

Independent Practice

Solve the problems.

MP3 24. Logan says he wrote three equivalent expressions to represent the volume of a right rectangular prism with a length and width of 17 cm and a height of 4 cm. Are his expressions all correct?

a. $17 \times (17 \times 4)$

b. $2 \times (17) \times 4$

c. $17 \times 17 \times 4$

MP1 25. Multiply the factors 12, 4, 8, and 7. Because of the Associative and Commutative Properties of Multiplication, you can multiply the factors in any order. Explain in which order you multiplied the factors, and why.


 Show your work.

Answer _____

MP3 26. Tyrone says he used the Associative Property of Multiplication to write two expressions equivalent to $8 \times 1.25 \times 9 - 5$. Evaluate all three expressions to see if they are equivalent. If they are not equivalent, explain the error Tyrone made.

a. $8 \times (1.25 \times 9) - 5$

b. $8 \times 1.25 \times (9 - 5)$

 Show your work.

Answer _____

Problem Solving: Apply Volume Formulas for Prisms

Essential Question:
How do you find volume
using a formula?

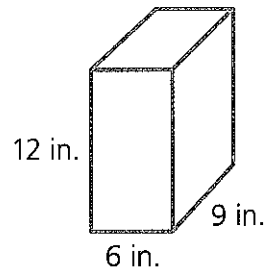
5.MD.5b

Guided Instruction

In this lesson you will solve real-world problems using formulas for volume.

Understand: How to solve problems using formulas for volume

Mr. Bower's new post office mailbox is 12 inches tall, 9 inches long, and 6 inches wide. What is the volume of the mailbox?



To find the volume of the mailbox, you can use a formula for the volume of a right rectangular prism. There are two equivalent volume formulas.

In this formula, V is the volume, ℓ is the length, w is the width, and h is the height:

$$V = \ell \times w \times h$$

In this formula, V is the volume, B is the area of the base, and h is the height:

$$V = B \times h$$

You know all three dimensions, so you can use the formula $V = \ell \times w \times h$. In this case, $\ell = 9$ in., $w = 6$ in., and $h = 12$ in.

$$V = \ell \times w \times h \longleftarrow \text{Start with the formula.}$$

$$V = 9 \times 6 \times 12 \longleftarrow \text{Substitute values for } \ell, w, \text{ and } h.$$

$$V = 648 \longleftarrow \text{Multiply to find the value of } V.$$

➤ The volume of Mr. Bower's post office mailbox is 648 in.³

🔧 • How would you find the volume of the mailbox using the formula $V = B \times h$?

Guided Instruction

Connect: What you know about formulas for volume to solve problems

There are two empty sandboxes on a school playground. Sandbox 1 has a base with dimensions 4 feet by 6 feet and is 2 feet high. Sandbox 2 has a base area of 35 square feet and is 1 foot high. The school maintenance crew has 90 cubic feet of sand. Is this enough to fill both sandboxes?

Step 1

Plan a solution.

Find the volume of each sandbox and then add to find the total volume. Compare this volume to 90 cubic feet to see if the crew has enough sand to fill both sandboxes.

Step 2

Use formulas to calculate the volumes.

Sandbox 1: You know all three dimensions, so you can use the formula $V = \ell \times w \times h$.

$$V = \ell \times w \times h$$

$$V = 4 \times 6 \times 2$$

$$V = 48$$

The volume is 48 ft³.

Sandbox 2: You know the base area and the height, so you can use the formula $V = B \times h$.

$$V = B \times h$$

$$V = 35 \times 1$$

$$V = 35$$

The volume is 35 ft³.

Step 3

Find the total volume and compare to 90 cubic feet.

$$48 \text{ ft}^3 + 35 \text{ ft}^3 = 83 \text{ ft}^3$$

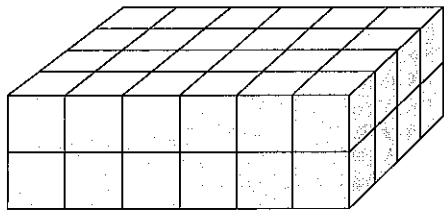
The total is less than 90 cubic feet.

► 90 cubic feet of sand is enough to fill both sandboxes.

