Finding Volume

Grade 5: Unit 1

Standards addressed: MD.C.3, MD.C.4, MD.C.5, OA.1, OA.2

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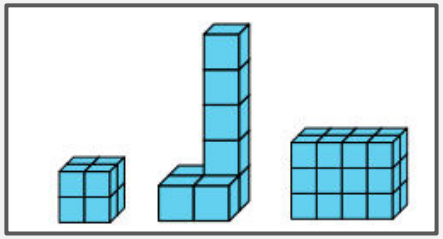
Unit 1 Progression Overview

Finding Volume

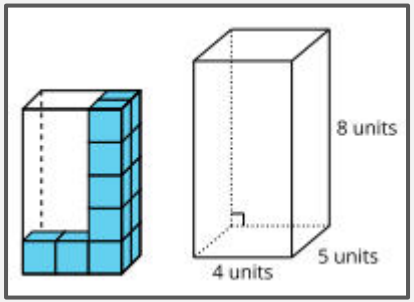
Section A
Lessons 1-4
MD.C.3, MD.C.4, MD.C.5, OA.1, OA.2

- Describe volume as the space taken up by a solid object.
- Measure the volume of a rectangular prism by finding the number of unit cubes needed to fill it.
- Use the layered structure in a rectangular prism to find volume.



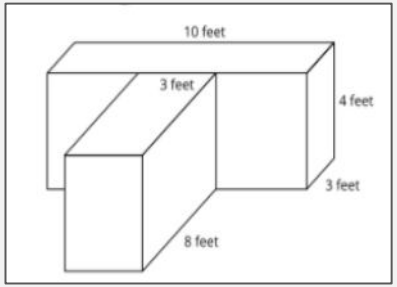
Section B
Lessons 5-7
MD.C.3, MD.C.4, MD.C.5, OA.1, OA.2

- Describe the calculations from the previous section as length x width x height or area of the base x height.
- Find volume using length x width x height or area of the base x height.



Section C
Lessons 8-12
MD.C.3, MD.C.4, MD.C.5, OA.1, OA.2

- Find the volume of a figure composed of rectangular prisms.



Unit 1 Quick Links

Adapt 1

Adapt 2

L1

L2

L3

L4

L5

L6

L7

L8

L9

L10

L11

L12

Adaptation
Lesson 1

Multiples of a Number Lesson

Let’s build some rectangles..

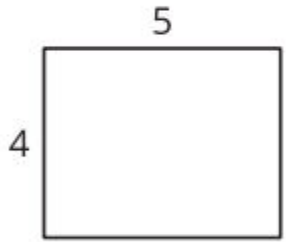
OA.B.4

Warm up

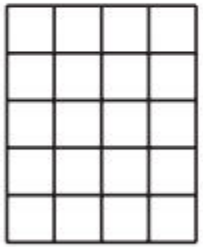
Which One Doesn't Belong?

Which one doesn't belong?

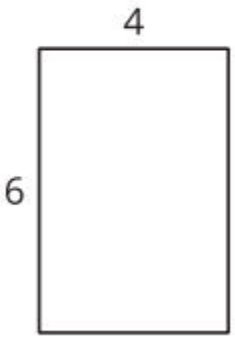
A



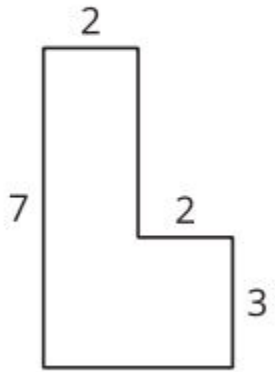
B



C



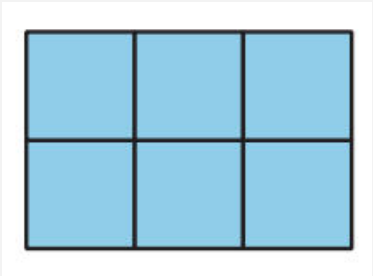
D



How could we determine the area of each figure?

Build Rectangles and Find Area

Activity #1



1. Build 5 different rectangles with the given width. Record the area of each rectangle in the table.

	area of rectangle
2 tiles wide	
3 tiles wide	
4 tiles wide	

Activity #1

Build Rectangles and Find Area

2. Discuss with a partner what you notice about areas in each row of the table.

3. Predict the area of another rectangle for each width and explain your reasoning.

For rectangles that were 2 tiles wide, how can we tell if our area predictions are true without building each rectangle?

How can we check our predictions for rectangles that are 3 or 4 tiles wide?

Activity #2

What Areas Can You Build?

1. Elena is building rectangles with a width of 3 units and an area of 30 square units or less.

   a. Build the rectangles Elena could make and draw the rectangles on grid paper. Label the area and the side lengths of each rectangle.

   b. What is the area of each rectangle you built?

   c. What do you notice about the areas?

2. Why is 28 square units not a possible area for a rectangle with a width of 3 units?

3. If the area of the rectangle can be more than 30 square units, find 2 other areas it could have. Explain or show your reasoning.

4. What is an area that is not possible for a rectangle with a width of 3 units? Explain or show your reasoning.

What did you notice about each of the areas your found?

A *multiple* of a number is the result of multiplying a number by a whole number.

Lesson Synthesis

Let's Put it All Together

What is a number that would not be a multiple of 4? How do you know?

How would you decide whether 28 is a multiple of 4?

Today, we built **rectangles** and learned about **multiples**. You found the **area** of rectangles when given a **side length**.

Next, let's keep learning about **area** by using **factor pairs**.

Adaptation
Lesson 2

Factor Pairs

Let's learn about **factor pairs.**

OA.B.4

Warm up

Number Talk

2 X 7

Warm up

Number Talk

4 X 7

Warm up

Number Talk

3 X 7

Warm up

Number Talk

7 X 7

How did the first three expressions help you find 7 x 7?

Activity #1

How Many Rectangles?

Group A: 11, 27

Group B: 25, 5

Group C: 16, 8

Group D: 9, 18

Group E: 24, 12

Group F: 14, 28

Group G: 15, 30

Group H: 19, 20

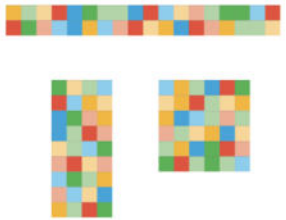
Your teacher will assign 2 numbers to your group. Each number represents the area of a rectangle.

1. On grid paper:
   - Draw all the possible rectangles that have the given area.
   - Label the area and the side lengths.
   - Use each pair of side lengths only once.

   (For example, if you draw a rectangle with 4 units across and 6 units down, you don't need to also draw a rectangle with 6 units across and 4 units down because they have the same pair of side lengths.)

2. When you think you've drawn all the possible rectangles for both areas, cut out your rectangles and put them on a poster for each area you were assigned.

3. Display your poster for all to see.



Activity #1

How Many Rectangles Gallery Walk

As you visit each poster, discuss with your partner:

1. What do you notice? Use the following sentence frames when you share:
    a. “I notice that some of the posters . . . .”
    b. “I notice the posters for numbers _____ and _____ are alike because . . . .”
2. How do you know that all possible rectangles were found for the given area?

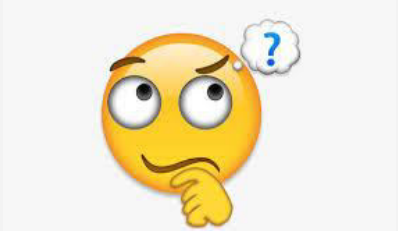
Lesson Synthesis

Let's Put it All Together

Today we learned that a **factor pair** of a whole number is a pair of whole numbers that multiply to result in that number. For example, 5 and 4 are a factor pair of 20.

What are the factor pairs of 24?

How do we know if we found all the factor pairs of 24?



Can you use the same strategies to find all the factor pairs of 45?

Today, we learned about **factor pairs** of **whole numbers**.

Next, let's learn about **prime** and **composite** using **rectangles**.

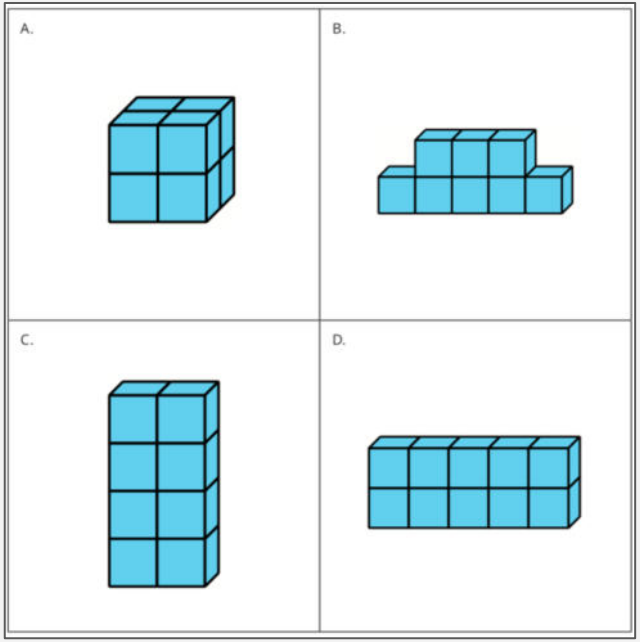
1

What is Volume?

Let’s build and compare objects made of cubes.

Warm up

Which One Doesn't Belong?

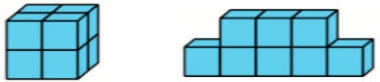


What do objects A, C, and D have in common?

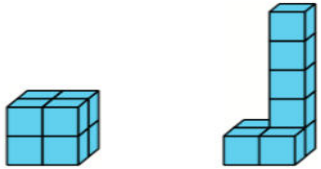
Build Objects with Cubes

Activity #1

1. Which is bigger? Explain your reasoning.



2. Which is bigger? Explain your reasoning.



3. What does it mean for an object to be "bigger"?

How would you describe the amount of space each object in #1 takes up?

Which object has a greater volume in #2?

Activity #2

Build & Order

1. Each group member:
   a. Take a handful of connecting cubes
   b. Build an object
2. Order the objects by volume.
3. Repeat.
4. Each group member:
   a. Take 9 connecting cubes
   b. Build an object
5. Order the objects by volume.

What is the same? What is different?

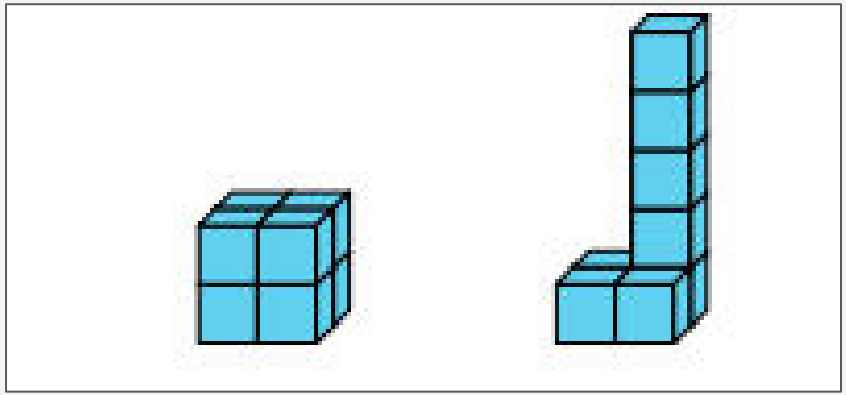
How do the volumes of these objects compare? How do you know?

