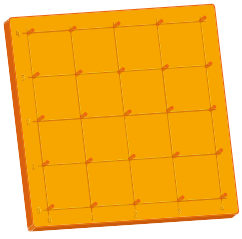
Squares Around a Triangle

OBJECTIVE

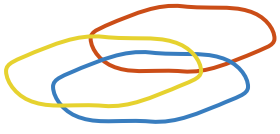
Students will apply strategies for determining areas (squares and triangles) while exploring the relationships among the sides of right triangles.

WHAT YOU WILL NEED

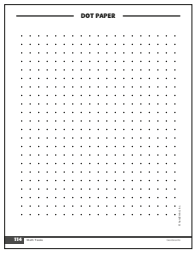
Geoboards,
1 per child



Rubber bands



Dot Paper, page 114

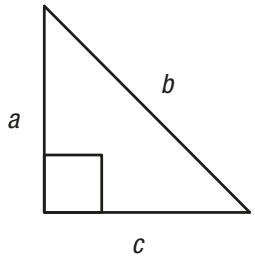


OVERVIEW

In this activity, students examine squares built on the sides of right triangles made on a Geoboard. They then look for a relationship among the areas of the squares.

THE BIG IDEA

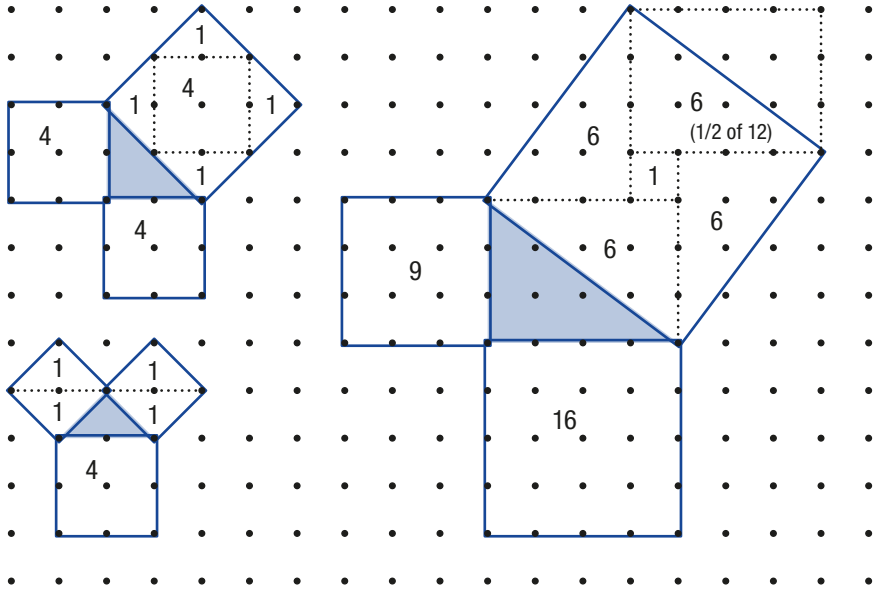
In examining the areas of the squares surrounding each right triangle, students notice that the sum of the areas of the squares on the two shorter sides of the triangle is equal to the area of the square on the longest side of the triangle. For any right triangle, where a and b are the lengths of the legs and c is the length of the a hypotenuse, this relationship, known as the Pythagorean Theorem, can be stated algebraically as $a^2 + b^2 = c^2$.



Squares Around a Triangle, page 122

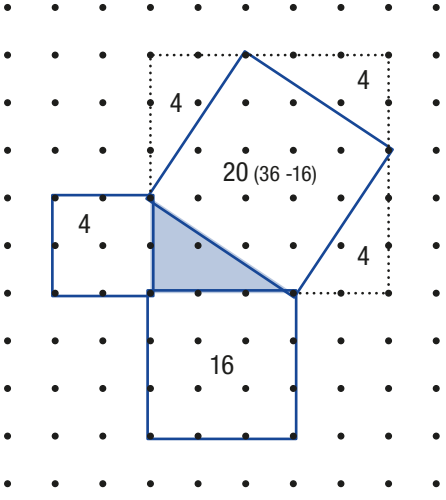
Students may use different strategies to find the areas of the squares they make. For the squares that have edges parallel to the edges of the dot paper, students may count the number of unit squares contained in the squares. Some students may realize that the area of these squares can be found by multiplying the length of one side of the square by itself.