Guided Practice

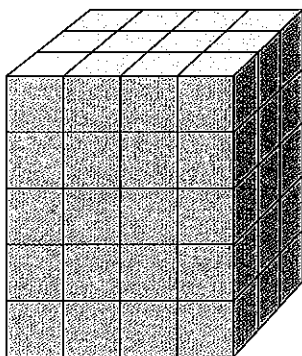
Use the formulas to find the volume of the right rectangular prisms.

1.



$$\begin{aligned} V &= \ell \times w \times h \\ &= 6 \text{ units} \times \underline{\hspace{1cm}} \text{ units} \times \underline{\hspace{1cm}} \text{ units} \\ &= \underline{\hspace{1cm}} \text{ cubic units} \end{aligned}$$

2.



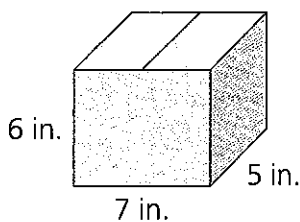
$$\begin{aligned} V &= \ell \times w \times h \\ &= 4 \text{ units} \times \underline{\hspace{1cm}} \text{ units} \times \underline{\hspace{1cm}} \text{ units} \\ &= \underline{\hspace{1cm}} \text{ cubic units} \end{aligned}$$

3. Anna builds a spice drawer that is 40 cm long, 15 cm wide, and 10 cm tall. What is the volume of the spice drawer that Anna built?

$$\begin{aligned} V &= \ell \times w \times h \\ &= 40 \times 15 \times \underline{\hspace{1cm}} \\ &= \underline{\hspace{1cm}} \text{ cm}^3 \end{aligned}$$

The volume of the spice drawer is $\underline{\hspace{1cm}} \text{ cm}^3$.

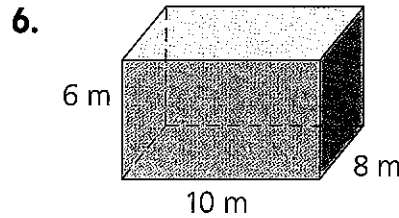
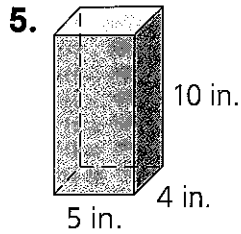
4. Skye is mailing a present and needs a box that has a volume of at least 200 cubic inches. Is this box big enough? Explain.



$$\begin{aligned} V &= B \times h \\ &= (7 \times 5) \times \underline{\hspace{1cm}} \\ &= \underline{\hspace{1cm}} \text{ in.}^3 \end{aligned}$$

Guided Practice

Find the volume of each figure.



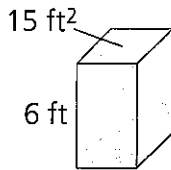
Solve.

7. Todd wants to use organic soil to fill his flower boxes. Each box is a right rectangular prism that has a base area of 3 ft^2 and a height of 2 ft. How many cubic feet of organic soil does Todd need to fill one of the flower boxes?

Todd needs _____ of organic soil to fill one of the flower boxes.

8. Which box has the greater volume?

Box A

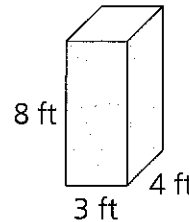


$$V = B \times h$$

$$V = \text{___ ft}^2 \times \text{___ ft}$$

$$V = \text{___ ft}^3$$

Box B



$$V = \ell \times w \times h$$

$$V = \text{___} \times \text{___} \times \text{___}$$

$$V = \text{___ ft}^3$$

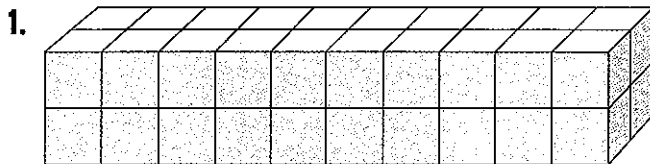
Box _____ has the greater volume.

Think-Pair-Share

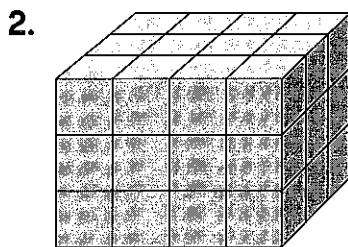
- MP4 9. Joy needs a container. The container has to have a volume between 600 cubic inches and 800 cubic inches. It has to be longer than it is tall. What could the dimensions of her container be?