How much space does each object take up?

Lesson Synthesis

Let's Put it All Together

How are the two shapes the same? How are the two shapes different?



Today, we built objects out of cubes and compared them by the amount of space they take up. We learned that this is called the object's **volume**.

Next, let's keep learning about **volume** by counting **unit cubes**.

2

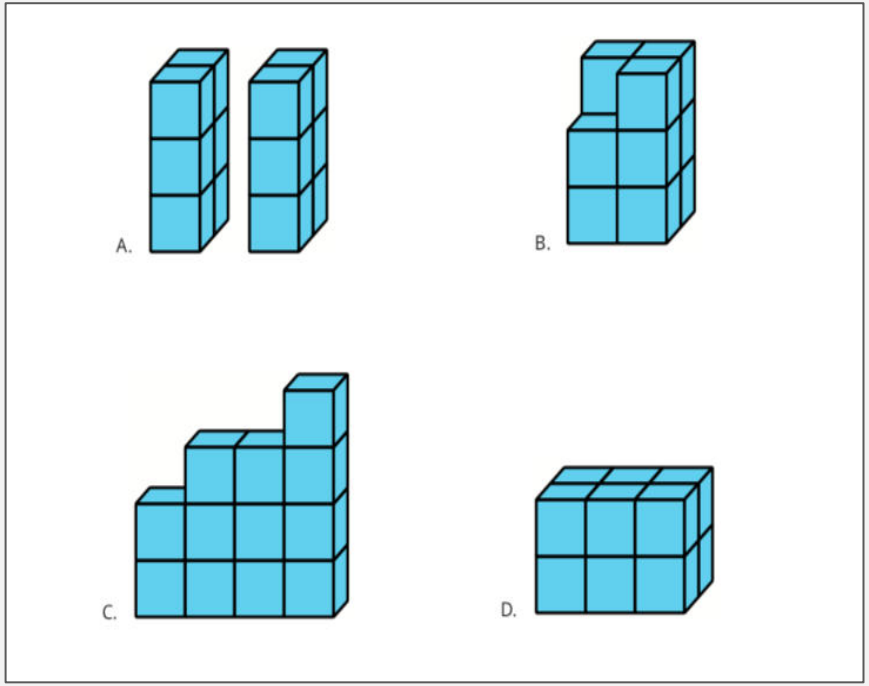
Measure Volume

Let’s count cubes.

MD.C.3, MD.C.4

Which One Doesn't Belong?

Warm up



How many cubes are in object D? Hoe did you count them?
What strategy would you use to count the cubes in other objects?

Activity #1

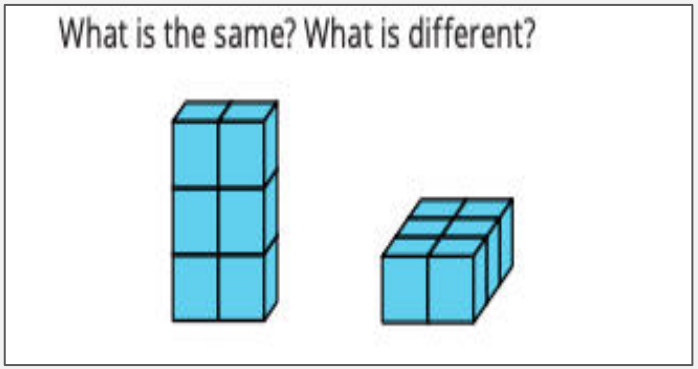
Finding Volume

1. Partner A: Build an object using 8 –12 cubes and give the object to Partner B.
2. Partner B: Explain how you would count the number of cubes in the object.
3. Partner A: Explain if you would count the cubes in the same way or in a different way.
4. Switch roles and repeat.
5. Which objects were easiest to count? Why?

Which objects aware most challenging to count?
Which objects were the simplest to count?

Guess My Prism

Activity #2



1. The goal of the game is to get your partner to build the same prism.
    - Partner A: Use 16–24 cubes to build a prism. Describe it to your partner.
    - Partner B: Build the prism your partner describes to you.
2. Place the two prisms next to each other and discuss what is the same and what is different about them.
3. Switch roles and repeat.

What language did your partner use that was most helpful for you to understand the prism they wanted you to build?

Lesson Synthesis

Let's Put it All Together

Let's look at some prisms you built.

How can we describe this rectangular prism so that our partner can build the same one?

How can we find the volume of this rectangular prism?

Today, we counted **unit cubes**, described **rectangular prisms** and measured their **volumes**.

Next, let’s learn about using **layers** to find **volume**.

3

Volumes of Prism Drawings

Let’s use layers to find volume.

Warm up

Number Talk

6 x 4

Warm up

Number Talk

3 x 2 x 4

Warm up

Number Talk

3 x 2 x 5

Warm up

Number Talk

3 x 2 x 6

How did changing one of the factors impact the product?

Activity #1

Build Rectangular Prisms

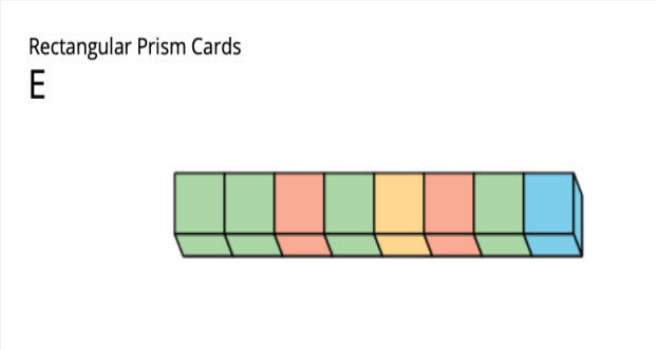
The prisms on the cards are completely packed with unit cubes.

1. Pick a card.
2. Build the rectangular prism.
3. Find the volume. Explain how you found the volume to your partner.
4. Repeat.

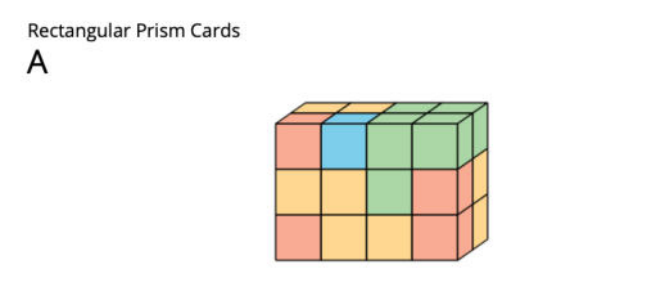
Activity #1

Build Rectangular Prisms

How did you build this rectangular prism?
What is the volume of this rectangular prism? How do you know?

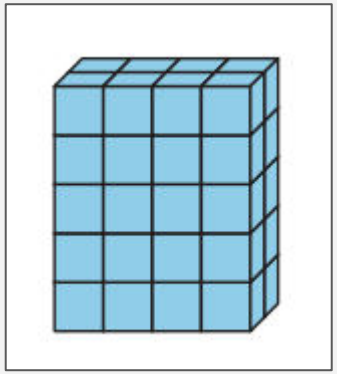


How did you build this rectangular prism?
What is the volume of this rectangular prism? How do you know?

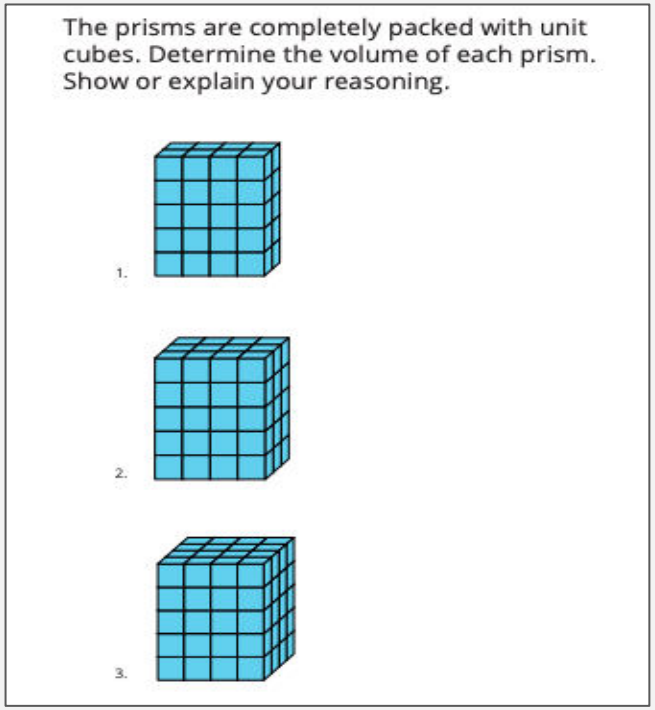


Layers, Layers, and More Layers

Activity #2



The expression 5 x 8 represents the volume of the prism. Where do you see 5 groups of 8 cubes in this prism?

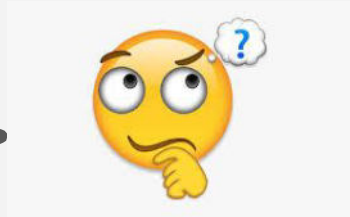


What do these rectangular prisms have in common?

Lesson Synthesis

Let's Put it All Together

What do you know about finding the volume of a prism made of cubes?



Is there anything you have questions about?

Today, we learned how to use **layers** to find the **volume** of a **rectangular prism.**

Next, let’s learn about finding the **volume** when we can’t see all of the **unit cubes**.

4

Use Layers to Determine Volume

Let’s relate multiplication to how we use layers to find volume.

MD.C.5a, OA.A.2

Estimation Exploration

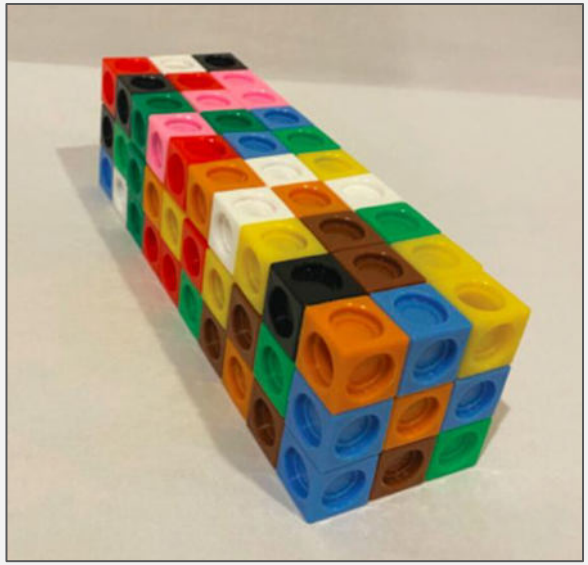
Warm up

About how many cubes were used to build this prism?

Record an estimate that is:

too low	about right	too high

Do you want to revise your estimate?

