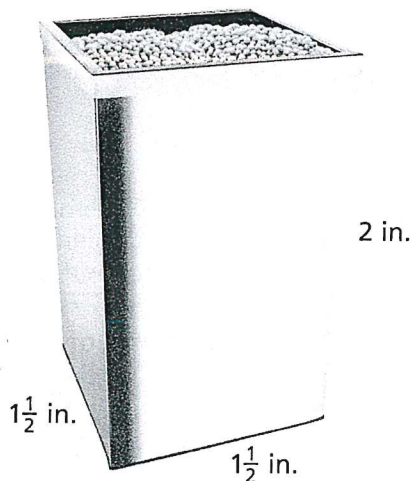


Solve & Discuss It!



ACTIVITY

A rectangular prism has the dimensions shown. What is the volume of this rectangular prism?



Use Structure How might filling the rectangular prism with layers of $\frac{1}{2}$ -inch cubes help you find the volume?

Lesson 7-8

Find Volume with Fractional Edge Lengths



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I can...

find the volume of a rectangular prism with fractional edge lengths.



MAFS.6.G.1.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
Also 6.EE.1.2a, 6.EE.1.2c, 6.EE.2.6
MAFS.K12.MP.1.1, MP.3.1, MP.6.1, MP.7.1

Focus on math practices

Look for Relationships You know how to use the formula $V = lwh$ to find the volume of a rectangular prism. How might you use the formula to find the volume of the prism above?

Essential Question How can you find the volume of a rectangular prism with fractional edge lengths?

EXAMPLE 1

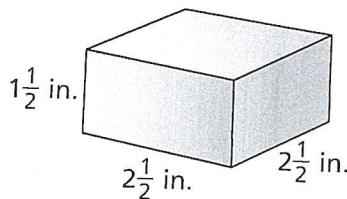


Find the Volume of a Rectangular Prism with Fractional Edge Lengths

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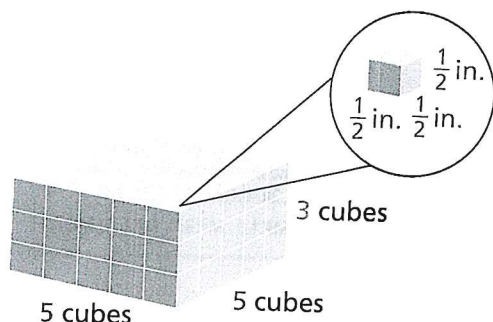


What is the volume of the rectangular prism?



Remember that volume is the number of cubic units needed to fill a solid figure.

STEP 1 Find the number of $\frac{1}{2}$ -inch cubes that will fill the prism.

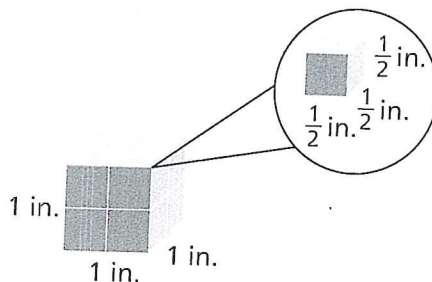


Five $\frac{1}{2}$ -inch cubes fit along each $2\frac{1}{2}$ -inch edge of the prism.

The bottom layer has 5×5 , or 25 cubes.

The prism is 3 cubes high, so there are 25×3 , or 75, cubes in the prism.

STEP 2 Find the volume of each smaller $\frac{1}{2}$ -inch cube.



There are 4 smaller cubes on the bottom layer of the unit cube, and the unit cube is 2 smaller cubes high.

There are 4×2 , or 8, smaller cubes in the unit cube. So each $\frac{1}{2}$ -inch cube has $\frac{1}{8}$ the volume of a unit cube, or $\frac{1}{8} \times 1 \text{ in.}^3 = \frac{1}{8} \text{ in.}^3$.

STEP 3 Find the volume of the prism.