Independent Practice

Use formulas to find the volume of the right rectangular prisms.

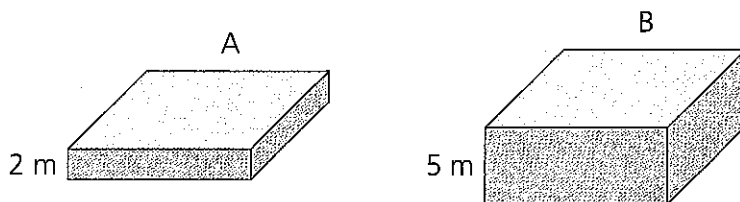


$$\begin{aligned}
 V &= \ell \times w \times h \\
 &= 10 \text{ units} \times \underline{\hspace{1cm}} \text{ units} \times \underline{\hspace{1cm}} \text{ units} \\
 &= \underline{\hspace{1cm}} \text{ cubic units}
 \end{aligned}$$



$$\begin{aligned}
 V &= \ell \times w \times h \\
 &= 4 \text{ units} \times \underline{\hspace{1cm}} \text{ units} \times \underline{\hspace{1cm}} \text{ units} \\
 &= \underline{\hspace{1cm}} \text{ cubic units}
 \end{aligned}$$

3. Each of the containers, labeled A and B, has a base with an area of 12 m^2 . Find the volume of each. Then find the difference in the volumes of the two containers.



The volume of container A is _____.

The volume of container B is _____.

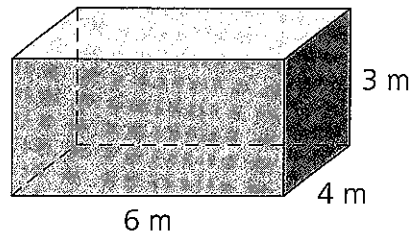
The difference in volumes is _____.

Independent Practice

For exercises 4–7, circle the correct answer.

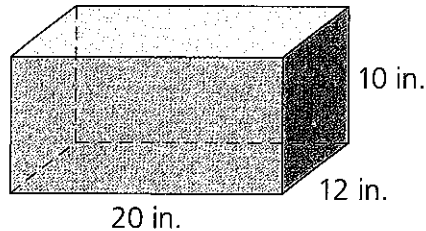
4. Erin built the box shown. What is its volume?

a. 42 m^3 b. 72 m^3
 c. 108 m^3 d. 144 m^3



5. Luke bought the reptile tank shown. What is the volume of the tank?

a. 440 in.^3 b. $1,200 \text{ in.}^3$
 c. $2,000 \text{ in.}^3$ d. $2,400 \text{ in.}^3$



6. A storage chest has a base with an area of 25 square feet and is 5 feet tall. What is the volume of the bin?

a. 15 ft^3 b. 25 ft^3
 c. 125 ft^3 d. 125 ft^2

7. Shelley has a pencil case that is 30 cm long, 4 cm wide, and 3 cm deep. What is the volume of Shelley's pencil case?

a. 210 cm^3 b. 360 cm^3
 c. 720 cm^3 d. 1200 cm^3

Solve.

8. Mr. Kim has a man-made pond that is shaped like a right rectangular prism with a base area of 72 square meters. The pond has a volume 72 cubic meters. What is the pond's depth?

The pond has a depth of _____.

Independent Practice

- MP2 9. Leonard is packing boxes that are cubes with 6-inch sides into a crate. The crate is 2 feet wide by 3 feet long by 2 feet tall. How many cubes can Leonard pack into the crate? Show your work.

Leonard can pack ____ cubes into the crate.

- MP1 10. Alexandra's house has a backyard patio that is 4 yards long by 5 yards wide. Alexandra's mother is building a rectangular storage shed with a volume of 1,080 cubic feet and with the entire patio as its base. What is the height of the shed Alexandra's mother is building? Give your answer in feet and then in yards. Show your work.

The height of the shed is ____ feet or ____ yards.

In exercise 11, the chart shows various dimensions and volumes of right rectangular prisms. Complete the chart, then answer the question below.

11.

