CONSTRUCTING TASK: QUADRILATERAL CHALLENGE

Adapted from a lesson by Amanda Grant, Eagle Springs ES, Houston County Schools

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.

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.

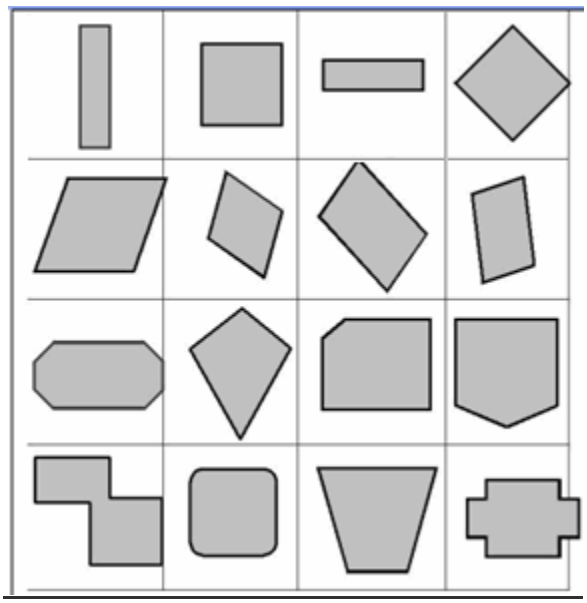
BACKGROUND KNOWLEDGE

Students should have the following background knowledge about quadrilaterals.

- Understand that opposite sides can not touch each other; they are on opposite sides of the quadrilateral.
- Understand that shapes can be described by the attributes and properties that it has.
- 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.

Students should have some experience with the properties of quadrilaterals as shown in the diagram below.

Students who are not clear on the important features of rectangles (four straight sides and four right angles) may not realize that the shapes in the first row are all rectangles, while none of the shapes in the other rows are rectangles. Note that two of the rectangles in the first row are 'special rectangles'; as well as having four straight sides and four right angles, the four sides are the same length, so these special rectangles are known as squares.



Recognizing parallelograms

In the diagram above, the second row contains four 'pushed over rectangles' or 'parallelograms'. These four-sided shapes are similar to rectangles in that the opposite sides are the same length, but the angles are not right angles.

Of the four parallelograms in the second row, the first two have equal-length sides and so are 'special parallelograms' known as rhombuses. They could also be thought of as 'pushed over squares'.

ESSENTIAL QUESTIONS

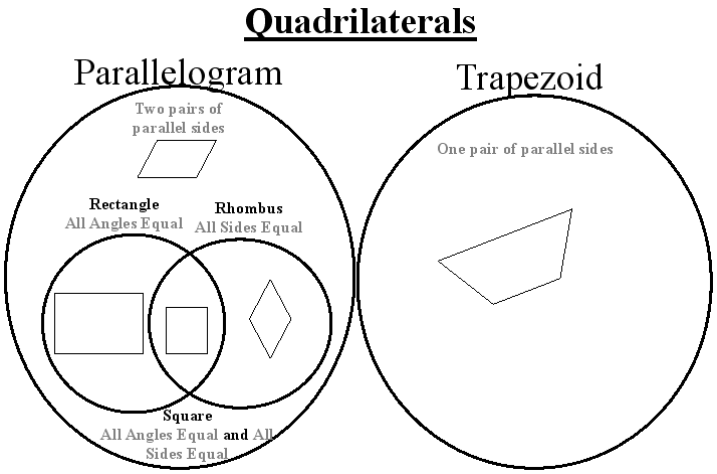
- What is a quadrilateral?
- How can you create different types of quadrilaterals?
- How are quadrilaterals alike and different?
- What are the properties of quadrilaterals?

MATERIALS

For Each Group:

- "Quadrilateral Challenge, Quadrilateral Mat" student recording sheet (print on legal-size paper)
- "Quadrilateral Challenge, Quadrilateral Properties" student sheet (One sheet for every two groups; cut along dotted line; print on colored paper)
- Rulers
- Index cards
- Scissors
- Glue sticks
- Wikki Sticks (optional, approximately five sticks per group) OR dot paper

- "Quadrilateral Challenge, Dot Paper" student recording sheet (optional)



Comments

Students will need Wikki Sticks, toothpicks or plastic coffee stirrers with modeling clay, or other materials with which to create their quadrilaterals) OR the "Quadrilateral Challenge Dot Paper" student recording sheet so that students can use to draw, cut out, and glue their quadrilaterals to their "Quadrilateral Mat."