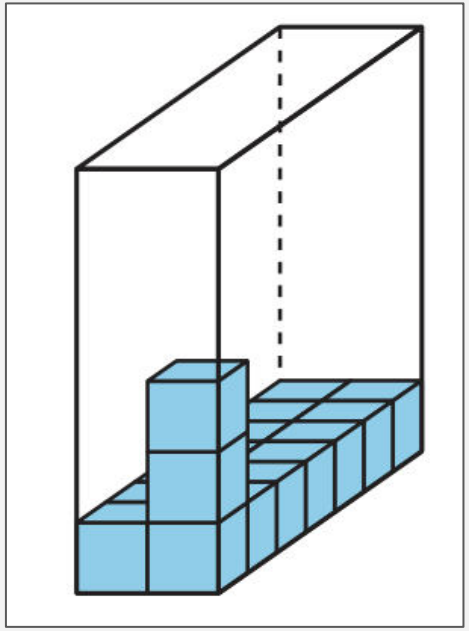


Why are multiples of 9 a good estimate?

What information would help you to find the exact number of cubes in the prism?

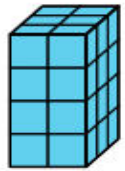
Layers in Rectangular Prisms

Activity #1

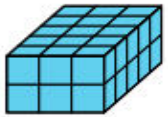


1. Complete the following table. Be prepared to explain your reasoning.

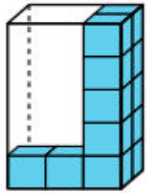
Prism	number of cubes in one layer	number of layers	volume
A			
B			
C			
D			



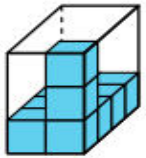
Prism A



Prism B



Prism C



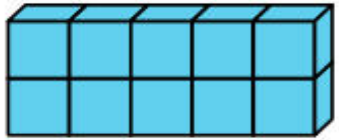
Prism D

Activity #1

Layers in Rectangular Prisms

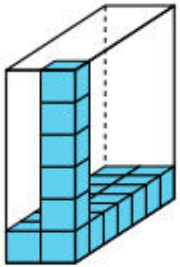
2. Find the volume of the prism. Explain your reasoning.

A.



Prism E

B.



Prism F

3. How can you find the volume of any rectangular prism?

2 x 12

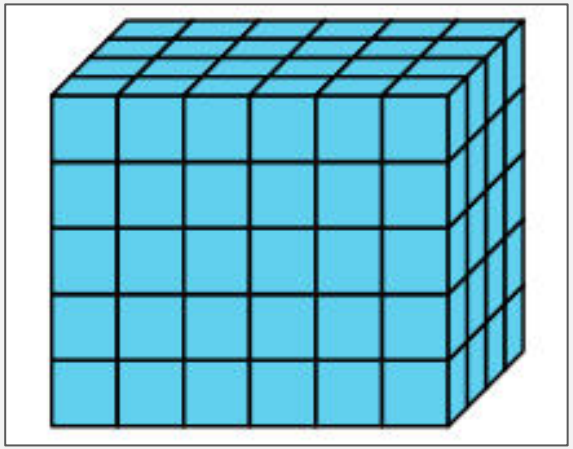
3 x 8

How do these expressions represent the volume of prism A?

How does thinking about layers help us find the volume of prisms that are not completely filled?

Finding Volume In Different Ways

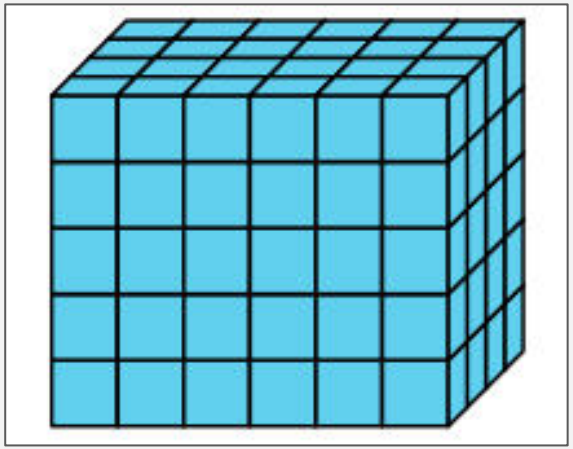
Activity #2



1. Explain or show how the expression 5×24 represents the volume of this rectangular prism.
2. Explain or show how the expression 6×20 represents the volume of this rectangular prism.
3. Find a different way to calculate the volume of this rectangular prism. Explain or show your thinking.
4. Write an expression to represent the way you calculated the volume.

Finding Volume In Different Ways

Activity #2



- **How does 5 x 24 represent the volume of the prism?**
- **5 x (4 x 6)**
- **How does this expression represent the volume of the prism?**
- **How does 6 x 20 represent the volume of the prism?**
- **6 x (4 x 5)**
- **How does this expression represent the volume of the prism?**

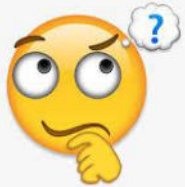
Lesson Synthesis

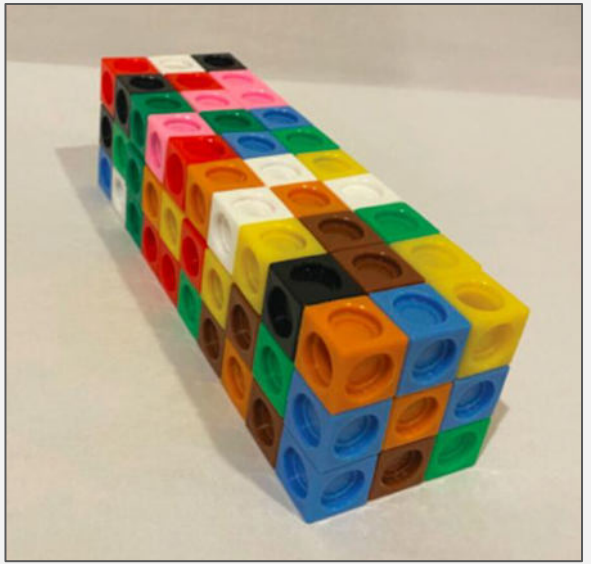
Let's Put it All Together

Describe the layers in the prism to a partner.

How does the expression represent the volume of the prism?

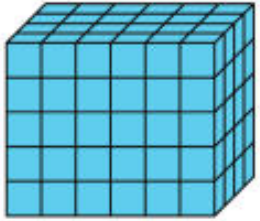
What is a multiplication expression that would represent the volume of the prism?





Section Summary

We call the amount of space an object takes up **volume**. This prism has a volume of 120 cubes.



To find the volume of any prism, we can find the number of cubes in one layer and multiply that number by the number of layers. We can describe this prism as having 6 layers of 20 cubes, 4 layers of 30 cubes, or 5 layers of 24 cubes. We can use all of these expressions to represent the volume of the prism:

5 x 24, 5 x (6 x 4)

6 x 20, 6 x (5 x 4)

4 x 30, 4 x (5 x 6)

So far we have:

learned to use cubes to build objects and compare the space they take up. The space they take up is called **volume**.

counted **unit cubes**, described **rectangular prisms** and measured their volumes.

learned how to use **layers** to find the **volume** of a **rectangular prism**.

figured out how to find the **volume** when we can't see all of the cubes.

Next, let's learn about how to describe the dimensions of a prism and find the **volume**.

Side Lengths of Rectangular Prisms

5

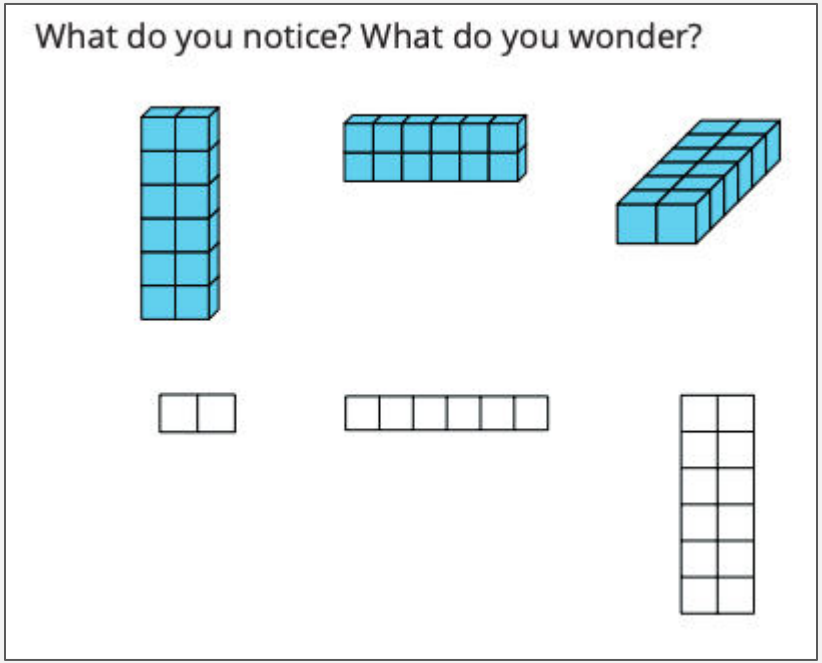
Let’s describe the side lengths of a prism and find the volume.

MD.C.5.A; MD.C.5.B; OA.A.1

Warm up

Notice & Wonder

What do you notice? What do you wonder?

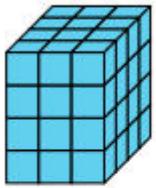


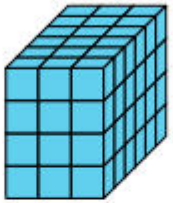
Where do you see the base in the prism?

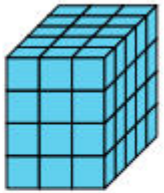
Activity #1

All About That Base

Here are 3 rectangular prisms.

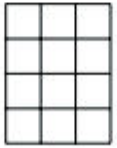
1. 

2. 

3. 

These rectangles represent bases of the prisms.

A. 

B. 

C. 

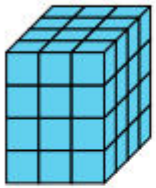
1. Match each prism with a rectangle that represents its base. Note: some prisms may match more than 1 rectangular base.

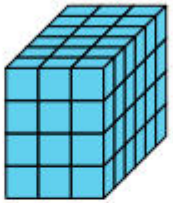
2. Find the volume of each prism. Explain or show your reasoning.

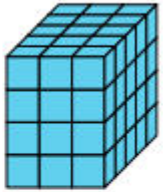
Activity #1

All About That Base

Here are 3 rectangular prisms.

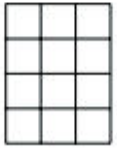
1. 

2. 

3. 

These rectangles represent bases of the prisms.

A. 

B. 

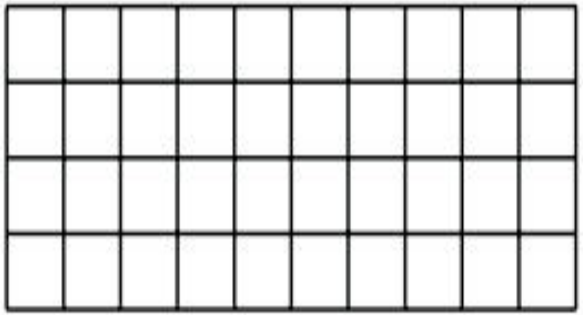
C. 

