G2-3  Squares and Rectangles

Pages 179–181

Standards: 2.G.A.1

Goals:
Students will identify squares and rectangles by their attributes.
Students will draw squares and rectangles.

Prior Knowledge Required:
Can identify squares and rectangles visually
Can identify straight and curved lines and open and closed lines
Can identify and count sides and vertices of shapes
Can measure lengths using a centimeter ruler

Vocabulary: closed, curved, equal sides, open, longer, rectangle, shape, shorter, side, square, square corner, straight, vertices

Materials:
large paper shapes (squares, different rectangles, parallelogram, trapezoid, pentagon, triangle, circle, and two shapes with curved sides)
tape
pattern block squares or squares from BLM Pattern Blocks (p. S-61), six per student
BLM Find the Squares (p. S-62)
colored chalk (red and blue)
scissors
BLM Squares and Rectangles (p. S-63), one section per student
blue and red colored pencils
2 cm dot paper or BLM 2 cm Dot Paper (p. U-6)
squares from BLM Attribute Shapes (1) to (2) (pp. S-56–57, see Extension 1), one per student

Being a square does not depend on size, color, or pattern. Show students a large paper square and ASK: What shape is this? (square) Divide the board in two (reserve the second side of the board to show shapes that are not squares later in the lesson). Trace the paper square on one side of the board so the bottom side of the square is parallel to the floor. ASK: Is this a square? (yes) How do you know? (it is the shape of a square) Draw a smaller square with the same orientation and ask the same questions. (yes, it is the shape of a square) Draw more squares of varying sizes and colors, all oriented the same way. Add a pattern, such as dots, to some of the squares. ASK: Do the dots change the shape? (no) Is it still a square? (yes) Write “squares” on the board above the shapes. Leave these on the board for the rest of the lesson.

Being a square does not depend on position. Tape the large paper square to the board in a slightly rotated position so that the bottom side is not parallel to the floor. Trace and then remove the paper square. ASK: Is this shape a square? (yes) How do you know? (it is the
shape of a square) SAY: It is the same square as before, but we turned it a little. Repeat several times, increasing the angle of rotation until the square stands on a vertex. SAY: The shape did not change—all I did was turn it.

Activity 1  
(MP.7) Give each student a pattern block square (or squares from BLM Pattern Blocks) and BLM Find the Squares. Students will use their pattern block squares to determine the shapes on the BLM that are squares and cross out those that are not. (1. square, 2. ×, 3. square, 4. square, 5. ×, 6. ×, 7. ×, 8. square, 9. ×, 10. square, 11. ×, 12. square, 13. SQUARE)  
(end of activity)

Squares have 4 sides and 4 vertices. Have a volunteer number and then count the sides of one of the squares drawn on the board with a bottom side parallel to the floor. ASK: How many sides does the square have? (4) Repeat with a different volunteer for the vertices. (4) Repeat for a square of a different size and then for a square that is rotated. ASK: Do all squares have four sides and four vertices? (yes) Does the number of sides and vertices change when a square is turned? (no)

