MINNESOTA Literacy COUNCIL
Sharing the Power of Learning

> **Weekly Focus:** perimeter, area, surface area and volume
> **Weekly Skill:** computation and application problems

LESSON 12: Length, Area, and Volume

Lesson Summary: First, students will solve a metric conversion problem. In Activity 1, they will review some measurement vocabulary. In Activities 2 and 3, they will measure the perimeter, area, and surface area of different objects. In Activity 4, they will measure the volume of objects. In Activity 5, they will do word problems about perimeter, area, and volume. Finally, they will measure 1-2 objects in the classroom for an application. There are also an exit ticket and extra word problem. Estimated time for the lesson is two hours.

Materials Needed for Lesson 12:
- Video (3 minutes) on surface area of a rectangle.
- Some rulers
- Activity 1 to print/project
- 3 worksheets (12.1, 12.2 and 12.3—attached)
- Video on measuring volume (length 7:49) from Khan Academy. It is required of teachers and recommended for students.
- Objects such as boxes to measure perimeter, area, and surface area
- *Mathematical Reasoning Test Preparation for the 2014 GED Test* Workbook pages 34-37.
- Exit ticket (attached)

Objectives: Students will be able to:

- Measure perimeter, area, and surface area of objects
- Understand math vocabulary about measurement
- Apply measurement skills to various problems

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

> **Notes:**
> **You can add more examples if you feel students need them before they work. Any ideas that concretely relates 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 12 Warm-up: Solve the candy question	Time: 5-10 Minutes

Write on the board: In the candy shop, chocolate is sold for $3.25 per 200 grams. Josh buys 1 kg for his family of four.

Basic Questions:

- How much does 1 kg of chocolate cost? *(200 g x 5 = 1 kg, so $3.25 x 5= $16.25)*
- How much does the candy cost per person? *($16.25 divided by 4=$4.06)*

Extension Questions:

- How many grams of chocolate can each person get if the 1 kg is divided evenly? *(250 g)*
- About what fraction of a pound would each person get? *(1 kg=2.2 lbs. so 2.2 divided by 4 = 0.55= a bit more than half a pound per person)*

Lesson 12 Activity 1: Vocabulary	Time: 10 Minutes

This activity can be projected on the board and completed as a whole class. Ask students to volunteer to write answers—they should give some examples of things for which you can measure the perimeter, the area, the surface area, and the volume.

Answers:
1. Circle (note: students will study circles in a later unit)
2. Circumference
3. Polygon (poly means many)
4. Perimeter
5. Area
6. Surface area
7. Volume

Lesson 12 Activity 2: Measure perimeter and area	Time: 15-20 Minutes

1) Practice A: Hand out rulers and have students measure the perimeter and the area of a sheet of paper. Do this together and also on the board. You can choose to have them do it in cm or inches.

2) Practice B: Do the same with students' cell phones: Measure the perimeter and then the area of one surface (the screen). It's ok to round since the purpose is to learn how to do the measurement.

Ex: IPhone with a case: Perimeter is 5 in+5in+2.5in+2.5in=15 in. Area is 2.5 x 5 = 12.5 inches

3) Do some problems on **Worksheet 12.1** and assign the rest as homework.

Lesson 12 Activity 3: Surface Area	Time: 15-20 Minutes

1) Practice: Have students use their cell phones again to measure surface area. What's the difference with just area? Surface area measures the area of all sides of a 3 dimensional object. You measure the area of each side and add all 6 together. You only need to measure 3 sides and double those since each side's opposite is exactly the same.

▪ I Phone example: We already know the area of the face so we double that for the back and get 25 inches. Now we add the area of the long side (5 in x. 0.5 in = 2.5 inches and double that to get 5 inches) and the end (2.5 x 0.5 = 1.25 and double that to get 2.5). Add all three together and get a surface area for the whole phone of 25 + 5 +2.5= 32.5 inches.

2) Do some problems on **Worksheet 12.2** and assign the rest as homework.

Lesson 12 Activity 1: Vocabulary

| perimeter | area | surface area | volume | polygon | circle | circumference |

1. A _____ is a closed figure with no sides or corners.

2. The distance around a circle is the _____.

3. A _____ is a figure with at least 3 straight sides.

4. The distance around an object with sides is the _____.

5. The measurement of a two-dimensional object such as a

   backyard is the _____.

