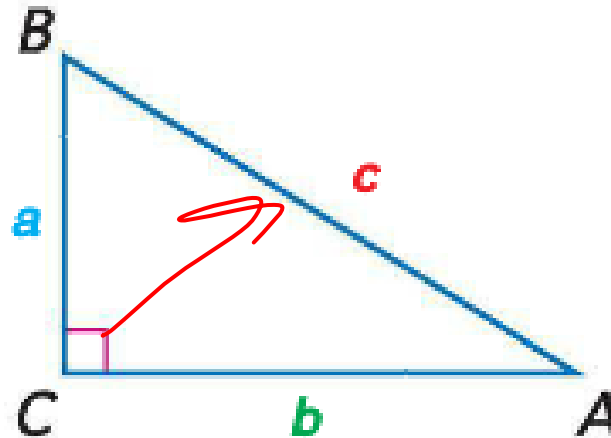


$$a^2 + b^2 = c^2$$

# Converse of the Pythagorean Theorem

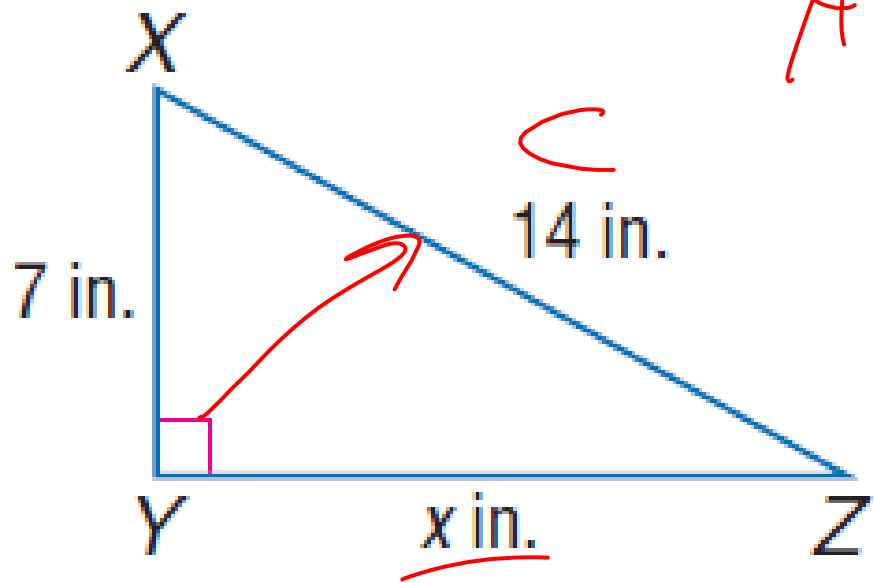
- If the sum of the squares of the measures of two sides of a triangle equals the square of the measure of the longest side, then the triangle is a right triangle.

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



# Examples

- Find x.



$$7^2 + x^2 = 14^2$$

$$49 + x^2 = 196$$

$$-49 \quad -49$$

$$\sqrt{x^2} = \sqrt{147}$$

$$x = \sqrt{147}$$

$$= \sqrt{3 \cdot 7 \cdot 7}$$

$$= 7\sqrt{3}$$

$$= \sqrt{7 \cdot 21}$$

$$= \sqrt{7 \cdot 7 \cdot 3}$$

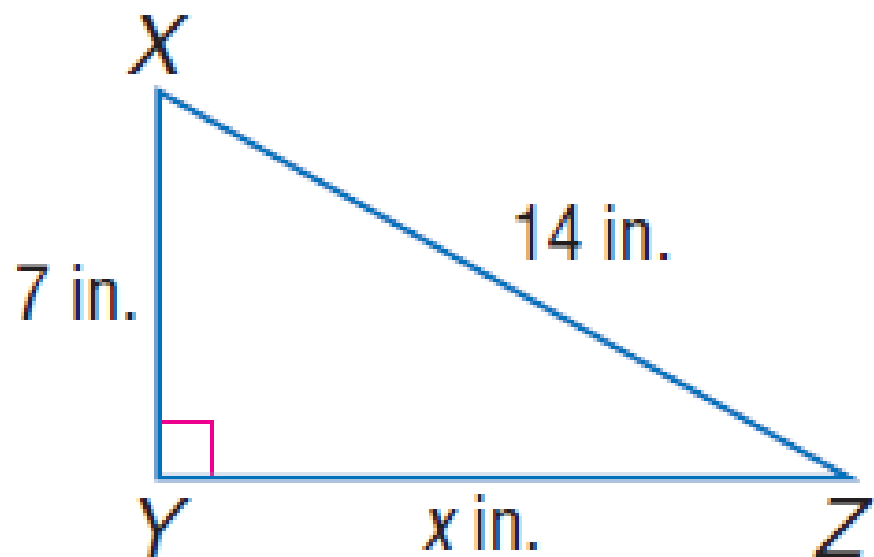
$$= 7\sqrt{3}$$

7 SORT 3

$$\begin{array}{r} 147 \\ \hline 1 \quad 147 \\ \hline \cancel{3} \quad \cancel{49} \\ \hline 7 \quad 21 \end{array}$$

