Weekly Focus: polygons
Weekly Skill: perimeter, area

LESSON 43: Polygons

Lesson Summary: For the warm up, students will solve a problem about distances. In Activity 1, they will learn vocabulary about polygons. In Activity 2, they will solve for perimeter and area of polygons. In Activity 3, they will solve word problems. There are two exit tickets: one is an additional perimeter and area problem, and the other is a perimeter question about The Pentagon. Estimated time for the lesson is 2 hours.

Materials Needed for Lesson 43:

- Video (length 3:30) on the area of polygons. The video is required for teachers and optional for students.
- 2 Worksheets (43.1, 43.2) with answers (attached)
- 1 polygon sheet to copy and use for Activity 1
- *Mathematical Reasoning Test Preparation for the 2014 GED Test* Student Book (pages 98 – 99)
- *Mathematical Reasoning Test Preparation for the 2014 GED Test* Workbook (pages 134 – 137)
- Link to Optional Exit Ticket: http://www.ck12.org/geometry/Area-of-Regular-Polygons/lesson/Area-of-Regular-Polygons-Intermediate/

Objectives: Students will be able to:

- Solve the distance word problem
- Name the polygons by the number of sides they have
- Solve perimeter, area and other problems related to polygons

ACES Skills Addressed: N, CT, LS
CCRS Mathematical Practices Addressed: Model with Math, Mathematical Fluency
Levels of Knowing Math Addressed: Intuitive, Pictorial, Abstract, and Application

Notes:
-You may encourage students to watch Video B from Lesson 41 again.
-Prepare Activity 1 ahead of time. Make copies of the polygons sheet. Cut out several sets of the shapes without the names. Put in envelopes (you can make envelopes by stapling the sides of folded paper).
-The GED test requires students to solve for the perimeter and the area of polygons. The focus is not on the names of the figures but students should still have a good idea of the name of each polygon.

You can add more examples if you feel students need them before they work. Any ideas that concretely relate to their lives make good examples.

For more practice as a class, feel free to choose some of the easier problems from the worksheets to do together. The "easier" problems are not necessarily at the beginning of each worksheet. Also, you may decide to have students complete only part of the worksheets in class and assign the rest as homework or extra practice.

The GED Math test is 115 minutes long and includes approximately 46 questions. The questions have a focus on quantitative problem solving (45%) and algebraic problem solving (55%).

Students must be able to understand math concepts and apply them to new situations, use logical reasoning to explain their answers, evaluate and further the reasoning of others, represent real world problems algebraically and visually, and manipulate and solve algebraic expressions.

This computer-based test includes questions that may be multiple-choice, fill-in-the-blank, choose from a drop-down menu, or drag-and-drop the response from one place to another.

The purpose of the GED test is to provide students with the skills necessary to either further their education or be ready for the demands of today's careers.

Lesson 43 Warm-up: Solve the distance problem	**Time: 5-10 Minutes**

Write on the board: Paula bikes 6 miles east from her house to the library. Then she bikes north from the library to the grocery store. The distance from the library to the store is 1/3 more than from her house to the library. Then she bikes SW directly to her home.

Basic Questions:

- How far is the store from the library?
  - 1/3 more than 6 miles is 2 miles, so it is 6+2=8 miles
- Draw a map of Paula's trip.

Extension Question:

- How far is the straight distance from the grocery store back to her house?
  - Hint: the trip makes a right triangle.
  - You can solve with the Pythagorean Theorem. $6^2 + 8^2 = 100$. The square root of 100 is 10, so the distance from the store to her house is 10 miles.

Lesson 43 Activity 1: Vocabulary on Polygons	**Time: 10 Minutes**

1. Do a quick geometry warm up by asking students to identify some shapes of items they see in the classroom.
2. Say that today you are studying polygons. Ask if anyone knows what the word poly means *(many, much)*.
3. Hand out the cutout shapes and ask students to work in small groups to identify the ones they can.
4. Write the names of the shapes students identified on the board.
5. Help students complete the list.
6. Give students a few minutes to make their own notes of the shapes in their notebooks.
7. You can use **Worksheet 43.1** as an alternative or for homework.