Squares have straight sides. Draw on the board:

```
  □
  □
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ASK: Is this a square? (no) Why not? (one side is curved) Have a volunteer fix the drawing so that it is a square. ASK: Do squares have all straight sides? (yes)

A square is a closed line. Draw on the board:

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  □
  □
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ASK: Is this a closed line or an open line? (open) Is this a square? (no) Why not? (one side has a hole in it) Have a volunteer fix the drawing so that it is a square. ASK: Is a square a closed line or an open line? (closed)

Squares have square corners. Draw on the board:

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  □
  □
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Ask a volunteer to circle the corner that matches the corners on a square. (the middle one) SAY: Squares have a special corner that we call a square corner.
Exercises: Is it a square?

a)  

b)  

c)  

d)  

Answers: a) no, b) no, c) yes, d) no

As a class, discuss why each shape from the previous exercises is or is not a square.
(a) 5 sides, 5 vertices; b) not closed, 3 vertices; c) 4 sides, 4 vertices, 4 square corners; d) not square corners)

(MP.7) Sorting shapes. Refer back to the half of the board labeled “squares.” Write “not squares” on the other half of the board. One by one, show students several large paper shapes that are squares and others that are not squares: different rectangles, a parallelogram, a trapezoid, a pentagon, a triangle, a circle, and two shapes with curved sides. Decide as a class whether each shape is a square or not (“square” or “not square”) and tape it to the appropriate half of the board. Encourage students to look at and count the sides and vertices of each shape to help them decide. Continue with shapes you draw on the board and include one or two open lines. Draw the first three or four shapes and then invite volunteers to draw others. Prompt students to use different sizes and patterns.

NOTE: The fact that the sides of a square are all of equal length is taught later in the lesson. If a student suggests this idea now, tell the class that you will check this later.

(MP.4) Identifying squares in the environment. Point to objects around the classroom and for each one, ASK: Does this shape look like a square? Students can compare the faces of 3-D objects with the squares on the board. Have volunteers identify other objects that include squares.

Identifying rectangles. Present rectangles as you did squares: show students a large paper rectangle and ASK: What shape is this? (a rectangle) Trace the rectangle on one side of the board, then draw or have volunteers draw more rectangles on the board (different sizes, colors, patterns, and orientations) and label them as “rectangles.” ASK: How many sides does a rectangle have? (4) How many vertices does a rectangle have? (4) What kind of corner does a rectangle have? (square) Emphasize that being a rectangle does not depend on pattern, color, size, or position.

Activity 2
Modeling rectangles. Have students create rectangles using up to six pattern block squares. Students will trace the rectangles in their notebooks and explain how the rectangles are different. (For example: This rectangle is 3 squares wide and 2 squares tall. The other rectangle is wider; it is 6 squares wide and only 1 square tall.)

(end of activity)

NOTE: Grade 2 students consider squares and rectangles different shapes, even though all squares are rectangles. They do not identify a square as a special type of rectangle. However, identifying a square as a rectangle is not a mistake and should not be considered as such.
Distinguishing between squares and rectangles. Draw several rectangles and squares on the board. For each one, ASK: Is this shape a square or a rectangle? Erase the shapes. Draw on the board:


ASK: Is the first shape a square? (yes) Is the second shape a square? (no) What do we call the second shape? (rectangle) What is the same about rectangles and squares? (both have 4 sides and 4 vertices, and all 4 corners are square) You may need to prompt students to get a complete answer. ASK: What is the difference between a square and a rectangle? (the rectangle is longer) Have a volunteer color the longer sides on the rectangle in red and the shorter sides in blue. ASK: Does the square have long or short sides? (short) Color the sides of the square in blue.

Activity 3
Distribute one section of BLM Squares and Rectangles to each student. Have students cut out the shapes and sort them into two groups: squares and rectangles. (squares: A and D; rectangles: B, C, and E)

(end of activity)

Length of sides in squares and rectangles. Hold up a large paper square. ASK: Is this a square or a rectangle? (square) Run your finger along one side and ASK: Is this side longer, shorter, or the same length as the other sides? (the same) SAY: We need to check that the sides are all the same as this one. Pointing to an adjacent side, ASK: How can we check if this side is the same? (measure the side) SAY: We can also fold the square to check. Demonstrate folding the square in half diagonally at the corner between the two sides and compare the sides. ASK: Are the sides the same? (yes) SAY: We call two sides that are the same length equal sides. Repeat with the other adjacent side then with the side opposite and use the word “equal” each time.

Repeat with the rectangle. Pointing to one of the shorter sides, ASK: How many sides of the rectangle are the same length as this side? (1) Fold the rectangle in half to demonstrate. Repeat with the longer sides.

Activity 4
(MP.1) Have students test the paper squares and rectangles they sorted in Activity 3 by folding to ensure that the squares have all equal sides and rectangles have two longer sides. Then have them retest the squares and rectangles by using indirect measurement. Students can mark the length of one side of a paper square in their notebooks, compare the other sides to the mark, and color all sides of the paper square blue. Have students do the same for a paper rectangle and color the shorter sides blue and the longer sides red.

(end of activity)
(MP.4) **Squares and rectangles in the environment.** Point to objects in the classroom, such as doors, windows, and books, and for each one, ASK: Does this shape look like a square or a rectangle? Students can compare the faces of 3-D objects with the squares and rectangles on the board. Then have volunteers identify other objects that include squares and rectangles.

For the following activities, students may wish to use pattern blocks to check square corners.

**Activities 5–6**  
(MP.1, MP.6) 5. **Drawing squares.** Have students draw squares of various sizes using 2 cm dot paper or BLM 2 cm Dot Paper. Have students also draw some shapes that have four sides and four vertices but are not squares (e.g., quadrilaterals or shapes with at least one curved side).

(MP.1, MP.6) 6. **Drawing rectangles.** Have students draw rectangles of various sizes using 2 cm dot paper or BLM 2 cm Dot Paper. Have students also draw some shapes that have four sides and four vertices but are not rectangles (e.g., quadrilaterals or shapes with at least one curved side).

(end of activities)

**Extensions**

1. Have students trace a square from BLM Attribute Shapes (1) and (2) in their notebooks and create a picture that incorporates the square.

