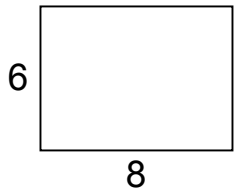
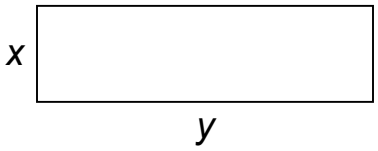
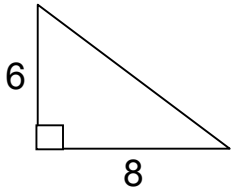
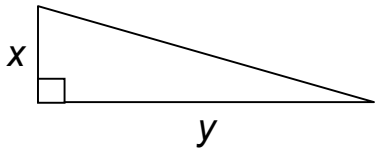
# THE PYTHAGOREAN THEOREM

| Ready (Goals) | Set (Standards) |
|---|---|
| We will explore the relationship between side lengths of right triangles and then look at a proof of the Pythagorean theorem. Then we will use this theorem to solve problems. | • Know and understand the Pythagorean theorem<br>• Know the converse of the Pythagorean theorem |

**Go (Warmup)**

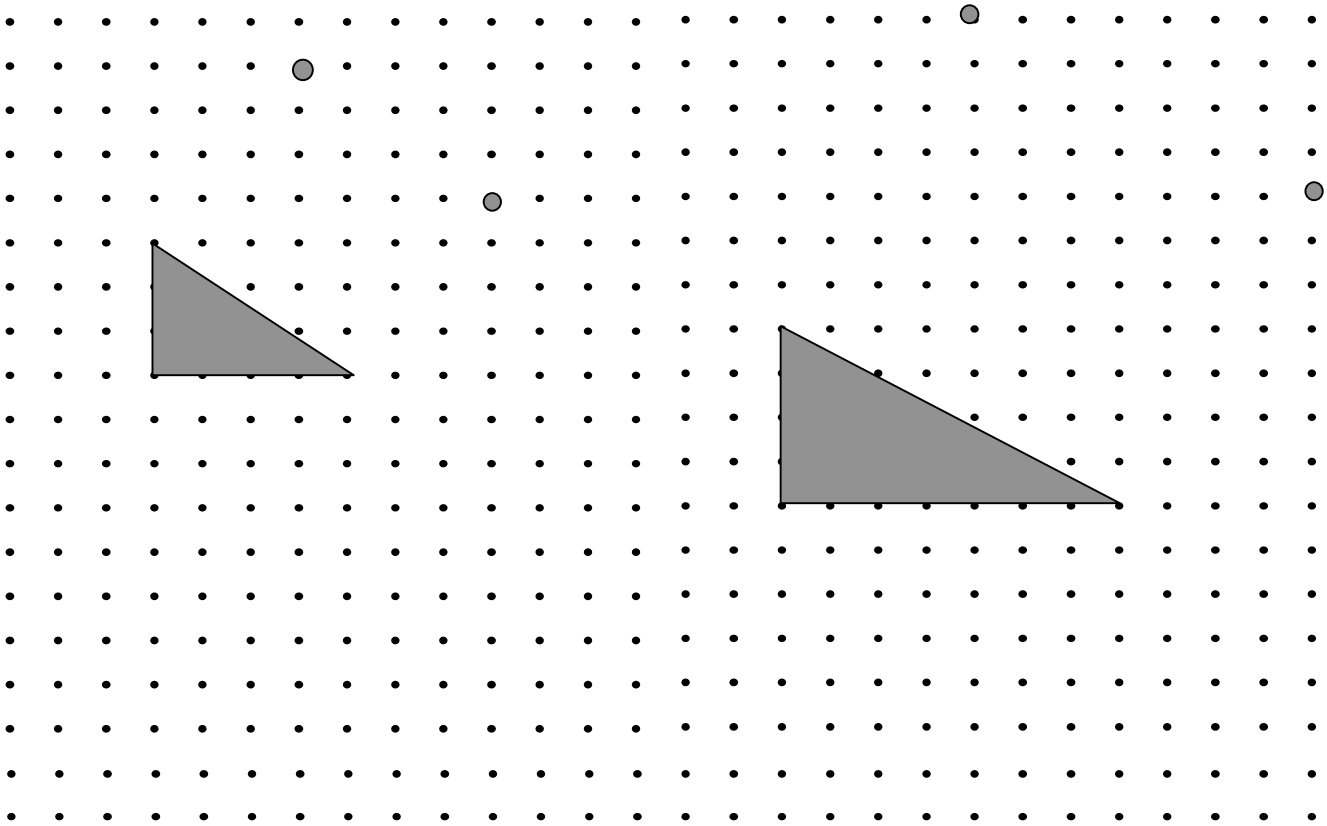
Find the area of each rectangle and triangle.

