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LESSON 30

Volume of Rectangular Prisms

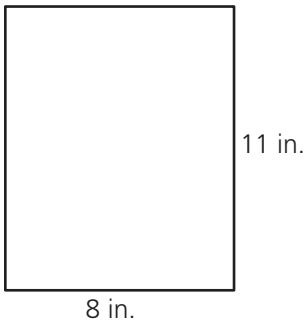
CCLS: 5.MD.5.a, b

PART 1 Introduction

The area of a rectangle or square is found by multiplying the length and width. Area is the measurement of a flat or two-dimensional figure in square units. Find the volume of a rectangular prism or cube by using the three dimensions of the figure: length, width, and height.

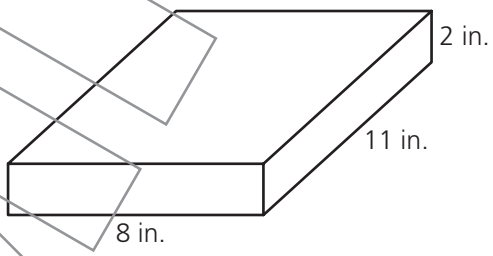
Volume = $l \times w \times h$
or
Volume = $B \times h$, where B is the area of the base

What is the volume of a stack of paper that is 2 inches high and made of sheets measuring 11 inches long by 8 inches wide?



Find the area of one sheet of paper: 11 inches × 8 inches = 88 square inches.

A stack of paper has a height of 2 inches.



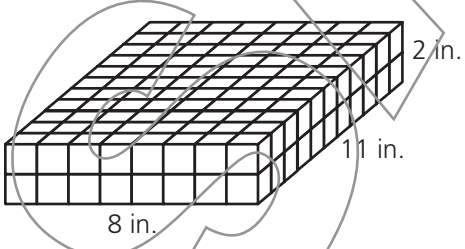
Use the area of one sheet of paper times the height of the stack to find the volume of the stack.

$$V = l \times w \times h$$
$$V = 11 \times 8 \times 2 = 88 \times 2$$
$$V = 176 \text{ in.}^3$$

The volume of the stack of paper is 176 cubic inches.

Volume is always given in cubic units.

Imagine modeling the stack of paper using unit cubes.



There are 88 cubes on the top layer. The stack of paper has 2 layers of cubes with 88 cubes in each.

$$88 + 88 = 176$$

There are 176 cubes in the rectangular prism formed by the stack of papers.

The volume of the stack of cubes is 176 cubic inches, which is the same as the volume found by multiplying the dimensions of the stack of papers: $11 \times 8 \times 2 = 176$ cubic inches.

Think About It

Why is using the formula $V = B \times h$ the same as using the formula $V = l \times w \times h$?

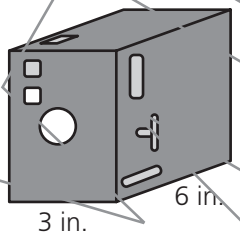
_____

_____

PART 2 Focused Instruction

Use the information given in diagrams and pictures to find the volume of figures.

➤ Minny collects old cameras. She has an old box camera like the one shown below.



What is the formula for the volume of a rectangular prism?

_____

What is the length of the camera? _____

What is the width of the camera? _____

What is the height of the camera? _____

Write an expression that can be used to find the volume of the box camera.

_____

What is the product of the length and width? _____

What part of the camera does this product represent?

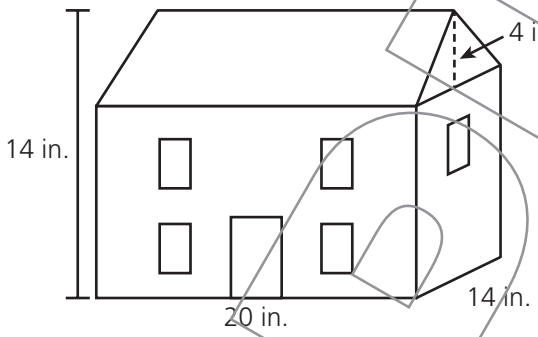
_____

The base of the camera is a rectangle.

What is the product of the length and the width and the height? _____

What is the volume of the box camera? _____

➤ A dollhouse is made up of a rectangular prism and a triangular prism, as shown below.



What is the length of the dollhouse? _____

What is the width of the dollhouse? _____

What is the total height of the dollhouse? _____

Can the total height be used in the volume formula to find the volume of the rectangular prism? _____

The total height of the dollhouse is the heights of the rectangular prism and the triangular prism.

How can you find the height of the rectangular prism portion of the house?

_____

What is the height of the rectangular prism? _____

What is the formula that can be used to find the volume of the rectangular prism? _____

Write two expressions that can be used to find the volume of the rectangular prism.

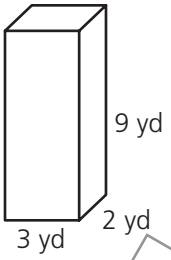
_____

What is the volume of the rectangular prism portion of this dollhouse?

