Geometry Unit 8
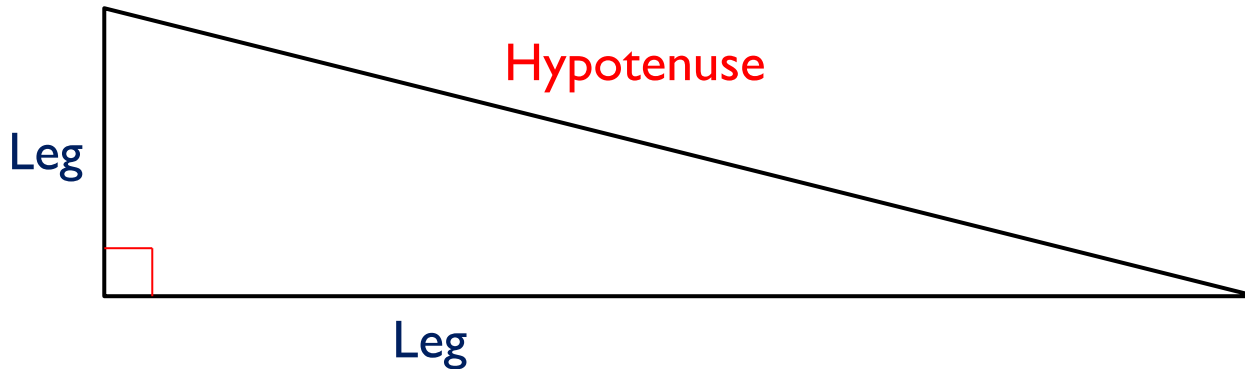
The Pythagorean Theorem

The Pythagorean Theorem

- **Content Objective:** Students will be able to find missing side lengths of Right Triangles using the Pythagorean Theorem.

- **Language Objective:** Students will be to state and write equations using the Pythagorean Theorem, as well as identify Pythagorean Triples.

Right Triangles

▶ The sides of a right triangle named as such:
  ▶ The side opposite the right angle is known as the **Hypotenuse.**
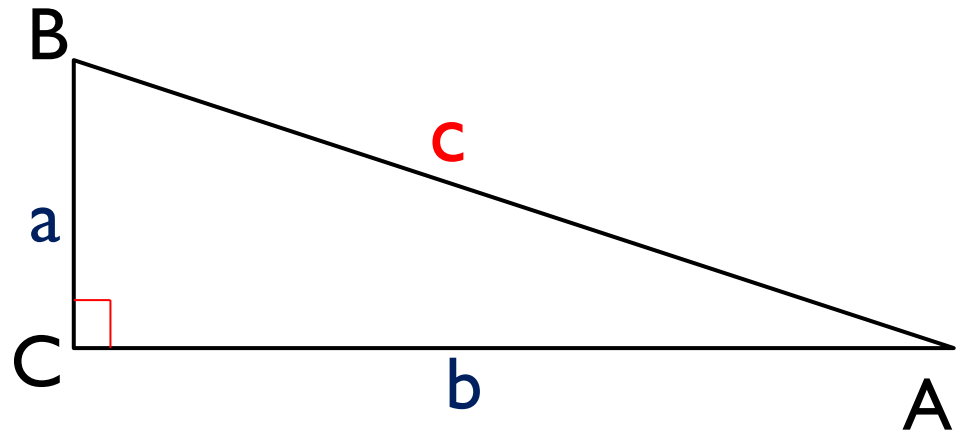 ▶ The other two sides are known as the **Legs.**

Hypotenuse

Leg

Leg

▶

The Pythagorean Theorem

▸ **Theorem 8-2 – The Pythagorean Theorem**: In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the legs.

Given: $\Delta ABC; < ACB$ is a right angle

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

▸

Pythagorean Theorem Examples

▸ Use the Pythagorean Theorem to find the value of x.