- **Where do we see this rectangle as a base in each prism?**
- **If prism 2 was resting on the 4 by 3 base, how many layers tall would the prism be?**
- **"If prism 3 was resting on the 4 by 3 base, what would the height of the prism be?"**

Growing Prism

Activity #2

Here is a base of a rectangular prism.



1. Fill out the table for the volumes of rectangular prisms with this base and different heights.

Height	Multiplication Expression to represent the volume	Volume
1		
2		
3		
10		
25		

Activity #2

Growing Prism

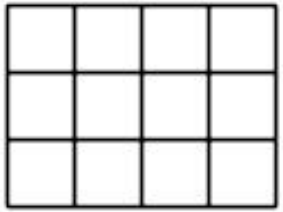
- **How does the volume of the prism change in the table?**
- **How is the change in volume represented by the multiplication expressions in each row?**
- **3 x 40**
- **How does the expression represent the volume of the prism?**

number of layers	multiplication expression for volume	volume
1	$4 \times 10 \times 1$ or 40×1	40 cubes
2	$4 \times 10 \times 2$ or 40×2	80 cubes
3	$4 \times 10 \times 3$ or 40×3	120 cubes
10	$4 \times 10 \times 10$ or 40×10	400 cubes
25	$4 \times 10 \times 25$ or 40×25	1,000 cubes

What is the Question?

Activity #2

This is the base of a rectangular prism that has a height of 5 cubes.



These are answers to questions about the prism. Read each answer and determine what question it might be answering about the prism.

A. 3 is the answer. What is the question?

B. 5 is the answer. What is the question?

C. 3 x 4= 12. The answer is 12. What is the question?

D. 12 x 5 = 60. The answer is 60 cubes. What is the question?

E. 3 by 4 by 5 is the answer. What is the question?

How does the expression 3 x 4 x 5 represent the prism described in the second question?

Lesson Synthesis

Let's Put it All Together

What information do you need to measure the volume of any rectangular prism?

What language can we add to our poster to explain how to find the volume of a prism when we can't see the cubes?

What is the connection between the number of layers and the height of the prism?

Today, we learned that to find the **base** of a **rectangular prism** we need to know the **area of the base**; to find the area of the base, we need to know the **length** and **width**.

We also learned we can use the word **height** to describe the number of **layers** or how tall a prism is.

Next, let's learn about how to write **expressions** for the **volume** of **rectangular prisms**.

Expressions for Volume

Let’s write expressions for the volume of rectangular prisms.

Warm up

True or False

Determine if the following equations are true or false. Be prepared to explain your reasoning.

$(4 \times 2) \times 5 = 4 \times (2 \times 5)$

$(2 \times 5) \times 4 = 2 \times 20$

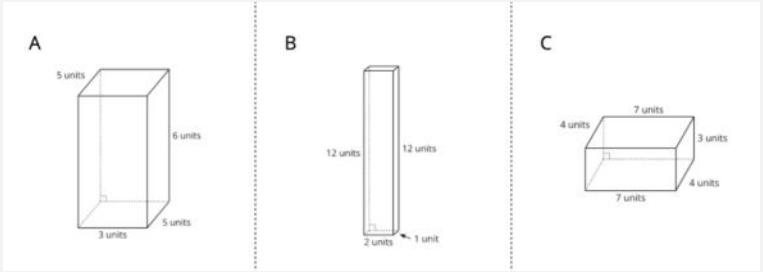
$5 \times 4 \times 2 = 10 \times 40$

How can you justify your answer without evaluating both sides

Activity #1

Card Sort: Match the Expression

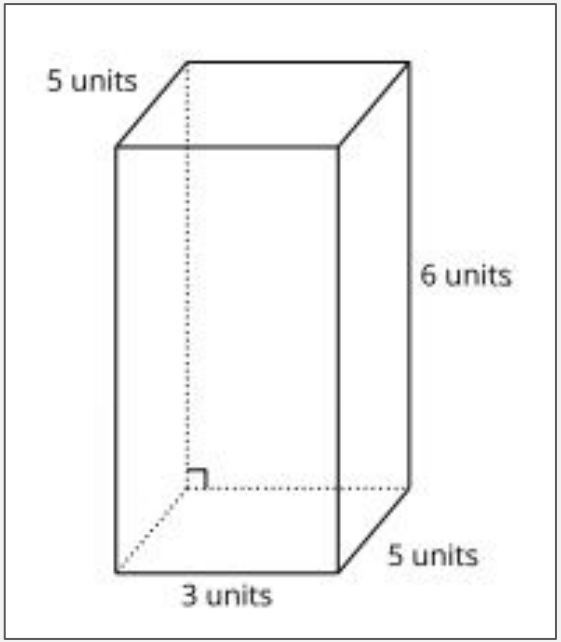
What do you notice about the prisms on these cards?



1. Match each rectangular prism with the expression(s) that represents its volume in cubic units. Be prepared to explain your reasoning.
2. For each prism write one additional expression, not in the card sort, that represents its volume in cubic units.

Activity #1

Match the Expression



6 x (5 x 3)

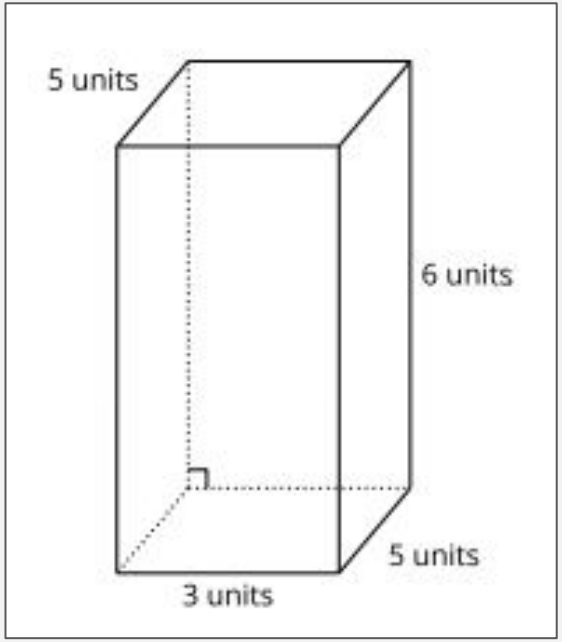
(6 x 5) x 3

15 x 6

How do these expressions represent the volume?

Activity #1

Match the Expression



(5 x 3) x 6 = 15 x 6

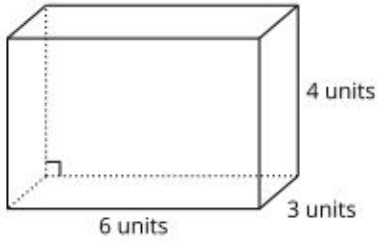
How does this equation relate to prism A?

A Tale of 2 Tables

Activity #2

1. Partner A complete Table 1.
2. Partner B complete Table 2.
3. Compare your tables and discuss:
   a. What do the tables have in common?
   b. What is different about the tables?

Prism a



Prism b

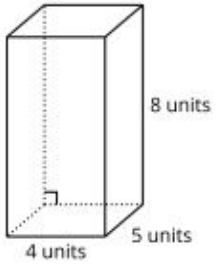


Table 1

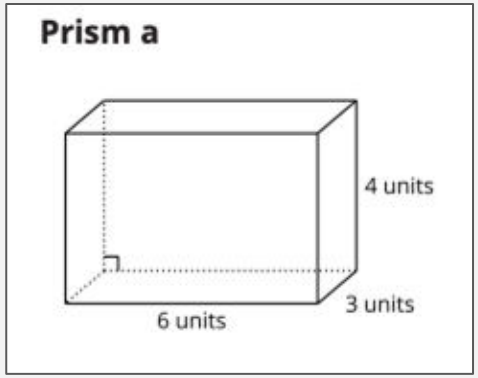
	length (unit)	width (unit)	height (unit)	volume (cubic units)
prism a				
prism b				

Table 2

	base (square units)	height (unit)	volume (cubic units)
prism a			
prism b			

Activity #2

A Tale of 2 Tables



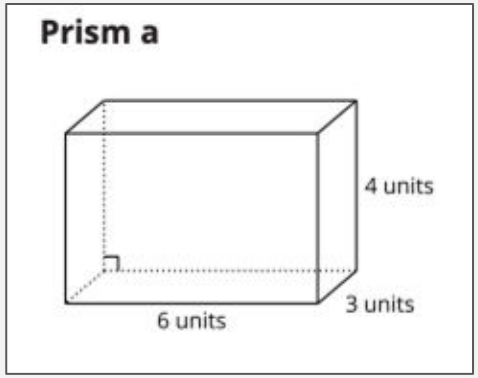
6 x 3 x 4

(6 x 3) x 4

How does this expression represent the volume of prism A?

Activity #2

A Tale of 2 Tables



(6 x 3) x 4 = (3 x 4) x 6

How do you know this equation is true?

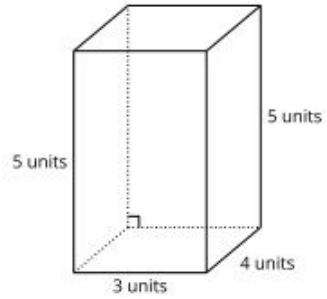
Which expression could you use to find the volume using the 3 unit by 4 unit base?

Activity #3 Optiona 1

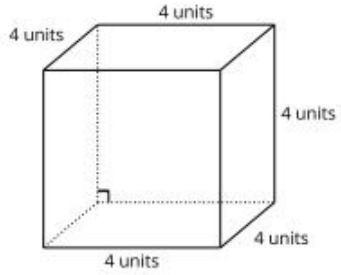
Two Truths and a Lie

Your teacher will assign you and your partner two prisms.

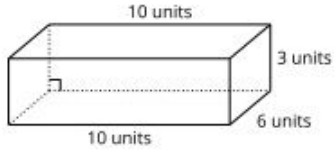
A



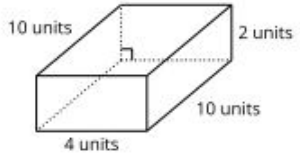
B



C



D



For each of your assigned prisms:

- Write 2 expressions to represent the volume in cubic units.
- Write 1 expression that does NOT represent the volume in cubic units.

Give your expressions to your partner:

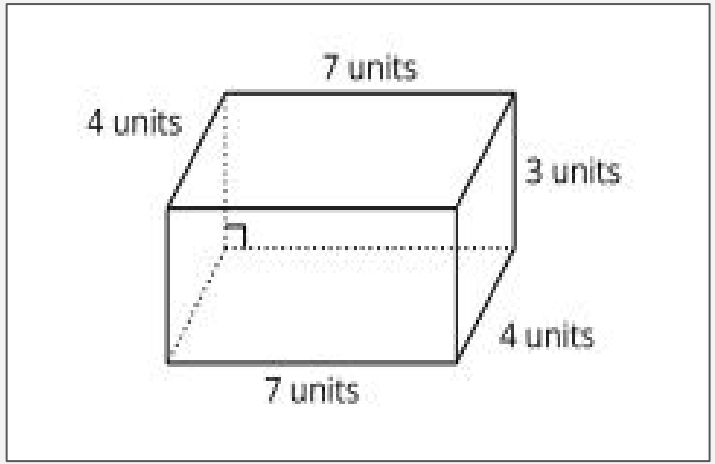
1. For each prism, which expression does not represent its volume in cubic units? How do you know?
2. What other expressions represent the volume of this prism in cubic units?

