# **Constructing Task:** Quadrilateral Roundup

## STANDARDS FOR MATHEMATICAL CONTENT

**MCC. 4.G.1** Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

**MCC.4.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

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.

- 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

- What is a quadrilateral?
- How can you create different types of quadrilaterals?
- How are quadrilaterals alike and different?
- 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"
- Blank index cards
- Markers
- Measuring tools such as rulers and index cards for students to test for right angles

## GROUPING

Partner/Small Group Task

## 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.

- 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 any shapes at all in the intersection there? What characteristics does it have?
- What do all the shapes on one ring have in common? The other?
- How much are the shapes in the ring different?
- What different label would eliminate one or more shapes form the ring?
- What different label for the one of the rings 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 rings and then asked to determine which label could go above each ring. 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 any shapes at all in the intersection there? What characteristics does it have?
- What do all the shapes on one ring have in common? The other?
- How much are the shapes in the ring different?
- What different label would eliminate one or more shapes form the ring?
- What different label for one of the rings would allow you to include a new shape?
- How can you be sure that label for the Unknown group is correct? What if your proof?

- Were students able to use the presence or absence of certain angles to classify the figures?

## DIFFERENTIATION

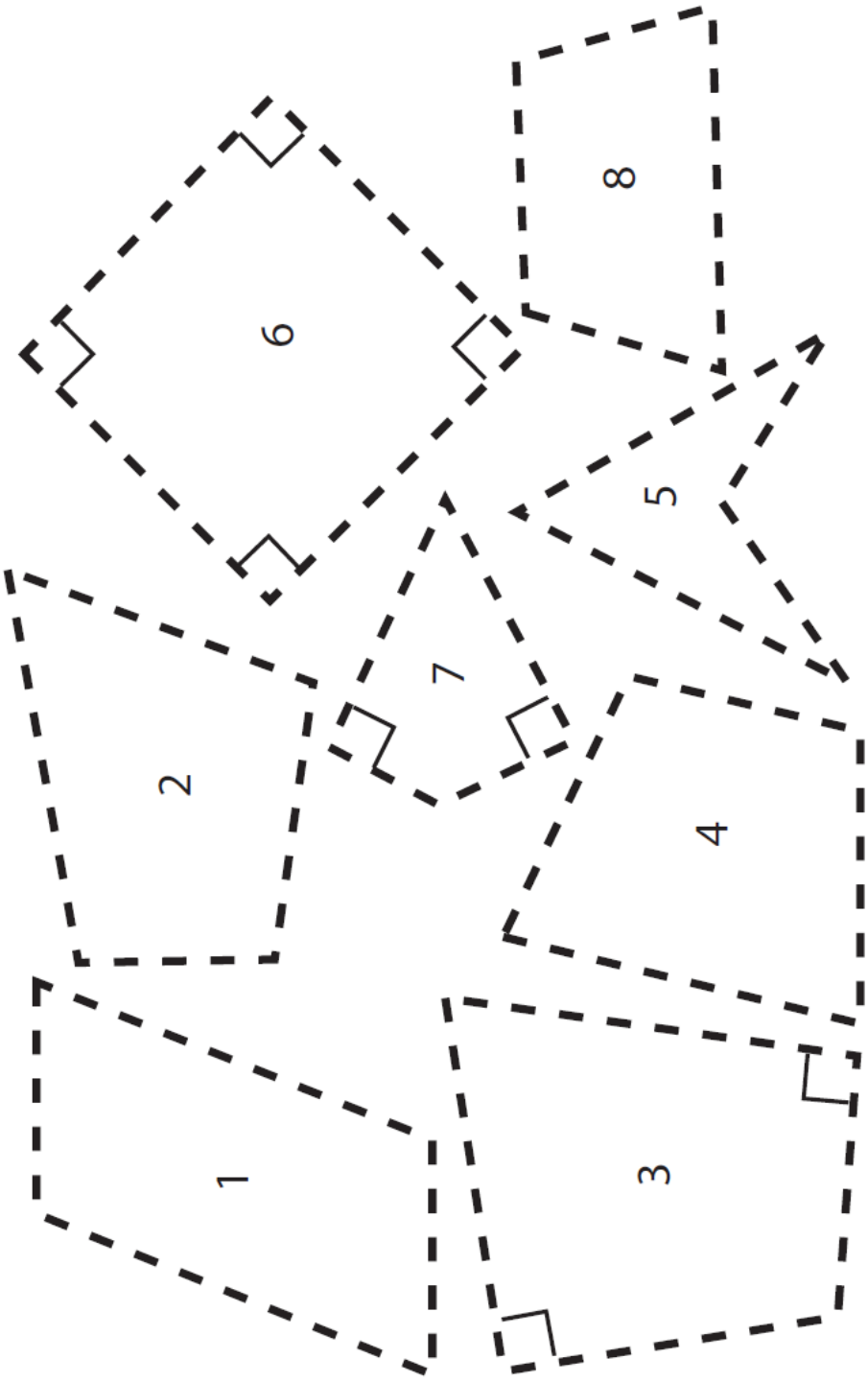
**Extension**

- 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.

