Weekly Focus: composite solids
Weekly Skill: find dimensions, applications

LESSON 49: Composite Solids

Lesson Summary: For the warm-up, students will solve a problem about the earth and sun. In Activity 1, they will review finding the area of 2-D figures. In Activity 2, students will examine examples of finding the volume and the surface area of composite solids. In Activity 3, they will do word problems. The first application activity is about the volume of discarded cigarette butts. The second (optional) application activity is about comparing a single-flush with a dual-flush toilet. Estimated time for the lesson is 2 hours.

Materials Needed for Lesson 49:
- Meter sticks for Application Activity 1
- Video (length 7:00) that is a good summary review of the volume and surface area of solids taught in the two previous lessons.
- Video (length 4:17) on volume of a composite cylinder, sphere, and cone.
- Video (3:42) on surface area of composite solids. (The videos are required for teachers and recommended for students.)
- Notes A are from: http://www.asu.edu/courses/mat142ej/geometry/Geometry.pdf (pages 30 – 31)
- Notes B (attached)
- 1 Worksheet (49.1) with answers (attached)
- *Mathematical Reasoning Test Preparation for the 2014 GED Test Student Book (pages 110 – 111)*
- *Mathematical Reasoning Test Preparation for the 2014 GED Test Workbook (pages 158 – 161)*
- The 1st application activity (attached) is from (link embedded in lesson plan)
- The 2nd optional application activity (attached) is from (link embedded in lesson plan)

Objectives: Students will be able to:
- Solve the earth and sun word problem
- Calculate the area of composite 2-D figures (review from lesson 45)
- Calculate the volume and surface area of composite solids
- Solve one or two real-life application problems involving ratios, volume, and/or algebra

ACES Skills Addressed: N, CT, LS
CCRS Mathematical Practices Addressed: Building Solution Pathways, Make Sense of Problems and Persevere in Solving Them, Model with Math
Levels of Knowing Math Addressed: Intuitive, Pictorial, Abstract, and Application

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Notes:
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

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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 49 Warm-up: Solve the Earth and Sun Problem	Time: 10 Minutes

Write on the board: The radius of the earth is about 6,370 km. The radius of the sun is about 695,000 km.

Basic Questions:
- What is the diameter of the earth?
  - The radius x 2 = 12,740 km
- What is the diameter of the sun?
  - The radius of the sun x 2 = 1,390,000 km
- What is the ratio of the earth's radius to the sun's radius?
  - $\frac{6370}{695,000} \approx \frac{1}{109}$ The sun's radius is over 100 times the earth's radius.

Extension Questions:
- What is the surface area of the earth?
  - $SA = 4\pi r^2 = 4 (3.14)(6,370^2) \approx 510,000,000$
- Write the surface area in scientific notation
  - 5.1×10^8
- Note: It would take about 1 million Earths to fill the Sun if it were a hollow ball.

Lesson 49 Activity 1: Area of Composite 2-D Figures	Time: 15 Minutes

1. The objective of this activity is for students to review finding the area of 2-dimensional shapes before they try to find the area of more difficult 3-dimensional solids.
2. Note: Students did an activity like this one in Lesson 45, but it is worth repeating to review.
3. Give students **Worksheet 49.1**. Do #1 on the board as an example.
4. Ask students what shapes they "see" in this figure. They may say a rectangle and half a circle.
5. Draw it on the board with a broken line to divide the half circle from the rectangle. Point out that the width of the rectangle is also the diameter of the circle. Solve the area of the rectangle (A = 6 x 10 = 60 m²) and add to the area of ½ a circle (A= ½ (3.14)(3²)= 14.13m² to get a total area of 60 + 14.13 = 70.13 m².
6. Students can do the rest of the problems independently. If necessary, have volunteers do 1-2 problems on the board.

Lesson 49 Activity 2: Volume and Surface Area Examples of Composite Solids	Time: 15 Minutes

1. Copy **Notes A, pages 30 – 31,** to give to students as an example of finding the <u>volume</u> of a composite solid.
2. A **composite solid** is one that is made of two or more solids. The one in this example is composed of a cylinder with a hemisphere (half of a sphere) at each end.
3. Go through the example on the board. In the notes, they wait until the end to mention that the two hemispheres make one sphere, but you may want to point that out right away to make the calculations faster. Even better, ask the students what they see at the two ends.
4. Also copy **Notes B** to do as an example to solve for the <u>surface area</u> of a composite solid.
5. Work through the example together.