How did you decide the expressions that did not represent the volume of a rectangular prism?

Lesson Synthesis

Let's Put it All Together

Which expressions could we write to represent the volume of this prism in cubic units?



Today, we learned how to write and match **expressions** that show the **volume** of a **rectangular prism** in **cubic units**.

Next, let’s learn about using different **cubic units** to measure **volume**.

7

Cubic Units of Measure

Let’s use different sized cubic units to measure volume.

Warm up

Notice & Wonder

What do you notice? What do you wonder?

The little cube represents a cubic foot. The big cube represents a cubic yard.

About how many of the big cubes could we fit in our classroom?

We have been using cubic units to measure volume, but haven't defined the size of the unit. The choice of the unit depends on the size of the object.

Activity #1

What are the Units?

What do you know about these objects?
What do you wonder?

Moving truck

Lunch Box

Freezer

Juice Box

Dumpster

Activity #1

What are the Units?

For each object, choose the cubic unit you would use to measure the volume: cubic centimeter, cubic inch, or cubic foot.

Moving truck

object	unit you would use
the volume of a moving truck	
the volume of a freezer	
the volume of a juice box	
the volume of a classroom	
the volume of a dumpster	
the volume of a lunch box	

Lunch Box

Freezer

Juice Box

Dumpster

What are the Units?

Activity #1

object	unit you would use
the volume of a moving truck	cubic feet
the volume of a freezer	cubic feet, cubic inches (depending on type)
the volume of a juice box	cubic cm
the volume of a classroom	cubic feet
the volume of a dumpster	cubic feet
the volume of a lunch box	cubic inches

How did you decide which units made sense?

What if I only wrote 24 as the volume for the freezer? What questions would you have?

24 cubic centimeters,
24 cubic inches,
24 cubic yards

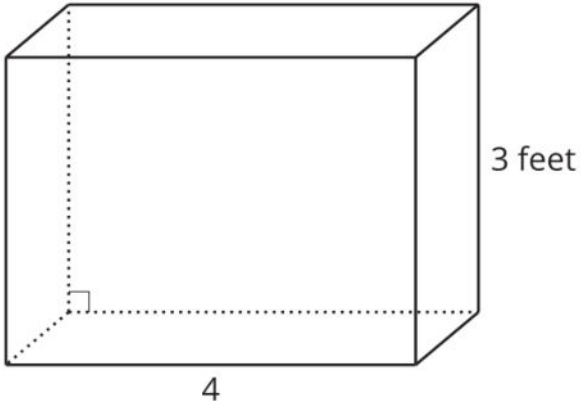
What is the same about these measurements? What is different about these measurements?

Activity #2

Info Gap: Sizing Up Cubic Units

Some of the information you need to solve this problem is missing, and I have it. With your partner, decide what information you need to solve the problem, and create a list of questions you can ask to find out.

This is a diagram of a freezer. What is the volume of the freezer?



Activity #2

Info Gap: Sizing Up Cubic Units

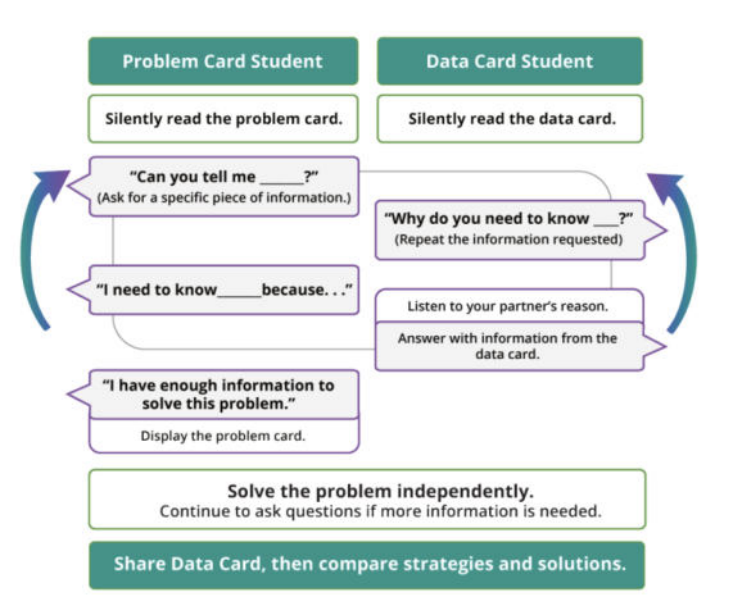
Problem 1:

- Partner A has the problem card.
- Partner B has the data card.

Problem 2:

- Partner B has the problem card.
- Partner A has the data card.

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.



Activity #2

Info Gap: Sizing Up Cubic Units

Dumpster

Problem Card 1

Andre wants to measure the volume of the dumpster that is outside a construction site.

What is the volume of the dumpster in cubic feet?

What questions did you ask to help you find the volume? What units were used for the problem? Did those units make sense?

Activity #2

Info Gap: Sizing Up Cubic Units

Juice Box

Problem Card 2

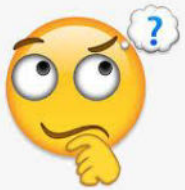
Jada wants to fit 10 juice boxes in her backpack for the field trip. Can Jada fit all 10 juice boxes in her backpack? Why or why not?

What questions did you ask to help you find the volume? What units were used for the problem? Did those units make sense?

Lesson Synthesis

Let's Put it All Together

Cubic Inches
Cubic Feet
Cubic Yards

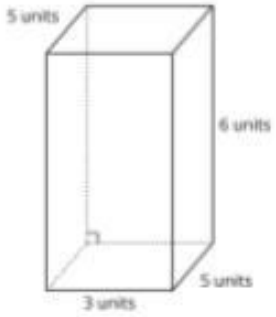


Think of an object for which you would use each unit of measure to find the volume.

Choose one to explain to a partner.

Section Summary

We find the volume of a right rectangular prism by multiplying the side lengths or by multiplying the area of the base by the height.



$6 \times (5 \times 3)$

$(6 \times 5) \times 3$

15×6

Each of these expressions represents the volume of this prism. The volume of this rectangular prism is 90 cubic units.

We can use different sized cubic units to measure the volume of different sized objects. In this section, we used cubic inches, cubic feet, cubic yards, and cubic centimeters.

In the past few lessons, we've:

described the dimensions of a **rectangular prism** using the words **length**, **width**, **height** and **base**.

interpreted and matched **expressions** to that represent the **volume** of a **rectangular prism**.

written expressions that represent the **volume** of a **rectangular prism**

figured out that different sized objects can be measured best by using different sized units. The names for these units are **cubic centimeters**, **cubic inches** and **cubic feet**.

Next, let's learn about finding the **volume** of figures made up of prisms.

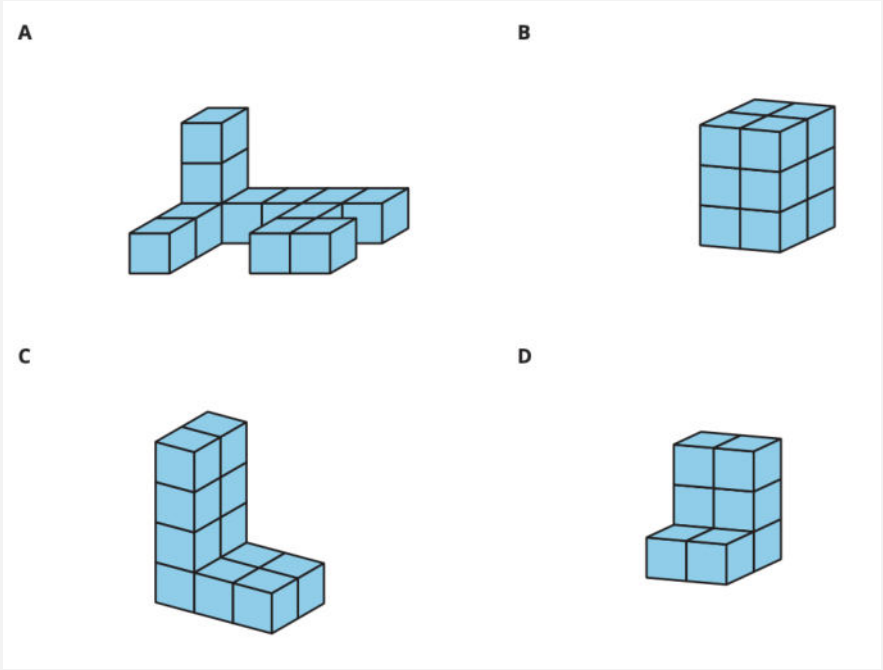
8

Figures Made of Prisms

Let’s find the volume of figures made of prisms.

Which One Doesn't Belong?

Warm up



Where do we see two rectangular prisms in Figure C?

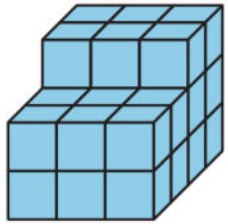
Activity #1

Put it Together

1. Partner A, build a rectangular prism with 12 cubes.
2. Partner B, build a rectangular prism with 10 cubes.
3. Put your two rectangular prisms together to make one figure. What is the volume of the new figure? Explain or show your thinking.

What was the volume of the shape you made when you put your prisms together? How do you know?

4. Diego and Jada put together two rectangular prisms to make this figure:



   a. What is the volume of the figure Diego and Jada made?
   b. Which rectangular prisms could Diego and Jada each have built? Explain or show your thinking. Organize it so it can be followed by others.

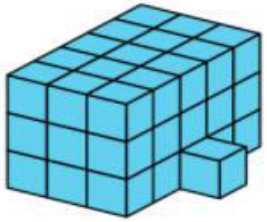
What is the volume of the figure Diego and Jada made? How do you know?

Activity #2

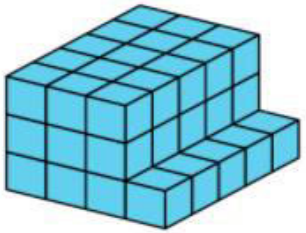
I See Two Prisms

Find the volume of each figure. Explain or show your reasoning.

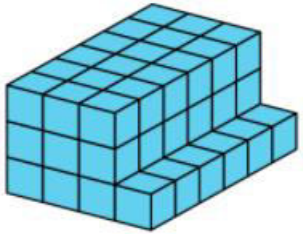
A.



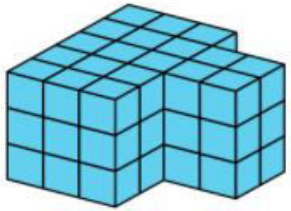
B.



C.



D.



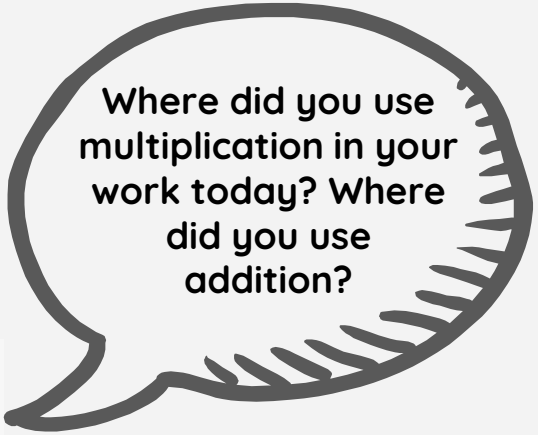
How did you break up C and D?