The volume of the prism equals the number of small cubes multiplied by the volume of a small cube.

$$75 \times \frac{1}{8} = \frac{75}{8} \text{ or } 9\frac{3}{8}$$

Number of small cubes \times Volume of small cube = Volume of prism

Be Precise Use the correct units to describe area and volume.

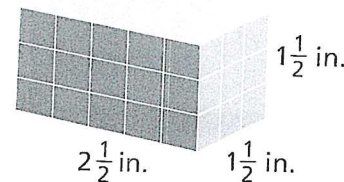
The volume of the prism is $9\frac{3}{8} \text{ in.}^3$.

Try It!

Find the volume of the rectangular prism built from $\frac{1}{2}$ -inch cubes.

The bottom layer has cubes. The prism is cubes high. There are a total of cubes in the prism. Each cube has a volume of in.^3 .

Volume of prism = \times = in.^3 .



Convince Me! Suppose that the length of the rectangular prism in the Try It! were $3\frac{1}{2}$ inches instead of $2\frac{1}{2}$ inches. How many cubes would there be in the prism? What would be the volume of the prism?



EXAMPLE 2



Use a Formula to Find the Volume of a Rectangular Prism



ACTIVITY



ASSESS

Sean bought the fish tank shown. What is the volume of Sean's fish tank?

Look for Relationships The volume V of any prism equals the area of the base, B , times the height of the prism, h . $V = Bh$. In a rectangular prism, $B = \ell \times w$.

Use the formula $V = \ell wh$ to find the volume of the fish tank.

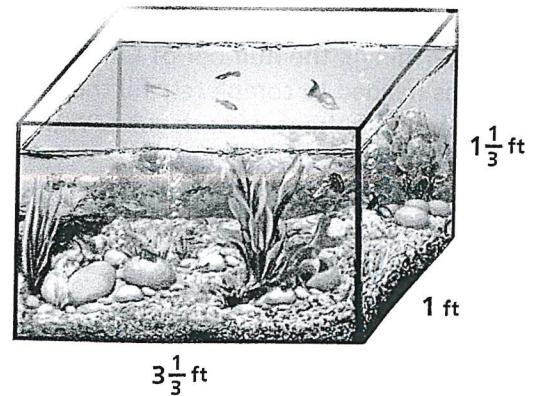
$$V = 3\frac{1}{3} \times 1 \times 1\frac{1}{3}$$

$$V = \frac{10}{3} \times \frac{1}{1} \times \frac{4}{3}$$

$$V = \frac{40}{9} \text{ or } 4\frac{4}{9}$$

Substitute the values for the length, width, and height. Rename mixed numbers as fractions to solve.

The volume of the fish tank is $4\frac{4}{9} \text{ ft}^3$.



EXAMPLE 3



Use a Formula to Find the Volume of a Cube

Adah has a ring box in the shape of a cube. What is the volume of Adah's ring box?

Because a cube is a rectangular prism, its volume is also the product of its length, width, and height. Since the length, width, and height of a cube are equivalent, let s represent the length of each edge.

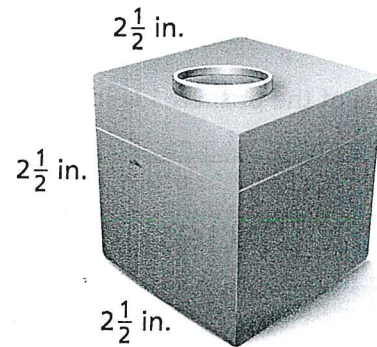
$$\text{Volume} = s \times s \times s = s^3$$

$$V = \left(2\frac{1}{2}\right)^3 = 2\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{2}$$

$$V = \frac{5}{2} \times \frac{5}{2} \times \frac{5}{2}$$

$$V = \frac{125}{8} \text{ or } 15\frac{5}{8}$$

Rename mixed numbers as fractions to solve.



