Title: Surface Area and Volume

Objectives	**Time frame to Complete**
Students will correctly calculate area and volume using formulas and appropriate units of measure.	45-60 minutes
	NRS EFL
	4

Stackable Cert. Documentation	*Technology*	*Study / Life skills*	*EL-Civics*	*Career Pathways*	Police	Paramedic	Fire Rescue	Medical Asst.	EKG / Cardio	Phlebotomy	Practical Nursing	Healthcare Admin	Pharmacy Tech	IMT	AMT	HVAC	Welding	Other:
X																		

Standard(s) Addressed in Lesson

Use Math to Solve Problems and Communicate

Benchmark(s) Addressed in Lesson

M.4.9. Use established formulas to calculate perimeter, circumference, area and volume for basic figures.
M.4.11. Show that geometric measures such as length, perimeter, area and volume depend on the choice of unit and that measurements are only as precise as the units used.
M.4.12. Apply measurement scales and units to describe geometric figures to solve one-step and two-step problems.
M.4.35. Perform with increasing independence, range and fluency in demonstrating level-appropriate mathematical skills in contextual situations (community, family, work).

Materials

Area and Volume reference chart available from http://www.abcteach.com/directory/basics/math/geometry/

Measuring Area and Volume worksheet

Four sheets of 8.5x11" paper, scissors, ruler, tape and pencil for each student

Calculator (optional)

Learner Prior Knowledge

Students should know the definitions of the following terms: perimeter, area, circumference, π, radius, diameter, surface area, and volume.

Activities

Step 1 Distribute *Area and Volume reference chart*. Review the definitions of perimeter, area, circumference, π, radius, diameter, surface area, and volume. Review formulas for calculating the areas of rectangles, circles, cylinders, and rectangular prisms as needed. Note that the units are significant when finding areas and volumes --- students often forget to label square inches or cubic inches (or feet or any other unit of measure).

Step 2 Give students four pieces of 8.5x11" paper, scissors, tape, and a ruler. First, ask students to calculate the perimeter of one piece of paper (Answer = 39") and the area of one piece of paper (Answer = 93.5 sq in).

Step 3 Students follow the directions on the *Measuring Area and Volume* worksheet to calculate surface area and volume of varied cylinders and boxes created using the scissors and 8.5x11" paper. Assist students as needed.

Step 4 Collect worksheets and materials when the lesson is complete. Check for accuracy and review or re-teach as needed. If students need additional practice, have them measure various containers in the classroom (tissue box, coffee cup, etc.) for surface area and volume.

Step 5 Discuss different applications for surface area and volume. How could students use these formulas in their jobs or lives? (Determining the square feet of a room for furniture placement or painting, determining how much mulch is needed for a garden, etc.)

Assessment/Evidence

Correct solutions to area and volume problems – Save this worksheet in the student portfolio if using as documentation for a Basic Skills Stackable Certificate.

Adaptations for Beginning Students

Beginning students may work in pairs and/or use a calculator if needed.

Adaptations for Advanced Students

Advanced students may complete additional exercises found on the following website:
http://www.figurethis.org/challenges/c03/challenge.htm
This link goes to a version of the cylinder problem with links to hints, answers, and additional challenges.

Teacher Reflection/Lesson Evaluation

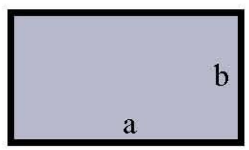
Remember to check student answers for accurate units of measure --- students often forget to label square inches or cubic inches (or feet or any other unit of measure).

An interesting resource that might help visual learners is an interactive tool that calculates surface area and volume based upon how users alter the shapes (rectangular prism and triangular prism):
http://www.shodor.org/interactivate/activities/SurfaceAreaAndVolume/

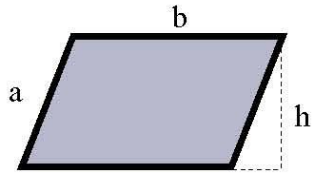
This lesson was created by Middletown ABLE.