**NOTE:** Students will need 2 cm dot paper or BLM 2 cm Dot Paper for Extensions 2–5. If students answer “Yes” to Questions 3–5, have them draw an example.

(MP.1) 2. Draw a shape with 4 sides that has opposite sides equal and is not a rectangle.  
**Sample answer:**

![Sample answer](image)

(MP.1, MP.4) 3. Is it possible to draw a shape with 4 equal sides, 4 square corners, and no other vertices that is not a square?  
**Answer:** no

(MP.1, MP.4) 4. Is it possible to draw a shape with straight sides, 4 square corners, and no other vertices that is not a rectangle or a square?  
**Answer:** no

(MP.1, MP.4) 5. Is it possible to draw a shape with straight sides and 4 square corners that is not a rectangle or a square?  
**Answer:** yes, sample shape:
G2-4  Polygons

Pages 182–184

Standards: 2.G.A.1

Goals:
Students will identify polygons and classify polygons by the number of sides, up to six sides.
Students will model polygons on geoboards.
Students will draw polygons by connecting dots.

Prior Knowledge Required:
Can identify straight and curved lines and open and closed lines
Can identify and count sides and vertices of shapes
Can identify triangles

Vocabulary: closed, curved, hexagon, pentagon, polygon, quadrilateral, rectangle, shape, side, square, straight, triangle, vertex, vertices

Materials:
shapes from BLM Attribute Shapes (pp. S-56–58), an assortment for each student
tape
index cards with names of polygons (triangles, quadrilaterals, pentagons, hexagons)
colored pencils
BLM Identifying Polygons (p. S-64)
BLM Game Cards (pp. U-2–3)
geoboards
2 cm dot paper or BLM 2 cm Dot Paper (p. U-6)
BLM Matching Polygons (pp. S-65–66)
rulers
BLM Space Polygons (p. S-67, see Extension 1)

Introduce polygons. Divide the board into two. On one side, draw a variety of polygons, including regular polygons (shapes with equal sides and equal angles) and irregular polygons. Write “polygons” above the shapes. SAY: These shapes are polygons. Write “not polygons” on the other side of the board and draw the following shapes:

not polygons

Pointing to the first shape. ASK: How is this line different from the polygons? (it is not closed)
Repeat with the second and third shapes. (it has a curved side, it has an extra line) Pointing to
the fourth shape, SAY: The sides of a polygon do not cross each other. This shape has two sides that cross, so it is not a polygon. Pointing to the fifth shape, SAY: In a polygon, exactly two sides meet at a vertex. In this shape, four sides meet at the middle vertex, so this is not a polygon.

Draw a variety of other non-polygons. ASK: What is the same about all the polygons? Are they all closed shapes? (yes) Do they all have straight sides? (yes) How many sides meet at each vertex? (2) Do they all have the same number of vertices? (no) SAY: All shapes that are closed and have straight sides that do not cross are called polygons.

(MP.4) Exercise: Draw two different polygons. Draw two different shapes that are not polygons.

Activity 1

(MP.7) Sorting shapes. Give each student an assortment of shapes from BLM Attribute Shapes. Have them sort the shapes into two groups: polygons and not polygons. Ask students to put aside all the shapes that are not polygons and sort the polygons by the number of sides: three sides, four sides, and so on. Have them compare their results with a partner. Then have students count the number of vertices of the shapes in each group. Have volunteers tape their groups of polygons that have the same number of sides to the board. Keep the groups of polygons on the board.

(end of activity)

Names of polygons. SAY: Mathematicians gave names to polygons depending on the number of sides and vertices they have. You know some of them already. ASK: What is a polygon with three sides and three vertices called? (triangle) Hold up an index card that says “triangles” and have a volunteer tape it to the board above the group of triangles. ASK: What shapes have four sides? (squares and rectangles) Have a volunteer indicate where the shapes with four sides are. ASK: Are they all squares or rectangles? (no) Hold up the card that says “quadrilaterals” and SAY: All polygons with four sides are called quadrilaterals. So squares and rectangles are quadrilaterals. ASK: How many vertices do quadrilaterals have? (4) Have the volunteer tape the card in the appropriate place. Hold up the card that says “pentagons” and SAY: A polygon with five vertices is called a pentagon. ASK: How many sides does a pentagon have? (5) Have a volunteer tape the card in the appropriate place. Hold up the card that says “hexagons” and SAY: A polygon with six sides is called a hexagon. How many vertices does a hexagon have? (6) Have a volunteer tape the card in the appropriate place.

Have students use colored pencils to complete BLM Identifying Polygons.

Draw on the board:

<table>
<thead>
<tr>
<th>Polygon</th>
<th>Number of Sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>triangle</td>
<td>3</td>
</tr>
<tr>
<td>quadrilateral</td>
<td>4</td>
</tr>
<tr>
<td>pentagon</td>
<td>5</td>
</tr>
<tr>
<td>hexagon</td>
<td>6</td>
</tr>
</tbody>
</table>
SAY: The table shows what we know about polygons. A triangle has three sides. ASK: How many vertices does it have? (3) Do we need to write that? (no) Why? (the number of sides and the number of vertices are always the same)

Use any or all of the following activities to reinforce the names of polygons. These games can be repeated for a few days to solidify learning.

**Activity 2**
Have students play *I Have ___, Who Has ___?* (see unit introduction) in groups of four. In advance, make cards using *BLM Game Cards*. Fill in the top of a card with a picture of a polygon. You can use the shapes from *BLM Matching Polygons*. In the bottom of the card, write the name of a different polygon (e.g., triangle, quadrilateral, pentagon, hexagon).

(Activity)

(MP.4, MP.7) *Modeling polygons*. Using a geoboard, create each of the polygons introduced in the lesson. Give each student a geoboard and have them name the polygon and then recreate it exactly on their geoboards.

**Activities 3–4**
3. Provide students with a geoboard, 2 cm dot paper or *BLM 2 cm Dot Paper*, and name cards from *BLM Matching Polygons* (1). Player 1 draws a card at random and (without showing the card to Player 2) creates the polygon on the geoboard or draws it on dot paper. Player 2 identifies the polygon. Players switch roles and play again.

4. Have students play *Memory* (see unit introduction) using the cards from *BLM Matching Polygons* to match a polygon with its name.

(Activity)

(MP.4, MP.7) *Drawing polygons from vertices*. ASK: How many vertices does a triangle have? (3) SAY: On a geoboard, we stretched an elastic around each vertex of the triangle. Draw and number three dots (not in a line) on the board. SAY: On the board, we use a dot for each of the three vertices of a triangle. Have a volunteer connect the dots in order to form a triangle, as shown below:

![Diagram of a triangle with vertices labeled 1, 2, and 3. Dot 1 connects to dot 2, dot 2 connects to dot 3, and dot 3 connects back to dot 1.]

SAY: Dot 1 connects to dot 2, dot 2 connects to dot 3, and dot 3 connects back to dot 1. ASK: Why do we have to connect dot 3 to dot 1? (to close the triangle) Repeat for a different set of three dots and let volunteers draw and connect the dots.

**Exercise**: Draw 3 dots in your notebook. Use a ruler to connect the dots in order. Join the first and last dots to make a triangle.
ASK: How many vertices does a quadrilateral have? (4) How many dots do I need to make a quadrilateral? (4) Draw and label four dots, as shown below:

