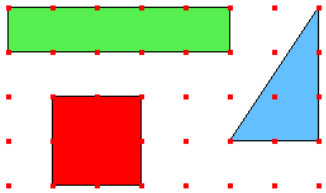
CONSTRUCTING TASK: GEOBOARD GEOMETRY GURU

STANDARDS FOR MATHEMATICAL CONTENT



MCC3.G.1 Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

MCC3.G.2 Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.*

STANDARDS FOR MATHEMATICAL PRACTICES

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

BACKGROUND

Students should begin to use what they have learned about properties from the previous activities to be able to begin to classify shapes. Begin with shapes learned in previous grades and move up to focusing on quadrilaterals.

Before beginning this task, students should be familiar with common quadrilaterals and the identification of their sides and angles. Also, they should be able to use a geoboard and transfer that information to paper. Some students may need specific instructions on how to transfer figures to the paper (e.g. counting the spaces between dots and directionality). Finally, students should be able to make multiple representations of the same shape with variance in size and orientation, and still determine it to be the same shape based on its attributes.

ESSENTIAL QUESTIONS

- How can I use attributes to compare and contrast shapes?
- Is it possible to make shapes that are quadrilaterals that are not shaped like what I might be used to?

MATERIALS

- Geoboards
- Rubber bands
- "Geoboard Geometry Guru" student recording sheet (3 per student)

GROUPING

Whole Group/Individual Task

TASK DESCRIPTION, DEVELOPMENT AND DISCUSSION

Part I

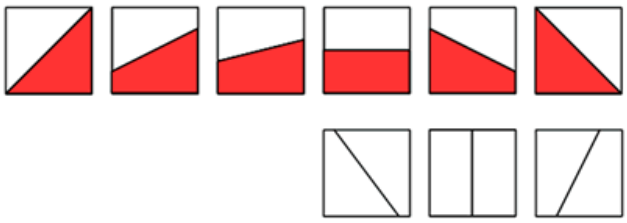
In this task, students begin exploring how to create plane figures using straight lines and angles and then discover common features of rectangles, squares, and triangles.

Students should be given the opportunity to explore freely with the geoboard and rubber bands before working this task. Also, teachers may want to begin this task by giving students opportunities to explore the geoboard by making a variety of shapes, lines, and angles. Throughout this task teachers should promote the key vocabulary of open figure, closed figure, polygon, rhombus/rhombi, rectangle, square, quadrilateral, parallelogram, and trapezoid. Also, students should be encouraged to use these key vocabulary words.

At the completion of this task the class will have created definitions for rectangle, square, rhombus, and trapezoid. These can be posted in the classroom along with each shape's attributes.

Part II

Have students return to the geoboard and begin to explore partitioning the shapes into equal parts. Is it possible to make all of the quadrilaterals into equal parts of two, three, four, six, and eight? Guide students through making sense of equal parts/areas. An anchor chart may be drawn to show how each quadrilateral can be partitioned into equal areas. Remember that each shape can be partitioned in multiple of ways. For instance, a square can be divided into half in all of these different directions:



Task Directions

Students should be challenged to make different shapes that describe one or more properties of shapes. Pose questions to students like: Can you make a shape with just one square

corner and four sides? Can you make a shape with 2 square corners (or 3, 4, 5, etc. square corners?) Can you make a shape that has two pairs of sides that go the same way or are parallel? Show student's examples so that students can begin to understand that there is more than one way to make a shape with the same properties. The focus should be on looking at the different quadrilaterals that can be created. Students are asked to create all of the different rectangles they can find on the geoboard and then record them on geoboard paper. Ask students to say aloud or write as many complete sentences as they can that begin with "All (or none, or some) of the rectangles…." in order to draw general conclusions about the shapes. After general conclusions have been stated or recorded, the teacher can lead the students to create an appropriate definition for a rectangle.
Follow the same procedures to create an appropriate definition for a square, rhombus, parallelogram, and trapezoid (review from 2nd grade). Note: This activity might take more than 1 day in order for students to get to explore each shape and think about what makes each shape different. For a more descriptive table, please see Table 8.1 "Categories of Two- Dimensional Shapes" on page 221 and Figure 8.11 "Classifications of Two-Dimensional Shapes" in the 3-5 Van de Walle text, page 222.

Shape		Description
Classified by sides	Equilateral	All sides are congruent.
	Isosceles	At least two sides are congruent.
	Scalene	No two sides are congruent.
Classified by angles	Right	Has a right angle
	Acute	All angles are smaller than a right angle.
	Obtuse	One angle is larger than a right angle.
Quadrilaterals		Polygon with exactly four sides
Trapezoid		At least on pair of parallel sides
Parallelogram		Two pairs of parallel sides
Different Classes of Parallelograms	Rectangle	Parallelogram with a right angle.
	Rhombus	Parallelogram with all sides congruent
	Square	Parallelogram with a right angle and all sides congruent.

In addition to recording the defining properties, the shapes that students have drawn on the geopaper might be used as a formative assessment for MCC3.G.2. Have students use the drawn shapes or the geoboards to show what they know about partitioning a shape into halves, thirds, fourths, sixths and eighths. Allow students to show a variety of ways to partition the shapes. It is important that students continue to develop their understanding of equal areas. More activities will follow that continue the exploration for MCC3.G.2

FORMATIVE ASSESSMENT QUESTIONS

- What is your definition of a rectangle (or square, rhombus, trapezoid, or parallelogram)?
- What are the attributes of a rectangle (or square, rhombus, trapezoid, or parallelogram)?
- How can you change this shape by changing only one attribute?

- Is this shape still a (rectangle..or any shape) if I turn the geoboard slightly? (Look to see if orientation confuses students)
- Show half (or thirds, fourths, sixths, eighths) in a different way.

DIFFERENTIATION

Extension

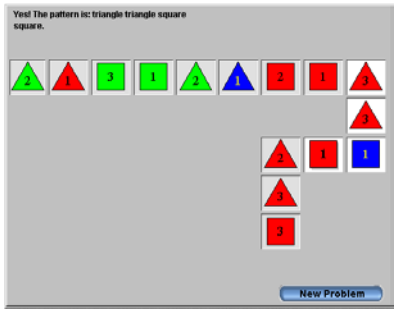
- Have students create a morph chain of a shape changing one attribute at a time and label each morphed shape with its description. (For example: small, red equilateral triangle morphs into a small, blue, equilateral triangle and then into a small, blue, isosceles triangle, etc.)

Intervention

- Provide the definition of the shape first and deconstruct the definition while creating each part of the shape until the shape is complete. Then have students create a congruent shape. Finally ask students to create a non-congruent shape, changing one attribute.

TECHNOLOGY CONNECTION

- http://nlvm.usu.edu/en/nav/frames_asid_172_g_2_t_3.html?open=activities This site offers an easy to use virtual geoboard.
- http://nlvm.usu.edu/en/nav/frames_asid_271_g_2_t_3.html?open=instructions&from=category_g_2_t_3.html Students follow a pattern to create attribute trains based on color, shape, or the number on the shape (e.g. triangle, square pattern; red, red, blue pattern; triangle, square, square pattern; 2,3,1 pattern).



Name _____ Date _____

Geoboard Geometry Guru