Length	Width	Height	Volume
50 in.	10 in.	10 in.	
50 in.	8 in.	10 in.	
50 in.		10 in.	2,500 in. ³
50 in.	3 in.		1,500 in. ³

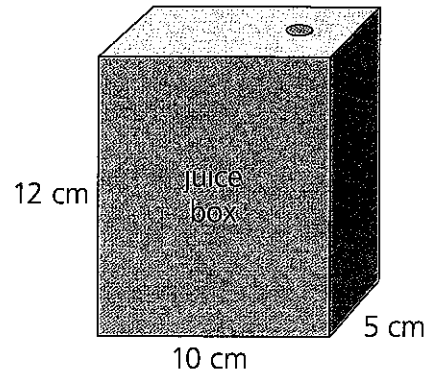
Describe what happens to the volume of the right rectangular prisms above as the base area changes.

Independent Practice

Solve. Use the figure.

- MP6 **12.** A manufacturer makes juice boxes that are 12 cm tall, 10 cm wide, and 5 cm deep. What is the volume of each juice box in cubic centimeters?

The volume of each juice box is _____.



- MP7 **13.** What is the liquid volume of the juice box in milliliters?

The liquid volume of each juice box is _____.

- MP4 **14.** The juice box company decides to make three different juice box sizes. They want to have a mini juice box, a regular sized juice box, and a large sized juice box. Use the rules given below to choose the new dimensions of each box and find its liquid volume in milliliters.

Rules: The mini box should hold no more than 300 mL. The regular sized box should hold between 450 and 550 mL. The large sized box must hold at least 800 mL.

Sketch each new box, showing the dimensions and volume. Explain your choices.

a. Mini juice box

b. Regular sized juice box

c. Large sized juice box

Problem Solving: Decompose Figures to Find Volume

Essential Question:
How do you find the
volume of a composite
figure?

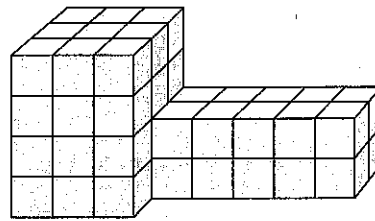
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Guided Instruction

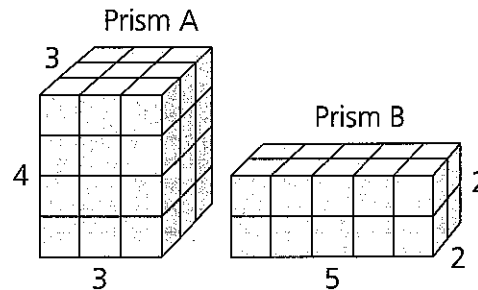
In this lesson you will find volumes of three-dimensional figures by breaking them into right rectangular prisms.

Understand: Breaking apart a figure made from unit cubes into right rectangular prisms to find volume

Jason uses cubes to construct a model of a building with two sections. Each cube is 1 cubic meter. What is the volume of the model?



To find the volume of the model, break apart the figure into two separate right rectangular prisms and find the volume of each. Count the cubes to determine each prism's length, width, and height.



Use the formula for the volume of a right rectangular prism

$$V = \ell \times w \times h.$$

Volume of Prism A

$$\begin{aligned} V &= \ell \times w \times h \\ &= 3 \times 3 \times 4 \\ &= 36 \text{ m}^3 \end{aligned}$$

Volume of Prism B

$$\begin{aligned} V &= \ell \times w \times h \\ &= 5 \times 2 \times 2 \\ &= 20 \text{ m}^3 \end{aligned}$$

Add to find the total volume: $36 \text{ m}^3 + 20 \text{ m}^3 = 56 \text{ m}^3$.

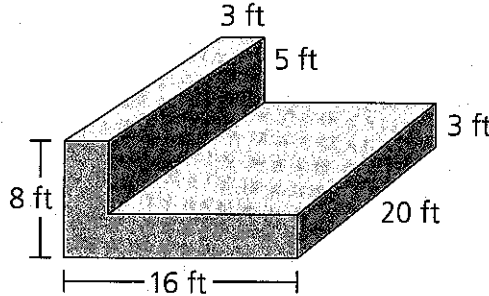
► The volume of the model is 56 m^3 .

► Find the volumes of Prisms A and B using the formula $V = B \times h$.

