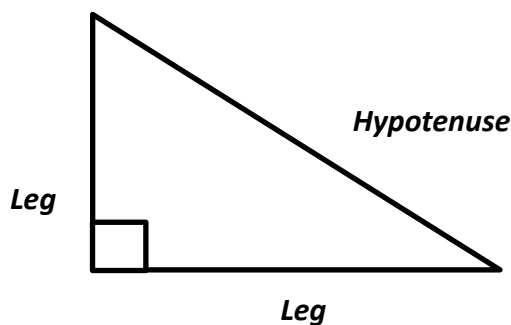


The Pythagorean Theorem

Guide Notes

The Pythagorean Theorem describes the relationship between the lengths of the legs and the hypotenuse of a right triangle.

In a right triangle, the side opposite the right angle is called **the hypotenuse**. This side is always the longest side of a right triangle. The other two sides are called **the legs** of the triangle.

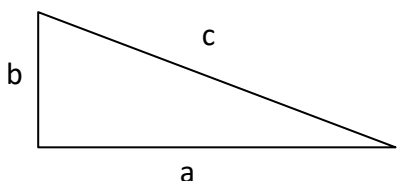


To find the length of any side of a right triangle when the lengths of the other two are known, you can use a formula by the Greek mathematician Pythagoras.

The 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 the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs.

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



Sample Problem 1: Find the length of the hypotenuse in the right triangle.

a. $a = 8$ $b = 15$ $c = ?$

Sample Problem 2: Find the length of the missing side of the right triangle.

a. $c = 10$ $a = 8$ $b = ?$

The Pythagorean Theorem Guide Notes

If three positive integers (a , b , c) that represent the length of each side of a right triangle, satisfy the equation $c^2 = a^2 + b^2$, it is called a **Pythagorean triple**.

Sample Problem 3: Determine whether each set of numbers form a Pythagorean triple.

a. (20, 21, 29)

b. (3, 6, 8)

The statement that can be easily proved using a theorem is often called a corollary. The following corollary based on the Pythagorean Theorem can be used to determine whether a triangle is a right triangle.

If a and b are measures of the shorter sides of a triangle, then c is the measure of the longest side and $c^2 = a^2 + b^2$, then the triangle is a right triangle.

If $c^2 \neq a^2 + b^2$ then the triangle is not a right triangle.

if $c^2 < a^2 + b^2$ then the triangle is acute, and

if $c^2 > a^2 + b^2$ then the triangle is obtuse.

Sample Problem 4: Determine whether the following side measures form right triangle.

a. (4, 6, 9)

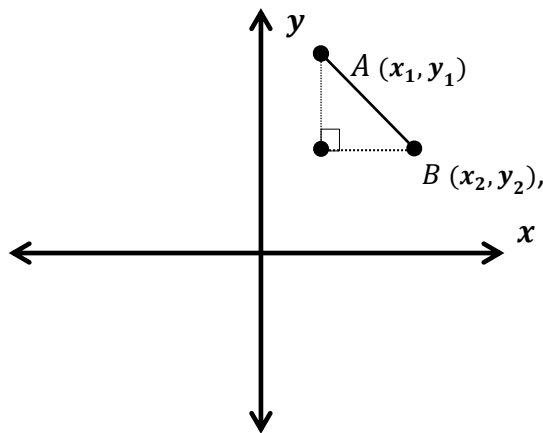
b. (16, 30, 34)

The Pythagorean Theorem Guide Notes

The Distance Formula

The distance formula is derived from the Pythagorean Theorem.

To find the distance between two points (x_1, y_1) and (x_2, y_2) , all that you need to do is use the coordinates of these ordered pairs and apply the formula pictured below.



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

Sample Problem 5: Find the distance between the point at $(2, 3)$ and $(-4, 6)$.

a. (x_1, y_1) (x_2, y_2) $d = ?$
 $(2, 3)$ $(-4, 6)$