Volume through Multiplying INSTRUCTIONAL GUIDE

Objective: Students will find volume of rectangular prisms using the formula *V = l x w x h*.	**CCSS.5.MD.C.5.B:** Apply the formulas *V = l x w x h* and *V = b x h* for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems.

Lesson Components

Opening

- Anything that has volume and takes up space has three dimensions- length, width, and height.
- To find the volume of a rectangular prism (a box), you simply multiply these three dimensions by each other.
- If a box has a side length of one centimeter, 1 x 1 x 1 = 1, which is why we call this a cubic centimeter.
- Count the cubes on each edge to determine the dimensions and then multiply them.

Key Points

- Volume can be found using the formula length x width x height.
- This formula doesn't work for every solid shape. Most shapes are much more complicated than this. Today we will be focusing on rectangular prisms, or boxes, and they use this simple formula.
- We write our unit as a cubic unit to remind us that it is 3-dimensional measurement. You can write cubic inches or in^3 for short.

Misconceptions and Tips

- If the rectangular prism is shown with cubes, students may struggle identifying which dimension is which. Have them shade the edge they are measuring and write the dimension next to that side. Make sure they count actually cubes and not corners (or they'll end up with one too many).
- Encourage students to read their answers out loud and include the unit when going over examples and answers. The more practice they get at saying "cubic inches" instead of "inches 3" the better! For students that struggle reading in^3 correctly, have them write it out longhand "cubic inches" until it sticks.
- For students who still struggle with multiplication, have them multiply the two biggest numbers first. This lowers the chance that they'll have to do a 2 x 2 digit multiplication problem, where error is more likely. For example- if the dimensions are 12 x 3 x 5, have students multiply 12 x 5 = 60 first and then 60 x 3. If not, they might end up trying to multiply 12 x 15 and for some lower students this might set them back or discourage them.
- Visually, it can be confusing when a rectangular prism has two or three dimensions that are the same, especially if it's a problem where you are counting cubes. Examples of this are Partner Practice 1 and 2 and Independent Practice 2. Bring it back to length, width, and height. Make sure students see that length and width for the base and height is how tall the figure is. Shading the edges will help eliminate confusion.

Partner Practice

- This page is designed for students to solve in partners or small groups.
- Go over problems from this section before they start Independent Practice.

Independent Practice/Challenge

- These problems are designed for students to complete at their own pace. Not everyone will complete all 4 pages, as they get progressively more difficult.

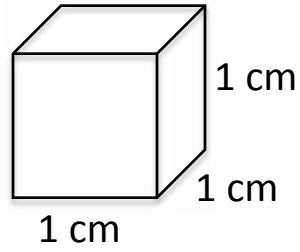
Exit Quiz

- This is your chance to see if your students mastered the concept.
- Should be done independently.
- This could count as your daily mastery grade.

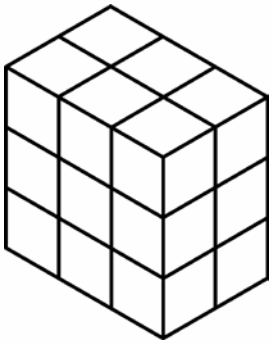
VOLUME *through multiplying*

NAME: _____

Solid shapes are called three-dimensional because they have a length, a width, and a height. To find the volume of a rectangular prism (a box!), you can simply multiply these three dimensions.

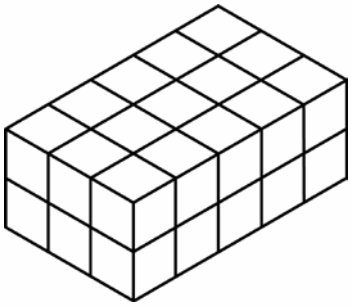


Volume = ____ ***x*** ____ ***x*** ____
length x width x height



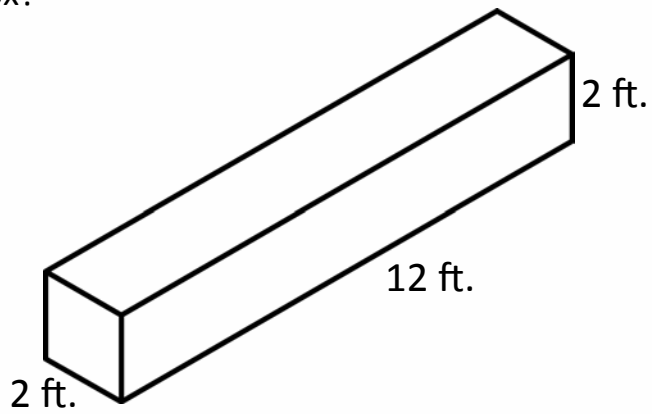
Volume = ____ ***x*** ____ ***x*** ____
length x width x height

Example #1: Josie built a tower out of blocks in the shape of a rectangular prism. Each block is one cubic inch. What is the volume of Josie's tower?