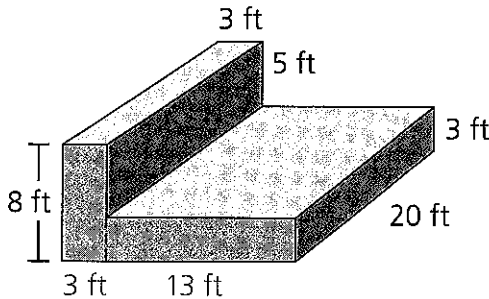
Guided Instruction

Understand: How to find the volume of a figure composed of two right rectangular prisms

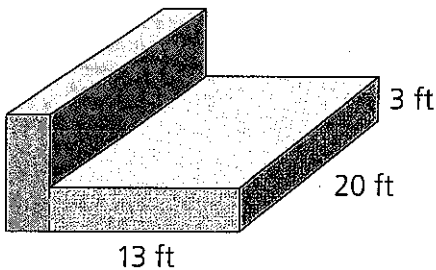
What is the volume of the figure?



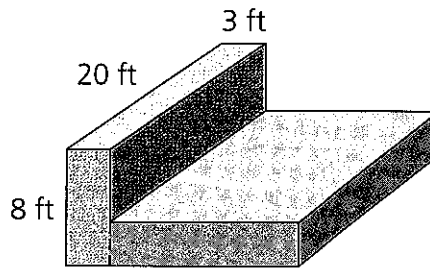
To find the volume of the figure, you can break it into right rectangular prisms. Be sure the prisms do not overlap. One way to break up the figure is shown at the right.



Find the volume of each prism using the volume formula.



$$\begin{aligned} V &= \ell \times w \times h \\ &= 20 \times 13 \times 3 \\ &= 780 \text{ ft}^3 \end{aligned}$$



$$\begin{aligned} V &= \ell \times w \times h \\ &= 20 \times 3 \times 8 \\ &= 480 \text{ ft}^3 \end{aligned}$$

Add the two volumes to find the volume of the composite figure.

$$780 \text{ ft}^3 + 480 \text{ ft}^3 = 1,260 \text{ ft}^3$$

➡ The volume of the composite figure is 1,260 cubic feet.

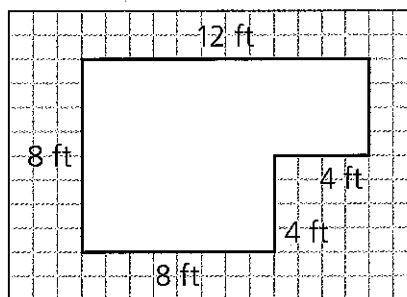
Guided Instruction

Connect: What you know about finding the volume of composite figures

Nan just bought an air conditioner. The manual says it will cool a space with a volume up to 1,000 cubic feet.

The diagram at the right represents the floor plan of Nan's bedroom. The height of the room is 12 feet.

Will the air conditioner be powerful enough to cool Nan's room?

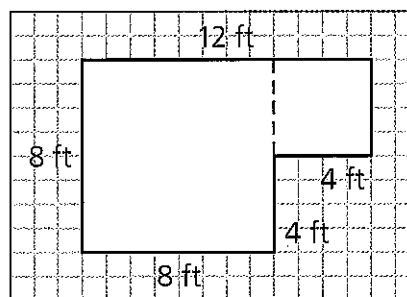


To solve this problem, find the volume of Nan's room and compare it to 1,000 cubic feet.

Step 1

Break apart the bedroom into two right rectangular prisms and find the volume of each one.

Separate the diagram into two squares as shown. Each square is the base of a prism with a height of 12 feet. Find the volume of each prism.



Larger prism

$$\begin{aligned} V &= \ell \times w \times h \\ V &= 8 \times 8 \times 12 \\ V &= 768 \text{ ft}^3 \end{aligned}$$

Smaller prism

$$\begin{aligned} V &= \ell \times w \times h \\ V &= 4 \times 4 \times 12 \\ V &= 192 \text{ ft}^3 \end{aligned}$$

The two prisms have volumes of 768 ft^3 and 192 ft^3 .