Lesson 43 Activity 2: Perimeter and area of polygons	**Time: 25 Minutes**

1. Draw a hexagon. Make each side of the hexagon 8 inches.
2. Ask students the **perimeter** of the hexagon (8 inches x 6 sides = 48 inches)
3. Now draw 6 triangles inside the hexagon (like in the video).
4. We can find the **area** of the hexagon by finding the area of the 6 triangles inside.
5. Note that the length of each side also happens to be the same as the base of each triangle.
6. Ask students if they remember how to find the area of a triangle. (½ base x height)

7. Draw an **apothem**- **a segment from the center of the hexagon to the middle of one side.** Make it 3 inches. The apothem is the height of the triangle.
8. Solve for the area of one triangle: ***½ x base x height = ½ x side x apothem***. In this example: ½ x 8 inches x 3 inches = 12 inches square. This is the area of one triangle.
9. Multiply the 12 inches of one triangle by 6 for the area of the whole hexagon. (72 inches square).
10. Do **Worksheet 43.2.** Students can use calculators and round their answers. Do #1 and possibly #2 together if needed.
11. Have students solve a few of the problems on the board if there is time.

Lesson 43 Activity 3: Solve word problems	**Time: 45 Minutes**

1. Do the problems in the **student book pages 98-99** together.
2. Note that a **regular polygon** is a polygon with congruent sides and angles (like example A).
3. An **irregular polygon** has angles and sides that are incongruent (like Example B).
4. Now students can do the problems in the **workbook pages 134-137** independently.
5. Circulate to help.
6. Ask students to volunteer to solve any challenging problems on the board if there is time.

Lesson 43 Exit Ticket Option A	**Time: 5 Minutes**

1. Draw a pentagon on the board. Label the sides as 8 inches and the apothem as 5 inches.
2. Ask students to solve for the perimeter and the area.
3. An alternative is to have students create problems for others to solve if there is time.
4. *Answers:*
   a. *Perimeter is 8 inches x 5 sides = 40 inches.*
   b. *Area of 1 triangle is ½ x 8 x 5 = 20 square inches. Area of pentagon is 5 triangles x 20 square inches = 100 inches^2.*

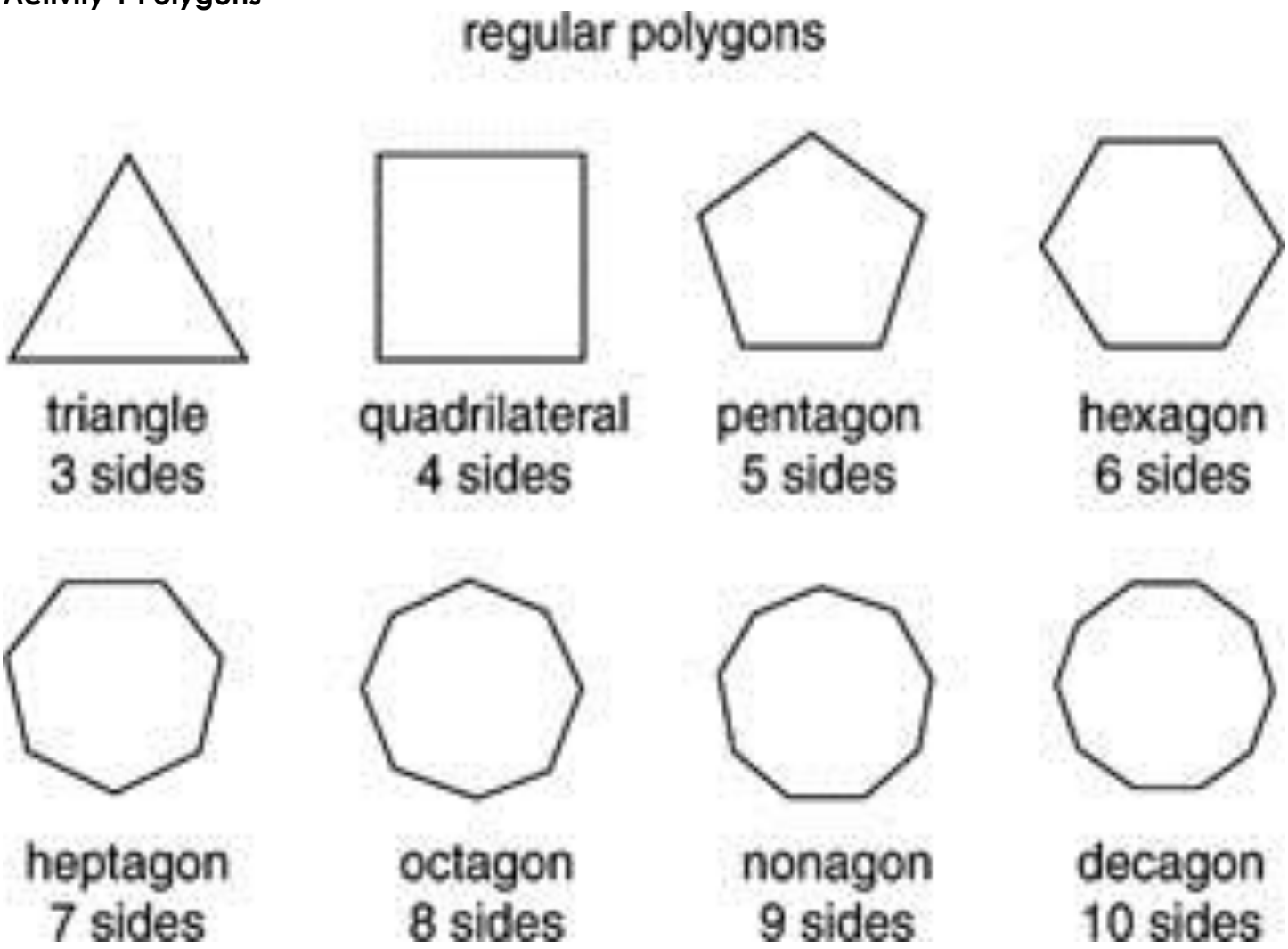
Lesson 43 Exit Ticket Option B: THE Pentagon	**Time: 5 Minutes**