Note: Your unit can be written in cubic inches or in^3 for short.

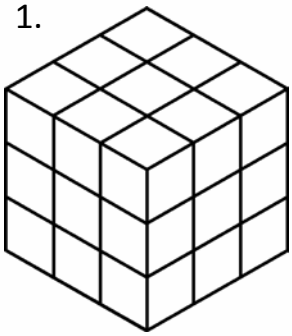
Example #2: Mikael built a flower box, shown below. What is the volume of Mikael's flower box?



PARTNER PRACTICE

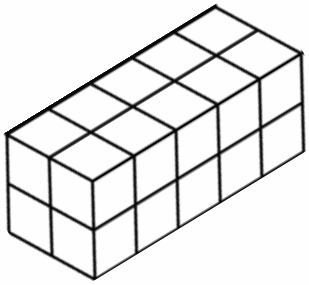
Find the volume of each rectangular prism.

1.



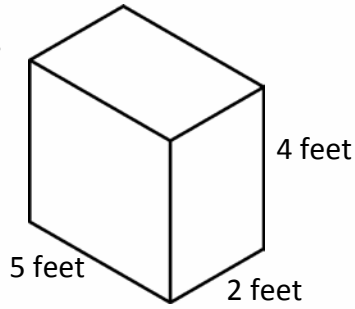
1 cube = 1 cm^3

2.

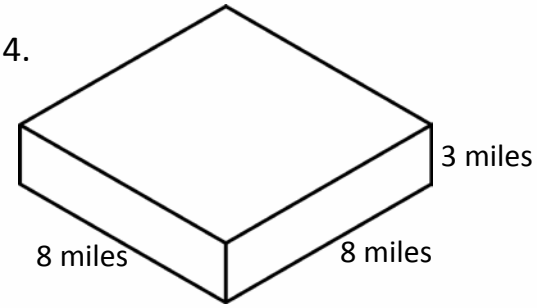


1 cube = 1 ft^3

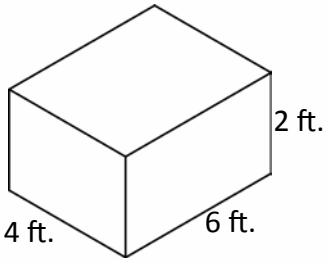
3.



4.



5. Desmond has a box in his backyard to store all his tools. Find the volume of the box.

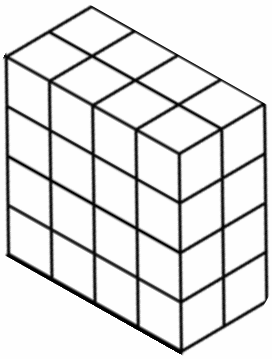


6. Nancy shipped a storage container that was 7 feet tall, 9 feet wide, and 13 feet long. What is the volume of this storage container?

INDEPENDENT PRACTICE

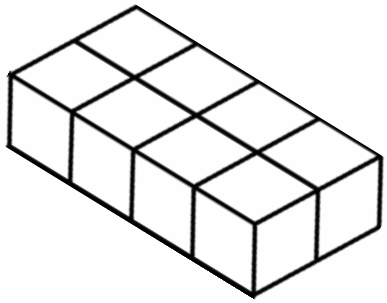
Find the volume of each rectangular prism.

1.



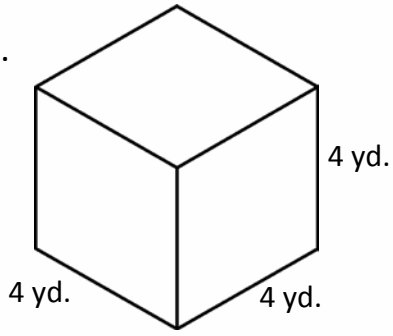
1 cube = 1 m^3

2.