| | |
|---|---|
| 1.   | 2.   |
| 3.   | 4.   |

Simplify each expression.

| | |
|---|---|
| *5.* $a + a$ | *6.* $ab + ab$ |
| 7. $\frac{1}{2}a+\frac{1}{2}a$ | 8. $\frac{1}{2}ab+\frac{1}{2}ab$ |

# TWO RIGHT TRIANGLES

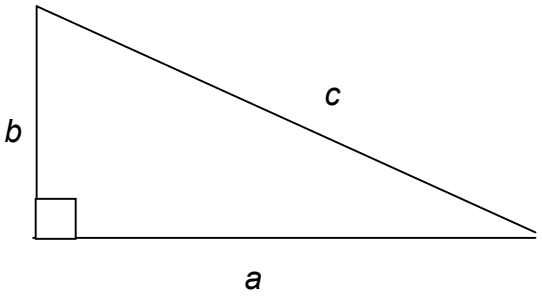


| | | Smaller triangle | Larger triangle |
|---|---|---|---|
| 1 | length of shorter leg | | |
| 2 | length of longer leg | | |
| 3 | area of square on shorter leg | | |
| 4 | area of square on longer leg | | |
| 5 | area of square on hypotenuse | | |
| 6 | length of hypotenuse | | |

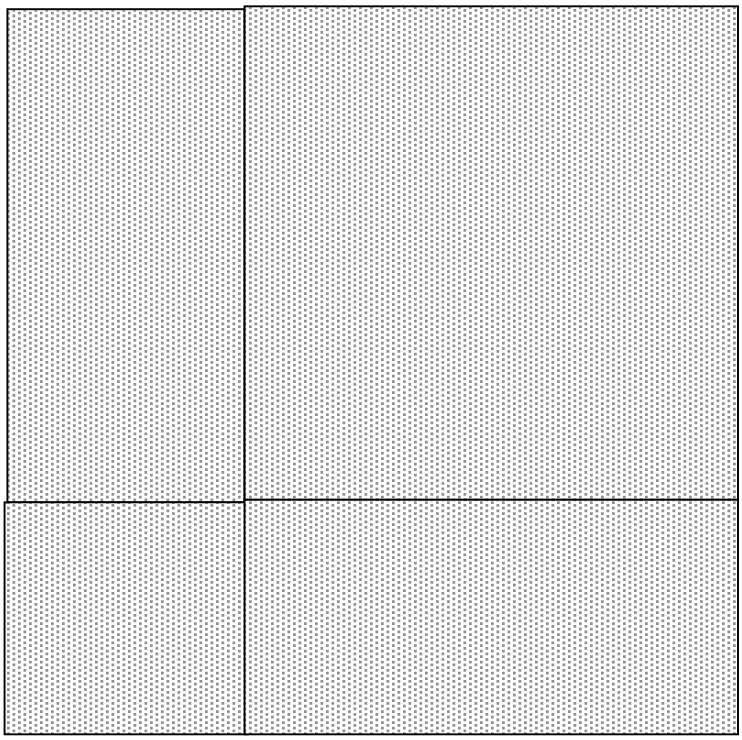
7. Write a conjecture about the relationship between the area of square on the hypotenuse and the area of the squares of the legs.

# THE PYTHAGOREAN THEOREM (PART 1)

Here is a right triangle:



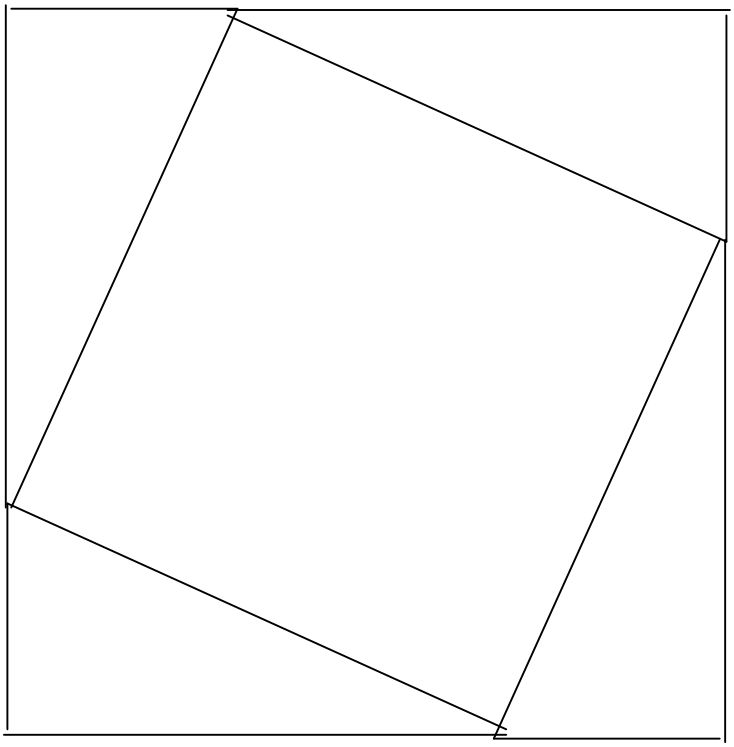

To the right are two congruent squares that have been made using lengths *a, b, and c.* Each square into polygons.