_____

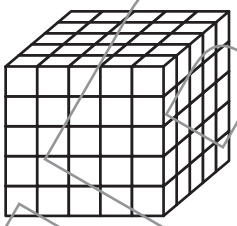
Use what you know about volume to answer these questions.

1 What is the volume of the figure?



_____

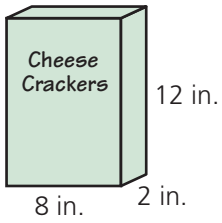
2 Write three multiplication expressions and an addition expression that can be used to find the volume of the figure.



_____

Solve the following problems.

1 Armando bought the box of crackers shown below.

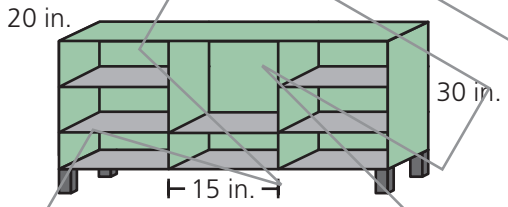


If the box were filled with 1-inch cubes, how many cubes would fit in the cracker box? Show your work.

Find the area of the base first.

Answer _____ cubes

2 Jennifer ordered a new TV stand.



The length of the stand is the total length of all of the shelves.

Each of the shelves has the same length and width. What is the volume of the TV stand? Explain how you found your answer.

_____

_____

_____

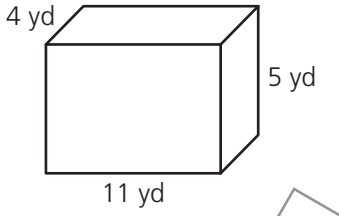
3 The associative property for multiplication is stated as $a \times (b \times c) = (a \times b) \times c$. Find the volume of a 3 in. by 4 in. by 5 in. rectangular prism using both sides of the equation. Show your work.

Use the order of operations to simplify the terms in parentheses first.

Answer _____ cubic inches

Solve the following problems.

1 What is the volume of the rectangular prism? Show your work.



Answer _____ cubic yards

2 Paige rents a moving truck with a cargo area measuring 12 feet long, 10 feet wide, and 9 feet tall. She needs exactly 1,000 cubic feet of space to move all of her things. Which statement about the truck's volume is true?

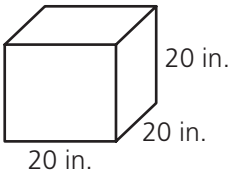
A It is 20 cubic feet less than Paige needs.

B It is exactly 1,000 cubic feet.

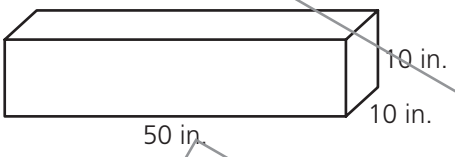
C It is 80 cubic feet more than Paige needs.

D It is double the volume Paige needs.

3 Tariq ships baseballs to sports equipment stores. Each baseball is in a box with a volume of 100 cubic inches. He ships the baseballs in one of the two crates below.



Crate 1



Crate 2

Part A In which crate can Tariq ship more baseballs?

Answer _____

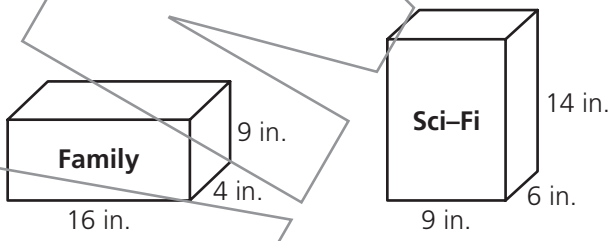
Part B The baseballs cost $0.50 each to ship. How much does it cost to ship the crate that fits the greatest number of baseballs? Explain.

_____

_____

_____

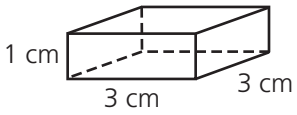
4 Boxed sets of DVDs of two different TV shows are shown.



Choose an option from each set that makes the statement true.

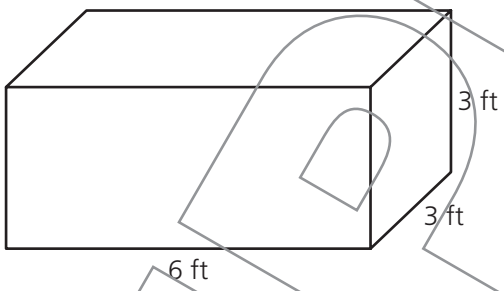
The volume of the [family show, sci-fi show] DVD set is [180, 576, 756] cubic inches greater than the volume of the other DVD set.

5 The box shown here was filled with 1-square centimeter sugar cubes. How many sugar cubes fit in the box?



Answer _____ sugar cubes

6 The city science center has a leafcutter ant tank that has the dimensions shown.



Part A Draw a model that can be used to find the number of cubic feet that will fit into the tank, without calculating the volume.

Part B What is the volume of the tank in cubic yards? Justify your answer using the model and volume formula.

_____

_____

_____