Step 2

Add the volumes of the prisms to find the volume of the bedroom.

$$\text{Volume of Nan's bedroom} = 768 \text{ ft}^3 + 192 \text{ ft}^3 = 960 \text{ ft}^3.$$

Step 3

Compare the volume to $1,000 \text{ ft}^3$. The volume, 960 ft^3 , is less than $1,000 \text{ ft}^3$.

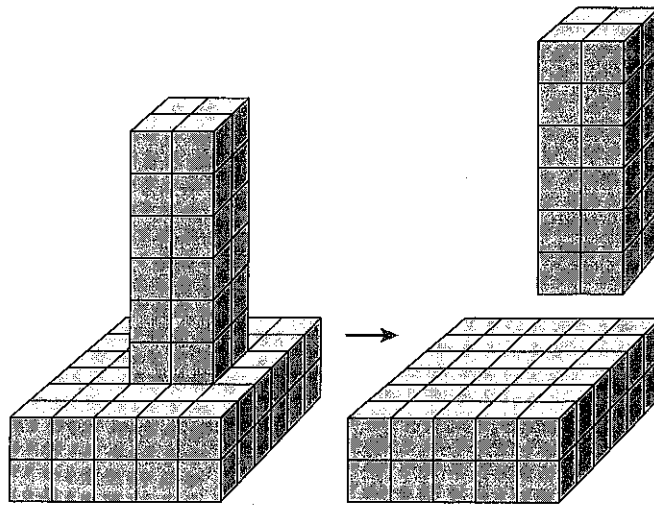
➔ Yes, the air conditioner will be powerful enough to cool Nan's bedroom.

Guided Practice

For exercises 1–3, use the figure shown at the right, which is made from centimeter cubes.

1. volume of top prism
 $V = \ell \times w \times h$
 $V = 2 \times 2 \times \underline{\hspace{1cm}}$
 $V = \underline{\hspace{1cm}} \text{ cm}^3$

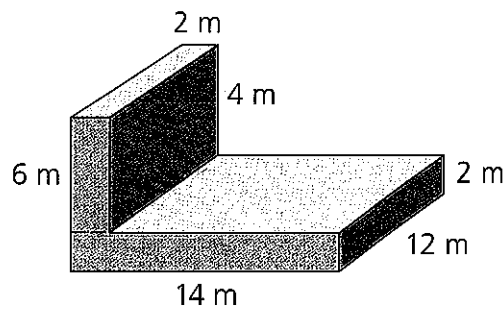
2. volume of bottom prism
 $V = \ell \times w \times h$
 $V = 5 \times 6 \times \underline{\hspace{1cm}}$
 $V = \underline{\hspace{1cm}} \text{ cm}^3$



3. volume of composite figure
 $\underline{\hspace{1cm}} \text{ cm}^3 + \underline{\hspace{1cm}} \text{ cm}^3 = \underline{\hspace{1cm}} \text{ cm}^3$

For exercises 4–7, use the figure shown at the right.

4. volume of bottom prism
 $14 \times 12 \times 2 = \underline{\hspace{2cm}}$
5. volume of top prism
 $2 \times 4 \times 12 = \underline{\hspace{2cm}}$
6. total volume
 $\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$



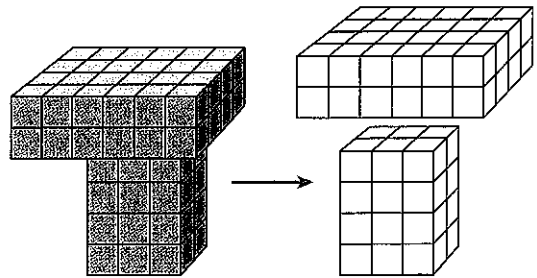
Think-Pair-Share

- MP4 7. Find the volume of the figure in exercises 4–6 by separating it into two different prisms. Describe the dimensions of the new prisms. What is the volume of the figure? Is it the same? Explain.

Independent Practice

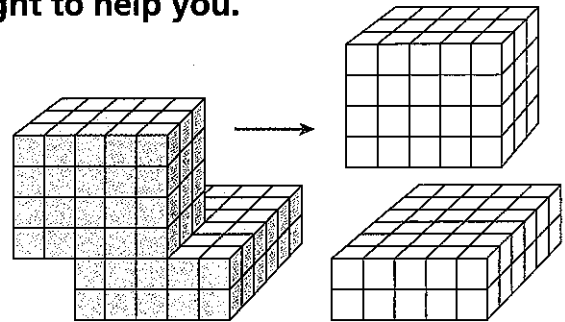
Find the volume of the green figure, which is made from centimeter cubes. Use the figure at the right to help you.