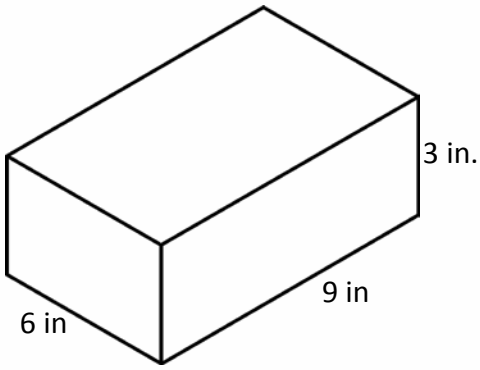


1 cube = 1 cm^3

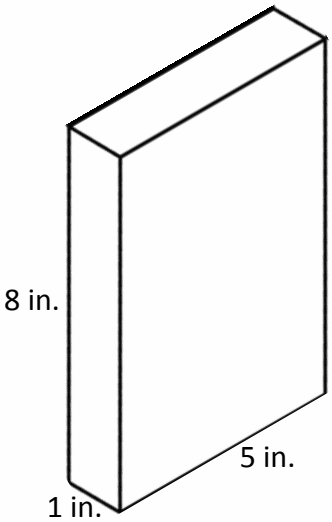
3.



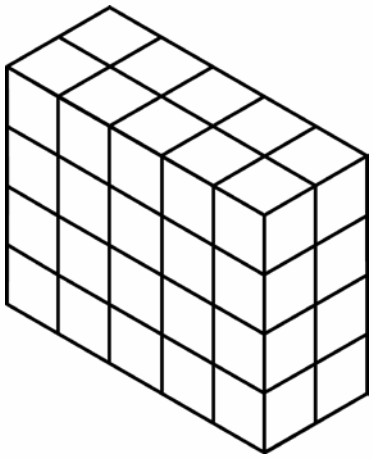
4.



5.



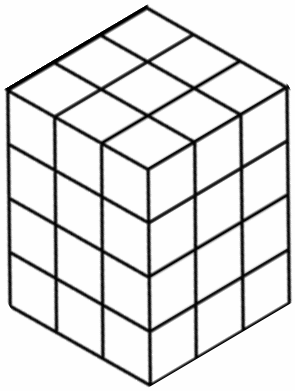
6.



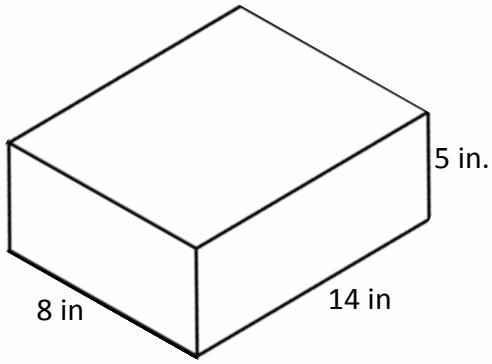
1 cube = 1 ft^3

INDEPENDENT PRACTICE

7. Jack is designing a new storage container for his company to manufacture. He builds the model below as an example. Each cube represents one cubic meter. What will the volume of the new storage container bed?



8. Rachel built a new jewelry box, shown below. Find the volume of Rachel's jewelry box.

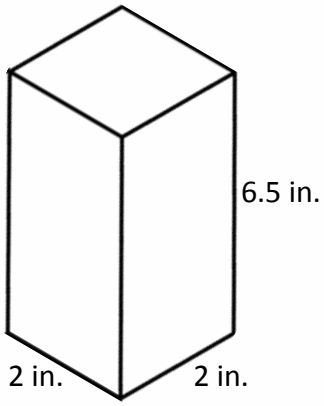


9. The dimensions of a cereal box are 8 inches in length, 2 inches in width, and 12 inches in height. What is the volume of a cereal box?

10. Danielle owns a company that produces concrete cinder blocks. Each cinder block measures 16 inches by 8 inches by 8 inches. What is the volume of a cinder block?

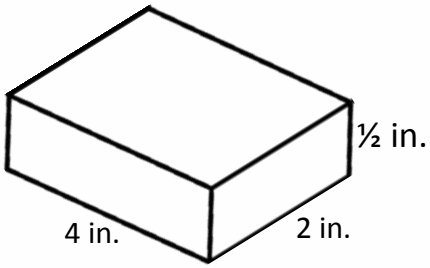
INDEPENDENT PRACTICE

11. Find the volume of the box shown below.



12. The largest suitcase that is allowed in the overhead compartment on an airplane is 14 inches in height, 26 inches in length, and 10 inches in width. What is the maximum volume of a suitcase that will fit in the overhead compartment?