6. The total area of a 3-dimensional object such as a box is the

   _____.

7. _____ refers to the amount of space inside a 3-

   dimensional object such as a car trunk.

Lesson 12.1 Worksheet—Area and Perimeter of Quadrilaterals

Identify and Calculate the Area and Perimeter for each Quadrilateral.

1)

s

s
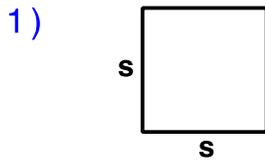
s = 5 cm

Area: _____

Perimeter: _____

Type: _____

2)

b

a
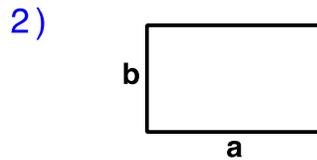
a = 7.1 cm   b = 4.3 cm

Area: _____

Perimeter: _____

Type: _____

3)

b

a
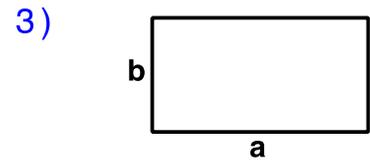
a = 8.7 cm   b = 4.6 cm

Area: _____

Perimeter: _____

Type: _____

4)

b

a
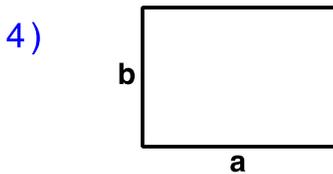
a = 7.8 ft   b = 5.6 ft

Area: _____

Perimeter: _____

Type: _____

5)

s

s
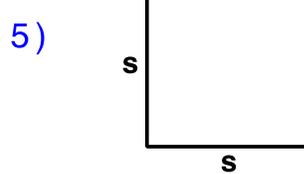
s = 6.6 ft

Area: _____

Perimeter: _____

Type: _____

6)

s

s
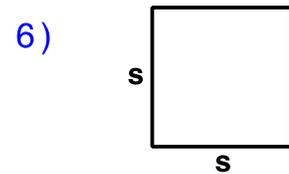
s = 5.6 inches

Area: _____

Perimeter: _____

Type: _____

7)

b

a
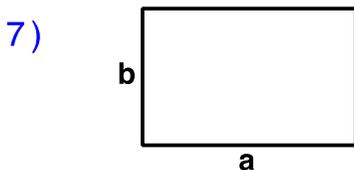
a = 8.6 inches   b = 5.5 inches

Area: _____

Perimeter: _____

Type: _____

8)

b

a
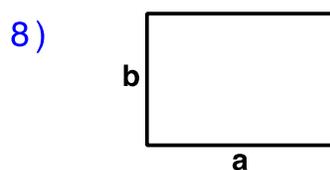
a = 7.6 ft   b = 5.3 ft

Area: _____

Perimeter: _____

Type: _____

9)

