Lesson 3: From Area to Volume

☐ Getting Started

Now that you know what a rectangular prism is, you're ready to learn about volume. You've reviewed that perimeter measures the distance around a 2D shape and area is the amount of space inside a 2D shape. **Volume** is the amount of space a 3D shape takes up. For example, imagine that you want to buy a storage box to keep under your bed. You would need to know the box's length, width, and height in order to determine how much space it takes up. You would the use length, width, and height measurements to figure out the box's volume.

While you can figure out the volume for all sorts of 3D shapes, during this unit, you're going to focus on working with the volumes of rectangular prisms.

Stuff You Need
- ✓ centimeter cubes (kit)* (Activity 2 - optional)
- ✓ laminated isometric dot sheet (kit)
- ✓ fine point dry-erase markers (kit)
- ✓ ruler (kit)

Ideas to Think About
- What is volume?
- How are volume and area related?

Things to Know
- **Volume**: the amount of space a 3D shape takes up
- **Cubic units**: the units used when measuring volume
- Isometric drawing is a way to draw 3D shapes on a 2D surface, like paper.

Math Downloads
www.movingbeyondthepage.com/link/9403/

Activities

☐ Activity 1: What Is Volume?

To learn more about volume and its relationship to area, watch a video segment at the following web link. Stop the video at the 2:37 mark.

Volume
www.movingbeyondthepage.com/link/9311/
Stop the video at 2:37.

Now, practice using the interactive tool at the following web link to create different rectangular prisms. Working in "Create" mode, click on the cube image on the left side of the screen, and then drag the arrow to the grid area. Click again to place a cube on the grid. To add cubes, move the arrow so that it is touching a face of a cube that's already there, and click again. Keep in mind that every time you add a cube to the prism, you're changing the prism's volume. You can take cubes away (which also changes the volume) by using the eraser tool. Once you've created a prism, click on "Inspect" mode to see its parts in 2D. For now, you just want to practice using this tool — you'll be using it again later in the unit.

Isometric Drawing Tool
www.movingbeyondthepage.com/link/9312/

Now that you've spent time exploring volume, complete the "Measurements: 2D and 3D Shapes" sheet. You can rewatch the video segment if needed to complete the questions comparing area and volume. Show your work to a parent and then store this sheet in your Interactive Notebook.

☐ **Activity 2: Isometric Drawing**
It's one thing to draw a 2D shape, but it's quite another to draw a 3D shape. During the previous activity, you used an online, interactive tool to create isometric drawings of shapes. Basically, isometric drawing allows us to draw 3D shapes on a 2D surface (such as a piece of paper), and it's often used by engineers and architects.

Now, you're going to practice isometric drawing using the laminated isometric dot sheet, a dry-erase marker, and a ruler.

Start by drawing a cube following these steps:

Practice drawing several more cubes on the laminated isometric dot sheet. Do you see how this type of drawing allows you to show all three dimensions (length, width, height)

of the shape?

Once you feel comfortable with drawing a single cube, you can add another cube to it by drawing more lines as shown in the following image.

Now, try drawing a larger cube by doubling the length of the lines. So, each line should include three dots (a beginning and ending one and another in the middle). Can you make an even bigger cube?

To see how to create rectangular prisms that are not cubes, watch a video segment at the following web link. As you watch, try following along on your own laminated isometric dot sheet.

Drawing 3D Shapes Using Isometric Paper
www.movingbeyondthepage.com/link/9313/   You can stop the video at 3:45. Note that the speaker uses the term "cuboid" for rectangular prisms.

Spend a few more minutes practicing drawing cubes and rectangular prisms on the laminated isometric dot sheet. Try adding more cubes and prisms to the ones you've drawn, attaching them to create more complex shapes. You'll be using this skill later during this unit.

☐ **Activity 3: Basic Skills Review**

You will complete the "Basic Skills Review #23" sheets. This review includes skills that you've already practiced. Use scratch paper as needed. Be sure to label units. For example, if a problem is about time, your answer should include a unit of time such as "seconds" or "minutes."

☐ **Wrapping Up**

During this lesson, you learned some of the basics about volume and how it's related to area. You also practiced drawing in 3D using an online tool and special paper. In the next lesson, you'll develop an even deeper understanding of volume.