13. Stephanie uses a mint tin to keep spare change in her purse. The dimensions are shown below. Find the volume of the mint tin.

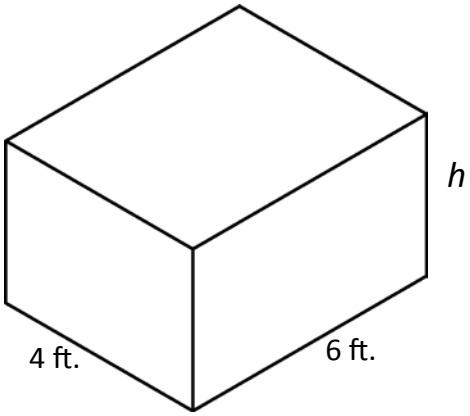


14. Larry dug a tornado shelter in his backyard. The shelter measures 17 feet x 5 feet x 12 feet. What is the volume of Larry's tornado shelter?

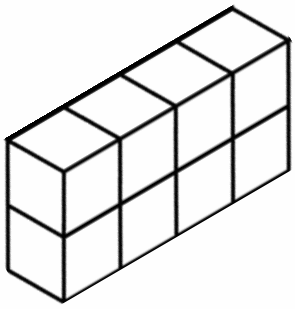
CHALLENGE

1. A king size bed and a queen size mattress are both 80 inches long and 10 inches deep. A king mattress is 76 inches wide and a queen is 60 inches wide. Find the difference in volume between a king and queen size mattress.

2. Find the height of the rectangular prism below if the volume is 72 ft^3.



3. Gloria built the tower shown below out of blocks. Each block measures 3 centimeters on each edge. What is the volume of Gloria's tower?



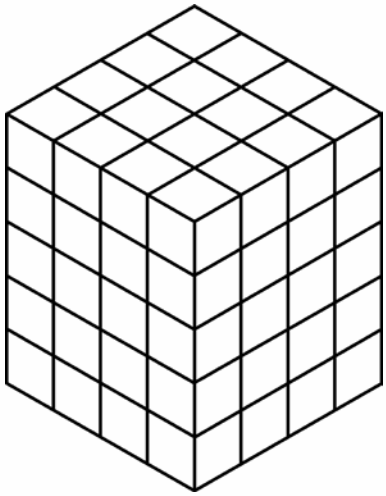
4. Simon installed a tool shed in his backyard. The shed has volume of 120 ft^3. List three possible sets of dimensions for Simon's tool shed.

EXIT QUIZ: VOLUME THROUGH MULTIPLICATION

NAME: _____

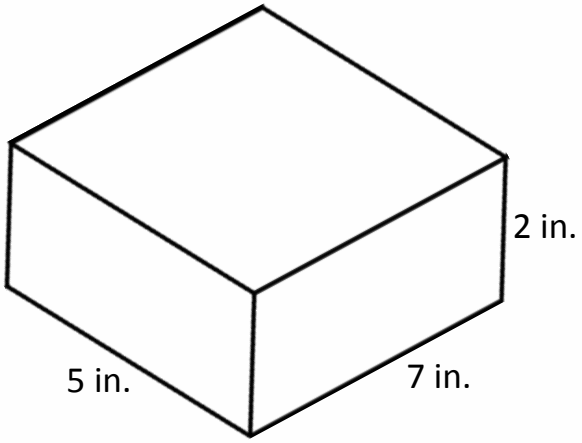
Find the volume of each rectangular prism.

1.



1 cube = 1 m^3

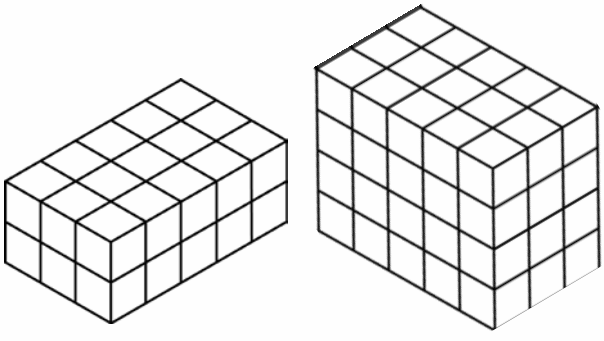
2.