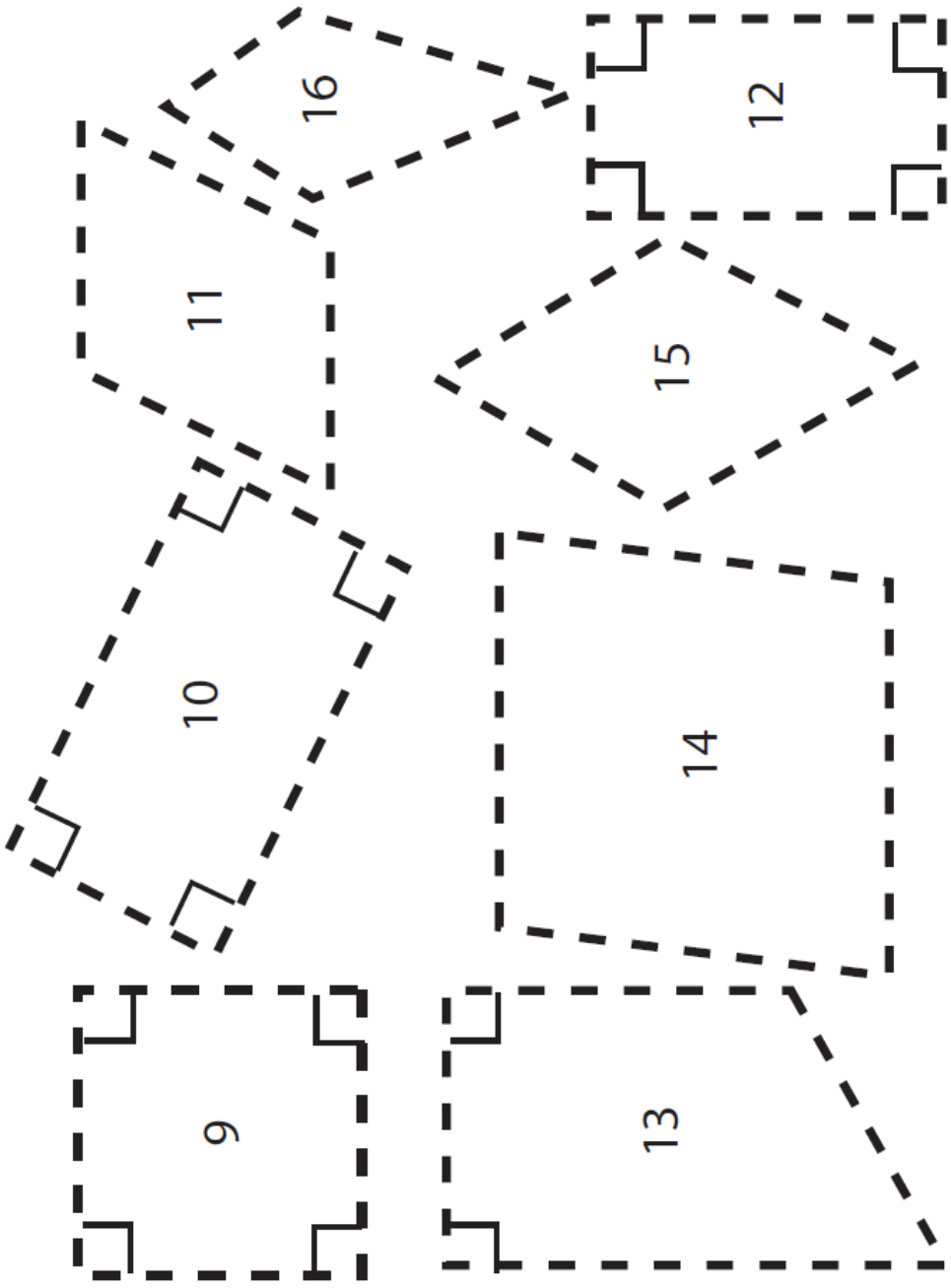
**Intervention**

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

# 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 rings. Sort your "Quadrilateral Pieces" unto each ring according to the label. You may need to overlap some rings 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 rings) | All sides are the same length | At least one obtuse angle |
| | At least one right angle | |

Name_____ Date_____

# Unknown Labels

Directions: Create each set of Unknown rings, make an appropriate label and explain your reasoning.

Unknown Rings 1

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

Center: None

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

Unknown Rings 2

Left Ring: None

Center: 6, 9, 11, 15

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

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

Unknown Rings 3

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

Center: 7, 13

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