Grade 8 Mathematics
Geometry: Lesson 2

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol (⇨) by them.

Purpose of Lesson 2:

- In this lesson, the tutor and the students will
  - ✓ identify, draw, or name 2-dimensional figures (circles, triangles, quadrilaterals, trapezoids, parallelograms, rectangles, squares, rhombuses, pentagons, hexagons, and octagons);
  - ✓ describe the properties of the figures above (number of sides, number of angles, length of sides, whether there are right angles, whether sides are parallel, and whether the sides are closed);
  - ✓ identify the parts of circles (diameter and radius);
  - ✓ identify the different types of triangles (isosceles, equilateral, and scalene); and
  - ✓ determine what shapes, or how many shapes, are found in a geometric figure.

Equipment/Materials Needed:

- Copies of Student Sheets 30 – 33
- One paper clip or zip lock bag for each student
- Measuring tape or ruler for each student

Preparations before beginning Lesson 2:

- Run off one copy of Student Sheet 30 for each student. Cut out the figure names and the figures. Put each set in a zip lock bag or paper clip them together.
- Run off one copy of Student Sheets 31 – 33 for each student.
- Have paper, pencils, and measuring tapes or rulers available.

Lesson 2: Geometry

Say:

In the last lesson, we looked at points, lines, rays, line segments, and angles. If we put line segments together, we can make geometric figures. We can make flat figures, figures that have two dimensions, length and width. These figures – such as squares and triangles – are called *plane figures.* We can also make figures that have three dimensions. These figures have length, width, and height. The figures – such as cubes and cones – are called *solid figures.* We will look at solid shapes in the next lesson.

⇨ Give the cutout figures and names from Student Sheet 30 to the students.

Say:

For right now, separate the pieces of paper into two groups: the figures and the names of the figures. Let's look at the figures. All of the figures that I have given you are polygons. Tell me some things about polygons. (The sides are straight lines or segments, the figures have at least 3 sides, and the figures are closed figures or their ends are connected.)

⇨ Draw a figure like this one. 

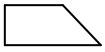
Ask:

Is this figure a polygon? (No. It is not closed; the ends are not connected.)

⇨ Draw a circle. 

Ask:

Is this figure a polygon? (No. It does not have straight sides.)

⇨ Draw a figure like this one. 

Ask:

Is this figure a polygon? (Yes. The students may have mistakenly thought that the sides have to be the same length.

Say:

Sort your figures by the number of sides. (The sheet should have 4 triangles, 5 figures with 4 sides, 2 figures with 5 sides, 2 figures with 6 sides, and 2 figures with 8 sides)

Say:

Let's look at our 3-sided figures. Which are the 3-sided figures? (#8, #9, #10, #15) **Find the name for 3-sided figures.** (triangle.) **Which figure has a right angle?** (#9) **How many angles do triangles have?** (3) **Do they have any parallel lines?** (No.) **If all three sides are the same length, the triangle is called an *equilateral* triangle. Which one is an equilateral triangle?** (#8) **If only two sides of a triangle are the same length, the triangle is called an *isosceles* triangle. Which triangle is isosceles?** (#15) **If all of the sides have different lengths, the triangle is called a *scalene* triangle. Which is the scalene triangle?** (#9 or #10; #9 is a right triangle and a scalene triangle.)

Say:

Put the triangles away for now. Let's look at the figures with 5 sides. Which are the 5-sided figures? (#5 and #12) **Find the name for 5-sided figures.** (pentagon) **How many angles do pentagons have?** (5) **What is different about the 2 pentagons?** (#5 has sides that are the same length; #12 has some right angles and parallel sides.) **Do pentagons have parallel sides?** (They can, but they don't have to.) You want to get the idea across that pentagons can look very different, but they all have 5 sides and 5 angles. **A pentagon that has all sides the same length is called a *regular pentagon.* Which pentagon is a regular pentagon?** (#5)

Say:

Put the pentagons away. Let's look at figures with 6 sides. Which are the 6-sided figures? (#6 and #13) **Find the name for 6-sided figures.** (Hexagon.) **How many angles do hexagons have?** (6) **How are the 2 hexagons different?** (#6 has sides that are the same length and has some lines that are parallel lines; #13 has a right angle with no parallel sides.) Again, you want the students to see that hexagons can look very different. **A hexagon that has all sides the same length is called a *regular hexagon.* Which hexagon is a regular hexagon?** (#6)

Say:

Put the hexagons away. Let's look at the figures with 8 sides. Which are the 8-sided figures? (#7, #14) **Find the name for 8-sided figures.** (octagon) **How many angles do octagons have?** (8) **How are the two octagons different?** (#7 has some parallel sides and all the sides are the same length; #14 has no parallel sides and the side lengths are all different.) **An octagon that has all sides the same length is called a *regular octagon.* Which octagon is a regular octagon?** (#7)

Say:

Put the octagons away. Which figures are left? (4-sided figures) **Which are 4-sided figures?** (#1, #2, #3, #4, and #11) **Some 4-sided figures have more than one name. All four-sided figures are called *quadrilaterals.* They can look very different, just as pentagons and hexagons can; but they all have 4 sides and 4 angles. In some quadrilaterals, the opposite sides are parallel. If a figure has *exactly* one set of parallel sides, it is called a *trapezoid.* Which figure is a trapezoid?** (#1)

If a figure has two sets of parallel sides, it is called a *parallelogram.* Which are parallelograms? (#2, #3, and #4)

If a figure has no sides parallel, it is simply called a *quadrilateral*. Which figure has no parallel sides? (#11)

Let's look at the 4-sided figures that have opposite sides parallel. (#2, #3, #4) **These figures are still quadrilaterals and parallelograms, but also have other names. Two of the three figures have 4 right angles. Put those in front of you.** (#2, #3) **How are the figures alike?** (They all have 4 sides, 4 angles, opposite sides are parallel, and all of the angles are right angles.) **Four-sided figures that have opposite sides parallel and 4 right angles are called *rectangles.* Both of these are rectangles. How are the 2 figures different?** (#3 has sides that are all the same length.) **This figure has another name; it is called a *square*.**

We have found that a rectangle can be called a rectangle, a parallelogram, and a quadrilateral. What are the other names for a square? (rectangle, parallelogram, and quadrilateral.)

Say:

Put all of the three 4-sided figures with opposite sides parallel in front of you. (#2, #3, #4) **Which two of these figures have sides that are the same length?** (#3 and #4) **Place them in front of you. How are they alike?** (They have 4 sides and 4 angles; all sides are the same length; and the opposite sides are parallel.) **Four-sided figures that have opposite sides parallel and have all sides the same length are called *rhombuses.***

So these two figures also have the name of rhombus. How are they different? (#3 has right angles.) **We have already named #3. It is a square, so a square can also be called a *rhombus.***

⇨ Place the square in front of you.

Say:

What are all the names for a square? (square, rectangle, rhombus, parallelogram, and quadrilateral)

⇨ Give Student Sheet 31 to the students. Allow the students 3–5 minutes to do 1–7. Then talk about each one. These are some responses:

1) 3; triangle

2) 4; they should tell you a square, rectangle (because it has opposite sides parallel and 4 right angles), rhombus (because opposite sides are parallel and all sides are the same length), parallelogram (because opposite sides are parallel) and quadrilateral (because it has 4 sides)

3) 5; pentagon

4) 8; octagon

5) 6; hexagon

6) 4; rhombus, parallelogram, and quadrilateral

7) 4; trapezoid

⇨ Now give Student Sheet 32 to the students. You want to make sure that the students realize that they should count the squares. Squares are also rectangles, just special ones.

1) 6 rectangles

2) 3 rectangles

Number 3 will take a little time.

3) B and C are triangles. They have 3 sides, the sides are straight, and they are connected. A is not a triangle, because the sides are not connected. D is not a triangle because it does not have straight lines.

⇨ Give Student Sheet 33 to the students.

Say:

Let's look at the circles. Circles are not polygons because they do not have straight sides. A *circle* is a set of points, all of which are the same distance from a given point. This point is called the *center* of the circle. Name the center of Circle 1. (F)

A *diameter* is a line segment that passes through the center and has its endpoints on the circle.
Name a diameter of Circle 1. (Segment DE or ED. You can name a segment either way.)

A *radius* is any line segment from the center of the circle that has the other endpoint on the circle. Name a radius on Circle 1. (AF, DF, or FE)

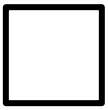
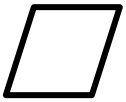
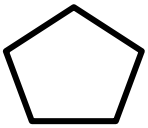
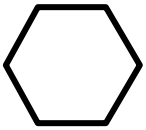
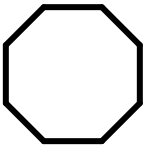
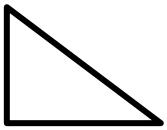
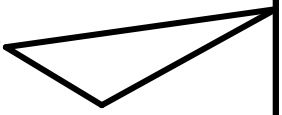
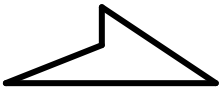
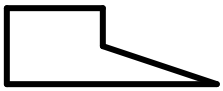
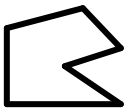
On Circle 2, draw a diameter and a radius of the circle. Look at the person sitting next to you. Did he/she draw the same diameter and radius? (probably not) **What is alike about the diameters?** (They all go through the center and have endpoints on the circle.)

Measure the diameter and the radius of Circle 1. (The diameter is 2½ inches; the radius is 1¼.) **What do you notice?** (The diameter is 2 times the radius.)

Measure the diameter and radius of Circle 2. (The diameter is 2 inches and the radius is 1 inch.) **What do you notice?** (The diameter is twice the radius.) **Why?** (The diameter goes through the whole circle. The radius goes through only half of it.)