3. Morgan mailed a gift to his cousin in a box that measured 3 inches wide, 4 inches tall, and 15 inches long. What is the volume of the box Morgan mailed to his cousin?

bonus

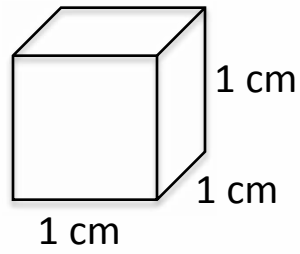
Sheila took the towers apart and built one big tower, in the shape of a rectangular prism. What could be the dimensions of Sheila's new tower?



VOLUME THROUGH MULTIPLYING

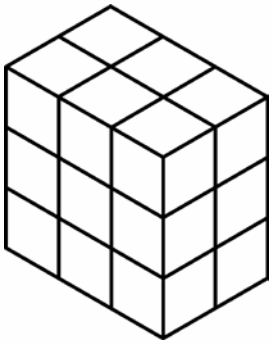
ANSWER KEY

Solid shapes are called three-dimensional because they have a length, a width, and a height. To find the volume of a rectangular prism (a box!), you can simply multiply these three dimensions.



Volume = 1 x 1 x 1
length x width x height

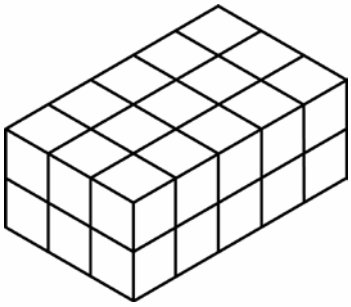
1 cubic centimeter



Volume = 3 x 2 x 3
length x width x height

18 cubic units

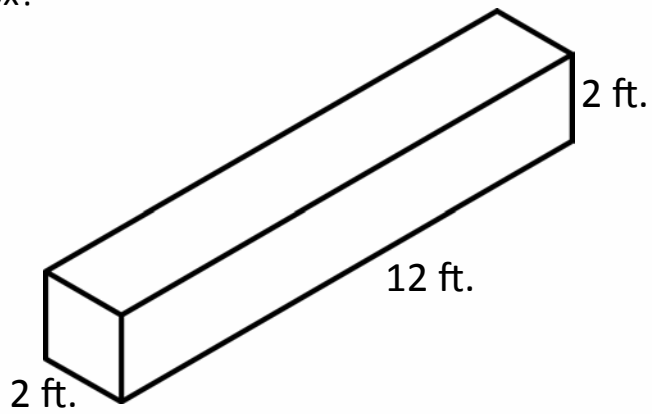
Example #1: Josie built a tower out of blocks in the shape of a rectangular prism. Each block is one cubic inch. What is the volume of Josie's tower?



3 x 2 x 5 = 30 cubic units
30 in^3

Note: Your unit can be written in cubic inches or in^3 for short.

Example #2: Mikael built a flower box, shown below. What is the volume of Mikael's flower box?



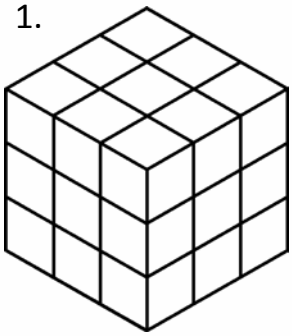
2 x 12 x 2 = 48 ft^3

ANSWER KEY

PARTNER PRACTICE

Find the volume of each rectangular prism.

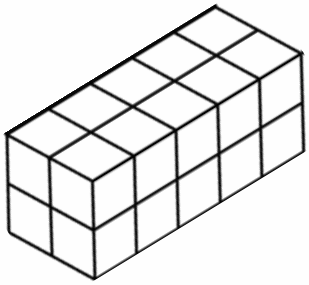
1.



1 cube = 1 cm^3

3 x 3 x 3 = 27 cm^3

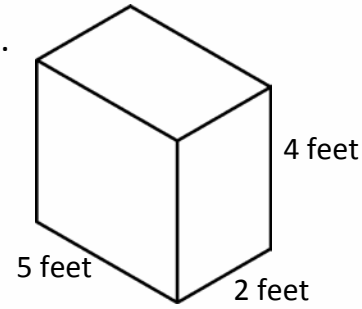
2.