```
1.

4.

3.

. 2
```

Have a volunteer connect the dots to make a quadrilateral.

Draw four different dots. Label the dot at the top “1,” as shown below:

```
1.

.

.
```

Point at the 1 and SAY: I will start to connect the dots here. Which dot should I connect to next to make a quadrilateral? Point to an adjacent dot and ASK: Can I connect here? (yes) Point to the other adjacent dot and ASK: Can I connect here? (yes) Point to the last dot and ASK: Can I connect here? (no) SAY: Let’s see what happens if I connect there. Draw the lines as shown below:

```
1

```

ASK: Is this a polygon? (no) Why not? (the sides cross, 4 lines meet at the middle vertex) Erase the lines and have a volunteer connect the dots to make a quadrilateral. Number the rest of the dots as shown below:

```
1

3

2

4
```

ASK: Why do we connect dot 4 to dot 1? (to close the shape)

**Exercise:** Draw 4 dots in your notebook. Use a ruler to connect the dots and make a quadrilateral.
Extensions

1. Have students complete **BLM Space Polygons**.

2. A heptagon has seven sides. Make a heptagon on a geoboard.

3. An octagon has eight sides. Make an octagon on a geoboard.

4. Demonstrate how to draw a pentagon by drawing four dots to make a quadrilateral, then adding one more dot on the outside. Example:

   ![Pentagon Drawing]

   Erase the line connecting the dots inside the pentagon. Have students draw their own pentagons using this method.

5. Demonstrate how to draw a pentagon by drawing four dots to make a quadrilateral, then adding one more dot in the middle. Example:

   ![Pentagon Drawing (Middle Dot)]

   Start at the middle dot and draw a line to an adjacent dot, then keep going in order. Example:

   ![Pentagon Drawing (Middle Dot)]

   Have students draw their own pentagons using this method.

6. Draw five dots as in Extension 5. Ask students to show all the different ways to connect the dots to make a pentagon.

   **Answers:**

   ![Pentagon Diagrams]