s

s
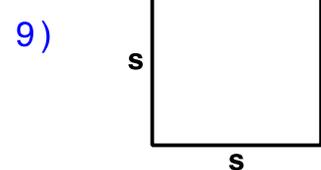
s = 6.8 inches

Area: _____

Perimeter: _____

Type: _____

Lesson 12.1 Worksheet—Area and Perimeter of Quadrilaterals Answers

1)
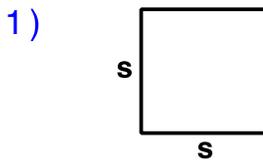
s = 5 cm

Area: 25 sq cm

Perimeter: 20 cm

Type: Square

2)
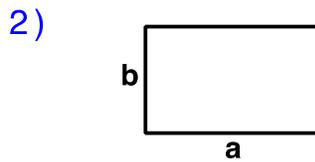
a = 7.1 cm   b = 4.3 cm

Area: 30.53 sq cm

Perimeter: 22.8 cm

Type: Rectangle

3)
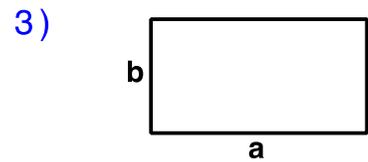
a = 8.7 cm   b = 4.6 cm

Area: 40.02 sq cm

Perimeter: 26.6 cm

Type: Rectangle

4)
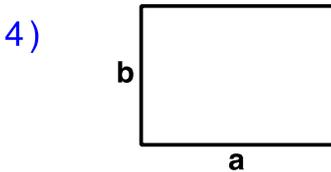
a = 7.8 ft   b = 5.6 ft

Area: 43.68 sq ft

Perimeter: 26.8 ft

Type: Rectangle

5)
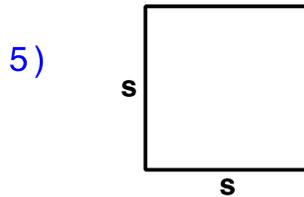
s = 6.6 ft

Area: 43.56 sq ft

Perimeter: 26.4 ft

Type: Square

6)
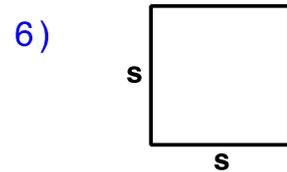
s = 5.6 inches

Area: 31.36 sq inches

Perimeter: 22.4 inches

Type: Square

7)
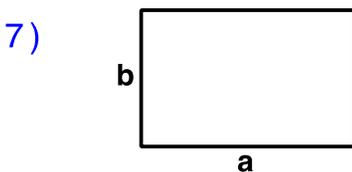
a = 8.6 inches   b = 5.5 inches

Area: 47.3 sq inches

Perimeter: 28.2 inches

Type: Rectangle

8)
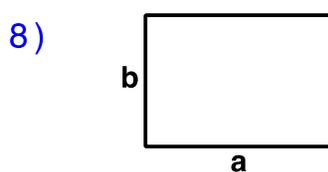
a = 7.6 ft   b = 5.3 ft

Area: 40.28 sq ft

Perimeter: 25.8 ft

Type: Rectangle

9)
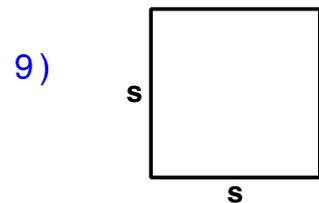
s = 6.8 inches

Area: 46.24 sq inches

Perimeter: 27.2 inches

Type: Square

Worksheet 12.2—Surface Area

Ex)

5

2

2

	4	
	10	
10	4	10
	10	

1)
9
5
9
7.8

2)
9
4
9

3)
7
8
7
6.1

4)
5
6
2

5)
9
2
9
7.8

6)
2
5
2
1.7

7)
4
4
5

8)
3
3
3
2.6
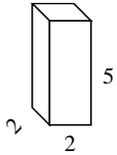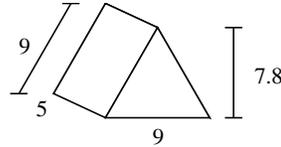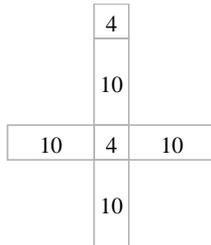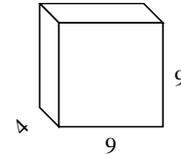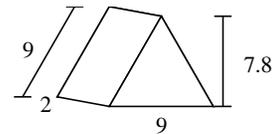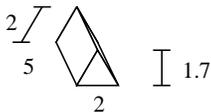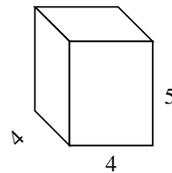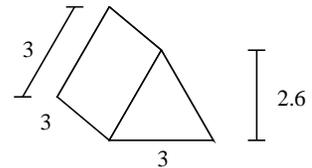
Lesson 12: Length, Area, and Volume

