

CONSTRUCTING TASK: Quadrilateral Roundup

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TASK CONTENT: Students will investigate and explain properties of quadrilaterals.

STANDARDS FOR MATHEMATICAL CONTENT

MGSE4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

MGSE4.G.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

STANDARDS FOR MATHEMATICAL PRACTICE TO BE EMPHASIZED

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.
5. Use appropriate tools strategically.
6. Attend to precision.
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 ruler, and how to identify right angles (90 degrees), obtuse angles, and acute angles (using the corner of an index card or another object with a known angle of 90 degrees).
- Understand that the side across from an angle on a triangle can be described as an opposite side
- Know parallel means that lines will never intersect or cross over each other no matter how long they are extended.
- Understand that perpendicular means lines or segments intersect or cross forming a right angle. (Some students may use a known 90-degree angle 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.

ESSENTIAL QUESTIONS

- How can you create different types of quadrilaterals?
- How are quadrilaterals alike and different?

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- What are the properties of quadrilaterals?
- How can the types of sides be used to classify quadrilaterals?

MATERIALS

For each group:

- Three pieces of yarn or three plastics hoops
- A set of “Quadrilateral Pieces” for each group of students
- Labels for each group from “Labels” document
- Blank index cards
- Markers
- Measuring tools such as rulers and index cards for students to test for right angles

GROUPING

Partner/Small Group Task

NUMBER TALKS

Continue utilizing the different strategies in number talks and revisiting them based on the needs of your students. Catherine Fosnot has developed problem “strings” which may be included in Number Talks to further develop mental math skills. See *Mini-lessons for Operations with Fractions, Decimals, and Percents* by Kara Louise Imm, Catherine Twomey Fosnot and Willem Uittenbogaard. (*Mini-lessons for Operations with Fractions, Decimals, and Percents*, 2007, Kara Louise Imm, Catherine Twomey Fosnot and Willem Uittenbogaard)

TASK DESCRIPTION, DEVELOPMENT, AND DISCUSSION

Students will be using Venn diagrams to classify figures, so it is advisable to review Venn diagrams with students beforehand by modeling a sort, such as those quadrilateral pieces having no right angles and those having at least 1 right angle.

The purpose of this task is for students to become familiar with the properties of quadrilaterals and their defining characteristics as a context for classifying figures by the absence or presence of angles of a specified size and/or parallel and perpendicular lines. This task is meant to elicit discussion about not only the size of the angles in each type of quadrilateral, but the types of lines used to make the sides. While students may sort the quadrilateral pieces in many ways, keep in mind that the focus is on the types of angles and the types of lines used to make the sides of the quadrilaterals.

Some properties of quadrilaterals that may 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. Much of the information below may come out as a result of students’ explorations. This is information to look for and highlight as they explore the quadrilaterals, not a list of understandings that you must teach them beforehand.

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- 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 rectangle is a parallelogram with 4 right angles and 2 sets of parallel sides.
- A square is a rectangle with sides of equal length.
- A parallelogram is a quadrilateral with 2 sets of parallel sides.
- A rhombus is a parallelogram with sides of equal length.

Task Directions

PART I

The students will place all 16 quadrilateral pieces in a Venn diagram they create from pieces of string or three hoops. They will use the labels from the “Label” sheet to direct their sorts. Students may leave shapes outside of the rings. Encourage them to think of a label that could be placed for the entire group if there was one big circle around both rings and the ones that fall outside of the rings. The same set of pieces can be used for several sorts using the different labels and/or several sets can be recreated so that students can glue their sorts onto mats or posters for sharing.

During the sorting, circulate among groups and ask students to explain and defend their placement of the figures in the different rings. After each sort use the following questions to guide discussion.

- Why did you place shapes in the intersection? What characteristics do they have?
- What do all the shapes in this section of the Venn Diagram have in common? The other?
- How are the shapes in the sections different?
- What different label would eliminate one or more shapes from a section?
- What different label for the one of the sections would allow you to include a new shape?

PART II

Give students the “Unknown Labels” figures to reverse this investigation. On this sheet, students are given the pre-sorted shapes in sections of the Venn Diagram and then asked to determine which label could go above each section. Students must then use the properties of the shapes (angles and parallel or perpendicular lines) to defend their labels.

Possible Solutions for “Unknown Labels”

Set 1: At least one pair of parallel sides (left), no side parallel (right)

Set 2: All sides the same length (inner), At least one pair of parallel sides (outer)

Set 3: At least one obtuse angle (left), At least one right angle (right)

FORMATIVE ASSESSMENT QUESTIONS

- Why did you place shapes in the intersection? What characteristics do they have?
- What do all the shapes in this section of the Venn Diagram have in common? The other?
- How are the shapes in the sections different?
- What different label would eliminate one or more shapes from a section?
- What different label for the one of the sections would allow you to include a new shape?

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- How can you be sure that label for the Unknown group is correct? What is your proof?

DIFFERENTIATION

Extension

- Students can create their own label and challenge a partner to sort the shape using their labels.
- Students can create their own “Unknown Labels” samples for other students to label.