Did anyone break them up the same way? Did anyone break them up differently?

Can you think of other ways you could break up these figures?

Lesson Synthesis

Let's Put it All Together



Today, we learned how to find the **volume** of shapes built from 2 or more **rectangular prisms**.

We also learned that when a shape is built from 2 or more **rectangular prisms**, we can find the **volume** by **adding** the **volumes** of each **rectangular prism** together.

Next, let's learn about finding the **volume** of more figures.

9

Measure Figures Made from Prisms

Let’s find the volume of more figures.

Warm up

Number Talk

6 x 2

Warm up

Number Talk

6 x 2 x 10

Warm up

Number Talk

6 x 20 x 10

Warm up

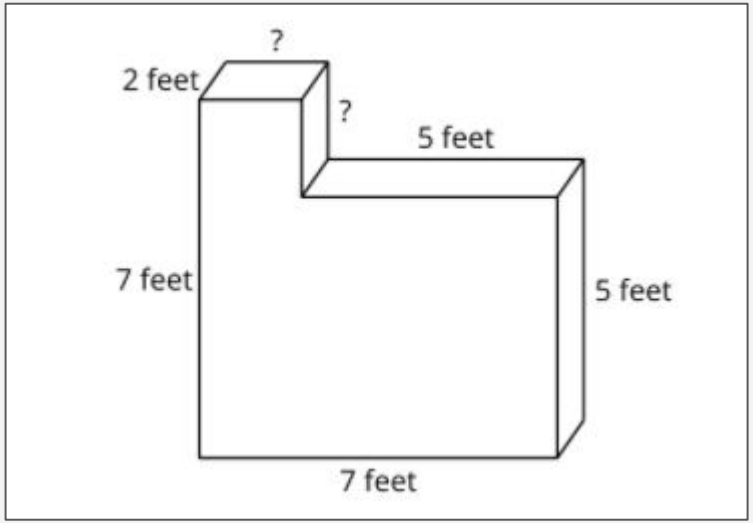
Number Talk

60 x 20 x 10

What patterns do you notice in the problems we solved?

Activity #1

Find the Volume of Figures



Activity #1

Find the Volume of Figures

Partner A: Find the volume of Figure 1.

Partner B: Find the volume of Figure 2.

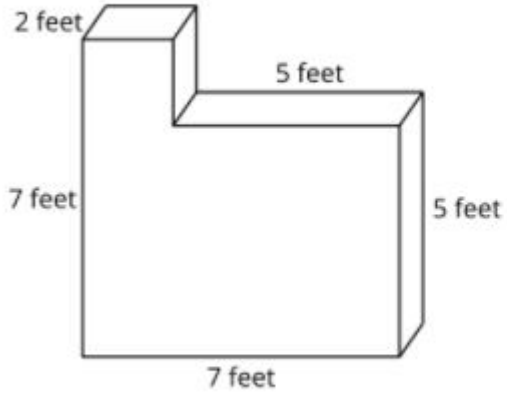


Figure 1

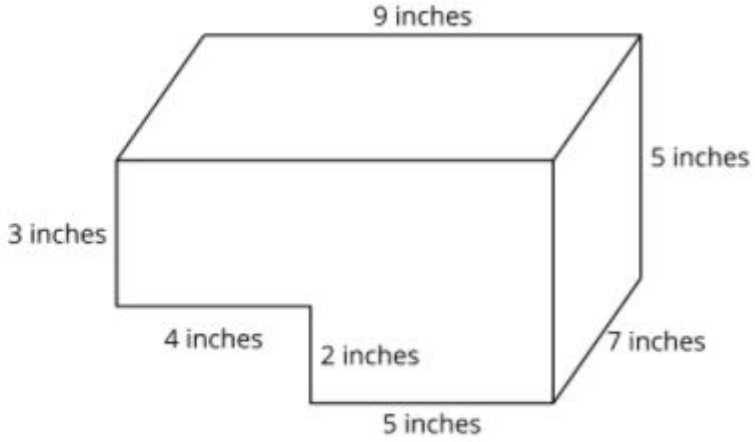


Figure 2

Activity #1

Find the Volume of Figures

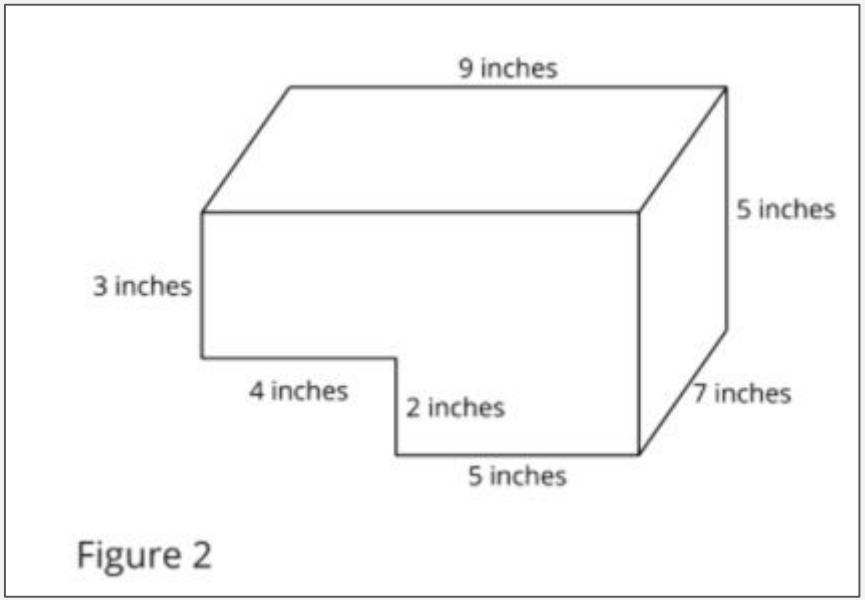


Figure 2

How did you break up this shape to find the volume?

How did you find the side lengths of the rectangular prism?

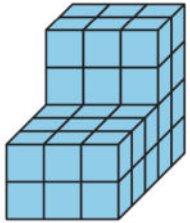
Did you get the same volume when you broke up the figure differently? Why?

Expressions for the Volume of Figures

Activity #2

1. Explain how each expression represents the volume of the figure. Show your thinking. Organize it so it can be followed by others.

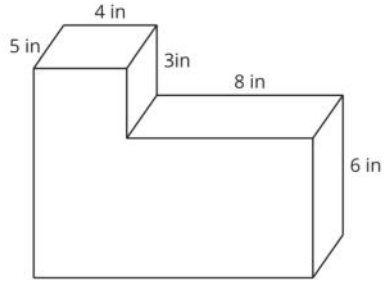
a. $((2 \times 3) \times 4) + ((3 \times 3) \times 2)$



b. $(5 \times 6) + (3 \times 4)$

2. How does each expression represent the volume of the prism? Explain or show your thinking. Organize it so it can be followed by others.

a. $(5 \times 8 \times 6) + (5 \times 4 \times 9)$ cubic inches



b. $(5 \times 4 \times 3) + (5 \times 12 \times 6)$ cubic inches

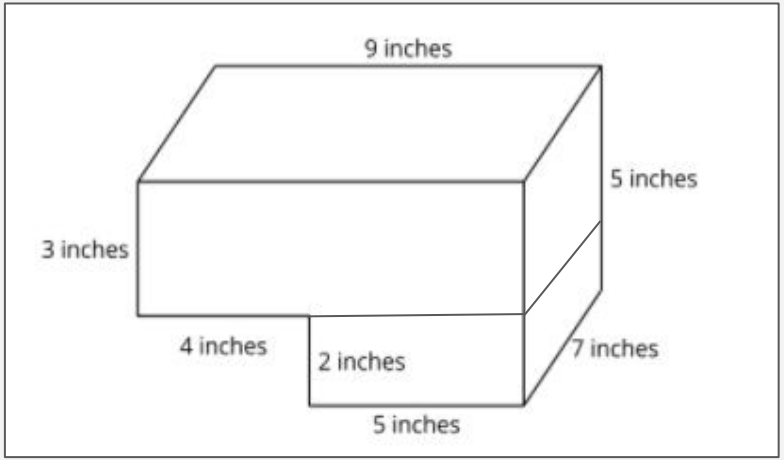
Why are there 3 factors in the expression (2 x 3 x4) bit only t2 factors in the expression (5 x 6)?

In the expression (3 x 3) x 2, what do the parentheses tell you?

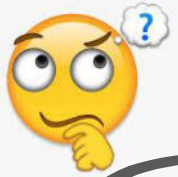
Lesson Synthesis

Let's Put it All Together

3 x 9 x 7 cubic inches



(3 x 7 x 9) + (2 x 5 x 7) cubic inches



Which part of the figure is represented by this expression? How do you know?

What is the volume of the other rectangular prism? How do you know?

How does this expression represent the volume of the figure?

Today, we learned how to represent the **volumes** of figures made of **rectangular prisms** with **expressions**.

Next, let's learn about writing **expressions** for the **volume** of figures.

10

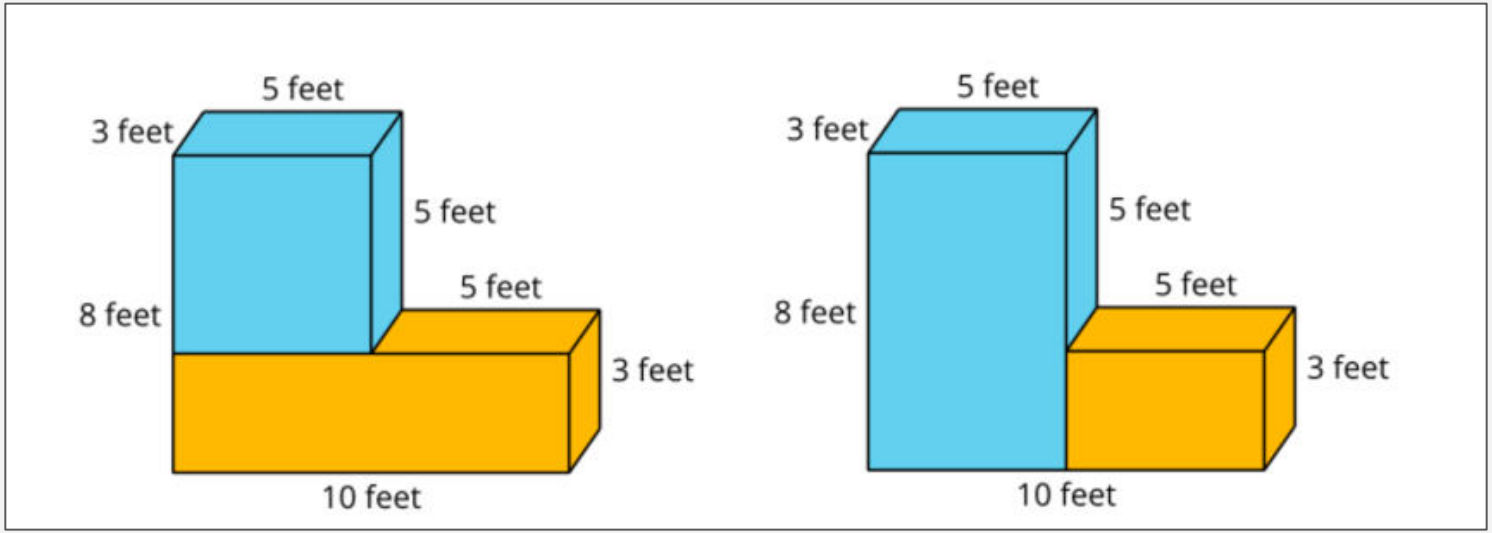
Represent Volume with Expressions

Let’s write expressions for the volume of figures.