To find the areas of the squares whose sides are not parallel to the edges of the dot paper, students may use partitioning techniques to divide the squares into shapes whose areas may be easier to find.



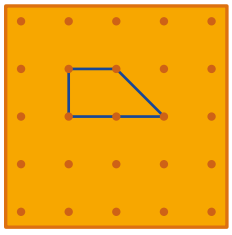
Students may also find the areas of squares by enclosing them inside squares whose sides are parallel to the edges of the dot paper. The areas of these "enclosing squares" can then be determined (by counting unit squares or by squaring the length of a side). Then the areas of the four triangular regions formed outside the original square can be subtracted from the area of the enclosing square.

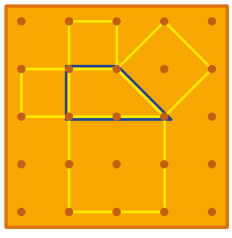
This activity allows students to discover geometric relationships that prepare them for their eventual work with irrational numbers—in particular, finding square roots.



1 INTRODUCTION

- Have students copy this shape on their Geoboards.
- Ask students to make a square on each side of the shape so that one side of each new square is also a side of the original shape.
- Have students compare results and verify that they have made a square on each side.





2 ON THEIR OWN

Students will complete the On Their Own. During this time, the teacher's role is to:

- ask probing questions to guide and extend
- record student thinking
- record student conversation that promotes collaboration

Use the information gathered to inform the Math Talk.

3 MATH TALK

Use prompts such as these to promote class discussion:

- How did you determine the areas of the squares? Are there other ways to find the areas?
- What patterns did you discover?
- Do you think you would find this pattern in all right triangles? Why?
- What generalization can you make about the areas of the three squares built on the sides of a right triangle?

4 EXTENSION

- Have the students repeat the activity using triangles in which all three angles are acute. (Students should find that the area of the square on the longest side will be less than the sum of the areas of the two smaller squares.)
- Have students also repeat the activity using triangles containing one obtuse angle. (Students should find that the area of the square on the longest side will be greater than the sum of the areas of the two smaller squares.)

Squares Around a Triangle

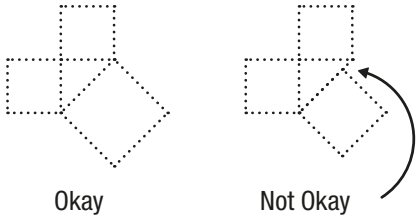
ON THEIR OWN

How are the squares made on the sides of a right triangle related?

1. Work with a group. You should each make a different-sized right triangle on your Geoboard.

2. Record your triangle toward the middle of a piece of dot paper.

3. Build a square on each side of your triangle. The sides of each square you build must match the triangle side on which it is built. Use a ruler to help you make the sides of your squares.



4. Find and record the area of each square.

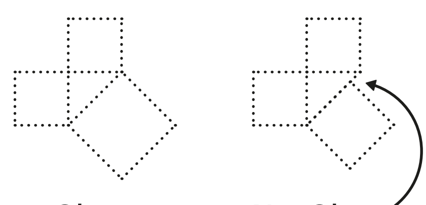
5. Check each other's work.

6. Look for relationships among the areas of the three squares surrounding each triangle.

SQUARES AROUND A TRIANGLE

How are the squares made on the sides of a right triangle related?

1. Work with a group. You should each make a different-sized right triangle on your Geoboard.
2. Record your triangle toward the middle of a piece of dot paper.
3. Build a square on each side of your triangle. The sides of each square you build must match the triangle side on which it is built. Use a ruler to help you make the sides of your squares.
4. Find and record the area of each square.
5. Check each other's work.
6. Look for relationships among the areas of the three squares surrounding each triangle.



SQUARES AROUND A TRIANGLE

How are the squares made on the sides of a right triangle related?

1. Work with a group. You should each make a different-sized right triangle on your Geoboard.
2. Record your triangle toward the middle of a piece of dot paper.
3. Build a square on each side of your triangle. The sides of each square you build must match the triangle side on which it is built. Use a ruler to help you make the sides of your squares.
4. Find and record the area of each square.
5. Check each other's work.
6. Look for relationships among the areas of the three squares surrounding each triangle.