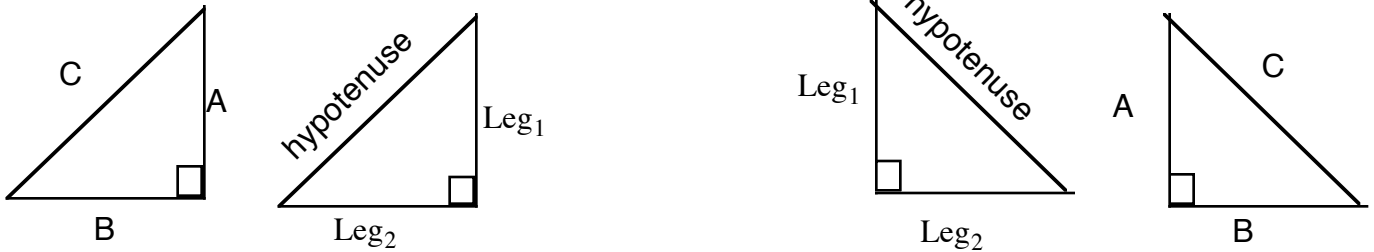


Section 9 – 6: The Pythagorean Theorem

A right triangle is any triangle with a 90 degree or right angle. The sides of a right triangle have special names. **The two shorter sides are called legs.** The two legs form the right angle and are called legs. A square box is used to show the location of the right angle. **The longest of the three sides is called the hypotenuse** and is located across from the right angle.

The length of one of the legs is labeled A and the length of the other leg is labeled B. The length of the hypotenuse is always labeled C.



The Pythagorean Theorem states that the **square of the first leg** can be **added to the square of the second leg** and that total will **equal the square of the hypotenuse.**

Pythagorean Theorem

If A and B are the lengths of the legs of a right triangle and C is the length of the hypotenuse then

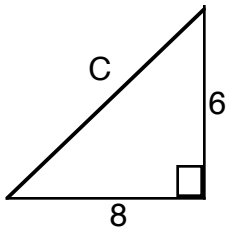
$$A^2 + B^2 = C^2$$

If we know any 2 sides of a right triangle then we can use the Pythagorean Theorem to find the length of the third side.

Finding the missing side in a Right Triangle

1. List the two values that you know.
2. Put the values that you know into $A^2 + B^2 = C^2$
3. Square the given numbers. There will not be any square roots at this points.
4. Get the variable term alone.
5. Take the square root of each side.
6. Reduce the square root if possible

Example 1



Find the hypotenuse C

if $A = 8$ $B = 6$

$$A^2 + B^2 = C^2$$

$$(8)^2 + (6)^2 = C^2$$

$$64 + 36 = C^2$$

$$100 = C^2$$

take the square root of both sides

$$\sqrt{100} = \sqrt{C^2}$$

$$10 = C$$

Example 3

Find the hypotenuse C

if $A = 2$ $B = 4$

$$A^2 + B^2 = C^2$$

$$(2)^2 + (4)^2 = C^2$$

$$4 + 16 = C^2$$

$$20 = C^2$$

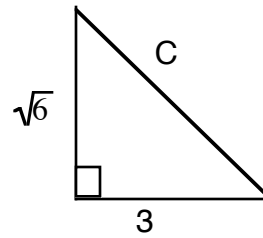
take the square root of both sides

$$\sqrt{20} = \sqrt{C^2}$$

$$\sqrt{4 \cdot 5} = C$$

$$2\sqrt{5} = C$$

Example 2



Find the hypotenuse C

if $A = \sqrt{6}$ $B = 3$

$$A^2 + B^2 = C^2$$

$$(\sqrt{6})^2 + (3)^2 = C^2$$

$$6 + 9 = C^2$$

$$15 = C^2$$

take the square root of both sides

$$\sqrt{15} = \sqrt{C^2}$$

$$\sqrt{15} = C$$

Example 4

Find the hypotenuse C

if $A = 2\sqrt{3}$ $B = \sqrt{6}$

$$A^2 + B^2 = C^2$$

$$(2\sqrt{3})^2 + (\sqrt{6})^2 = C^2$$

$$4 \cdot 3 + 6 = C^2$$

$$18 = C^2$$

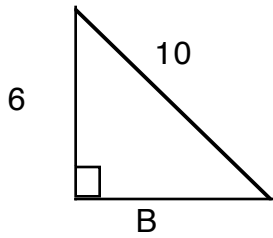
take the square root of both sides

$$\sqrt{18} = \sqrt{C^2}$$

$$\sqrt{9 \cdot 2} = C$$

$$3\sqrt{2} = C$$

Example 5



Find the leg B
if $A = 6$ $C = 10$

$$A^2 + B^2 = C^2$$

$$(6)^2 + B^2 = 10^2$$

$$36 + B^2 = 100$$

Solve for B^2 by subtracting 36 from both sides

$$B^2 = 64$$

take the square root of both sides

$$\sqrt{B^2} = \sqrt{64}$$

$$B = 8$$

Example 7

Find the leg B
if $A = 2\sqrt{3}$ $C = 6$

$$A^2 + B^2 = C^2$$

$$(2\sqrt{3})^2 + B^2 = 6^2$$

$$24 + B^2 = 36$$

Solve for B^2 by subtracting 24 from both sides

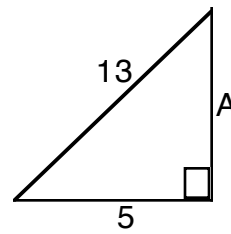
$$B^2 = 12$$

take the square root of both sides

$$\sqrt{B^2} = \sqrt{12} = \sqrt{4 \cdot 3}$$

$$B = 2\sqrt{3}$$

Example 6



Find the leg A
if $B = 5$ $C = 13$

$$A^2 + B^2 = C^2$$

$$A^2 + (5)^2 = 13^2$$

$$A^2 + 25 = 169$$

Solve for A^2 by subtracting 25 from both sides

$$A^2 = 144$$

take the square root of both sides

$$\sqrt{A^2} = \sqrt{144}$$

$$A = 12$$

Example 8

Find the leg A
if $B = 4\sqrt{5}$ $C = 10$

$$A^2 + B^2 = C^2$$

$$A^2 + (4\sqrt{5})^2 = 10^2$$

$$A^2 + 80 = 100$$

Solve for A^2 by subtracting 80 from both sides

$$A^2 = 20$$

take the square root of both sides

$$\sqrt{A^2} = \sqrt{20} = \sqrt{4 \cdot 5}$$

$$A = 2\sqrt{5}$$