

## Volume of Solids

Name: \_\_\_\_\_

**Prerequisite: Volume of Rectangular Prisms**

**Study the example showing how to find the volume of a rectangular prism. Then solve problems 1–7.**

**Example**

Alex is constructing a box in which to grow vegetables on his patio. The box will be 6 feet long, 2 feet wide, and  $3\frac{1}{2}$  feet deep. What is the volume of soil needed to fill the box?

You can model the volume using 1-foot unit cubes. Notice that the first three layers are whole cubes, and the top layer is made up of half-cubes.

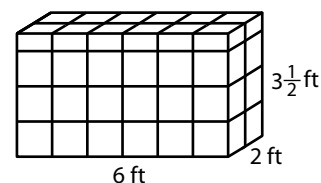
Cubes in one of the bottom 3 layers:  $6 \cdot 2 = 12$

Total cubes in the bottom 3 layers:  $3 \cdot 12 = 36$

Cubes in the top layer:  $\frac{1}{2}(6 \cdot 2) = 6$

Total cubes needed to fill the box:  $36 + 6 = 42$

Alex needs 42 cubic feet of soil to fill the box.



- 1** Why do you multiply 12 by 3 to find the total number of cubes in the bottom 3 layers?

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- 2** Why do you multiply  $(6 \cdot 2)$  by  $\frac{1}{2}$  to find the number of cubes in the top layer?

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- 3** Use the formula  $V = lwh$  to find the volume of the box. Compare the volume found using the formula with the volume computed above.

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**Solve.**

- 4 A rectangular box of pasta is 10 inches long, 8 inches wide, and  $2\frac{1}{4}$  inches deep. What is the volume of the box?

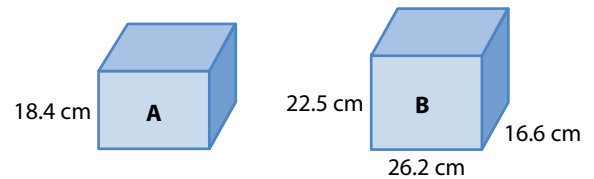
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- 5 Meghan says that the formula  $V = Bh$ , where  $B$  is the area of the base, can be used to find the volume of any rectangular prism. Do you agree? Explain.

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- 6 Lao is thinking of buying a fish tank. Tank A has a base area of 530 square centimeters. Which fish tank has the greater volume? How much greater?



**Show your work.**

*Solution:* \_\_\_\_\_

- 7 If you double the length, the width, and the height of a rectangular prism, how does the volume of the prism change? Use algebra to justify your answer. Then give a numerical example.

**Show your work.**

*Solution:* \_\_\_\_\_

## Volume of Prisms

**Study the example problem showing how to find the volume of a prism. Then solve problems 1–7.**

### Example

A triangular prism is shown at the right. What is the volume of the prism?

The bases of this prism are the right triangles at either end of the prism. So, first find the area of one of the bases.

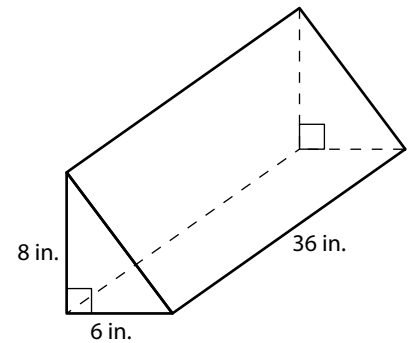
$$\frac{1}{2}bh = \frac{1}{2}(6)(8) = 24$$

The area of a triangular base is 24 square inches.

Next, use the formula  $V = Bh$ , where  $B$  is 24 and  $h$  is 36.

$$V = Bh = 24(36) = 864$$

The volume of the prism is 864 cubic inches.



- 1** How do you know that the right triangles are the bases of the prism?

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- 2** Describe the faces of the prism that are not bases. How are they alike? How are they different?

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- 3** A second prism has dimensions that are  $\frac{1}{2}$  of the dimensions of the prism in the example. Kathy says that the volume of the smaller prism is  $\frac{1}{2}$  of the volume of the prism in the example. Do you agree? Explain.

**Show your work.**

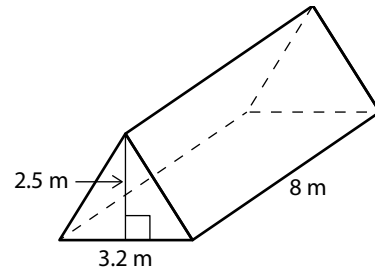
*Solution:* \_\_\_\_\_



**Solve.**

- 4 What is the volume of the prism shown?

