Objective

Classify quadrilaterals using the lengths of their sides and the measurements of their angles.

Common Core State Standards

- **5.G.1** Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and *y*-coordinate).
- **5.G.2** Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
- **5.G.3** Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*
- **5.G.4** Classify two-dimensional figures in a hierarchy based on properties.

Geometry

Exploring Quadrilaterals: Sides and Angles

Students can be expected to examine the features of a variety of shapes, such as quadrilaterals, and describe the characteristics of those shapes. Even without specific exposure to the concept of *parallel,* many students will begin to form that understanding by measuring the sides and angles of the quadrilaterals encountered in this lesson. Students also will learn to articulate the differences and similarities among the types of quadrilaterals.

Try It! *Perform the Try It! activity on the next page.*

Talk About It

Discuss the Try It! activity.

- **Ask:** *Are all squares also rectangles? Explain.*
- **Ask:** *Are all rectangles also squares? Explain.*
- **Ask:** *Are all squares also parallelograms? Explain.*

Solve It

Reread the problem with students. Have them form quadrilaterals on a coordinate graph. Have them refer to the properties of quadrilaterals to determine which shape they have graphed.

More Ideas

For other ways to teach about the classification of quadrilaterals by sides and angles—

- Have students create the following quadrilaterals using AngLegs®: a square, a rectangle, a rhombus, a parallelogram, and a trapezoid. Have students measure and record the angles of the shapes they assemble. Then have students discuss the similarities and differences they notice among the figures.
- Have students use the XY Coordinate Pegboard and their knowledge of the properties of quadrilaterals to show that squares are rectangles, rectangles are parallelograms, and squares are rhombuses.

Formative Assessment

Have students try the following problem.

Which of the following statements is true?

A. All rectangles are squares.

B. All squares are rhombuses.

C. All parallelograms are rectangles.

D. All quadrilaterals are trapezoids.

Try It! 20 minutes | Pairs

Here is a problem about classifying quadrilaterals.

Jesse's soccer coach has the team doing drills from cone to cone. For each drill, the coach places four cones into a different configuration. The drills are named for the shape the cones make. Her coach made a grid to mark the placement of each cone. He marked the following ordered pairs on his grid:

> *Drill 1: (9, 12), (1, 12), (1, 4), and (9, 4)*
> *Drill 2: (11, 14), (5, 14), (5, 2), and (11, 2)*
> *Drill 3: (13, 8), (4, 8), (0, 3), and (9, 3)*

What are the names of the soccer drills Jesse will be doing? What angle will she have to turn at each cone?