Intervention

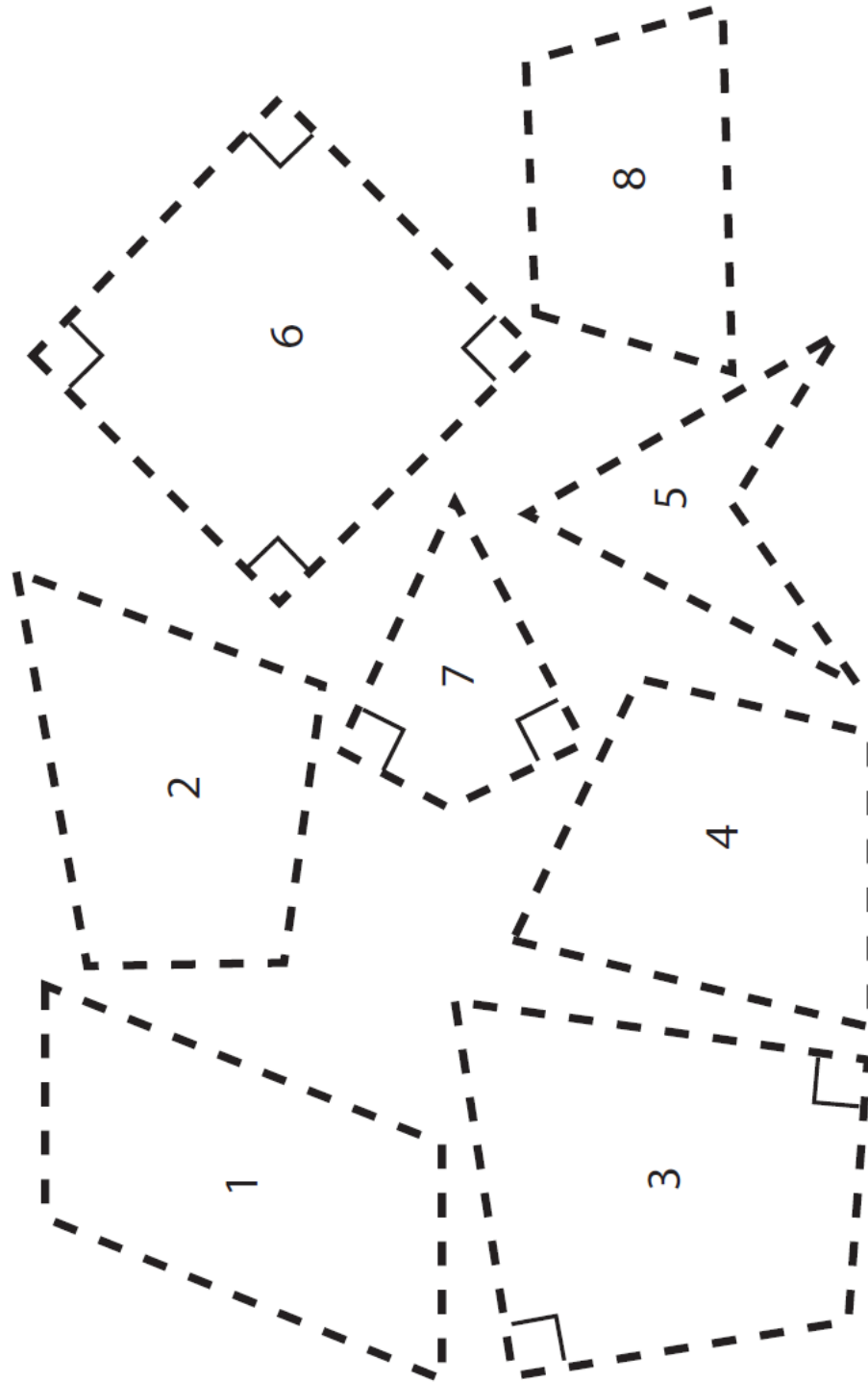
- Have students label each shape with its known properties (perpendicular lines, 1 right angle), etc. and use those as an aid when sorting.

[Intervention Table](#)

