ALL ABOUT SQUARES

Getting Ready

What You’ll Need
Geoboards, 1 per pair
Rubber bands
Geodot paper, page 90
Overhead Geoboard and/or geodot paper transparency (optional)

Overview
Children make as many different-sized squares as they can on their Geoboards. In this activity, children have the opportunity to:

- learn that squares have four square corners and four sides of the same length
- notice that squares can differ in size and orientation

The Activity

Show children how to check for square corners by placing the corner of a book over each corner of the shape to see if the corners match.

Introducing
Ask children to use a rubber band to make a four-sided shape on their Geoboard. Then have them hold up their work.

Without identifying their shapes, select several children who have made squares and several who have not. Have those with squares stand on one side of you, and those with other shapes stand on the other side.

Ask these children to hold up their Geoboards for the class to see. Then ask the other children if anyone knows how you grouped these Geoboard shapes.

After hearing children’s responses, elicit that the shapes are sorted into squares and not squares.

Point out that the squares each have four sides of the same length and four square corners.
On Their Own

How many different-sized squares can you make on your Geoboard?

- Work with your partner to make a square on your Geoboard. Check to see that your shape has 4 square corners and 4 sides of the same length.
- Copy your square onto geodot paper. Cut out your square.
- Now make a square that is bigger or smaller than your first square. Copy your new square and cut it out.
- Put one of your cut-out squares on top of the other to make sure they are really different sizes.
- Do this again until you have made as many different-sized squares as you can.
- Be ready to talk about your squares.

The Bigger Picture

Thinking and Sharing

Invite one pair of children to bring the drawing of their smallest square to the front of the room and hold it up. Continue calling for the next-sized square until you have a row of children holding squares in order, from smallest to largest. Draw a line across the chalkboard. Make a class chart by having the children post their squares, in order, on the line.

Use prompts such as these to promote class discussion:

- How many different-sized squares did you find?
- How did you make sure that each of your shapes was really a square?
- What was your way of checking that your squares were different sizes?
- How did you try to make sure you had found all of the squares? Did you ever think you had them all, then changed your mind? If so, why?
- Were you surprised to find as many squares as you did? Why or why not?
- Which different-sized squares have only two pegs on a side? Are these squares different from each other in some way? How?

Writing

Have children tell why a Geoboard is good for making squares.

Extending the Activity

1. Have children repeat this activity using rectangles or triangles instead of squares.
2. Have children begin a book called All About Shapes. After children have worked with a particular shape on the Geoboard, ask them to make a page showing samples of that shape. They might, for example, make pages showing different squares, triangles, rectangles, and so on. As new shapes are discussed in class, new pages can be added to the book.

If children have not included squares that have been made using diagonal lines, you may want to include them.
There are eight possible squares that children can make on their Geoboards. Most children find it easy to make the four squares whose sides are parallel to the sides of the Geoboard.

![Squares on Geoboard](image1)

The four squares that are not parallel to the sides of the Geoboards are often harder for young children to discover.

![Squares on Geoboard](image2)

Some children may construct these squares on the diagonal and then perceive them to be “diamonds,” not recognizing that these shapes have the attributes of squares—four equal sides and four right angles.

Children may experience difficulty identifying squares for other reasons, as well. For example, some may consider squares of identical size that are in different locations on the Geoboard to be different squares.

![Squares on Geoboard](image3)

These children may find it useful to place a paper copy of one of the squares over the other three to compare their sizes.

Children may also confuse rectangles and squares, and thus count rectangles among their solutions. Through class discussion, children can learn that, although squares and rectangles share certain characteristics, only the square has four sides of equal length. (Children may not yet be able to understand that a square is a special example of a rectangle.)
Children approach the task of finding squares differently. Some work in a random way, perhaps, after making each square, removing the rubber band and starting all over again. Other children have a more organized system, first finding the one-by-one square, then the two-by-two square, and so on.

To determine whether a shape is really a square, children are apt to first tackle those shapes with four sides parallel to the sides of the Geoboard. Children can see if the sides of such shapes are equal in length by simply counting the number of pegs that the rubber band touches. It can be more of a challenge for children to measure the sides of the tilted squares, since these lengths are indeterminate. Children may notice that the distance from one peg to the next along the diagonal is greater than from one peg to the next moving horizontally or vertically.

![Diagrams showing different square shapes on a geoboard.]

Other children may need to fold their cut-out paper squares in half along a diagonal to prove that the two sides are equal in length. Having the children compare the corners of their squares to the corner of a 3 x 5 card may help them to check that the four angles of the square are all the same size.

Arranging the squares from smallest to largest results in the following order:

![Arranged squares on a geoboard.]

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