Worksheet 12.2— Surface Area Answers
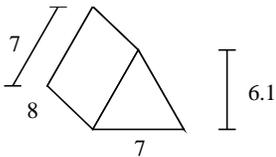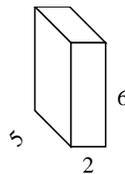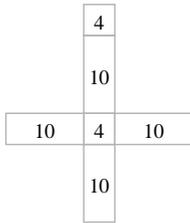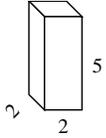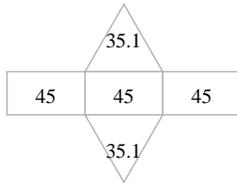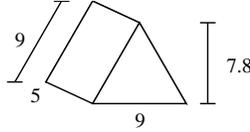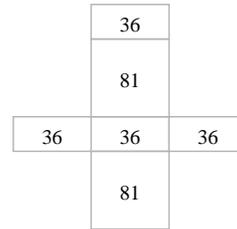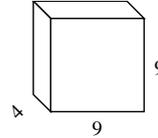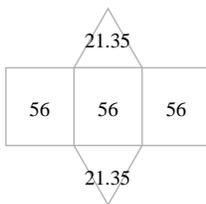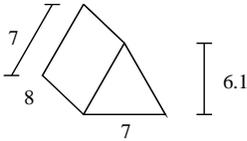
Ex)

4
10

10	4	10

10

1)

9 / 7.8 / 5 / 9

35.1

45	45	45

35.1

2)

9 / 4 / 9

36
81

36	36	36

81
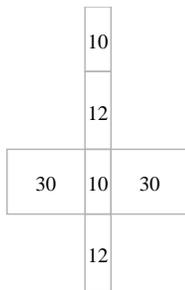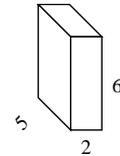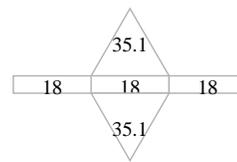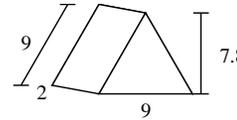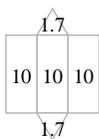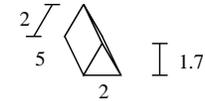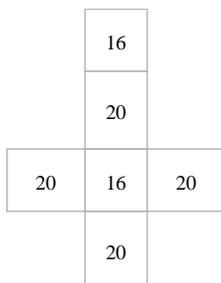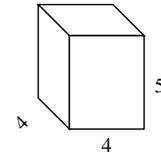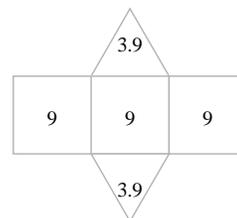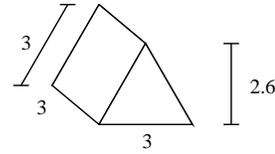
Ex.	**48**
1.	**205.2**
2.	**306**
3.	**210.7**
4.	**104**
5.	**124.2**
6.	**33.4**
7.	**112**
8.	**34.8**

3)

7 / 8 / 6.1 / 7

21.35

56	56	56

21.35

4)

6 / 5 / 2

10
12

30	10	30

12

5)

9 / 2 / 7.8 / 9

35.1

18	18	18

35.1

6)

2 / 5 / 1.7 / 2

1.7

10	10	10

1.7

7)

5 / 4 / 4

16
20

20	16	20

20

8)

3 / 3 / 2.6 / 3

3.9

9	9	9

3.9

Lesson 12 Activity 4: Volume Measurement	**Time: 10-15 Minutes**

1. Volume refers to the amount of space inside an object. It is measured in cubic units because it uses 3 dimensions: the length, the width, and the height. Some examples of where volume is used are the space inside a rental storage unit, the space inside the trunk of a car, how much a swimming pool can hold.

2. Example A: A shipping company uses containers for its overseas transportation. Each container measures 40 feet long by 8 feet wide and 9.5 feet tall. How much volume does each container hold? *(40 ft x 8 ft x 9.5 ft = 3,040 cubic feet)*

3. Example B: A cereal company wants to design a box that can hold 165 cubic inches of cereal. If the height of the box is 11 inches and the width is 5 inches, what should the depth be? *(11 x 5 x depth = 165 cubic inches so depth is 165 divided by 55 = 3 inches)*

4. Do some of the problems on **Worksheet Lesson 12.3** and assign the rest for homework.

5. Note to teacher: Volume tells us how much space there is inside something and is measured in cubic units. Capacity is more appropriate to use with how much liquid a container holds and it is measured in ounces, etc. However, many people use the terms interchangeably and may even use the term liquid volume.

Lesson 12 Activity 5: Word Problems	**Time: 20-25 Minutes**

Do the word problems in the **workbook pages 34-37.** Choose some of the more challenging ones to do on the board.