Volumes and Areas

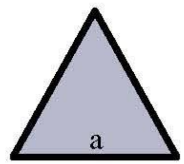
AREA



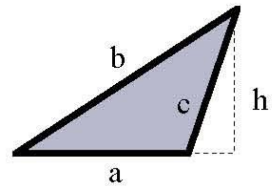
Rectangle
Perimeter = 2a + 2b
Area = a x b



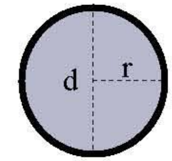
Parallelogram
Perimeter = 2a + 2b
Area = b x h



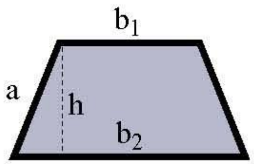
Equilateral Triangle
Perimeter = 3a
Area = (1/4) (Ö3) a^2



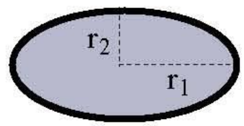
Triangle
Perimeter = a + b + c
Area = (a x h) / 2



Circle
Circumference = 2 x p x r
Area = p r^2

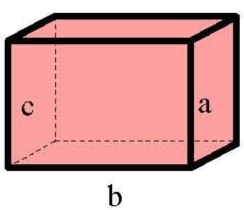


Trapezoid
Perimeter = 2a + b_1 + b_2
Area = h/2 (b_1 + b_2)

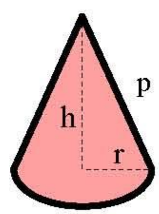


Ellipse
Area = p r_1 r_2

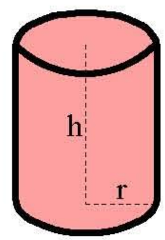
VOLUME



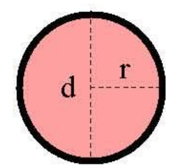
Rectangular Block
Volume = a x b x c
Surface Area = 2(a x b)+2(c x b)+2(a x c)



Cone
Volume = 1/3 p r^2 x h
Surface Area = p x r x (r + $(r^2 + h^2)^{1/2}$)



Cylinder
Volume = p r^2h
Surface Area = (r x h) + 2 (p r^2)



Sphere
Volume = (4/3) p r^3
Surface Area = 4 p r^2

Measuring Area and Volume

1. Measure this worksheet (in inches) and determine the following:

    a. Length:
    b. Width:
    c. Perimeter:
    d. Area:

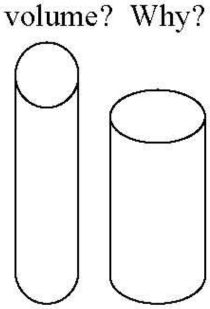
2. A gallon of paint will cover approximately 350 square feet. The family room measures 15x18 feet and has 8-foot ceilings. How many gallons of paint must be purchased in order to paint the walls? Show your work.

3. Complete the following for a rectangular prism:
    Length = 2 cm
    Width = _____
    Height = 12 cm
    Surface Area = _____
    Volume = 192 cubic cm

4. If you wanted to create a sidewalk from your front door to the street, how much cement would you need if your sidewalk were going to be the following dimensions?
    Length = 20 feet
    Width = 3 feet
    Depth = 4 inches

    Show your work.

5. Roll one piece of 8.5x11" paper to create a tall cylinder. Roll another piece of 8.5x11" paper to create a shorter cylinder. Which do you predict has more volume? Why?