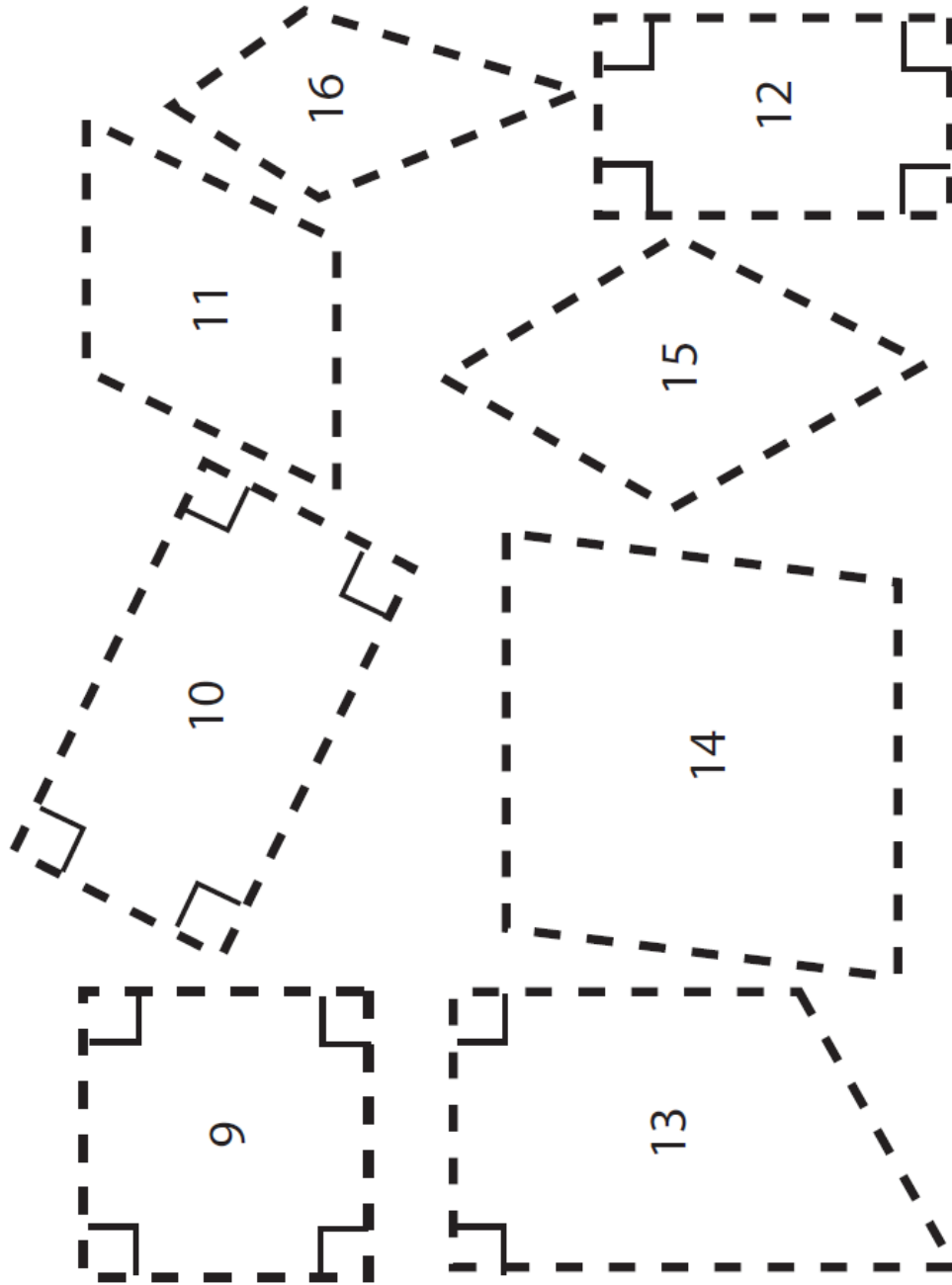
TECHNOLOGY

- <http://illuminations.nctm.org/LessonDetail.aspx?ID=L350> Rectangles and Parallelograms: This lesson examines the properties of rectangles and parallelograms and then identifies what distinguishes a rectangle from a more general parallelogram. It can be used for additional practice or for remediation purposes.
- http://teams.lacoe.edu/documentation/classrooms/amy/geometry/6-8/activities/quad_quest/quad_quest.html Quadrilateral Quest: This activity involves identifying quadrilaterals based on properties. It can be used for additional practice or remediation purposes.
- http://www.bbc.co.uk/bitesize/ks2/maths/shape_space/shapes/play/popup.shtml This activity looks at grouping shapes. It can be used for additional practice or remediation purposes.

Quadrilateral Pieces: Page 1



Quadrilateral Pieces: Page 2



Labels

Use hoops or yarn string to make circles. Then cut out each card for each task, and place it near one of the circles. Sort your “Quadrilateral Pieces” into each circle according to the label. You may need to overlap some circles to form intersections.

TASK 1	At least one right angle	No right angles
TASK 2	All sides the same length	At least one acute angle
TASK 3	At least one set of parallel sides	At least one obtuse angle
TASK 4	At least one pair of congruent sides	All pairs of opposite sides congruent
TASK 5 (three sections)	All sides are the same length	At least one obtuse angle
	At least one right angle	

Name _____ Date _____

Unknown Labels

Directions: Create Venn diagrams using two overlapping circles. Make an appropriate label and explain your reasoning.

Unknown Circles 1

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Left Circle: 1, 6, 8, 9, 10, 11, 12, 13, 14, 15

Center: None

Right Circle: 2, 3, 4, 5, 7, 16

Unknown Circles 2

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Left Circle: None

Center: 6, 9, 11, 15

Right Circle: 1, 8, 10, 12, 13, 14

Outside All Circles: 2, 3, 4, 5, 7, 16

Unknown Circles 3

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Left Circle: 1, 2, 3, 4, 5, 8, 11, 14, 15, 16

Center: 7, 13

Right Circle: 3, 6, 9, 10, 12,