⇨ Have one student summarize today's lesson. Make sure that the students understand the different names for 4-sided figures.

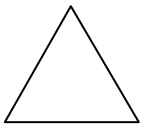
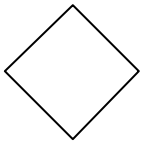
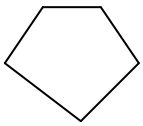
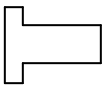
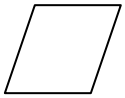
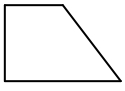
Student Sheet 30 (Geometry: Lesson 2)

Triangle	**Parallelogram**	**Quadrilateral**
Rectangle	**Rhombus**	**Square**
Pentagon	**Hexagon**	**Octagon**
Trapezoid	**1.** 	**2.** 
3. 	**4.** 	**5.** 
6. 	**7.** 	**8.** 
9. 	**10.** 	**11.** 
12. 	**13.** 	**14.** 
15. 		

Student Sheet 31 (Geometry: Lesson 2)

How many sides does each figure have? Name each shape with all of the names that describe it. The names are in the box below.

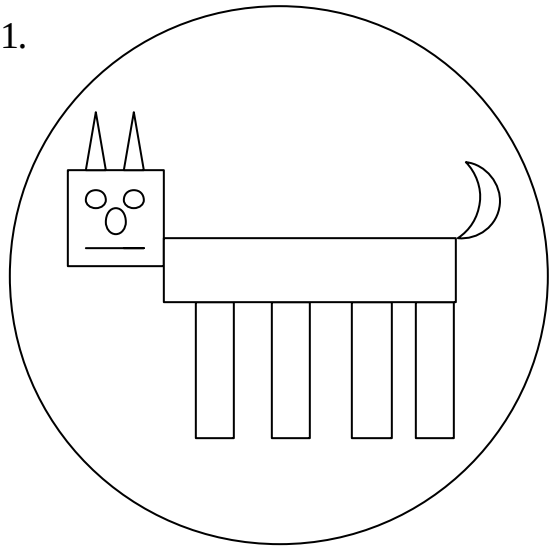
Triangle	Rectangle	Pentagon	Circle	Octagon	Trapezoid
Hexagon	Quadrilateral	Rhombus	Square	Parallelogram	

		Number of Sides	Name(s)
1.		_____	_____
2.		_____	_____
3.		_____	_____
4.		_____	_____
5.		_____	_____
6.		_____	_____
7.		_____	_____

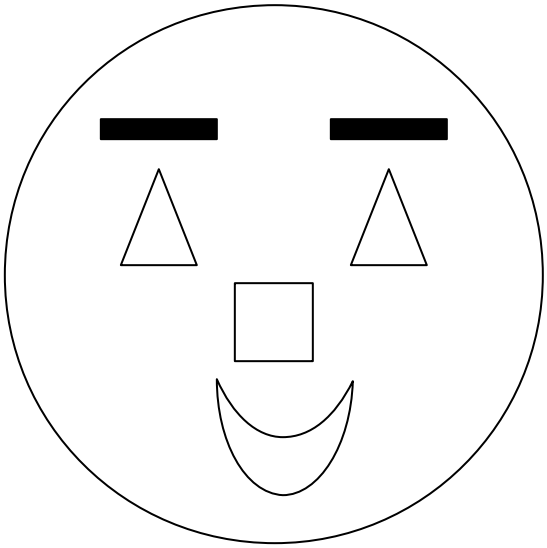
Student Sheet 32 (Geometry: Lesson 2)

How many rectangles are in the following figures?

1.



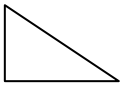
2.



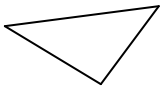
3. **Which of the following are triangles? Explain in writing why you think each is or is not a triangle.**

A.

B.



C.



D.

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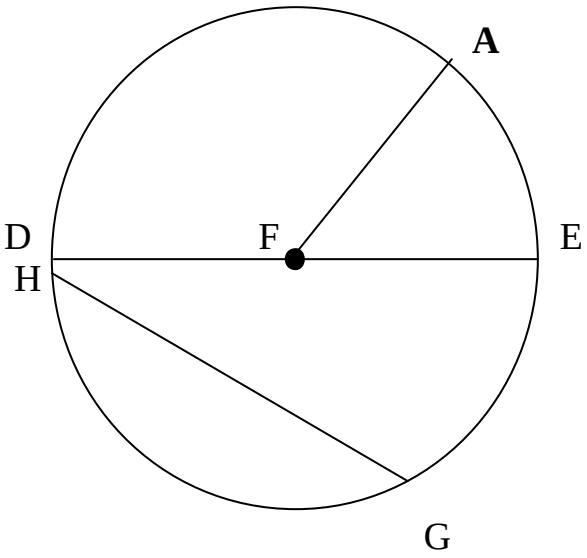
Student Sheet 33 (Geometry: Lesson 2)

Circle 1



Circle 2