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Measurements: 2D and 3D Shapes

Instructions: Fill in the information for finding area and volume.
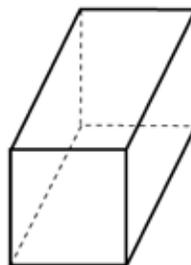
Area

How many dimensions does this have? _____

What measurements are needed to calculate area?

_____

Area is measured in _____ units.

Volume

How many dimensions does this have? _____

What measurements are needed to calculate volume?

_____

Volume is measured in _____ units.

Instructions: Read each scenario and decide if the person needs to find perimeter, area, or volume.

1) Tony wants to lay bricks around the edges of his rectangular patio. He needs to find the patio's _____.

2) Estrella has received a fish tank for her birthday and needs to make sure it fits on the middle shelf of her bookcase. She needs to find the fish tank's _____.

3) Brian is covering his desk with chalkboard paint. He needs to find the desk's _____.

4) Taylor wants to find how much space her art box takes up. She needs to find the box's _____.

5) Jenn wants to put strings of lights across all four walls of her room. She needs to find the room's _____.

6) Jacob is replacing the glass in a window. He needs to find the window's _____.

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Basic Skills Review #23

1. Cat's lemonade recipe calls for $\frac{1}{8}$ cup of sugar per pint of lemonade. How much sugar will she need to make a gallon of lemonade?

2. Marc's garden has an area of 36 square feet. What are 3 possible dimensions of his garden?

3. If the dividend is 1.92 and the divisor is 0.06, what's the quotient?

4. What is the product of $4\frac{2}{3}$ and 5? Simplify your answer.

5. Write >, <, or =.

$$13 \times 11 - 54 \bigcirc 156 \div 12 \times 6.5$$

6.

$$\frac{1}{8} \div 7 =$$

7. Zach cuts 6 pizzas into eighths. How many pieces of pizza does he have?
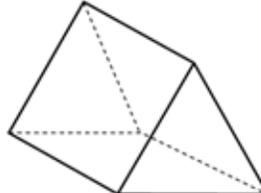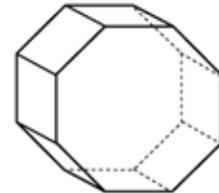
8. Circle the hexagonal prism.

(a)
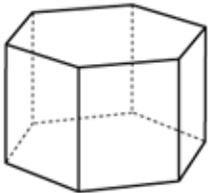
(b)

(c)

(d)

9. Tanner ate $\frac{1}{6}$ of a pizza, and Bess ate $\frac{1}{4}$ of the same pizza. How much pizza is left?

10. Solve:

$$72 - 10 \div 2 \times (3 \times 4)$$

Parent Overview

Lesson 3: From Area to Volume

Getting Started

? **Big Ideas**
- What is volume?
- How are volume and area related?

📖 **Facts and Definitions**
- **Volume**: the amount of space a 3D shape takes up
- **Cubic units**: the units used when measuring volume
- Isometric drawing is a way to draw 3D shapes on a 2D surface, like paper.

⊙ **Skills**
- Recognize volume as an attribute of solid figures and understand concepts of volume measurement
- Create rectangular prisms using cubes

Introducing the Lesson

During this lesson, your child is going to learn what volume is and how it relates to area. Then, he will practice drawing rectangular prisms.
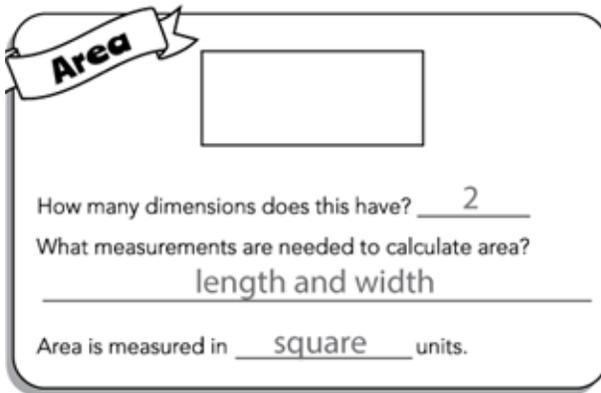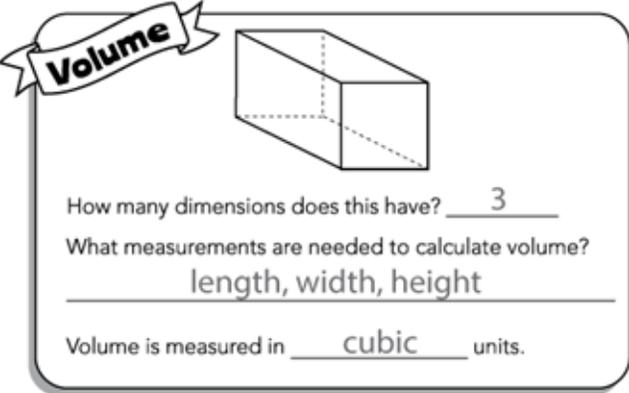
MATERIALS NOTE: The isometric dot sheet used in this and future lessons in this unit can be downloaded from the following web link. You can laminate the sheet or place it in a plastic page protector for your child to use with a thin-tipped dry-erase marker. If you prefer, you can instead print out several paper copies for your child to use in this lesson with a pencil.