Introduce the problem. Then have students do the activity to solve the problem. If necessary, review quadrilaterals briefly with students. Distribute the materials. Have students set up their pegboards for Quadrant I graphing.
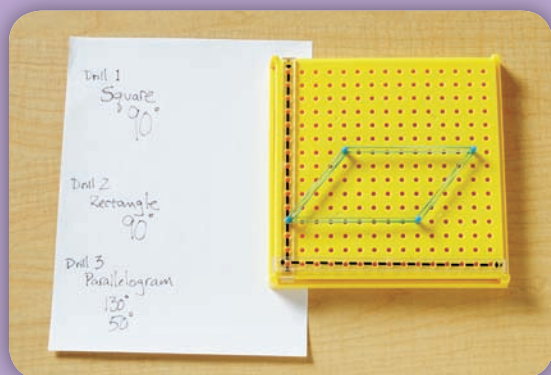
Materials
- XY Coordinate Pegboard (1 per pair)
- protractor or angle ruler
- Centimeter Grid (BLM 6; 1 per pair)
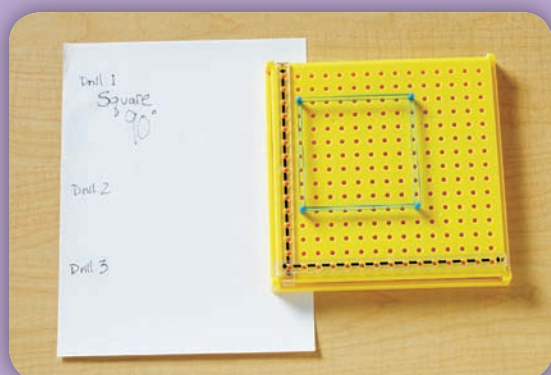
1. Have students plot the points for Drill 1 on the pegboard and connect the pegs with a rubber band. **Ask:** *What is the name of Jesse's first drill? What angle will Jesse have to turn at each cone?*
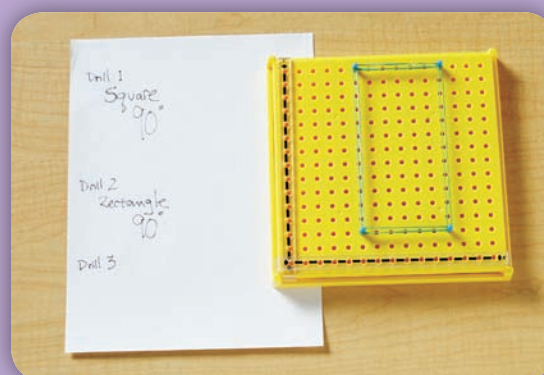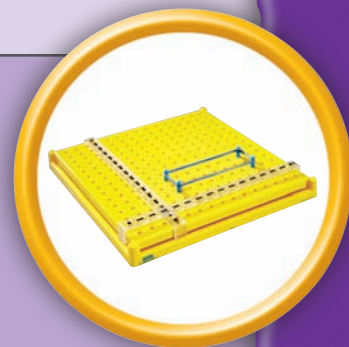
2. Next, have students plot Drill 2 on the pegboard and connect the pegs with a rubber band. **Ask:** *What is the name of the second drill? What angle will Jesse have to turn at each cone?*

⚠ Look Out!

Some students may have trouble remembering the properties of the less common quadrilaterals and may benefit from illustrations and definitions of the quadrilaterals.

3. Have students plot Drill 3 on the pegboard and connect the pegs with a rubber band. **Ask:** *What is the name of the third drill?* Have students transfer this figure to graph paper and measure the angles. **Ask:** *What angle will Jesse have to turn at each cone?*

Use an XY Coordinate Pegboard. Model each quadrilateral shown. Classify the quadrilateral by measuring its sides and its angles. Justify your answer.
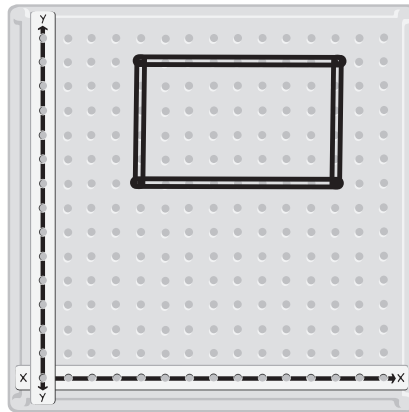
(Check students' work.)

1.
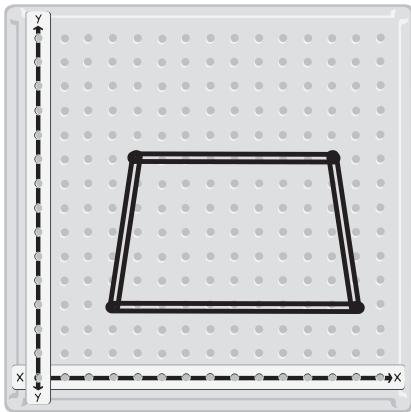
Trapezoid; the quadrilateral has exactly one pair of parallel sides.
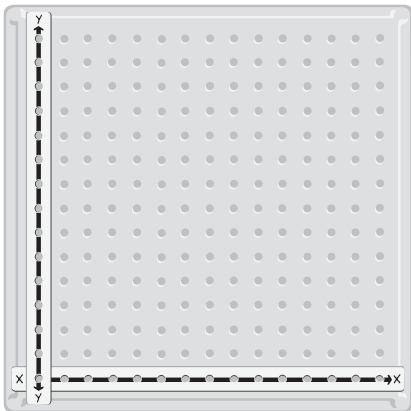
2.

