CONSTRUCTING TASK: Property Lists of Quadrilaterals

Adapted from Van De Walle, Teaching Student-Centered Math pg. 207

The purpose of this task is for students to become familiar with the properties of quadrilaterals. They will identify the attributes of each quadrilateral, then compare and contrast the attributes of different quadrilaterals.

STANDARDS FOR MATHEMATICAL PRACTICE

MCC5.G.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that categories.

STANDARDS FOR MATHEMATICAL PRACTICE

SMP 1. Make sense of problems and persevere in solving them.
SMP 2. Reason abstractly and quantitatively.
SMP 6. Attend to precision.
SMP 7. Look for and make use of structure.

BACKGROUND KNOWLEDGE

Students should have the following background knowledge.

- Be able to use a straight edge or ruler to draw a straight line.
- Know how to use a protractor, a ruler, and how to identify right angles (90 degrees), obtuse angles, and acute angles (using a protractor or the corner of an index card).
- Understand that opposite sides can not touch each other; they are on opposite sides of the quadrilateral.
- Know parallel means that lines will never intersect or cross over each other no matter how long they are extended. (Students may prove that lines are parallel by laying down 2 straight objects, such as rulers, on the parallel sides of the quadrilateral, extending those sides. This will show how the line segments do not intersect even if they are extended.)
- Understand that perpendicular means lines or segments intersect or cross forming a right angle. (Some students may use a protractor, while others may use the corner of an index card or the corner of a sheet of paper to show an angle is a right angle.)
- Know that a property is an attribute of a shape that is always going to be true. It describes the shape.
- Be able to use a ruler to measure sides to verify they are the same length.
- Be able to use a mirror to check lines of symmetry
- Be able to use tracing paper to check for angle congruence

Some properties of quadrilaterals that should be discussed are included below. As students draw conclusions about the relationships between different figures, be sure they are able to explain their thinking and defend their conclusions.

- A shape is a quadrilateral when it has exactly 4 sides and is a polygon. (To be a polygon the figure must be a closed plane figure with three or more straight sides.)
- A square is always a rectangle because a square will always have 4 right angles like a rectangle.
- A rectangle does not have to have 4 equal sides like a square. It can have 4 right angles without 4 equal sides. Therefore, rectangle is not always a square.
- A square is always a rhombus because it has 4 equal sides like a rhombus and it is also a rectangle because it has 4 right angles like a rectangle.
- A rhombus does not have to have right angles like a square. It can have 4 equal sides without having 4 right angles. Therefore a rhombus is not always a square.
- A parallelogram can be a rectangle if it has 4 right angles.

COMMON MISCONCEPTIONS

Students think that when describing geometric shapes and placing them in subcategories, the last category is the only classification that can be used.

ESSENTIAL QUESTIONS

- What can be used to determine whether or not the angles are the same size?
- What characteristics make quadrilaterals different from each other?
- How can I use my knowledge of parallel and perpendicular lines to classify quadrilaterals?
- How can I use the attributes of quadrilaterals to sort and classify them into groups?

MATERIALS

- Rulers
- Protractors
- Index cards
- Mirror, pipe cleaners or tooth picks (choose one to check lines of symmetry)
- Copies of Property List Sheets Blackline Masters 37-40 found at http://www.ablongman.com/vandewalleseries/Vol_1_BLM_PDFs/BLM37-40.pdf
- Chart Paper-(Class List) One chart per polygon for the students to record their answers after the presentations.

GROUPING

Partner/Small Group Task

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

The purpose of this task is for students to become familiar with the properties of quadrilaterals. They will identify the attributes of each quadrilateral, then compare and contrast the attributes of different quadrilaterals.

Assign students to work in groups of three or four to one type of quadrilateral. The task is for the students to list as many properties as they can for their quadrilateral. The list of properties must be applicable to all of the shapes on their sheet. Students may need an index card or protractor to check right angles. They will also need a ruler to compare lengths and draw straight lines. Mirrors can be provided for the students to check for symmetry. If you don't have mirrors, the students can use pipe cleaners or toothpicks to place on top of the shapes to show lines of symmetry. Some students may also need to trace the shapes onto another piece of paper and cut it out to check for symmetry. They will then be able to fold the shape and manipulate it to decide if it is symmetrical. The words "at least" should highly be encouraged when the students are describing how many of something: for example, "rectangles have at least two lines of symmetry."

The groups will be asked to present their list to the rest of the class and justify any answers. If the answers are correct, the list should then be added to a class list. It is recommended that the presentations go in order beginning with parallelograms, rhombi, rectangle, and finally square. A class list (chart paper per polygon) will need to be posted in the room for the students to record their correct findings. As one group presents their list, the other students who worked on the same shape should add to or subtract from it. The class must agree with everything placed on the class list. You may have to introduce proper vocabulary as the students discuss and present their shapes.

FORMATIVE ASSESSMENT QUESTIONS

- How do you know this quadrilateral is a _____ (square, rectangle, parallelogram, trapezoid, or rhombus)?
- What is meant by the term "opposite sides"?
- What does "parallel" mean? How can you show that those sides parallel?
- What does "perpendicular" mean? How can you show that those sides are perpendicular?
- How can you show that 2 sides are equal?
- What are some ways we can show an angle is a right angle?

DIFFERENTIATION

Extension

- Ask students to create a Venn diagram which contains a comparison of the properties of two quadrilaterals.

Intervention

- Play Shape Sorts by Van De Walle, Student Centered Mathematics pg. 194

TECHNOLOGY CONNECTION

- http://teams.lacoe.edu/documentation/classrooms/amy/geometry/6-8/activities/quad_quest/quad_quest.html Quadrilateral Quest