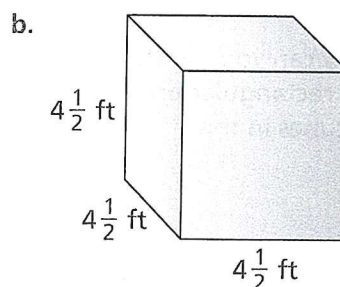
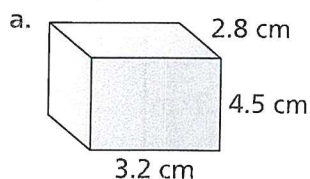
The length, width, and height of a cube are the same.

The volume of the ring box is $15\frac{5}{8} \text{ in.}^3$.



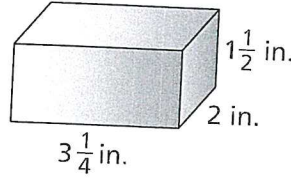
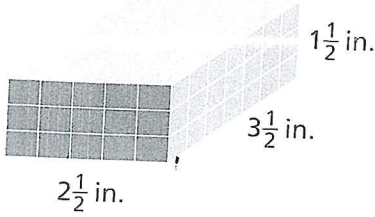
Try It!

Find the volume of each rectangular prism.





You can find the volume of a rectangular prism with fractional edge lengths by determining the number of same-sized cubes with unit fraction edge lengths needed to completely fill the prism, then multiplying that number of cubes by the volume of each cube. You can also apply a formula.



Each $\frac{1}{8}$ -inch cube has a volume of $\frac{1}{8}$ in.³.

Prism Dimensions:

Five $\frac{1}{2}$ -inch cubes wide

Seven $\frac{1}{2}$ -inch cubes long

Three $\frac{1}{2}$ -inch cubes tall

$5 \times 7 \times 3 =$ One hundred five $\frac{1}{8}$ -inch cubes

$$V = 105 \times \frac{1}{8} = 13\frac{1}{8}$$

The volume of the prism is $13\frac{1}{8}$ in.³.

$$V = \ell wh$$

$$V = 3\frac{1}{4} \times 2 \times 1\frac{1}{2}$$

$$V = \frac{13}{4} \times \frac{2}{1} \times \frac{3}{2}$$

$$V = \frac{78}{8} \text{ or } 9\frac{3}{4}$$

The volume of the prism is $9\frac{3}{4}$ in.³.

Do You Understand?

Do You Know How?

1. **Essential Question** How can you find the volume of a rectangular prism with fractional edge lengths?

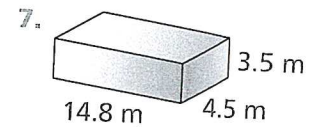
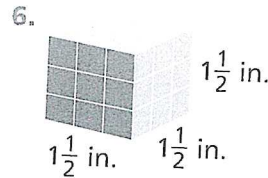
In 4 and 5, tell how many of each size of cube can fill a 1-inch cube.

4. Edge = $\frac{1}{3}$ inch

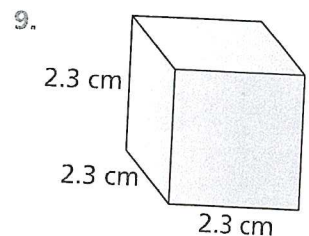
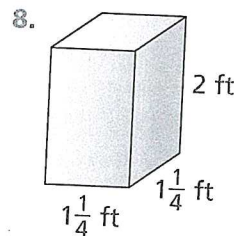
5. Edge = $\frac{1}{4}$ inch

2. How is finding the volume of a rectangular prism with fractional edge lengths similar to finding the volume of a rectangular prism with whole number edge lengths?

In 6–9, find the volume of each rectangular prism.



3. **Construct Arguments** How can you use the number of $\frac{1}{2}$ -inch cubes in a rectangular prism to find the number of unit cubes in the rectangular prism?