1. top prism: $V =$ _____
2. bottom prism: $V =$ _____
3. volume of composite figure:
 _____ + _____ = _____



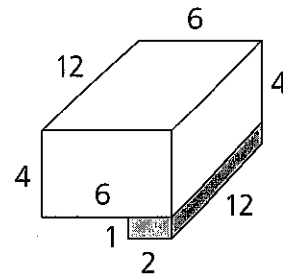
Find the volume of the blue figure, which is made from centimeter cubes. Use the figure at the right to help you.

4. top prism: $V =$ _____
5. bottom prism: $V =$ _____
6. volume of composite figure:
 _____ + _____ = _____



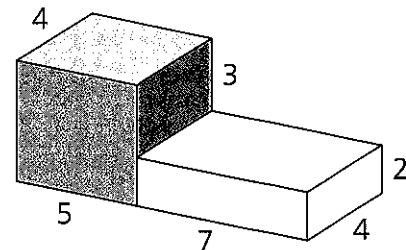
Find the volume of the figure by adding the volumes of the two right rectangular prisms. The measures are in inches.

7. white prism: $V =$ _____
8. red prism: $V =$ _____
9. total volume:
 _____ + _____ = _____



Find the volume of the figure by adding the volumes of the two right rectangular prisms. The measures are in inches.

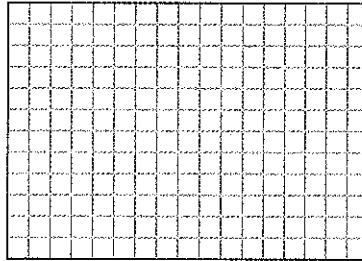
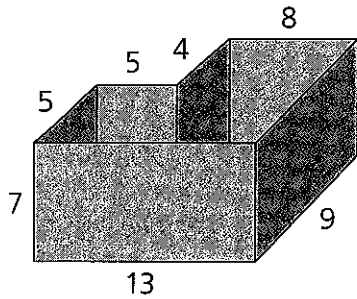
10. white prism: $V =$ _____
11. purple prism: $V =$ _____
12. total volume:
 _____ + _____ = _____



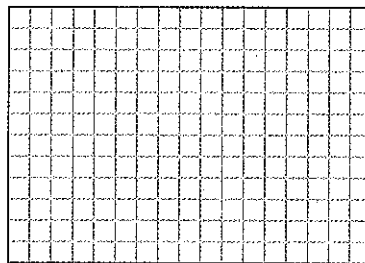
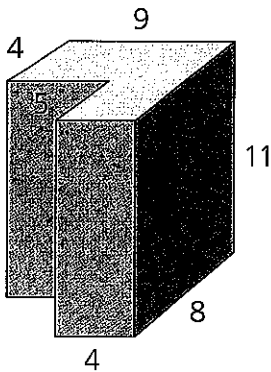
Independent Practice

For exercises 13–14, draw the base of each figure on the grid provided. Separate the base into rectangles to represent the bases of two right rectangular prisms. Find the volume of the figure by finding and adding the volumes of the two right rectangular prisms.

13. This box has an open top. Lengths are in inches.



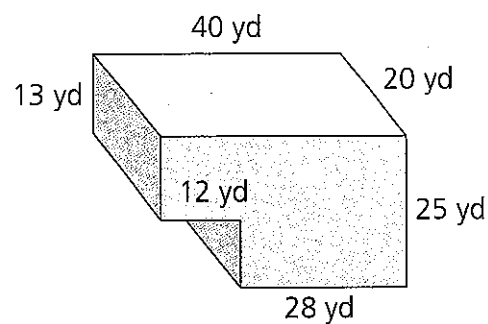
14. This figure is a solid piece of wood. Lengths are in centimeters.



Independent Practice

Use figure to solve.

- MP2 15. Mr. Arthur dug this foundation for a building. Describe two different ways to find the volume of this figure by breaking it apart into two prisms.



- MP1 16. What is the volume of soil removed to pour this foundation?

