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Pythagorean Theorem

Unit 11 Lesson 2

PYTHAGOREAN THEOREM

Students will be able to:

Understand and use Pythagorean theorem in problems involving the sides of a right triangle.

Key Vocabulary:

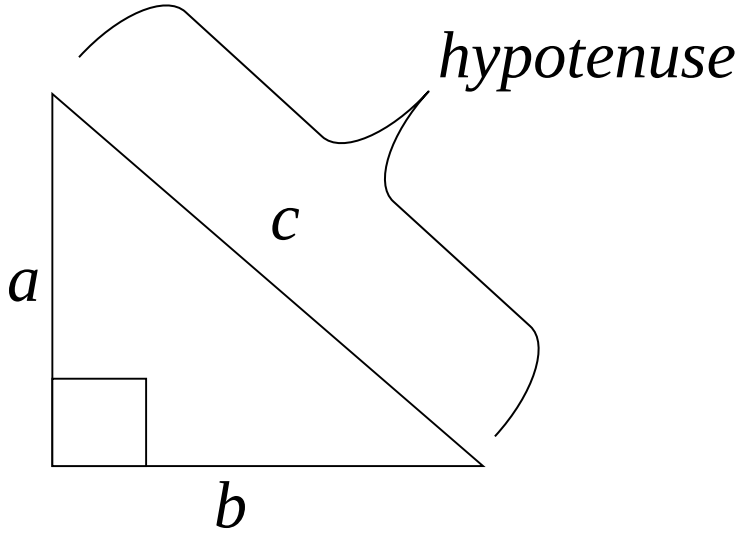
- Square Roots
- Square of a number
- Right Triangle
- Hypotenuse side

PYTHAGOREAN THEOREM

One of the most famous theorems in mathematics provides a way to determine the length of one of the sides of a right triangle given the length of the other two.

The theorem was named after Pythagoras, a Greek mathematician. It was believed that he was the first one to present a proof for the relationship. Other's proofs were presented after his time.

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



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

CONVERSE OF THE PYTHAGOREAN THEOREM

If the side of a triangle have lengths a, b, and c such that $c^2 = a^2 + b^2$, then the triangle is a right triangle.

Example:

Is the triangle whose sides with the given lengths a right triangle?

4, 5, 7

5, 12, 13

PYTHAGOREAN THEOREM

Is the triangle whose sides with the given lengths a right triangle?

4, 5, 7

Solution:

$$4^2 + 5^2 = 7^2$$
$$16 + 25 = 49$$
$$41 \neq 49$$

Not a Right Triangle

5, 12, 13

Solution:

$$5^2 + 12^2 = 13^2$$
$$25 + 144 = 169$$
$$169 = 169$$

Right Triangle

Sample Problem 1:

Tell whether the following triangle is a right triangle or not given their sides.

1. 3, 4, 5

Solution:

$$3^2 + 4^2 = 5^2$$
$$9 + 16 = 25$$
$$25 = 25$$

Right Triangle

2. 6, 8, 12

Solution:

$$6^2 + 8^2 = 12^2$$
$$36 + 64 = 144$$
$$100 \neq 144$$

Not a Right Triangle

Sample Problem 2:

Find the hypotenuse side of the following right triangle.

3. a=6, b=8

Solution:

$$c^2 = a^2 + b^2$$
$$c = \sqrt{a^2 + b^2}$$
$$c = \sqrt{6^2 + 8^2}$$
$$c = \sqrt{36 + 64}$$
$$c = \sqrt{100}$$
$$c = 10$$

4. a=4, b=5

Solution:

$$c^2 = a^2 + b^2$$
$$c = \sqrt{a^2 + b^2}$$
$$c = \sqrt{4^2 + 5^2}$$
$$c = \sqrt{16 + 25}$$
$$c = \sqrt{41}$$

Sample Problem 3:

Find the missing sides of the following right triangle given their hypotenuse and one other side.

5. a=6, c=8

Solution:

$$c^2 = a^2 + b^2$$
$$b^2 = c^2 - a^2$$
$$b = \sqrt{c^2 - a^2}$$
$$b = \sqrt{8^2 - 6^2}$$
$$b = \sqrt{64 - 36}$$
$$b = \sqrt{28}$$
$$b = 2\sqrt{7}$$

6.b=4, c=5

Solution:

$$c^2 = a^2 + b^2$$
$$a^2 = c^2 - b^2$$
$$a = \sqrt{c^2 - b^2}$$
$$a = \sqrt{5^2 - 4^2}$$
$$a = \sqrt{25 - 16}$$
$$a = \sqrt{9}$$
$$a = 3$$