Rectangle; the quadrilateral has opposite sides that are the same length and four 90° angles.

Using an XY Coordinate Pegboard, model each quadrilateral named. Sketch the model.
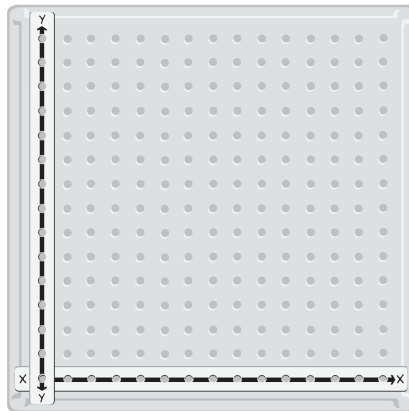
3. rhombus   Check students' models.

4. square   Check students' models.

Name each quadrilateral described.

5. four equal sides, one angle 50°, another angle 130°

rhombus

6. two sides 6 inches long, two sides 4 inches long, one set of parallel lines, no right angles

trapezoid

7. two sides 30 cm long, two sides 70 cm long, four equal angles

rectangle

8. four equal sides, four 90° angles

square

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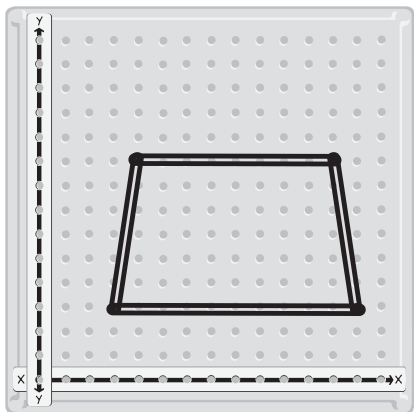Download student pages at hand2mind.com/hosstudent.

Answer Key

Challenge!   You are given the length of two adjacent sides of a quadrilateral. There are two sets of parallel sides and one right angle. Can you classify the quadrilateral? Explain. Can you identify the lengths of all four sides and all four angles? Draw a picture to help.

Challenge: (Sample) Yes; if the adjacent sides are congruent, the quadrilateral is a square, otherwise it is a rectangle; yes.
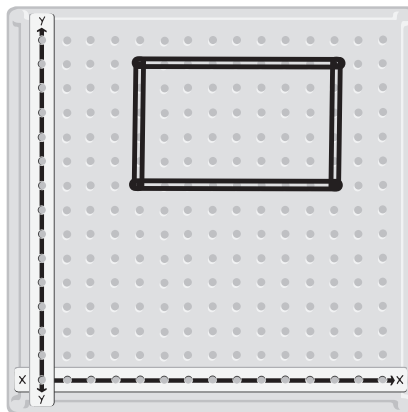
Name _____

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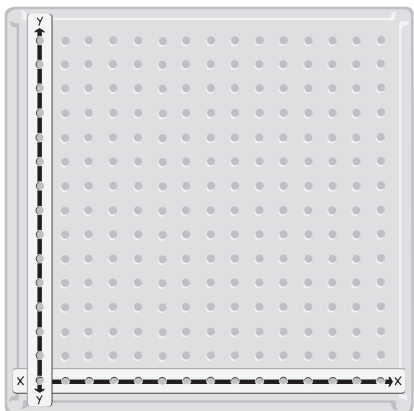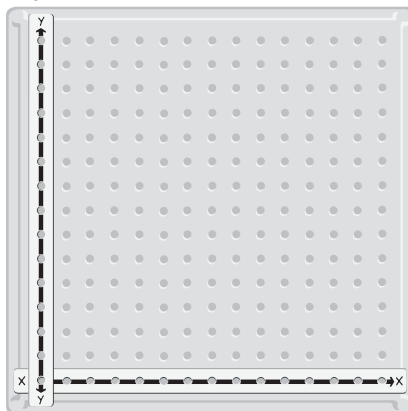
1.

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2.

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7. two sides 30 cm long, two sides 70 cm long, four equal angles

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Name _____

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Name _____