Lesson 49 Activity 3: Composite Solids Computation and Word Problems	Time: 45 Minutes

1. Do the problems in the **student book** pages 110-111 together.
2. Students can do the problems in the **workbook** pages 158-161 independently.
3. Circulate to help and solve some of the problems on the board as needed.

Lesson 49 Application Activity 1: How Big a Problem Are Littered Cigarette Butts	Time: 20-30 Minutes

1. This is an interesting [activity](#) that includes graphs, volume measurement and other computations. It also increases environmental awareness.
2. Become familiar with the activity before presenting it to students.
3. Students can measure the volume of the classroom with meter sticks and figure out how many classrooms would be filled with those cigarette butts instead of the cafeteria or stadium options mentioned in the activity.

| Lesson 49 Application Activity 2: Which Toilet Uses Less Water?	Time: 20-30 Minutes

1. This is a fun (and funny) culminating [activity](#). It includes ratios, volume, and even systems of equations from algebra.
2. Become familiar with the activity before presenting it to the students.

3. Give students time to discuss and struggle to get to a reasonable answer. Provide more or less support to them depending on their needs, but do help them with the idea of systems of equations, which you may need to review first.
4. Start the activity by showing the photo of the dual flush toilet and asking the students if they are familiar with it. Also ask if they know its purpose.

Notes B: Surface Area of a Composite Solid Example

Find the surface area of the figure below:

1.

12 ft

32 ft

10 ft

10 ft
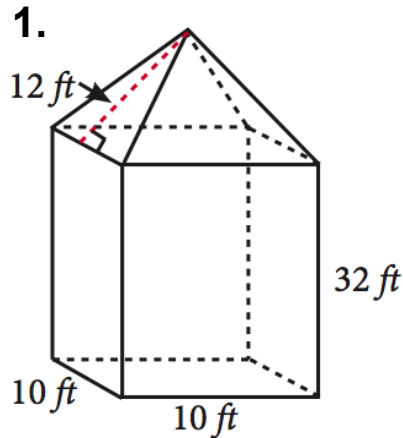
Identify the parts of the solid on the surface.

Find the area of the base.

$$A_{Base} = 10(10) = 100$$

Find the lateral area of the prism.

$$LA_{Prism} = P_{base}h$$
$$LA_{Prism} = 4(10)(32) = 1280$$

Find the lateral area of the pyramid.

$$LA_{Pyramid} = \frac{1}{2}P_{base}h$$

$$LA_{Pyramid} = \frac{1}{2}(40)(12) = 240$$

Find the sum of all three parts.

$$S.A. = 1280 + 240 + 100$$

The surface area of the composite solid is 1620 square feet.

Worksheet 49.1 Area of Composite 2-D Figures

Area - Compound Shapes

Find the area of each figure. Round tha answer to 2 decimal places if necessary.

1)

6 m

10 m

Area = _____

2)

12 cm

12 cm

17 cm

Area = _____

3)

8 yd

8 yd

7 yd

Area = _____

4)

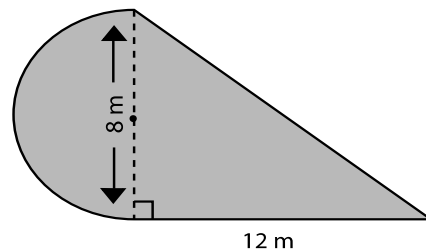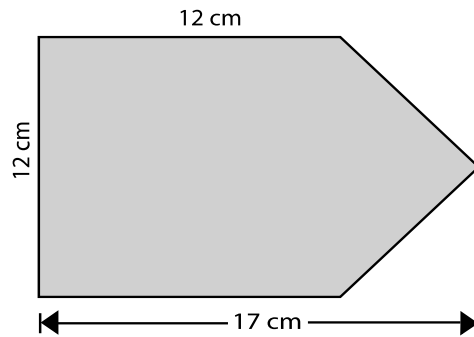11 ft