# Examples

- Find  $x$ .



$$7^2 + x^2 = 14^2$$

$$x^2 = 14^2 - 7^2$$

$$x^2 = 196 - 49$$

$$x^2 = 147$$

$$x = \sqrt{147} = \sqrt{7 * 21} = \sqrt{7 * 7 * 3}$$

$$x = 7\sqrt{3}$$

# Pythagorean Triple

- A Pythagorean triple is a set of three nonzero whole numbers  $a$ ,  $b$ , and  $c$ , such that  $a^2 + b^2 = c^2$ .

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
$3x, 4x, 5x$	$5x, 12x, 13x$	$8x, 15x, 17x$	$7x, 24x, 25x$

2

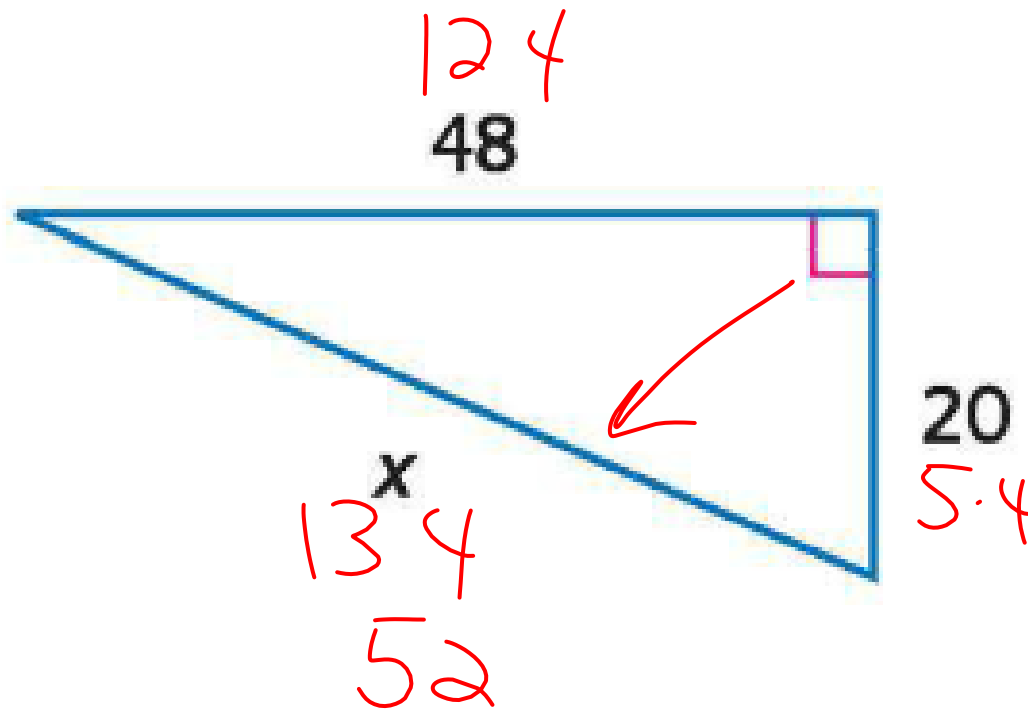
4

3

5  
9, 40, 41

# Examples

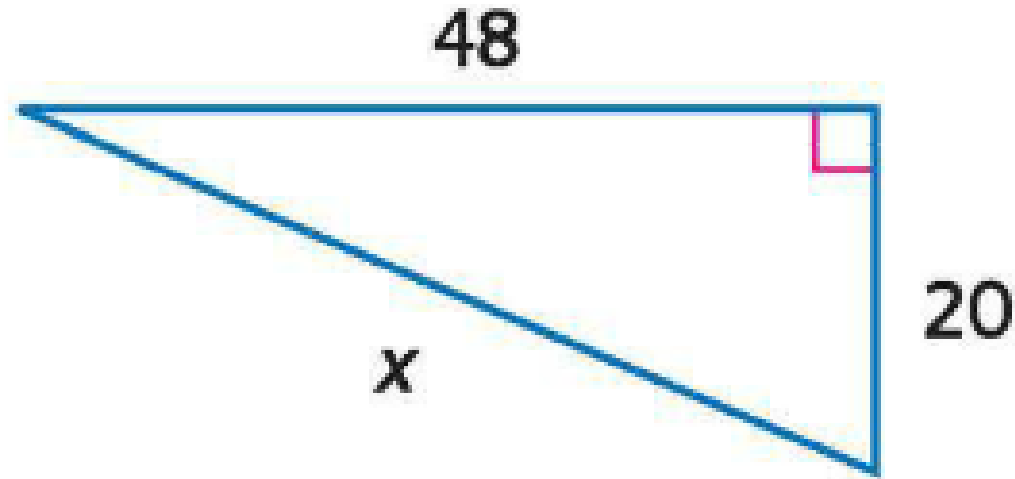
- Use a Pythagorean triple to find  $x$ . Explain your reasoning.



# Examples

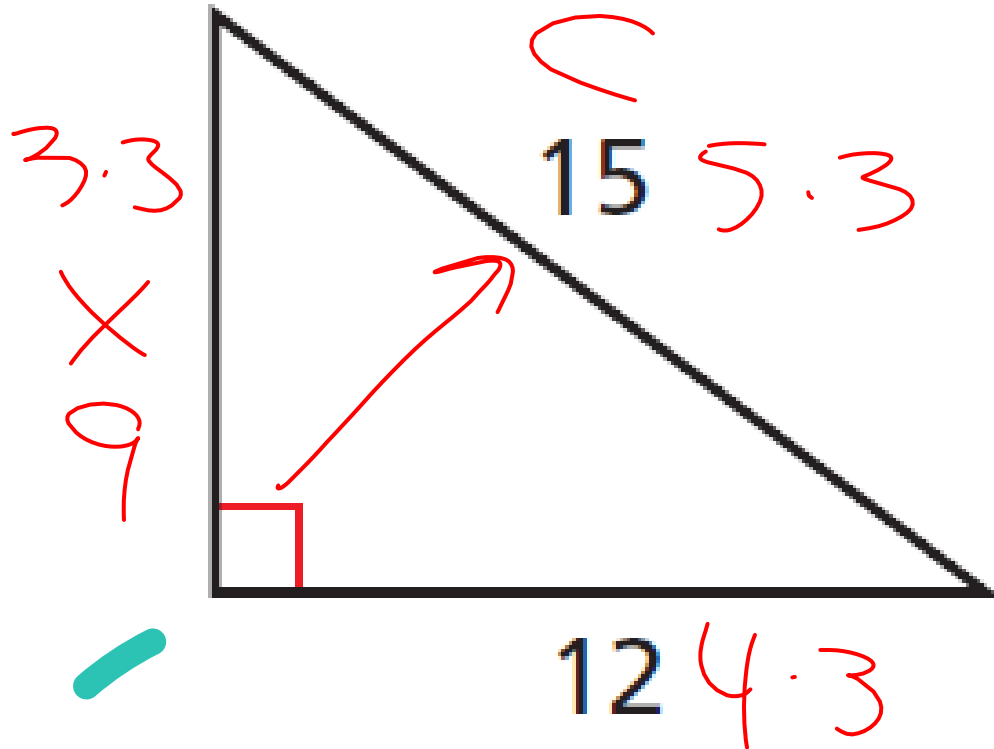
- Use a Pythagorean triple to find  $x$ . Explain your reasoning.