$a = 5$

$b = 12$
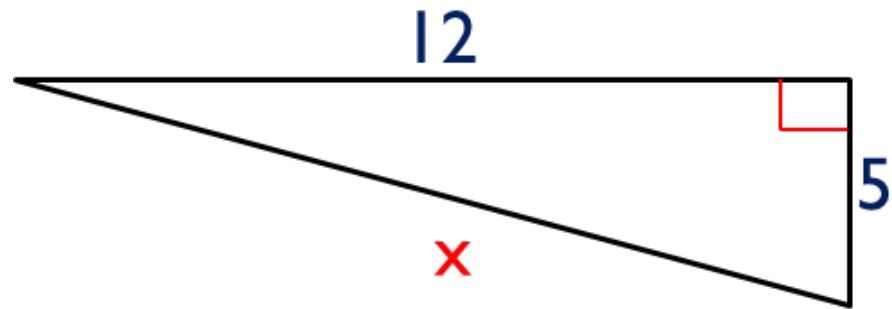
$c = x$

Then $x^2 = 5^2 + 12^2$

$x^2 = 25 + 144$

$x^2 = 169$

$x = \sqrt{169} = 13$

Pythagorean Theorem Examples

▸ Use the Pythagorean Theorem to find the value of x.

$a = x$

$b = 9$
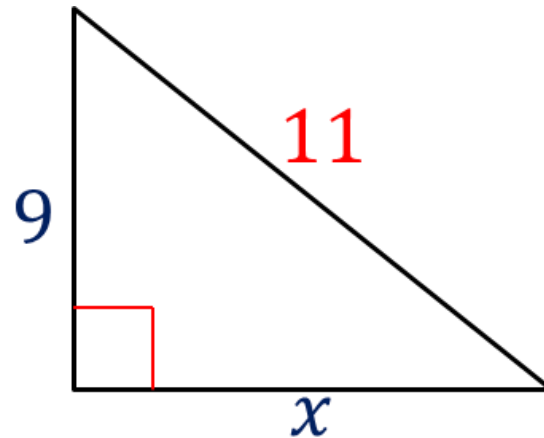
$c = 11$

Then $11^2 = x^2 + 9^2$

$121 = x^2 + 81$

$x^2 = 40$

$x = \sqrt{40} = 2\sqrt{10}$

Pythagorean Triples

▸ When a right triangle has side lengths that are all whole numbers, we call those a **Pythagorean Triple**

▸ Here is a list of (a few) 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

12 – 16 – 20

15 – 20 – 25

▸

More Pythagorean Theorem Examples

▸ Find the value of x.

1.) $3^2 + 4^2 = x^2$

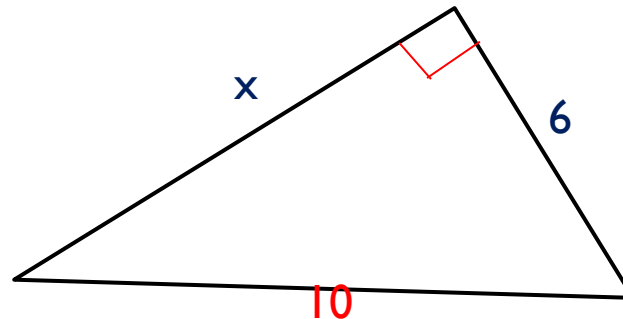$\qquad 9 + 16 = x^2$

$\qquad 25 = x^2$

$x = \sqrt{25} = 5$
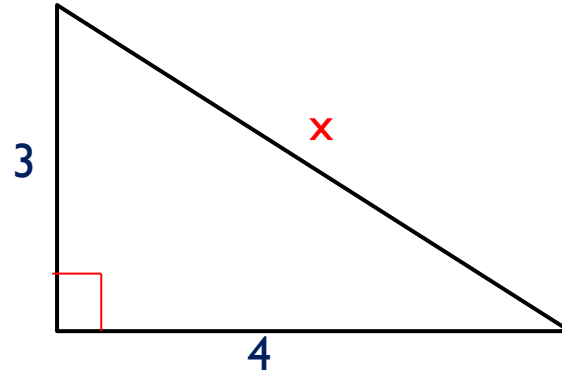
2.) $6^2 + x^2 = 10^2$

