

GED 2002 Teachers' Handbook of Lesson Plans

Content Area Mathematics	Lesson Topic/Theme Geometry – Volume of Cubes and Boxes	Correlation to Math Framework 05.03/05.16	Lesson Number - 50
<p>Title: Verifying Volume Objectives/Learner Outcomes</p> <p>At the end of this lesson, the learner will be able to:</p> <ul style="list-style-type: none"> • Recall that the volume formula is $V = \text{length} \times \text{width} \times \text{height}$ • Use the formula to calculate the volume for a given cube or box • Label all volumes in cubic units • Apply the concept of volume to a word problem 		<p>Materials/Resources/Internet Sites/Handouts/Worksheets</p> <ul style="list-style-type: none"> • Chart paper/white board • Markers • Rulers or tape measures • Advertisement for gardening products sold by cubic units (such as mulch or sand) • Different sized boxes or cubes (i.e., shirt boxes, cereal boxes, VCR tapes, stacks of Post-It Notes, etc.) labeled with letters to identify each one • Handout – <i>Verifying Volume – Side A</i> • Handout – <i>The Volume of Landscaping – Side B</i> 	
<p>Pre-Requisite Knowledge</p> <p>The learner should be able to:</p> <ul style="list-style-type: none"> • Complete basic multiplication problems with whole numbers, decimals, and fractions • Use a ruler or tape measure to find the length, width, and height of an object 		<p>Key Words</p> <ul style="list-style-type: none"> • Volume • Length • Width • Height • Cubic units (i.e., inches, feet, yards, centimeters, meters, etc.) 	
<p>Anticipatory Set/Introduction</p> <p>Show the group a box or cube. Say: I want to fill this three-dimensional box (or cube, if appropriate) with sand. Ask: In order to figure out how much sand will fill this box, what are some things that we need to know?</p>			
<p>Preview Questions for Lesson</p> <ol style="list-style-type: none"> 1. Who has heard of the term volume? 2. What are some objects that people might like to know the volume? (Answers could include: pools, fish tanks, boxes, trash bins, etc.) 3. Who can show me the length of this box (or cube)? What about the width of it? What about the height? 4. What types of units can be used when measuring the length, width, or height of an object? (Answers could include: inches, feet, yards, miles, centimeters, meters, etc.) 			

Instructional Outline

Say: Volume is the amount of space a three-dimensional figure occupies. Today, we're going to examine how to find the volume of cubes and boxes.

Ask: What's special about a cube? (Answer: all sides have the same measurement)

Ask: When we learned about the area of a square or rectangle, what was the formula that we used? (Answer: Area = length x width)

Ask: For a cube or a box, what else is there in addition to the length and width of the figure? (Answer: height)

Say: The formula for the area of an item is length times width. The formula for volume is very similar.

Ask: What piece do you think we have to incorporate into the formula to find the volume? (Answer: height)

Write: Volume = length x width x height

Say: Let's do an example together. (Use the cube or box shown at the beginning of class. Have a student come up and measure the length, width, and height of the figure. Write each measurement on the board/chart paper. Use the correct formula to calculate the area.) Explain that the units of measurement will always be cubic (which means to the third power).

Hand out rulers and **Verifying Volume – Side A** and **The Volume of Landscaping – Side B**. Separate the class into groups of three.

Say: In groups of three, you will work together to find the volume of different boxes. Each person has a ruler. One person will measure the length, another person will measure the width, and the last person in the group will measure the height of the box. Write all of this information on your worksheet. Make sure that you show the calculations that you used to find the volume. When I say *Pass*, pass your box to the group on your left. After you receive your new box, find its volume. Work together with your team members.

Circulate around the room to keep groups on task and to answer any questions. When groups have found the volume of three or four boxes, review their answers. Allow a representative from each group to come up to the board/chart paper to show how they arrived at their answer. Ask the other groups who found the volume of the same box whether they agree or disagree with the calculations.

Process/Activities

Divide the class into pairs. Show an advertisement from the newspaper for something that talks about a store selling an item sold by cubic units (i.e., bags of sand, mulch, etc.).

With the class, work through a problem that requires that they compute a total price.

The following example can be used:

Lamar wants to build a sandbox for his son. He plans on having the sandbox measure 6 feet long by 6 feet wide and wants the sand to be 1 foot deep. If he can buy sand for \$1.55 per cubic foot, what would the cost be to fill the sandbox? (Stress that students should first sketch a picture of the shape, label the length of each of the measurements, use the volume formula, and then find the total price.)

Say: Flip over your worksheet to the side marked *The Volume of Landscaping*. With your partner, decide how you'd figure out the cost for each job listed. Show your calculations and be ready to explain your steps. As you work together, discuss what you're doing.