Activity 6 Application: Measure Classroom Items	**Time: 10-15 Minutes**

Find a 3-dimensional item in the class that students can measure. Try to find things such as books for which you may several. Have the students measure the perimeter, the area of one surface, the surface area of the whole object and the volume of that object.

If there is time and you can find more objects, ask students to do the same for the other object.

Lesson 12 Exit Ticket: True or False	**Time: 5 Minutes**

This activity can be done verbally as a group or written on the board and worked out in pairs.

1) The distance around a rectangle is called the circumference. (F, is perimeter)
2) It is possible to measure the volume of a piece of paper. (F, only 2 dimensions)
3) It is possible to measure the perimeter of a building. (T)
4) It is possible to measure the surface area of a cereal box. (T, is 3-dimensional, has 6 surfaces)
5) The surface area of a 3-dimensional object is more than its area. (T)

Lesson 12 Extra Problem	**Time: 5-10 Minutes**

Write on the board: Marisa is planning a garden for her backyard. The total area she has available is 72 square feet.

Basic Questions:
- If the length of her garden area is 9 feet, what is the width? *(72 divided by 9 = 8 feet)*
- If she wants each row to be 2 feet wide, how many rows can she have? *(8 feet wide divided by 2 feet each row = 4 rows)*

Extension Questions:
- She wants her plants to be the same distance apart from each other. If there are 36 plants per 9 foot-long row, how far apart should she plant them (discounting the size of the plant)? *(36 plants divided by 9 feet = 4 plants per foot so 12 inches divided by 4 = 3 inches apart).*
- The plants she bought cost $65.00 originally but went on sale for 25% off. What did she pay? *(65.00 x 0.75 = $48.75)*

Lesson 12: Length, Area, and Volume

Worksheet 12.3—Volume

Find the volume of each rectangular prism. Remember V = BH and V=L ×W×H

1)
7
2
1

2)
6
42

3)
8
7
5

4)
8
56

5)
7
48

6)
8
1
2

7)
6
81

8)
8
56

9)
8
63
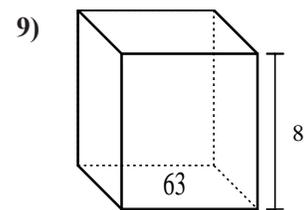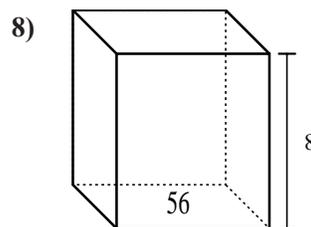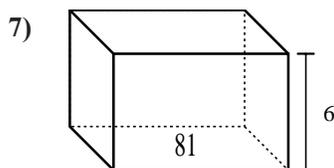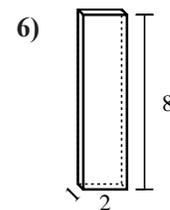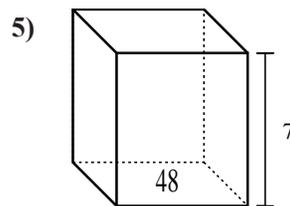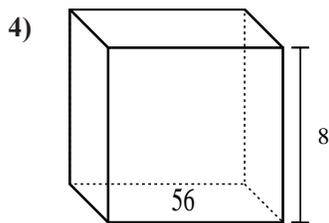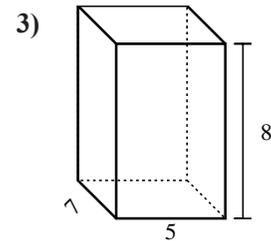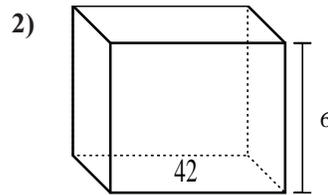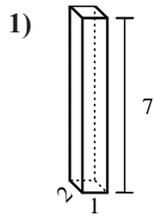
Worksheet 12.3—Volume Answers

1. _____**14**_____

2. _____**252**_____

3. _____**280**_____

4. _____**448**_____

5. _____**336**_____

6. _____**16**_____

7. _____**486**_____

8. _____**448**_____

9. _____**504**_____