Classroom Activities: Geometry (Grades K-6)

C. J. Daane * Julie Herron† Patsy K. Lowry‡ Dale Campbell§

Alabama Journal of Mathematics (Spring/Fall 2009)

Abstract

The foundation of the formal study of high school geometry lies in the elementary grades. Thus, teachers must provide a systematic exposure to geometric concepts in Grades K-8. The National Council of Teachers of Mathematics suggests that spatial visualization is part of this foundation. "Spatial visualization - building and manipulating mental representations of two- and three-dimensional objects and perceiving an object from different perspectives - is an important aspect of geometric thinking" (NCTM, 2000, p. 41). There are many manipulatives available to help students visualize geometric concepts and foster their geometric thinking. Some of these include geoboards, attribute shapes, pattern blocks, tangrams, 3-dimensional models, and paper models. We have presented some activities below that need a minimum amount of materials, most of which can be found in the elementary classroom. All activities are aligned with the new Alabama Course of Study: Mathematics (2009) objectives.

Activity 1: Who am I?

Materials:

2 cut outs of following shapes: circle, square, rectangle, rhombus, hexagon, trapezoid

Objective:

Identifying two-dimensional shapes (Kindergarten)

1. Review the names of all the shapes.
2. Explain to the children that when they are told to "go" they need to find someone who has the same shape.
3. Pass out a shape to each child.
4. Tell the children to "go".
5. Once the children have found a match, each pair needs to say you what their shape is.
6. Next tell the children that they need to find someone who has a shape that is different than their shape.
7. Tell the children "go".

*The University of Alabama
†The University of Alabama
‡Jacksonville State University
§Jacksonville State University

8. Once they have found someone who has a different shape, the pairs need to tell the teacher how their shapes are different.

9. As a group review the shapes and discuss how the shapes are similar and different.

Additional resources:

- Put the shape into the puzzle: (LINK)
- I Spy Shapes: (LINK)
- Match the shapes: (LINK)

Activity 2: Musical Shapes

Materials:

Music (any music without words will work), 3-4 construction paper cut-outs of the following shapes: circle, triangle, rectangle, square, trapezoid, rhombus, hexagon, pentagon, heptagon and octagon

Objective:

Describing attributes of two-dimensional shapes (Grade 1)

1. This game can be played two ways: (a) like musical chairs and some children would be out each time if they are unable to find the shape for the given clue or (b) more than one child could be on a shape, so no children would out of the game.

2. Place the shapes all over your carpet area. The number of shapes you use will depend on the size of your class. Tell the students that the music will play and when it stops they need to freeze and listen for a clue. Then you will give the clue and the students will find the shape based on your clue.

3. Play the music, then turn it down, give a clue:

   (a) Example clues

      i. Find a shape with four sides
      ii. Find a shape with a pair of long sides
      iii. Find a shape with equal sides
      iv. Find a shape with four angles
      v. Find a shape with more than four sides
      vi. Find a shape with three angles
      vii. Find a shape with six sides or less
      viii. Find a quadrilateral

4. Once the children have found their shape they need to tell the geometric name for that shape.

Additional resources:

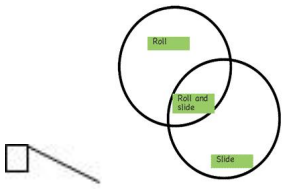
- Put the correct shape on the shelf: (LINK)
- Guess my shape from the clues: (LINK)

Activity 3: The Rolling and Sliding of 3-Dimensional Shapes

Materials:

Tub of geometric 3-D shapes, cards with each 3-D shape and its name for the Venn diagram, a ramp made of blocks and a piece of cardboard.

Example:



Objective:

Describing attributes of three-dimensional shapes (Grade 2)

1. Draw a Venn diagram on the board with Roll, Roll and Slide, and Slide.
2. Pass out one 3-D shape to each pair of students.
3. In pairs have the students predict if their shape will Roll, Roll and Slide, or Slide. Have the students give an explanation using the correct mathematics vocabulary for the reasons behind their prediction.
4. Have each pair take a turn to see if their object slides or rolls down the ramp or does both. Let them try a few times.
5. Complete the Venn diagram with the 3-D shape cards as the students test their shapes.
6. Discuss the objects in each category. Ask questions using correct math vocabulary about why certain shapes roll, roll and slide, or slide.
7. Have the students write about the attributes of their 3-D shape and determine if their prediction was correct or incorrect and why.