Walk around the room to monitor student progress and to keep each pair on task. Have volunteers share their answers and explanations. It may be helpful for students to sketch their figures on the board/chart paper and show their calculations.

Product/Evaluation/Summary

Check student answers on *The Volume of Landscaping* handout.

Ask: What are the three measurements you must know to calculate the volume of a cube or box? (Answer: length, width, and height)

Ask: What's special about a cube? (Answer: length, width, and height are all the same measurement)

Ask: What is the volume formula for a cube or box? (Answer: Volume = length x width x height)

Ask: What kind of unit measurement do you use for a figure's volume? (Answer: cubic units)

Teaching to Different Types of Learners

	Visual	Auditory	Kinesthetic/Tactile
Learning Activity	Provide written directions, charts, and worksheets to students.	Incorporate activities that allow students to work together and discuss what they have done. Have students repeat answers, directions, and formulas to you or a partner.	Students can draw pictures or trace shapes with their fingers to demonstrate what volume is and how they do the calculations. Students can also visually demonstrate area by using their

			hands to show the size of the figure. Construction of boxes and cubes can also be done with construction paper, tape, and scissors.
Special Differentiation Strategies	Use an overhead transparency or answer key worksheet to visually show the correct answers for the volume activities rather than just providing the answers verbally. When providing directions orally, have them in writing as well.	Check for understanding by asking questions when giving directions or assignments in writing.	Show students pictures of what's being discussed (i.e., sandboxes, aquariums, gardens, yards, etc.). Create the figure (i.e., sandbox, garden, etc.) in the classroom and allow students to walk around to explore its size. Bring in an old aquarium for students to use as a model to explore volume by filling it with water or sand.
Evaluation	Allow learners to write their answers instead of saying them aloud.	Allow students to orally report what they have learned.	Allow students to use drawings to demonstrate their understanding of how to find the area of a cube or box.
The Family and Adult Literacy Connection		ESE/ESOL Accommodations	
<p>If students have school-aged children, have them complete similar examples to find the volume of various cubes or boxes at home (i.e., books, cereal/pasta boxes, doors, etc.). Students can have their children use rulers or measuring tapes or assist others by holding the measuring tape. Students and children can construct boxes of different sizes using construction paper and tape.</p> <p>Students can connect the concept of volume to the real world by looking for examples presented in newspapers, magazines, and store advertisements. Instructors can facilitate this by having periodicals that students can browse through in the classroom. A field trip can also be organized to a home improvement store.</p>		<p>Partner students with a peer buddy who can facilitate discussion and model tasks. Allow for non-verbal responses such as pointing, nodding, or showing numbers on fingers. Games, such as <i>Volume Bingo</i> or <i>Who Wants to be a Volume Millionaire</i>, can be used.</p>	

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**Verifying Volume
Side A**

1. A. Box or Cube Letter: _____
- B. Length: _____, Width: _____, Height: _____
- C. Volume Calculations:
- D. Volume: _____
-

2. A. Box or Cube Letter: _____
- B. Length: _____, Width: _____, Height: _____
- C. Volume Calculations:
- D. Volume: _____
-

3. A. Box or Cube Letter: _____
- B. Length: _____, Width: _____, Height: _____
- C. Volume Calculations:
- D. Volume: _____
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The Volume of Landscaping Side B

1. Marisol loves to garden. In her latest gardening magazine, she read that it's important to keep her plants covered in mulch so that the soil does not dry out too fast during the hot summer months.
 - a. If the garden along her walkway measures 13 feet long by 3 feet wide and she wants the mulch to be 0.5 feet high, how much mulch is needed?
 - b. Marisol can buy the mulch for \$1.88 at the local nursery. How much will she spend to put mulch on her garden?

2. Ms. Johnson needs to buy sod for her front yard. She heard that she can buy a palette from the home improvement store. A palette measures 4 feet wide by 4 feet long by 5 feet high.
 - a. What's the volume of sod that she'll be receiving?
 - b. She'll need a minimum of 65 cubic feet of sod to complete the job. How many palettes should Ms. Johnson order?

3. Ronald wants to put decorative stones in the bottom of his aquarium. He knows that the stones can be purchased for \$0.05 per cubic inch. His aquarium measures 12 inches wide by 20 inches long.
 - a. If he decides to make the stone layer 0.25 inches high, how much will he pay?
 - b. If he decides to make the stone layer 0.5 inches high, how much will he pay?

4. Sherry just bought a new home, but knows she'll need to do a lot of work outside. The trash company can provide a dumpster that's a cube where each side measures 2.5 yards.
 - a. How many cubic yards of landscaping debris can the dumpster hold?
 - b. There are two pricing options available. Sherry can pay a flat rate of \$250 or pay \$15.00 per cubic yard. Assuming she fills the dumpster, which is the better price to pay? Why?