What if you were asked to find the distance around The Pentagon in Arlington, VA? The Pentagon, which also houses the Department of Defense, is composed of two regular pentagons with the same center. The entire area of the building is 29 acres (40,000 square feet in an acre), with an additional 5-acre courtyard in the center.

The length of each outer wall is 921 feet. What is the total distance around the pentagon?

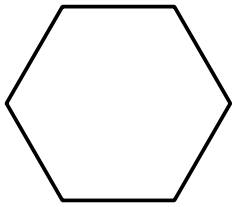
1. See more at http://www.ck12.org/geometry/Area-of-Regular-Polygons/lesson/Area-of-Regular-Polygons-Intermediate/.
2. *Answer: Perimeter is 921 feet x 5 sides = 4605 feet*

Activity 1 Polygons

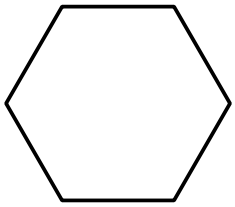


Worksheet 43.1

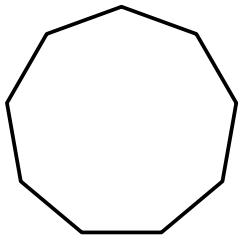
Identify the Type For Each Regular Polygon.

1) 

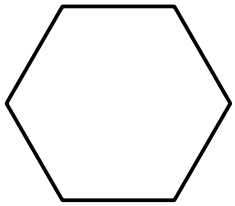
Type: _____

2) 

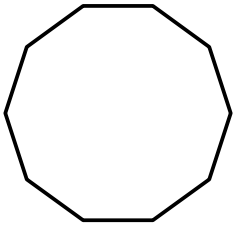
Type: _____

3) 

Type: _____

4) 

Type: _____

5) 

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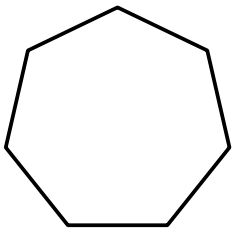
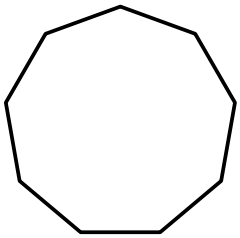
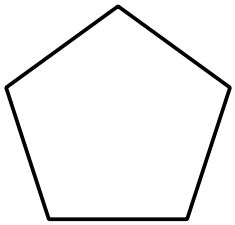
6) 

Type: _____

7) 

Type: _____

8) 

