Name: _____

Instructional Activity: Why is the Pythagorean Theorem true?

Recall the statement of the Pythagorean Theorem:

> **The Pythagorean Theorem**
> In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

In other words, if a right triangle has side lengths a, b, and hypotenuse c, then

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

but why is this true? Where does this formula come from? We will investigate this question using ideas from geometry and algebra. In what follows, all of our computations will be in terms of a, b, and c.

Triangle/Square Activity:

1. Arrange the provided triangles into a large square.
   - Is there more than one way to do this?
   - Can you arrange the triangles into a large square with a "missing" square in its interior?
2. Place the provided square into the interior of the region created by your triangles.
3. Compute the area of the "filled" large square.
4. Is there another method you could use to compute the area of the large square?
   - What shape can you make by combining two of the triangles?
   - What is the area of this shape?
   - What is the area of one triangle?

5. Set the two different formulas you found for computing the area of the large square equal to each other.

   - What happens if you simplify?

This brings us to an important question – How do you know the shape you made in Step 1 (with side lengths $(a + b) \times (a + b)$) was actually a square?

6. Can you provide an example of a shape having equal side lengths that *is not* a square?

7. What must the angles of the shape be to guarantee it is a square?

As a follow-up, how do you know the provided shape (with side lengths $c \times c$) was a square?

8. Recreate the "filled" large square from Step 2.

9. What is the sum of the angles of a triangle?

10. Use what you know about complementary and supplementary angles to explain why the $c \times c$ shape must be a square.