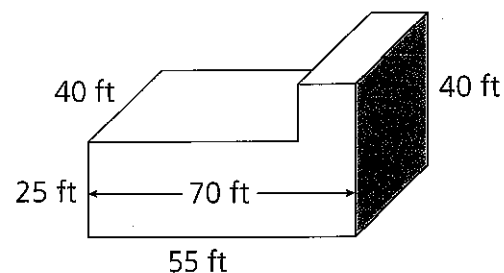
 Show your work.

Answer _____

For exercise 17, find the missing lengths to solve.

- MP2 17. The shaded face of the figure is square. Lengths are in feet. Find the volume of the figure.

Label the figure to show missing lengths. Show how you divide it into two prisms.



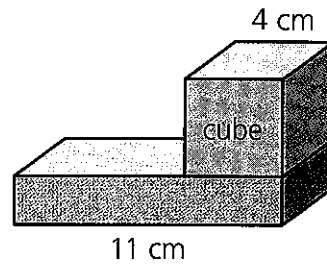
Answer _____

- MP3 18. Explain how you used the given information to solve the problem.

Independent Practice

Solve. Use the figure.

- MP2 **19.** A purple cube that measures 4 cm on each edge sits on top of a green right rectangular prism with an edge of length 11 cm as shown. The volume of the green prism is 88 cm^3 . Find the total height of the figure.



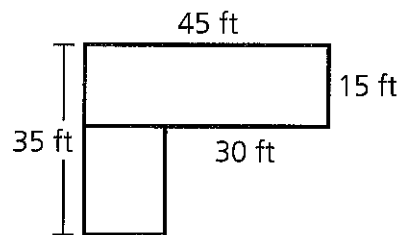
Answer _____

Justify your answer using words, drawings, or numbers.

- MP6 **20.** Show how to break apart the figure from exercise 19 into two right rectangular prisms so that neither prism is a cube. Make a drawing and mark the dimensions or lengths of each prism.

Solve.

- MP1 **21.** The drawing shows the floor plan of a 7-story building. Each story is 11 ft. How many cubic feet are in this building?



Label the drawing to show the missing dimensions. Show the steps in your solution.

Show your work.

Answer _____

UNIT 4 Common Core Review

Convert the measurements from one metric unit to another.

1. 1.6 kilograms = grams
_____ grams

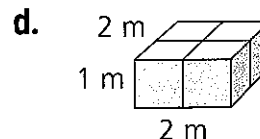
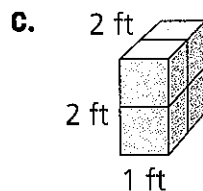
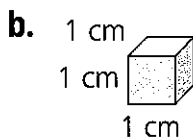
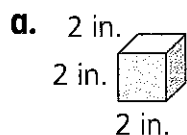
2. 32,000 centimeters = kilometers
_____ kilometers

Circle the correct answer.

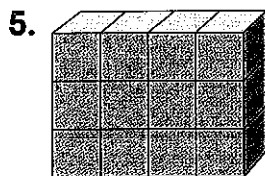
3. Which of the following is more than 2 gallons?

- a. 8 quarts b. 25 cups c. 20 pints d. 200 fluid ounces

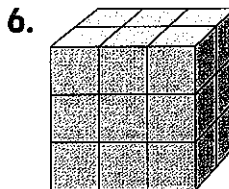
4. Which of the following is a unit cube?



Count the unit cubes to find the volume of each figure.

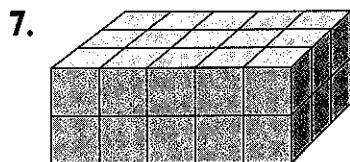


There are _____ unit cubes.
The volume is _____ cubic units.

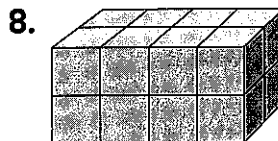


There are _____ unit cubes.
The volume is _____ cubic units.

Show how to use the formula $V = \ell \times w \times h$ to find the volume of each figure.



$V = \underline{\quad} \times \underline{\quad} \times \underline{\quad}$
Volume _____ cubic units



$V = \underline{\quad} \times \underline{\quad} \times \underline{\quad}$
Volume _____ cubic units