Warm up

Notice and Wonder: Prism Pieces

What do you notice? What do you wonder?

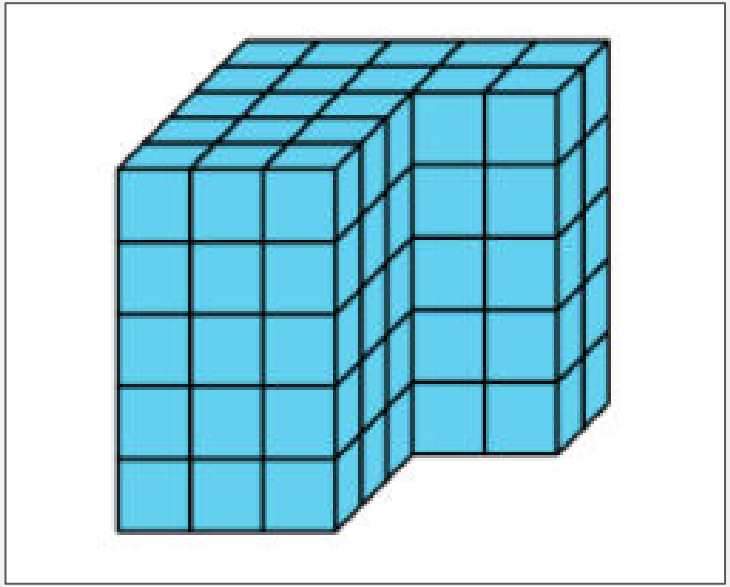


Do you think the pictures show the same figure? Why or why not?

Activity #1

Compare Expressions

1. Write an expression to represent the volume of the figure in unit cubes.
2. Compare expressions with your partner.
   a. How are they the same?
   b. How are they different?
3. If they are the same, try to find another way to represent the volume.



Activity #1

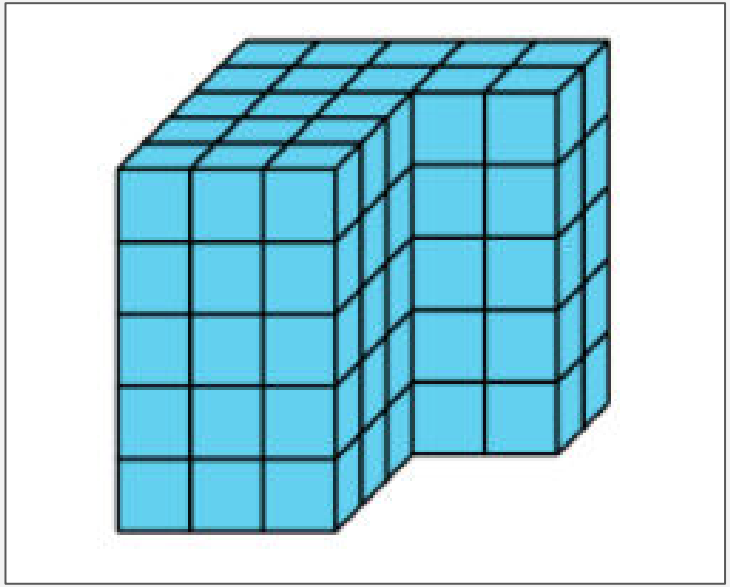
Compare Expressions

(3 x 5 x 5) + (2 x 2 x 5)

How does the expression represent the volume of the figure?

(5 x 5 x 5) - (2 x 3 x 5)

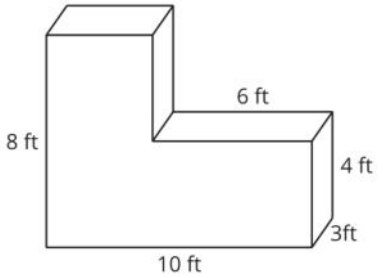
How does the expression represent the volume of the figure?



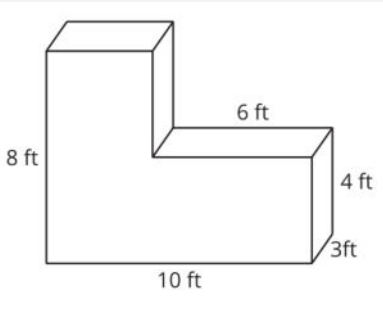
Activity #2

Find the Volume in Different Ways

1. Find the volume of the figure by decomposing the figure 2 different ways. Show your thinking. Organize it so it can be followed by others.



2. For each way you decomposed the figure, write an expression that represents the volume.



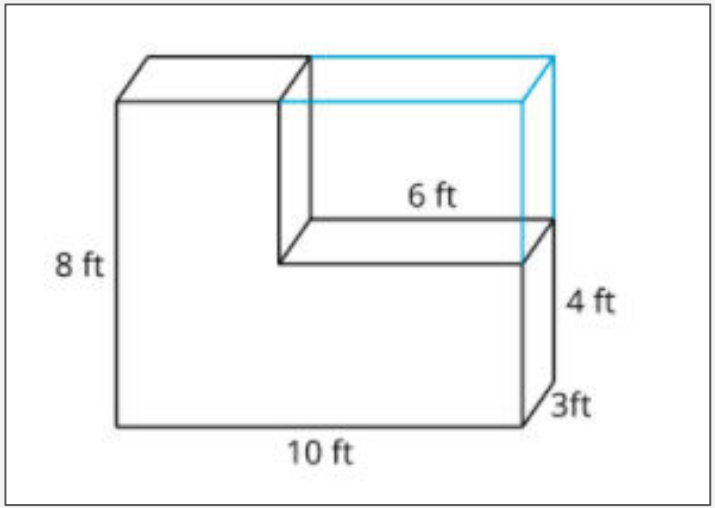
Activity #2

Find the Volume in Different Ways

3. Mai used this expression to find the volume of the figure:

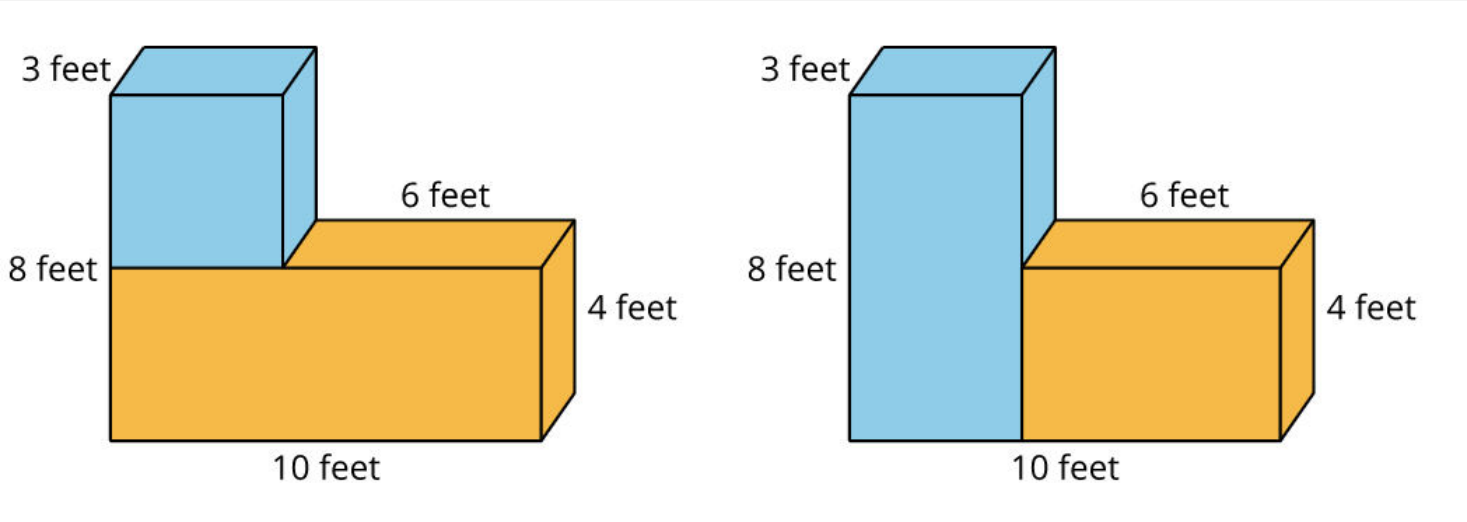
$$(10 \times 8 \times 3) - (6 \times 4 \times 3).$$

Use the diagram to interpret Mai's expression. Show your thinking. Organize it so it can be followed by others.



Find the Volume in Different Ways

Activity #2



How are the diagrams the same? How are they different?

(10 x 8 x 3) - (6 x 4 x 3)
How does this expression represent the volume of the prism?

What is the value of (10 x 8 x 3) - (6 x 4 x 3)?

Lesson Synthesis

Let's Put it All Together

Do you get the same expressions using either decomposition? Why?

Which decomposition strategy did you prefer to use? Why?

The expressions are different, depending on how we decomposed the shape, but the volume is the same. Why?

Today, we learned how to decompose the same figure in different ways.

We also learned to write **expressions** to represent the **volume**.

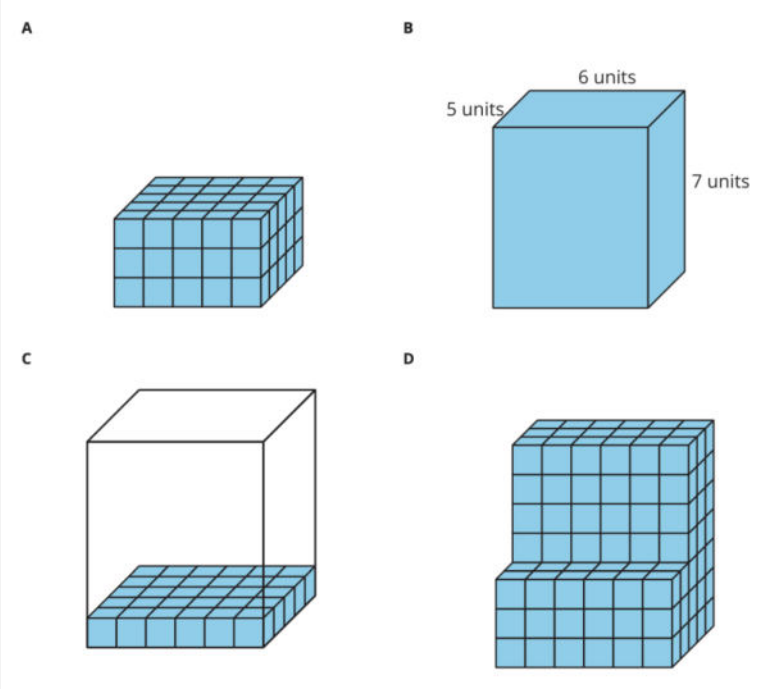
Next, let's learn about finding the **volume** of all different kinds of **rectangular prisms**.