Outline of Activities and Answer Keys

Activity 1: What Is Volume?

To learn more about volume, your child will watch a video segment. Then, he will practice using an interactive tool to build rectangular prisms. Allow him to try using different features of the tool. Instructions for using the tool are provided below the tool itself. He will conclude this activity by completing a page that will be stored in his Interactive Notebook.

> **"Measurements: 2D and 3D Shapes" Answer Key**
>
> **Area**
>
> How many dimensions does this have? ___2___
> What measurements are needed to calculate area?
> ___length and width___
> Area is measured in ___square___ units.
>
> **Volume**
>
> How many dimensions does this have? ___3___
> What measurements are needed to calculate volume?
> ___length, width, height___
> Volume is measured in ___cubic___ units.

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Answer Key (continued):

1. perimeter
2. volume
3. area
4. volume
5. perimeter
6. area

Activity 2: Isometric Drawing

During this activity, your child will learn how to use isometric dot sheet to draw 3D shapes (cubes and rectangular prisms). If he struggles with this, encourage him to watch the video again and follow along as it plays. It may also help to allow him to use centimeter cubes as a model. Be sure to place a cube so that he can copy its shape on the paper. He should draw only what he can see of the top and sides of the cube (not the back or bottom). During this unit, he will model rectangular prisms both on paper and using the cubes.

Activity 3: Basic Skills Review

Your child will complete another Basic Skills Review.

1. Cat's lemonade recipe calls for 1/8 cup of sugar per pint of lemonade. How much sugar will she need to make a gallon of lemonade? (1 cup) *8 pints = 1 gallon; 1/8 × 8 = 8/8 = 1 cup*
2. Marc's garden has an area of 36 square feet. What are 3 possible dimensions of his garden? (36 ft × 1 ft, 2 ft × 18 ft, 3 ft × 12 ft, 4 ft × 9 ft, 6 ft × 6 ft)
3. If the dividend is 1.92 and the divisor is 0.06, what's the quotient? (32) *1.92 ÷ 0.06 = 32*
4. What is the product of 4 2/3 and 5? Simplify your answer. (23 1/3) *4 2/3 × 5 = 14/3 × 5 = 70/3 = 23 1/3*
5. Write >, <, or =. 13 × 11 − 54 _____ 156 ÷ 12 × 6.5 (>) *13 × 11 − 54 = 89; 156 ÷ 12 × 6.5 = 84.5*
6. 1/8 ÷ 7 = (1/56)
7. Zach cuts 6 pizzas into eighths. How many pieces of pizza does he have? (48 pieces) *6 ÷ 1/8 = 6/1 × 8/1 = 48*
8. Circle the hexagonal prism. (Prism a)
9. Tanner ate 1/6 of a pizza, and Bess ate 1/4 of the same pizza. How much pizza is left? (7/12 of the pizza) *1/6 + 1/4 = 5/12; 1 = 12/12; 12/12 − 5/12 = 7/12*
10. Solve: 72 − 10 ÷ 2 × (3 × 4) (12)

Wrapping Up

Questions to Discuss

- What is volume? (the amount of space inside a 3D shape or object)
- How is volume similar to area? (both measure the space inside a shape or object)
- To figure out volume, what do you need to know about a shape? (its length, width, and height)

Things to Review

Review what volume is and how it relates to area