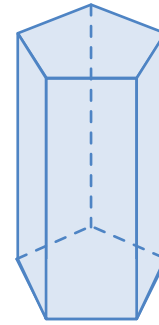
**Show your work.**



Solution: \_\_\_\_\_

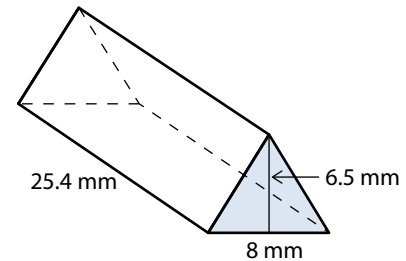
- 5 A pentagonal prism is shown. The volume of the prism is 91.8 cubic inches. If the height of the prism is 10.8 inches, what is the area of each base? Explain.

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- 6 A store sells two types of tiny crystals. One of the crystals is a triangular prism whose dimensions are shown at the right. The other crystal is shaped like a rectangular prism with a length of 26 millimeters, a width of 8.5 millimeters, and a height of 7 millimeters. Alice says that the volume of the rectangular crystal is greater than two times the volume of the triangular crystal. Find the volumes to prove whether or not Alice is correct.

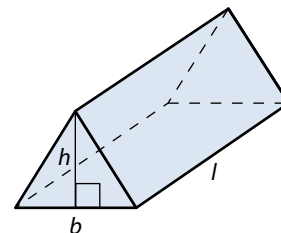
**Show your work.**



Solution: \_\_\_\_\_

- 7 Use the diagram at the right to write a formula in terms of  $b$ ,  $h$ , and  $l$  for the volume of a triangular prism.

**Show your work.**



Solution: \_\_\_\_\_

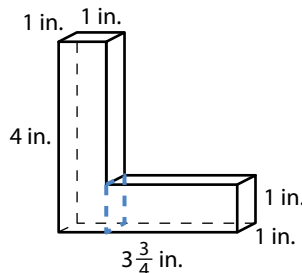
## Volume of Complex Solids

**Study the example showing how to find the volume of a composite solid. Then solve problems 1–7.**

### Example

Lázaro is designing a set of blocks for young children. He needs to know the volume of the block shown.

First he draws lines to divide the block into two rectangular prisms. Then he draws the two prisms and labels the dimensions of each.

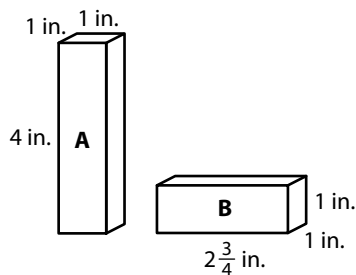


$$\text{Volume of prism A} = 1 \times 1 \times 4 = 4$$

$$\text{Volume of prism B} = 2\frac{3}{4} \times 1 \times 1 = 2\frac{3}{4}$$

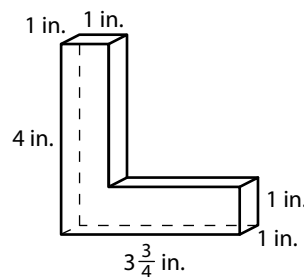
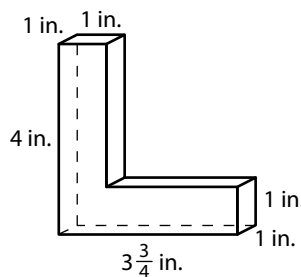
$$\text{Total volume of block} = 4 + 2\frac{3}{4} = 6\frac{3}{4}$$

The block has a volume of  $6\frac{3}{4}$  cubic inches.



**1** How did Lázaro find the length of prism B?

**2** Draw lines to show two other ways that Lázaro could divide the block into other prisms.



**3** Choose one of the ways in which you divided the block in problem 2. Sketch the prisms, label the dimensions of each one, and find the total volume.

**Show your work.**

*Solution:* \_\_\_\_\_

**Solve.**

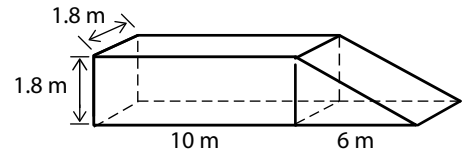
- 4 How is the process for finding the volume of a complex three-dimensional figure like the process for finding the area of a complex two-dimensional figure?