Additional Resources:

- Shape Tic-Tac-Toe: (LINK)
- Identify the 3-D shapes: (LINK)

Activity 4: Meaning of Area

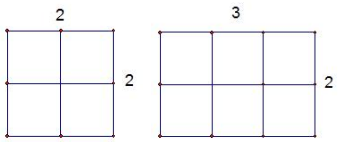
Materials:

squares cut from 1 square inch graph paper (or square inch tiles)

Objective:

Calculating area of rectangular shapes (Grade 3)

1. Students need about 15 squares per person.
2. Discuss what a 1" square means (1 inch per side).
3. Determine the perimeter of one of the squares (4 inches). Put 4 squares together and determine the perimeter (6 inches). Draw this figure on the board and label the length and width (2 and 2). Repeat for a 2 x 3 figure.



4. Ask the students how many squares are in each figure (4 and 6). Indicate that this means 4 square inches and 6 square inches and that this is the area (space inside) of the figure. Discuss why this cannot be 4 and 6 inches, but must be SQUARE inches.
5. Repeat for several other rectangles such as 4 x 3; 3 x 3; 2 x 6. Draw all figures on the board and label the length and the width.
6. Give the students the area (15 square inches) and ask them to construct a rectangle with that given area.
7. Draw this on the board and label the length and width.
8. With all the figures on the board go over the area of each one. Ask the students if they see a way of determining the area without having to count all the squares. When they arrive at multiplying the length times the width, show the formula (A = L x W).
9. Ask the students to determine what the possible length and width might be for a rectangle with the area of 24 square inches (1 x 24; 2 x 12; 3 x 8; 4 x 6).
10. Give the students several problems with length and width asking them to find the area. Be sure the students give their answers in square inches.

Additional Resources:

- Find the area of the excavation: (LINK)
- Find the area of the shapes: (LINK)
- Find the area of the spaceship: (LINK)

Activity 5: Transformational Geometry

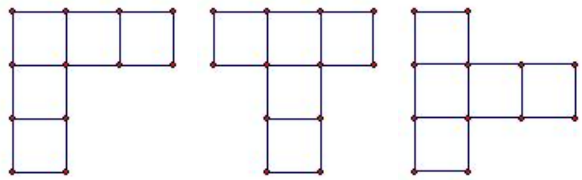
Materials:

Squares cut from 1 square inch graph paper, tape

Objective:

Determining results of a reflection, rotation, or translation of a given shape (Grade 4)

1. Students can work in pairs and need about 40 squares per person.
2. Have students create pentominoes with 5 squares for each pentomino. All squares must touch at least one other square completely on a side. Here are some examples of pentominoes:



3. When the students have created some pentominoes, have them tape the squares together and post them on a poster, bulletin board, etc. where all can see the figures.
4. After several have been posted ask the students to examine all the figures and determine if any of them might be the same. (There should be words like "if you turned this one around and moved it over . . ." or "if you flipped this one over, it would be the same."). Have the students remove any they believe are the same if they can show how they are the same. (The second and third figures in number 2 are the same if the third figure is rotated 90 or "turned" and then translated to the left).
5. Write the terms: translation, rotation, reflection on the board and discuss these with the students. Encourage them to use the terms when they discuss the figures that are the same.
6. Have students continue to make new figures and post them. (They should be able to find 12 distinct pentominoes). For a complete set of pentominoes, see (LINK)

Additional Resources:

- Use transformational geometry to locate the house: (LINK)
- Transformational geometry vocabulary will help you in this game: (LINK)
- Use transformational geometry to play golf: (LINK)
- On-line Pentominoes: (LINK)

Activity 6: Similarity

Materials:

squares cut from 1 square inch graph paper (or square inch tiles)

Objective:

Recognizing similar shapes and figures based on their attributes (Grade 6)

1. Students need about 30 squares per person and can work in pairs. Discuss the meaning of similarity of two rectangles (corresponding sides must be proportional).
2. Have each student create a 1 in. x 3 in. (length by width) rectangle with the graph paper squares. In pairs, have the students compare their rectangles by corresponding sides - find the ratio of the width and lengths of the rectangles (1:1; 3:3 so the ratio is 1 for the corresponding sides).

3. Then have the students create another rectangle: 2 in. x 6 in. (length x width). Compare this rectangle to one of 1 in. x 3 in. rectangles. Ask them to find the proportion of width to width and length to length between the two rectangles. This should be and 3/6. Thus the ratios are the same and the figures are similar.

4. Now ask the students to determine the width of a larger similar rectangle with the length of 3 in. What would be the length of the new rectangle? (9 in.)

5. Then give the students problems to solve involving other similar rectangles without using graph paper squares (e.g., length x width of one rectangle is 4 in. x 5 in.; what is the length of a similar rectangle with a width of 25 in. (20 in.)?

Additional Resources:

- Similarity Game: (LINK)

References

NCTM (2000). *Principles and Standards for School Mathematics.* Author, Reston, VA.