All Kinds of Prisms

Let’s find the volume of all different kinds of prisms.

Warm up

Which One Doesn't Belong?

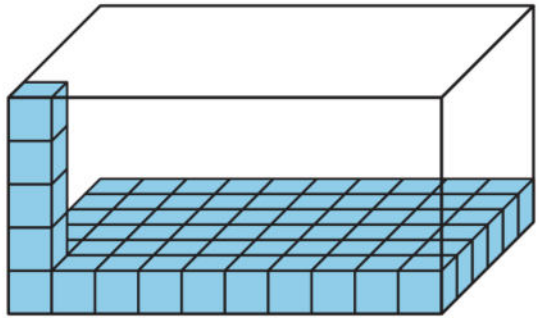


What do Figures A, C, and D have in common?

Prism Palooza

Activity #1

1. Han is filling a box with cubes. Below is a diagram of the box. How many cubes can fit in the box if Han completely packs it, without gaps between cubes?



2. Clare bought a storage container for her art supplies. The storage container was 4 feet wide, 9 feet long, and 5 feet high. What is the volume of her container?

3. Mai's new bedroom has a walk-in closet with a floor that measures 30 square feet. Her closet ceiling is 9 feet from the floor. What is the volume of her closet?

How is the third problem different from the first two?

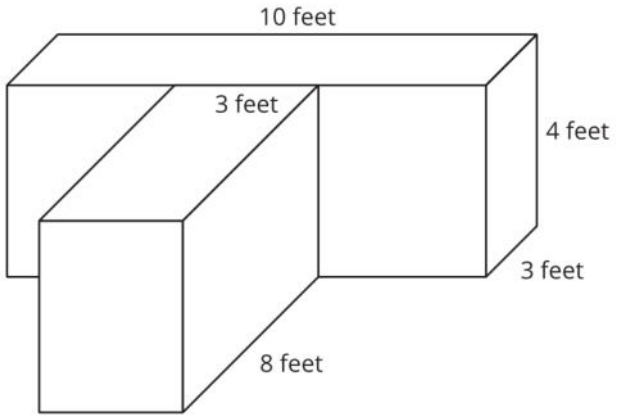
Activity #2

Problem Solving with Figures

Problem Solving with Figures

Activity #2

The elementary school is going to build a raised bed garden like the one in the picture, but they will use a different design. Here is a diagram that shows the side lengths of the garden the school will build.



1. What is the volume of the garden? Explain or show your reasoning.
2. Write an expression to represent the volume of the garden.

3. Noah wants to design a garden with the same volume but different side lengths. What could the side lengths of his garden be?
4. Which garden design do you like better? Explain or show your reasoning.

What do the two parts of the garden have in common? What is different about the two parts of the garden?
How could you put the pieces together to make a single rectangular prism?

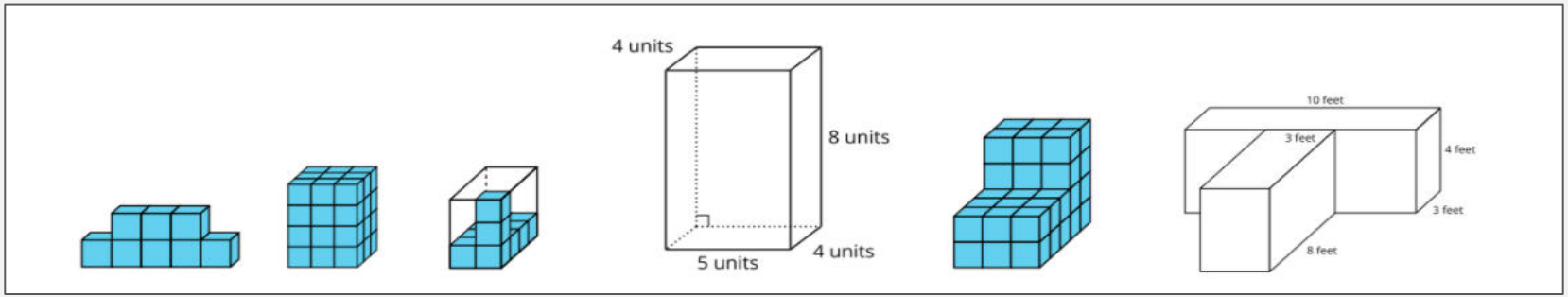
Lesson Synthesis

Let's Put it All Together

What are some things you know about volume and rectangular prisms?

Which part was your favorite part? Why?

How did learning about the cubes help you with the rest of the volume work in this unit?



Today, we used what we have learned about **layers**, **volume**, **rectangular prisms**, **unit cubes**, **length**, **width**, **height** and writing **expressions** to solve real world problems where we had figure out the **volume** of figures made up of two **rectangular prisms**.

In our next unit, let's learn about **multiplication**, **division** and **area** with **fractions**.

12

Lots and Lots of Garbage

(optional)

Let’s investigate what happens to garbage.

Warm up

Notice & Wonder

What do you notice? What do you wonder?

If this truck collects trash only from our school, what kinds of things might the truck be filled with?

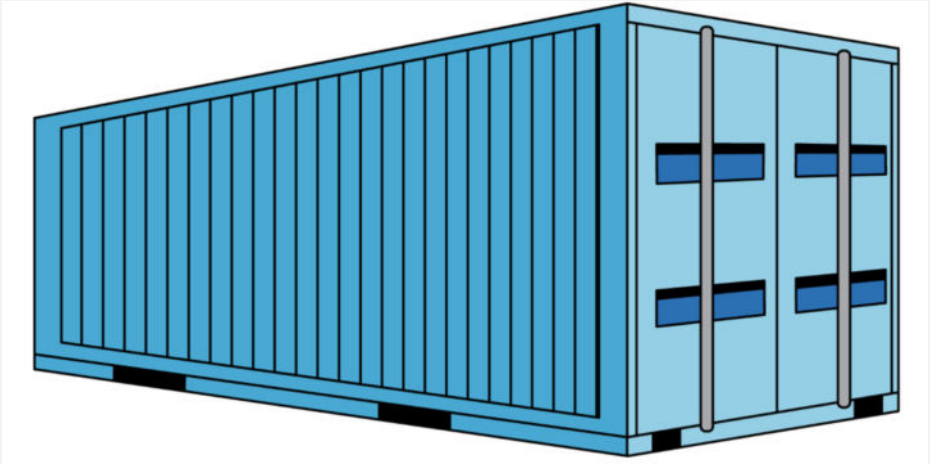
How long do you think it would take our school to completely fill the truck?

Activity #1

60 Containers

Malaysia plans to send back roughly 3,300 tons of plastic trash to countries like the U.S. and Canada.

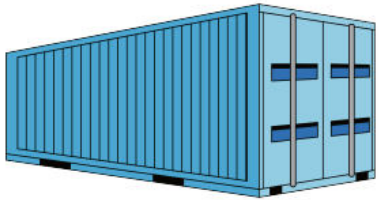
The trash fits in 60 shipping containers and will be returned in a largo cargo ship over water.



Activity #2

60 Containers

1. Find at least 5 different ways to arrange 60 containers. Represent each arrangement with an expression.



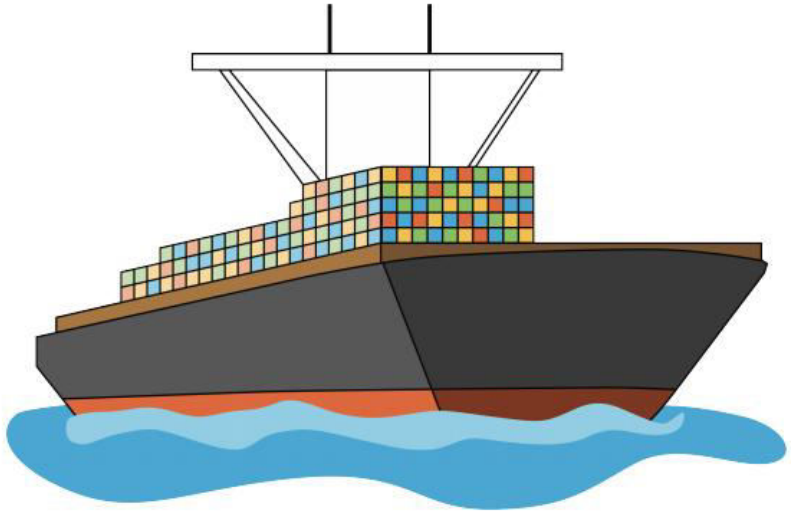
2. Create a visual display to show which is the best arrangement for shipping the 3,300 tons of garbage.

- **What arrangement does this group's visual display represent? Why might they think this is the best arrangement?**
- **What can you tell this group that may make them change their decision?**

How Many Containers on the Ship?

Activity #2

1. How many containers are on the cargo ship?



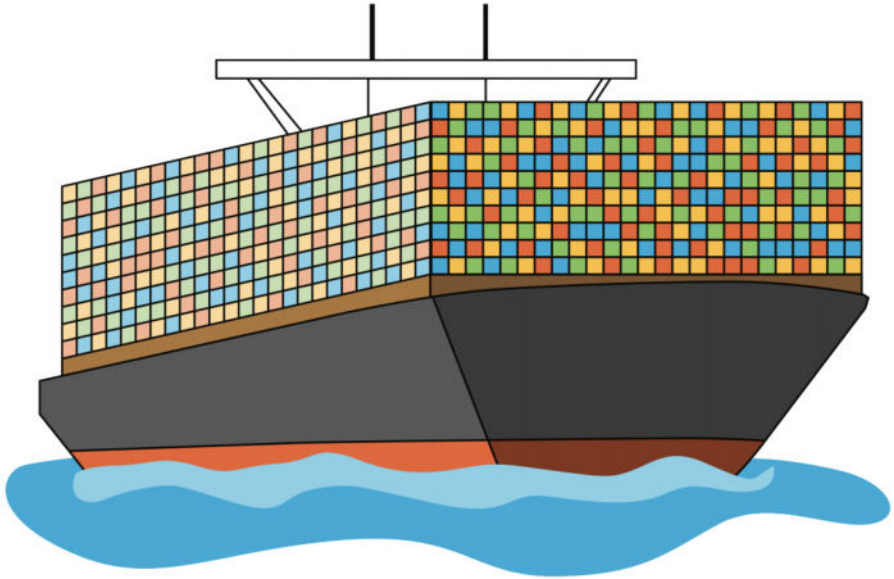
Record an estimate that is:

too low	about right	too high

How Many Containers on the Ship?

Activity #2

2. How many containers are on the cargo ship?



Record an estimate that is:

too low	about right	too high

What assumptions were you making when you came up with your estimate?

How could you improve your estimate?

Lesson Synthesis

Let's Put it All Together

- How much trash do you think our community makes and where do you think it goes?
- Where can the US and Canada put the 3,300 tons of garbage returned from Malaysia?

- What are some challenges about taking care of the 3,300 tons of garbage and putting it somewhere in the US or Canada?
- What are some challenges about sending the trash to another city or country?