Copy the "Quadrilateral Mat" student recording sheet onto white paper. To contrast the white paper, the "Quadrilateral Properties" student sheet should be copied onto **colored paper**; otherwise crayons need to be provided so that students can color the quadrilaterals before they cut them out.

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. Working in pairs, students will create the following quadrilaterals: parallelogram, rhombus, square, rectangle, trapezoid. They will identify the attributes of each quadrilateral, then compare and contrast the attributes of different quadrilaterals.

Students will work in pairs. They will first construct an example of each quadrilateral (square, rectangle, trapezoid, and rhombus) on their quadrilateral mats. After they have created each quadrilateral, the students will determine the properties of each figure by sorting the property cards. Students need to sort all of the property and picture cards and match them to the correct quadrilateral before they glue the cards underneath the figures that they have created.

Once students finish their Quadrilateral Mats, students should choose 2 quadrilaterals and write to compare and contrast their properties.

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 at least three 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 trapezoid can never be a parallelogram because a trapezoid has only one pair of opposite sides that are parallel and a parallelogram has two pairs of opposite sides parallel.
- A parallelogram can be a rectangle if it has 4 right angles.

Task Directions

Students will create at least one quadrilateral (using a material such as Wikki Sticks, toothpicks/straws and modeling clay, or dot paper) for each section of the "Quadrilateral Mat" Then students will cut, sort, and glue the properties and pictures for each quadrilateral from the "Quadrilateral Properties" student sheet **(Note: only 1 sheet is needed for every 2 students)**. Finally, students will write to compare and contrast the properties of two quadrilaterals.

FORMATIVE ASSESSMENT QUESTIONS

- How do you know this quadrilateral is a _____ (square, rectangle, trapezoid, or rhombus)?
- How did you create your quadrilaterals?
- Is there a quadrilateral that was easier/harder to create than others? Why?
- How do you know these are quadrilaterals?
- How are quadrilaterals different from other 2-D shapes? How are they the same?
- What is meant by the term "opposite sides"?
- How can you show that 2 sides are equal?
- What are some ways we can show an angle is a square or right angle?

DIFFERENTIATION

Extension

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

Intervention

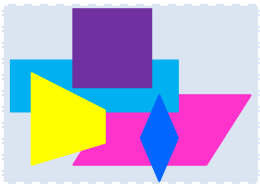
- Allow students to list similarities and differences of two quadrilaterals rather than write a paragraph.
- Help students organize the quadrilateral properties before placing them on the mat. There are several that are the same. Have students place like properties in a pile and then decide which shape has that particular property. Place all of one property on the mat before moving to another property.

TECHNOLOGY CONNECTION

- http://www.regentsprep.org/regents/math/geometry/GP9/LQuad.htm A summary of the properties of several quadrilaterals.
- http://teams.lacoe.edu/documentation/classrooms/amy/geometry/6-8/activities/new_quads/quads.html A virtual "Quest" where students match properties with quadrilaterals.
- http://www.shodor.org/interactivate/lessons/IntroQuadrilaterals/ An introduction to Quadrilaterals
- http://www.mathsisfun.com/quadrilaterals.html - Use after completing the Quadrilateral Challenge; does allow for students to move the corners of the quadrilaterals

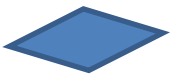
My Quadrilateral Sort Map

Square	Rectangle
Rhombus	Trapezoid



Quadrilateral Challenge

Quadrilateral Properties

4 square corners (right angles)	One pair of sides that go the same way (parallel)	Both pairs of opposite side are equal (congruent)	Both pairs of opposite side are equal (congruent)
4 square corners (right angles)	Both pairs of sides go the same way (parallel)	One pair of opposite sides do NOT go the same way (NOT parallel)	All 4 sides are equal (congruent)
4 corners but none are square (right angles)	Both pairs of sides go the same way (parallel)	Both pairs of sides go the same way (parallel)	All 4 sides are equal (congruent)
4 sides	4 sides	4 sides	4 sides
			
			

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