1 cube = 1 ft^3

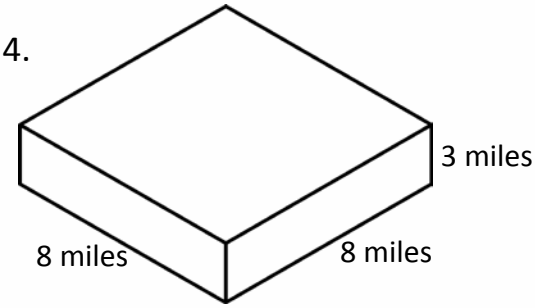
2 x 2 x 5 = 20 ft^3

3.



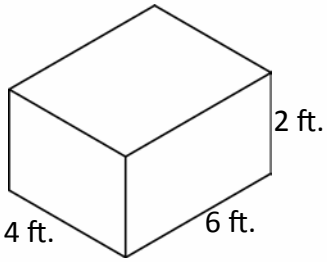
40 ft^3

4.



192 mi^3

5. Desmond has a box in his backyard to store all his tools. Find the volume of the box.



48 ft^3

6. Nancy shipped a storage container that was 7 feet tall, 9 feet wide, and 13 feet long. What is the volume of this storage container?

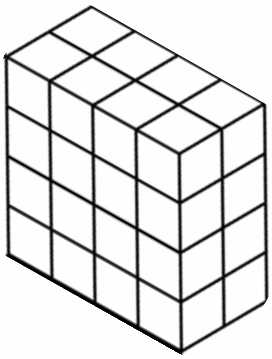
819 ft^3

ANSWER KEY

INDEPENDENT PRACTICE

Find the volume of each rectangular prism.

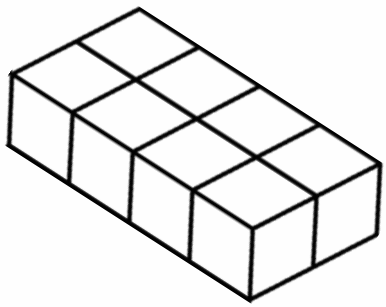
1.



1 cube = 1 m^3

2 x 4 x 4 = 32 m^3

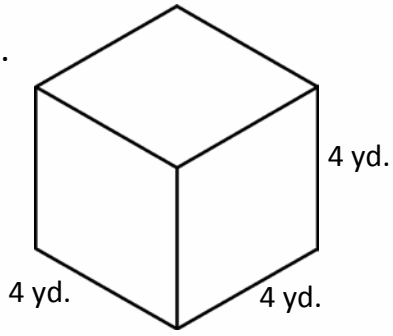
2.



1 cube = 1 cm^3

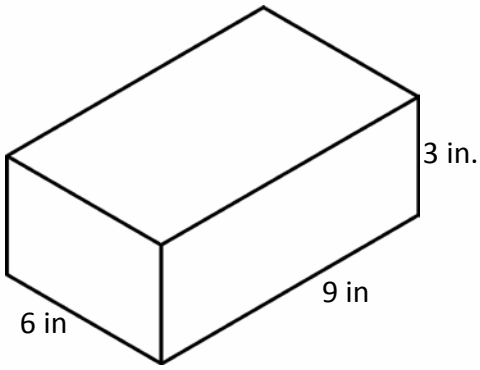
2 x 1 x 4 = 8 cm^3

3.



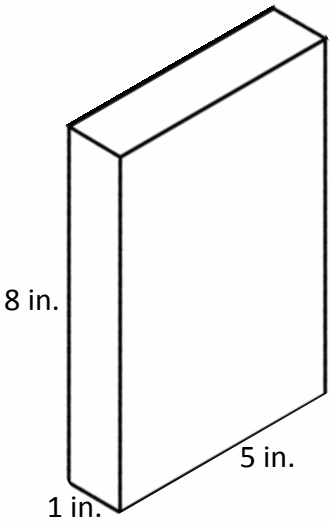
64 yd^3

4.



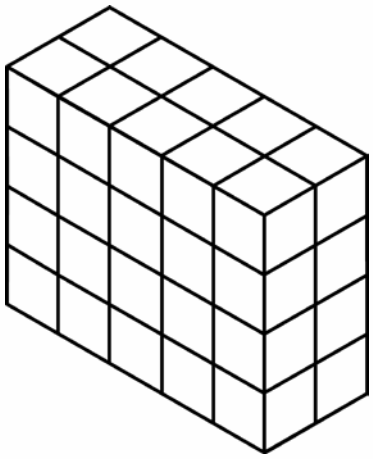
162 in^3

5.