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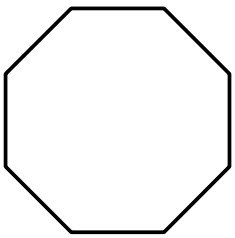
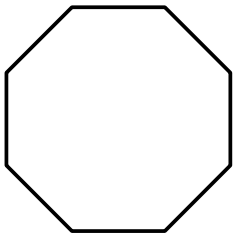
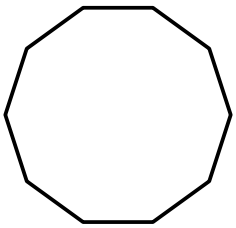
9) 

Type: _____

10) 

Type: _____

11) 

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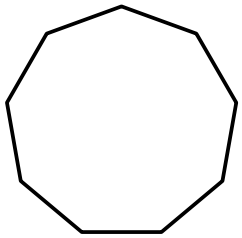
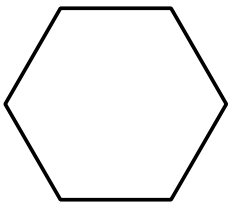
12) 

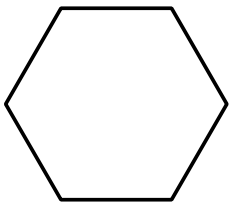
Type: _____

Worksheet 43.1 Answers

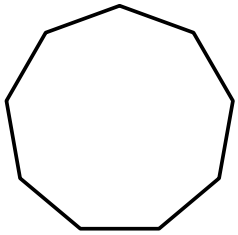
Identify the Type For Each Regular Polygon.

1) 

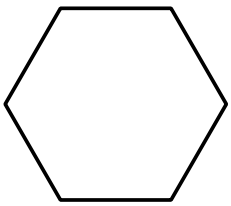
Type: Hexagon

2) 

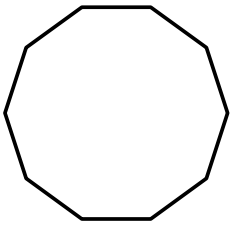
Type: Hexagon

3) 

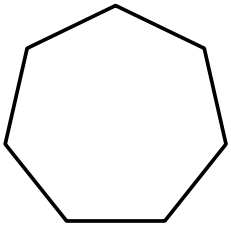
Type: Nonagon

4) 

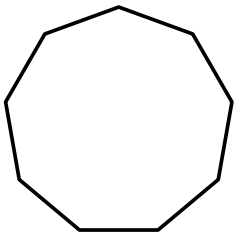
Type: Hexagon

5) 

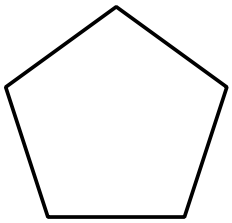
Type: Decagon

6) 

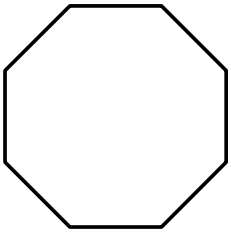
Type: Heptagon

7) 

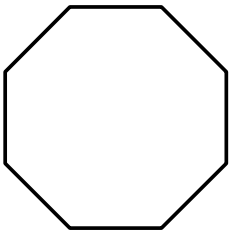
Type: Nonagon

8) 

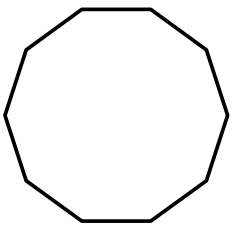
Type: Pentagon

9) 

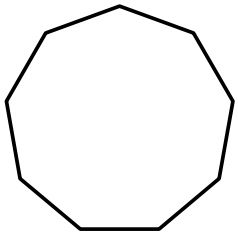
Type: Octagon

10) 

Type: Octagon

11) 

Type: Decagon

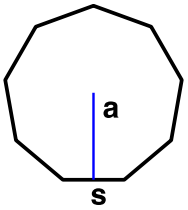
12) 

Type: Nonagon

Worksheet 43.2

Identify and Calculate the Area and Perimeter for each Polygon.

1)



s = 3.1 cm

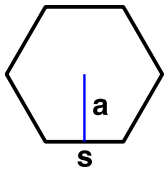
a = 4.2586 cm

Area: _____

Perimeter: _____

Type: _____

2)



s = 6.3 cm

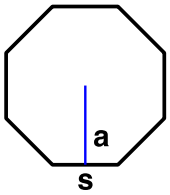
a = 5.456 cm

Area: _____

Perimeter: _____

Type: _____

3)



s = 6.4 cm

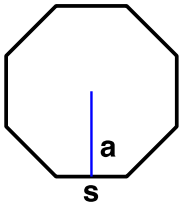
a = 7.7255 cm

Area: _____

Perimeter: _____

Type: _____

4)



s = 6.9 inches

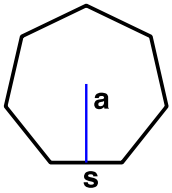
a = 8.329 inches

Area: _____

Perimeter: _____

Type: _____

5)



s = 2.9 inches

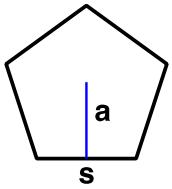
a = 3.011 inches

Area: _____

Perimeter: _____

Type: _____

6)



s = 6.5 inches

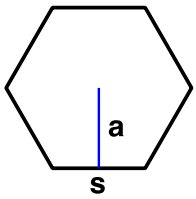
a = 4.4732 inches

Area: _____

Perimeter: _____

Type: _____

7)



s = 7.5 cm

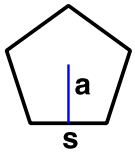
a = 6.4952 cm

Area: _____

Perimeter: _____

Type: _____

8)



s = 5 inches

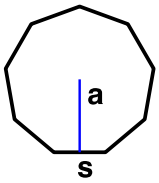
a = 3.441 inches

Area: _____

Perimeter: _____

Type: _____

9)



s = 2.6 cm

a = 3.5717 cm

Area: _____

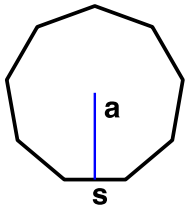
Perimeter: _____

Type: _____

Worksheet 43.2 Answers

Identify and Calculate the Area and Perimeter for each Polygon.

1)



s = 3.1 cm

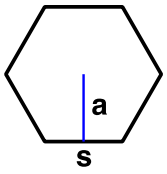
a = 4.2586 cm

Area: 59.41 sq cm

Perimeter: 27.9 cm

Type: Nonagon

2)



s = 6.3 cm

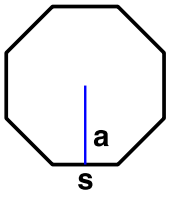
a = 5.456 cm

Area: 103.12 sq cm

Perimeter: 37.8 cm

Type: Hexagon

3)



s = 6.4 cm

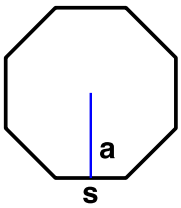
a = 7.7255 cm

Area: 197.77 sq cm

Perimeter: 51.2 cm

Type: Octagon

4)



s = 6.9 inches

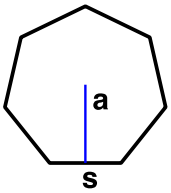
a = 8.329 inches

Area: 229.88 sq inches

Perimeter: 55.2 inches

Type: Octagon

5)



s = 2.9 inches

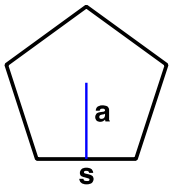
a = 3.011 inches

Area: 30.56 sq inches

Perimeter: 20.3 inches

Type: Heptagon

6)



s = 6.5 inches

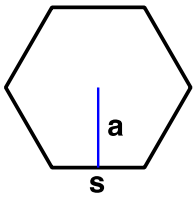
a = 4.4732 inches

Area: 72.69 sq inches

Perimeter: 32.5 inches

Type: Pentagon

7)



s = 7.5 cm

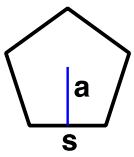
a = 6.4952 cm

Area: 146.14 sq cm

Perimeter: 45 cm

Type: Hexagon

8)



s = 5 inches

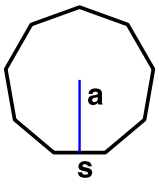
a = 3.441 inches

Area: 43.01 sq inches

Perimeter: 25 inches

Type: Pentagon

9)



s = 2.6 cm

a = 3.5717 cm

Area: 41.79 sq cm

Perimeter: 23.4 cm

Type: Nonagon