$\qquad 36 + x^2 = 100$

$\qquad x^2 = 64$
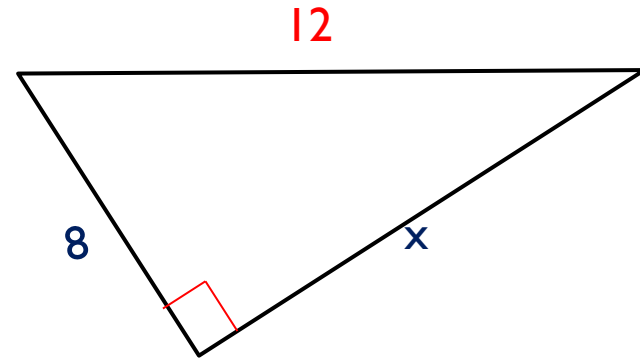
$x = \sqrt{64} = 8$

More Pythagorean Theorem Examples

▸ Find the value of x.

3.) $8^2 + x^2 = 12^2$

$\quad 64 + x^2 = 144$

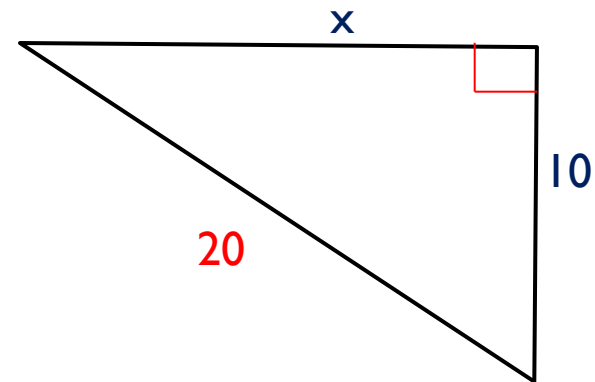$\quad x^2 = 80$

$x = \sqrt{80} = \sqrt{16 * 5} = 4\sqrt{5}$

12

8

x

4.) $10^2 + x^2 = 20^2$

$\quad 100 + x^2 = 400$

$\quad x^2 = 300$

$x = \sqrt{300} = \sqrt{100 * 3} = 10\sqrt{3}$

x
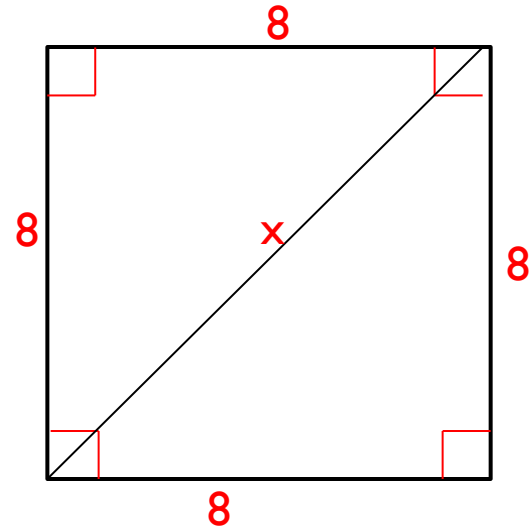
10

20

More Pythagorean Theorem Examples

▸ Find the value of x.

5.) $8^2 + 8^2 = x^2$

$\qquad 64 + 64 = x^2$

$\qquad x^2 = 128$

$x = \sqrt{128} = \sqrt{64 * 2} = 8\sqrt{2}$

6.) $7^2 + 24^2 = x^2$

$\qquad 49 + 576 = x^2$

$\qquad x^2 = 625$

$x = \sqrt{625} = 25$