40 in^3

6.



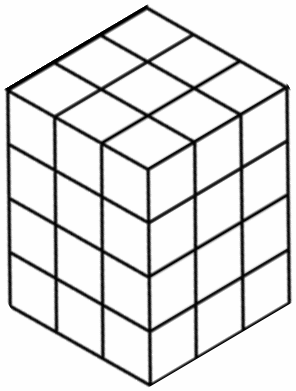
1 cube = 1 ft^3

5 x 2 x 4 = 40 ft^3

ANSWER KEY

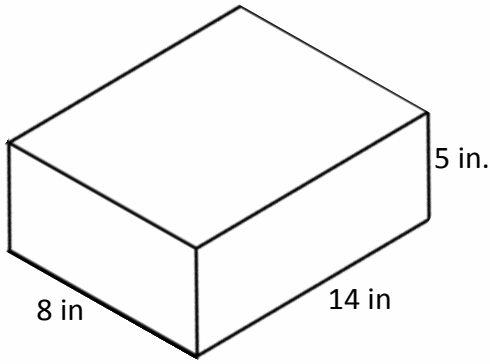
INDEPENDENT PRACTICE

7. Jack is designing a new storage container for his company to manufacture. He builds the model below as an example. Each cube represents one cubic meter. What will the volume of the new storage container bed?



3 x 3 x 4 = 36 m^3

8. Rachel built a new jewelry box, shown below. Find the volume of Rachel's jewelry box.



560 in^3

9. The dimensions of a cereal box are 8 inches in length, 2 inches in width, and 12 inches in height. What is the volume of a cereal box?

192 in^3

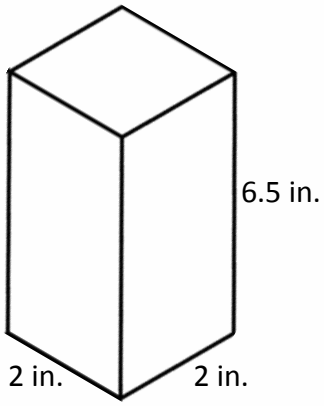
10. Danielle owns a company that produces concrete cinder blocks. Each cinder block measures 16 inches by 8 inches by 8 inches. What is the volume of a cinder block?

1,024 in^3

ANSWER KEY

INDEPENDENT PRACTICE

11. Find the volume of the box shown below.

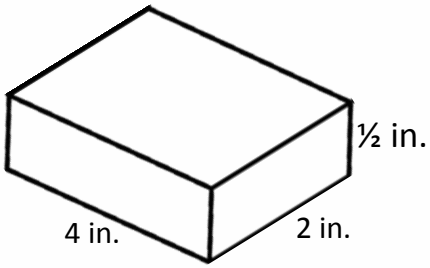


26 in³

12. The largest suitcase that is allowed in the overhead compartment on an airplane is 14 inches in height, 26 inches in length, and 10 inches in width. What is the maximum volume of a suitcase that will fit in the overhead compartment?

3,640 in³

13. Stephanie uses a mint tin to keep spare change in her purse. The dimensions are shown below. Find the volume of the mint tin.



8/2 = 4 in³

14. Larry dug a tornado shelter in his backyard. The shelter measures 17 feet x 5 feet x 12 feet. What is the volume of Larry's tornado shelter?

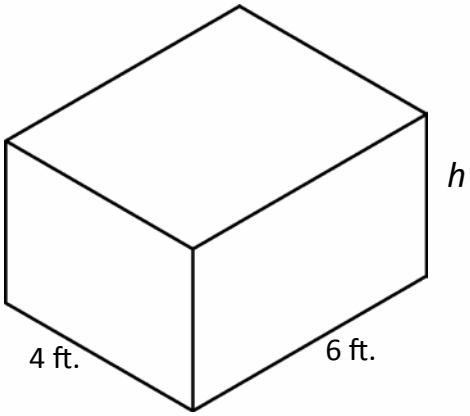
1,020 ft³

ANSWER KEY CHALLENGE

1. A king size bed and a queen size mattress are both 80 inches long and 10 inches deep. A king mattress is 76 inches wide and a queen is 60 inches wide. Find the difference in volume between a king and queen size mattress.