6 ft

5 ft

7 ft

Area = _____

5)

6 in

14 in

10 in

8 in

Area = _____

6)

8 m

12 m
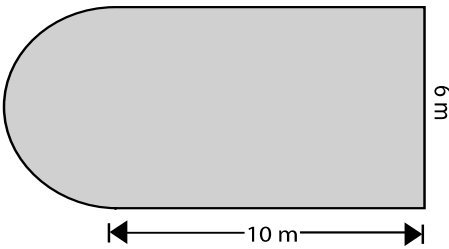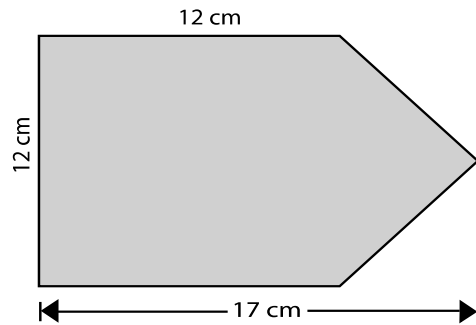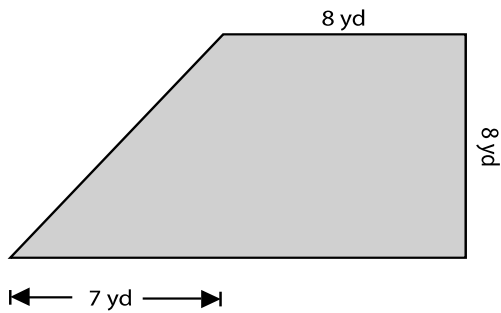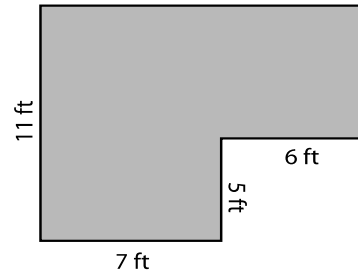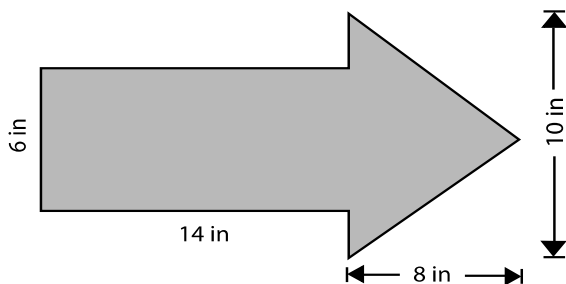
Area = _____

Worksheet 49.1 Answers

Answer Key

Find the area of each figure. Round tha answer to 2 decimal places if necessary.

1)

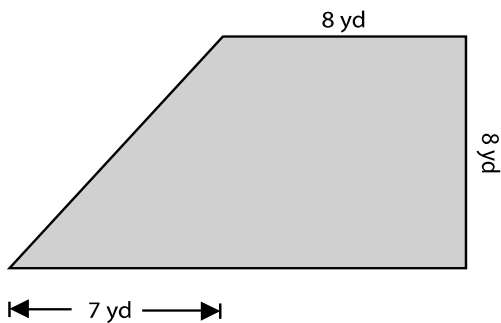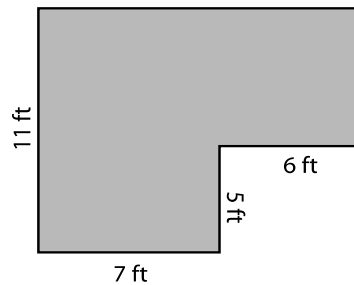Area = __**74.13 m²**__

2)

12 cm

12 cm

17 cm

Area = __**174 cm²**__

3)

8 yd

8 yd

7 yd

Area = __**92 yd²**__

4)

11 ft

6 ft

5 ft

7 ft

Area = __**113 ft²**__

5)

6 in

14 in

8 in

10 in

Area = __**124 in²**__

6)

8 m

12 m

Area = __**73.12 m²**__