Name: _____



PRACTICE



TUT

Practice & Problem Solving

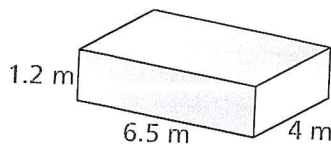


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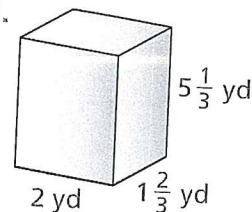


In 10–13, find the volume of each rectangular prism.

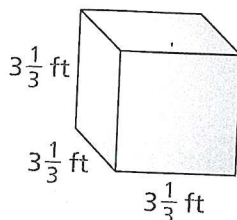
10.



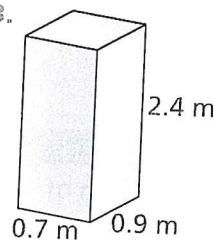
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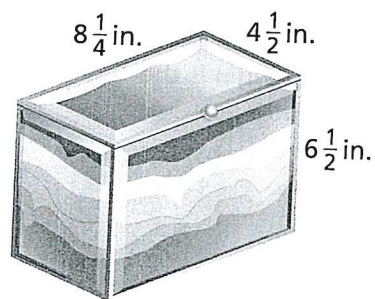
12.



13.



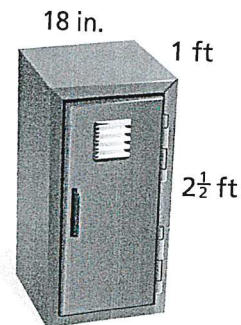
14. A clear box has the shape of a rectangular prism and is filled with sand. Find the volume of the box.



15. **Use Structure** A rectangular prism has a length of $2\frac{1}{2}$ yd, a width of $1\frac{1}{2}$ yd, and a height of $1\frac{1}{2}$ yd. You use cubes with fractional edge lengths of $\frac{1}{2}$ yd to find the volume. How many cubes are there for each of the length, width, and height of the prism? What is the volume of the prism?

16. A gift box has the shape of a cube. The length of each side is 10.5 cm. What is the volume of the gift box?

17. A school locker has a length of 1 ft, a width of 18 in., and a height of $2\frac{1}{2}$ ft. What is the volume of the locker in cubic feet?



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In 18 and 19, use the table.

18. **Use Structure** Sandy has two boxes with the dimensions shown. She wants to use the box with the greater volume to ship a gift to her friend. Which box should Sandy use? Explain.

	Length	Width	Height
Box A	$7\frac{1}{2}$ in.	2 in.	$11\frac{1}{2}$ in.
Box B	9 in.	$2\frac{1}{4}$ in.	$8\frac{1}{2}$ in.

19. Sandy finds a third box, box C, that has a length of 8 inches, a width of $2\frac{3}{4}$ inches, and a height of $10\frac{1}{2}$ inches. If Sandy wants to use the box with the greatest volume, should she use box C? Explain.

20. The volume of a large crate is 84 yd^3 . It is $2\frac{2}{3}$ yd wide and $4\frac{2}{3}$ yd high. What is the length of the crate?

21. **Higher Order Thinking** A box covers an area of $8\frac{3}{4} \text{ in.}^2$ when resting on its base. The volume of the box is $74\frac{3}{8} \text{ in.}^3$. Can you find the surface area of the box? Explain.

22. **Make Sense and Persevere** A gold bar is similar in shape to a rectangular prism. A standard mint bar is approximately $7 \text{ in.} \times 3\frac{5}{8} \text{ in.} \times 1\frac{3}{4} \text{ in.}$ If the value of gold is \$1,313 per ounce, about how much is one gold bar worth? Use the formula $w \approx 11.15n$, where w is the weight in ounces and n is the volume in cubic inches, to find the weight in ounces. Explain how you found your answer.



Assessment Practice

23. Which rectangular prism with the given dimensions has the same volume as the prism shown? 6.G.1.2

- (A) 1 in., 3.5 in., 4.25 in.
- (B) 1.25 in., 3.5 in., 4 in.
- (C) 1.75 in., 3 in., 3.5 in.
- (D) 2 in., 2.25 in., 4 in.