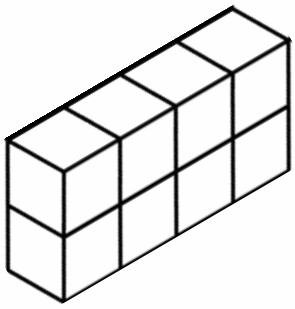
King- 80 x 10 x 76 = 60,800 in^3
Queen- 80 x 10 x 60 = 48,000 in^3
60,800 – 48,000 = 12,800 in^3

2. Find the height of the rectangular prism below if the volume is 72 ft^3.



4 x 6 x ____ = 72ft^3
24 x ____ = 72ft^3
h = 3 feet

3. Gloria built the tower shown below out of blocks. Each block measures 3 centimeters on each edge. What is the volume of Gloria's tower?



3 x 3 x 3 = 27 cm^3
27 x 8 = 216 cm^3

2. Simon installed a tool shed in his backyard. The shed has volume of 120 ft^3. List three possible sets of dimensions for Simon's tool shed.

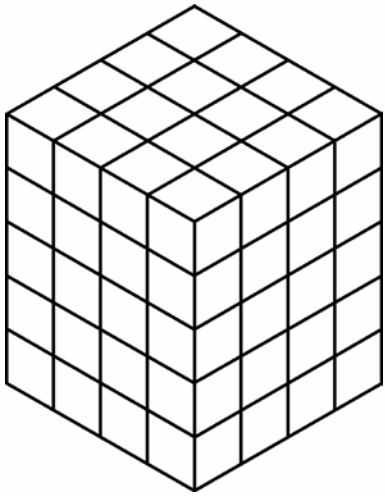
Answers will vary. Dimensions should multiply to make 120.
Examples: 12 x 2 x 5, 6 x 5 x 4, 10 x 3 x 4, etc.

EXIT QUIZ: VOLUME THROUGH MULTIPLICATION

ANSWER KEY

Find the volume of each rectangular prism.

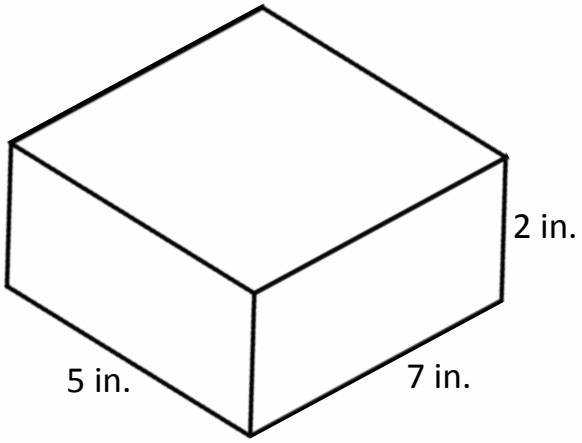
1.



1 cube = 1 m^3

4 x 4 x 5 = 80 m^3

2.



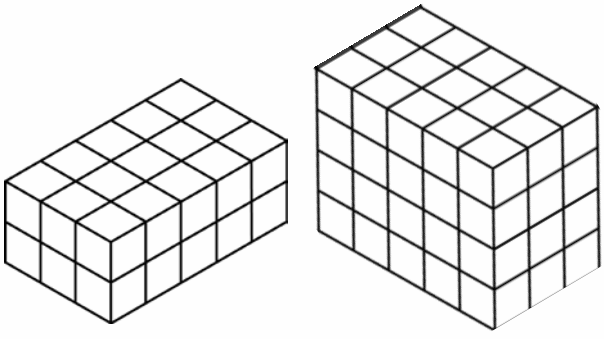
5 x 7 x 2 = 70 in^3

3. Morgan mailed a gift to his cousin in a box that measured 3 inches wide, 4 inches tall, and 15 inches long. What is the volume of the box Morgan mailed to his cousin?

3 x 4 x 15 = 180 in^3

bonus

Sheila took the towers apart and built one big tower, in the shape of a rectangular prism. What could be the dimensions of Sheila's new tower?



Answers will vary, dimensions should multiply to make 90. Examples:

- ***5 x 6 x 3***
- ***10 x 3 x 3***
- ***9 x 2 x 5***