- $20 = 5 \cdot 4$
- $48 = 12 \cdot 4$
- $x = 13 \cdot 4 = 52$



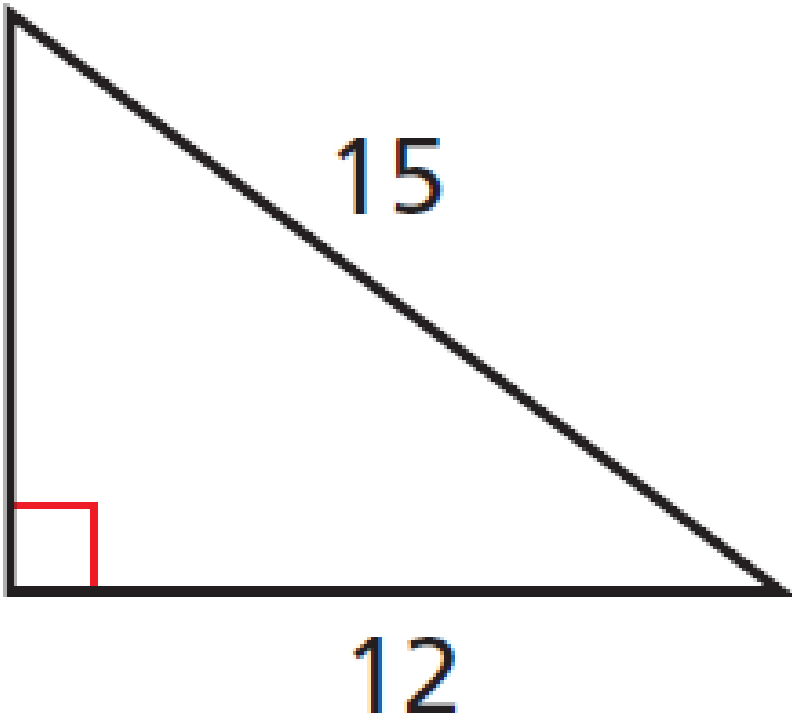
# Examples

- Use a Pythagorean triple to find the missing side. Explain your reasoning.



# Examples

- Use a Pythagorean triple to find the missing side. Explain your reasoning.



3, 4, 5:

$$15/3 = 5$$

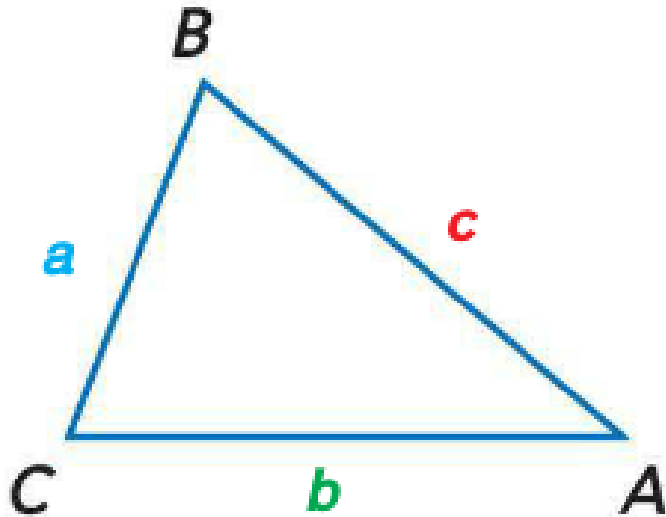
$$12/3 = 4$$

$$x/3 = 3$$

$$x = 9$$

# Pythagorean Inequality Theorem

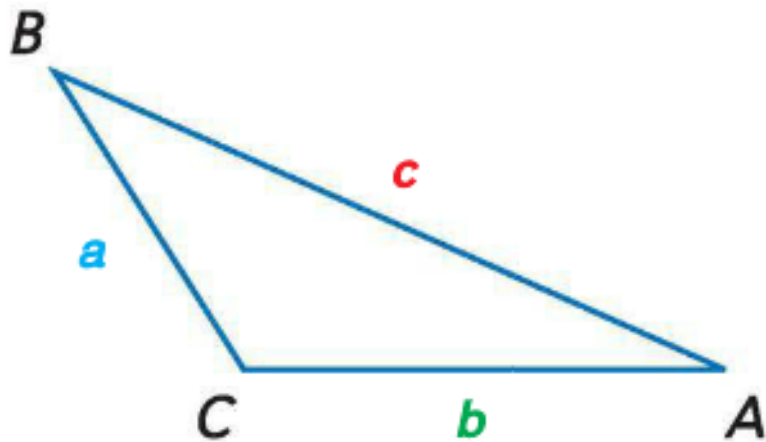
- If the square of the length of the hypotenuse is less than the sum of the squares of the lengths of the other two sides, then the triangle is an acute triangle.



$$c^2 < a^2 + b^2$$

# Pythagorean Inequality Theorem

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



$$c^2 > a^2 + b^2$$

# Examples

- Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right.

• 8, 11, 13

$$8 + 11 > 13$$

$$11 + 13 > 8$$

$$8 + 13 > 11$$

$$8^2 + 11^2 < 13^2$$
$$64 + 121 > 169$$
$$185 > 169$$
$$9^2 + 5^2 < 13^2$$

Acute

# Examples

- Tell if the measures can be the side lengths of a triangle. If so, classify the triangle as acute, obtuse, or right.
- 8, 11, 13
  - $c^2 \leq a^2 + b^2$
  - $13^2 \leq 11^2 + 8^2$
  - $169 \leq 121 + 64$
  - $169 < 185$
  - Acute triangle