1. Label some right angles and some lengths.

2. Write the area of each polygonal piece inside of it.

3. Cut out both squares. Then cut them up into the polygons.



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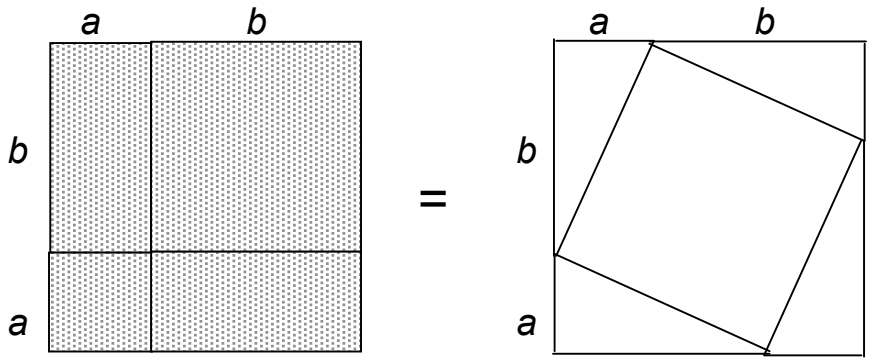
# THE PYTHAGOREAN THEOREM (PART 2)

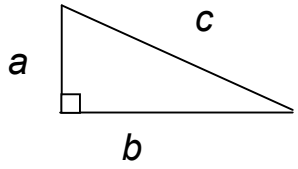



1. Write the areas inside the polygonal pieces in the two square figures above.

2. Write an equation to show that the sum of the areas of the shaded polygons is the same as the sum of the areas of the unshaded polygons.

3. Simplify your equation.

4. Use words to state the meaning of this equation as it refers to the legs and the hypotenuse of the original triangle.




4. This relationship is called the _____

# PYTHAGOREAN THEOREM PRACTICE

Pythagorean Theorem: If a triangle is a right triangle, then the sum of the squares of the two shorter legs is equal to the square of the hypotenuse.

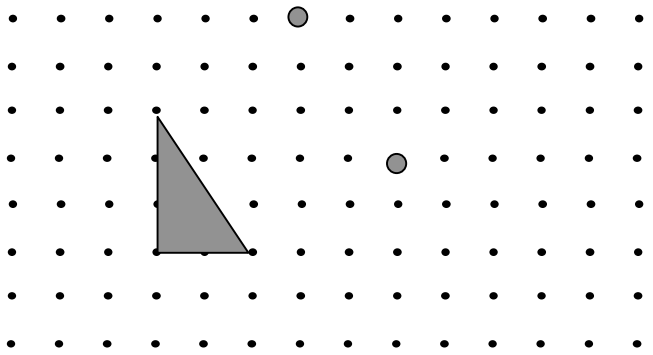
Converse of the Pythagorean theorem: If the sum of the squares of the two shorter legs is equal to the square of the hypotenuse, then the triangle is a right triangle.

Use the Pythagorean Theorem and its converse to answer these questions:

1. Draw the squares on the legs and the square on the hypotenuse of the right triangle below. Find the area of each square and the length of each side of the triangle. Using the correct numerical values, fill in the blanks to show the Pythagorean relationship.

   Area equation: (_____) + (_____) = (_____)

   Side length equation: (_____)$^2$ + (_____)$^2$ = (_____)$^2$



2. A classmate suggests that a triangle with side lengths of 4, 5, and 9 is a right triangle. Use the Pythagorean theorem to show that this must be incorrect.

# PYTHAGOREAN THEOREM PRACTICE (continued)

3. A right triangle has legs of lengths 5 and 12. What must be the length of its hypotenuse?

4. Notice that the answer to problem 3 is a whole number. When all three sides of a right triangle have whole number side lengths, it is called a Pythagorean triple. Is this true for problem 1?

5. Find another Pythagorean triple in this lesson and write the three side lengths.

6. One triangle has sides of length 4, 6 and 8 centimeters. Another triangle has sides of length 6, 8 and 10 centimeters. Is either of these triangles a right triangle? Why?

7. Tommy said, "The third side of this triangle is $\sqrt{36+25} = \sqrt{61}$ inches." Is it possible that Tommy could be right? Explain.