Investigating the Pythagorean Theorem

**Purpose:** To use physical modeling to determine the validity of the Pythagorean Theorem.

**Outline:** For Parts A and C you will be using a physical model, measuring lengths, determining the area of figures to determine the validity of the Pythagorean Theorem (for those particular values). In Parts B and D you will generalize what has been found in previous parts for any values \(a\), \(b\) and \(c\).

**Content Objectives:** Modeling, the Pythagorean Theorem, measurement, basic calculations, algebraic manipulation.

**Instructions:** Go through the following exercises, and answer the questions given. You must show all work, and provide a cover page (date, project title, names).

**Materials:** Construction paper, scissors, measuring device.

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**Part A:**
1. Cut out a square from construction paper (any size, but it would be to your advantage to make sure it’s not too small).
2. Measure the sides, and determine the area. Record this on a separate sheet.
3. Draw a square inside this, where the corners touch each side as pictured below.

![Diagram of square and triangle](image)

4. Measure and label all the sides of each “line”
5. Calculate and label the areas of each figure (4 triangles and 1 square)
6. Show how the values found in (5) sum to the value found in (2)

**Part B:**
1. Cut out a square from construction paper.
2. Draw a square inside this, where the corners touch each side as pictured below.

![Diagram of square and triangle](image)

3. Label the sides of the inside square as \(c\)
4. The length of the larger square is bisected by the smaller one. Label these lengths as $a$ and $b$ so that the length of one side of the larger square is $a + b$. Using symmetry, label the “legs” of each triangle.

5. Calculate and label the areas of each figure (4 triangles and 1 square)

6. Using algebra, simply (5) to show that $a^2 + b^2 = c^2$.

Part C:

1. Using construction paper, cut out a right triangle.
2. Measure the lengths of each side of your triangle, and make three squares whose side lengths are the same as the triangles sides.

3. Find the areas of each square, and record.
4. Show how the area of the larger square is related to the area of the two smaller squares.

Part D:

1. Using construction paper, cut out a right triangle.
2. Label each side of your triangle ($a$, $b$ and $c$), and make three squares whose side lengths are equal to the triangles sides.

3. Using scissors and cutting your smallest square into pieces, show how the two smaller squares cover the same area as the larger square.

4. Convert this into a formula relating $a$, $b$ and $c$. 