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**Use the figure at the right for problems 5–7.**

- 5 Sierra is designing a stage platform with a ramp. Draw lines on the figure at the right to divide the figure into solid figures whose volume you know how to find.
- 6 Find the volume of each solid from problem 5 and the total volume of the stage and ramp.

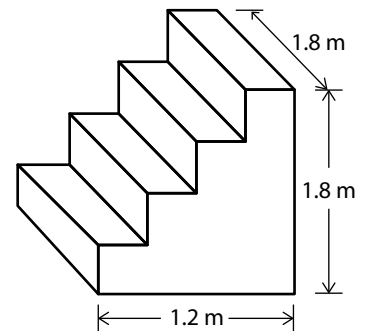


**Show your work.**

*Solution:* \_\_\_\_\_

- 7 Sierra decides to add a set of stairs to the stage on the side opposite the ramp. Each stair has the same width and height. By how much does the volume of the structure increase?

**Show your work.**



*Solution:* \_\_\_\_\_

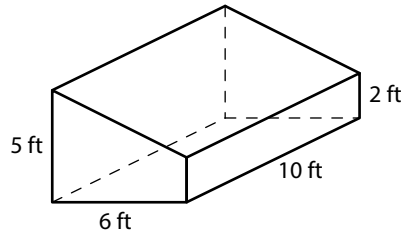
## Volume of Solids

Solve the problems.

- 1 What is the volume of the figure shown?

Show your work.

What shapes make up this solid?

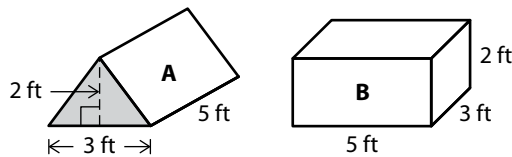


Solution: \_\_\_\_\_

- 2 How do the volumes of the two figures compare? Select all that are correct.

- A Volume A = Volume B
- B Volume A =  $\frac{1}{2}$  Volume B
- C Volume A > Volume B
- D Volume B > Volume A

How can you answer without actually computing the volumes?



- 3 Jayden needs to store boxes that are 4 feet long, 3 feet wide, and 2 feet high. The boxes must remain upright with one of the 4-foot by 3-foot sides on top. Jayden's storage locker is 12 feet long, 6 feet wide, and 9 feet high. What is the greatest number of boxes that he can store in the locker?

- A 24
- B 27
- C 30
- D 32

Be sure to satisfy all conditions of the problem.



June chose **B** as her answer. How did she get that answer?

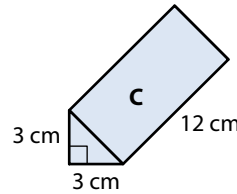
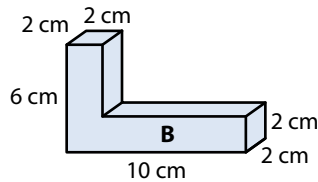
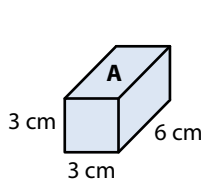
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**Solve.**

- 4** Find the volume of each figure. Tell whether each statement is *True* or *False*.

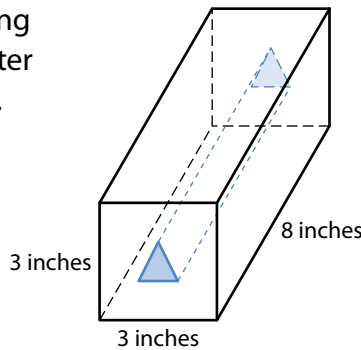


Do you have to compute the volumes of figures A and C to know if they are the same?



- |   |                               |                                |
|---|-------------------------------|--------------------------------|
| a. Figure B has the greatest volume.        | <input type="checkbox"/> True | <input type="checkbox"/> False |
| b. Figures A, B, and C have equal volumes.  | <input type="checkbox"/> True | <input type="checkbox"/> False |
| c. No two figures have equal volumes.       | <input type="checkbox"/> True | <input type="checkbox"/> False |
| d. Only figures A and B have equal volumes. | <input type="checkbox"/> True | <input type="checkbox"/> False |

- 5** A child's toy is made by removing a triangular prism from the center of a wooden rectangular prism. The triangular base of the triangular prism has a base length of 1 inch and a height of 1 inch. What is the volume of the toy?



Should you add or subtract to find the volume?



*Solution:* \_\_\_\_\_