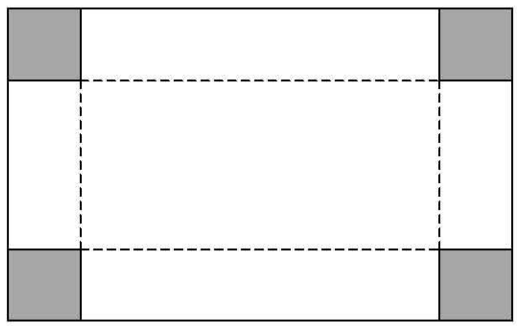


6. Check your work. Using the correct formula, determine the volume of each.

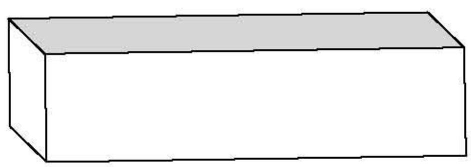
    a. Tall cylinder:

    b. Short cylinder:

7. Next, cut equal squares from the corners of a piece of paper.



Fold to create an open box.



8. Use a ruler to measure the dimensions of your open box.

    a. Length:
    b. Width:
    c. Height:

9. Calculate the volume of the Box 1.

10. Using the same process, create a second open box that will have a larger volume than Box 1.

    a. Length:
    b. Width:
    c. Height:
    d. Volume:

Measuring Area and Volume

1. Measure this worksheet (in inches) and determine the following:

   a. Length: 11”
   b. Width: 8.5”
   c. Perimeter: 39”
   d. Area: 93.5 square inches

2. A gallon of paint will cover approximately 350 square feet. The family room measures 15x18 feet and has 8-foot ceilings. How many gallons of paint must be purchased in order to paint the walls?

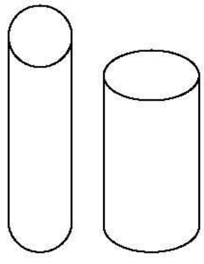
   15x8 = 120, 120x2 = 240
   18x8 = 144, 144x2 = 288
   240+288= 528 sq feet
   528/350 = approximately 1.5
   Buy two gallons of paint.

3. Complete the following for a rectangular prism:
   Length = 2 cm
   Width = __8 cm___
   Height = 12 cm
   Surface Area = __272 square cm___
   Volume = 192 cubic cm

4. If you wanted to create a sidewalk from your front door to the street, how much cement would you need if your sidewalk were going to be the following dimensions?
   Length = 20 feet
   Width = 3 feet
   Depth = 4 inches
   Show your work.

   Four inches is 1/3 of a foot.
   20 x 3 x 1/3
   60 x 1/3
   60/3 = 20 cubic feet

5. Roll one piece of 8.5x11” paper to create a tall cylinder. Roll another piece of 8.5x11” paper to create a shorter cylinder. Which do you predict has more volume? Why?



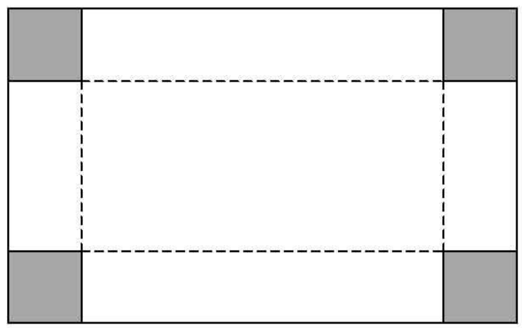
Answers will vary.

6. Check your work. Using the correct formula, determine the volume of each.

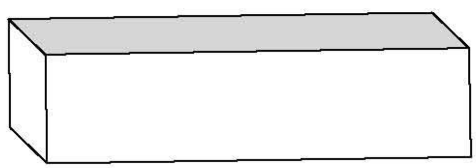
    a. Tall cylinder: approximately 63 cubic inches

    b. Short cylinder: approximately 82 cubic inches

7. Next, cut equal squares from the corners of a piece of paper.



Fold to create an open box.



8. Use a ruler to measure the dimensions of your open box.

    a. Length:
    b. Width:
    c. Height:

9. Calculate the volume of the Box 1.

Answers will vary.

10. Using the same process, create a second open box that will have a larger volume than Box 1.

Answers will vary.

    a. Length:
    b. Width:
    c. Height:
    d. Volume: