Name: _____

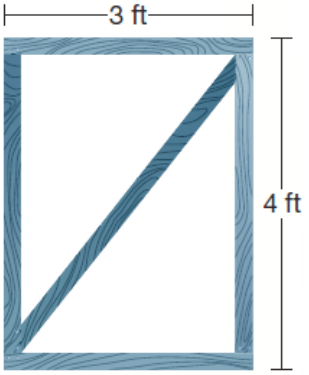
Date: _____

Period: _____

Geometry Investigation 2

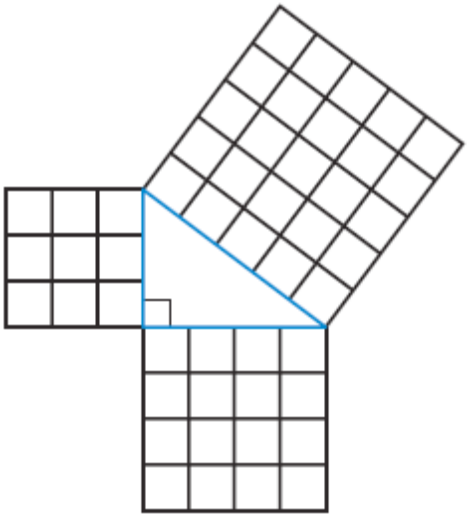
Proving the Pythagorean Theorem

A carpenter has built a rectangular frame with dimensions of 3 feet by 4 feet. To help secure this frame and ensure that the corners are at 90° angles, she places a brace across the diagonal between two opposite corners.



1. What type of triangle is formed when the diagonal brace is positioned across the frame?

The carpenter can determine the length of the brace if she knows the lengths of the triangle's legs by using the _____ Theorem. The concept of the Pythagorean Theorem can be demonstrated using a model. In the diagram below, each side of the triangle is also a side of a square with each side congruent to that side of the triangle. All three squares are illustrated as blocks to make it easier to calculate the area of each one. In the figure, the lengths of the sides of the triangle are __, __, and __ units and the area of each square is __, __, and __ square units, respectively.



2. Draw a right triangle with side lengths of 6 centimeters, 8 centimeters, and 10 centimeters, using a protractor to ensure that one angle is exactly 90°. Now make and cut out three squares; one with 6-centimeter long sides, one with 8-centimeter long sides, and one with 10-centimeter long sides. Place each square next to the corresponding sides of the triangle. Which side is the hypotenuse in your diagram?

3. Which square has the largest area?

4. Try to fit the squares you made for the two legs of the triangle into the square for the hypotenuse. Do the two smaller squares fit exactly into the third square if you cut up the smaller squares? What can you say about the relationship between the areas of the squares?

5. Calculate the area of each of the squares that you constructed. Does this support your answer for part 4?

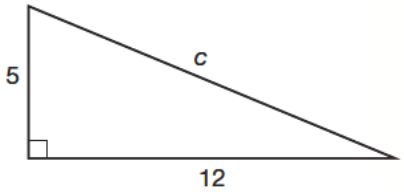
6. Write How do these results demonstrate the relationship in the Pythagorean Theorem?

The length of the brace that the carpenter needs can be calculated algebraically. If the brace in the carpenter's frame represents the hypotenuse of a right triangle, *c*, and the length and width of the frame represent the legs of a right triangle, *a* and *b*, the equation $a^2 + b^2 = c^2$ can be used.

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

Therefore, a 5-foot long brace is needed.

7. Determine *c* for this triangle.



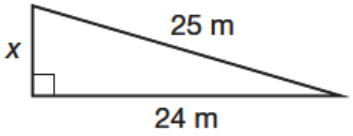
8. A right triangle has a hypotenuse that measures 20 centimeters and one leg that is 16 centimeters. What is the length of the other leg?

9. Landscaping: Design Jillian has a corner garden in her backyard and wants to place decorative edging along the front edge. The garden is 6 feet along the back fence and 8 feet along the side fence. The two fences meet at a right angle. How much edging will Jillian need?

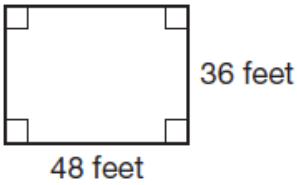
Investigation Practice

a. If the length of one leg of a right triangle increases while the length of the other leg is constant, what happens to the length of the hypotenuse in a right triangle? the measure of the right angle? the measure of the acute angles?

b. Find the length of side *x* in the triangle.



c. A right triangle has a hypotenuse of 15 inches and one leg that measures 12 inches. What is the length of the third side?



A builder is framing a house and wants to make sure that the walls will be at 90° angles to each other. The diagram shows the length measurements of two walls. Use this figure to answer the following questions.

d. How could the Pythagorean Theorem be used to determine if the walls meet at a right angle?

e. If the builder strings a rope across the diagonal of the floor, what length would the rope be if the walls were at right angles to each other?