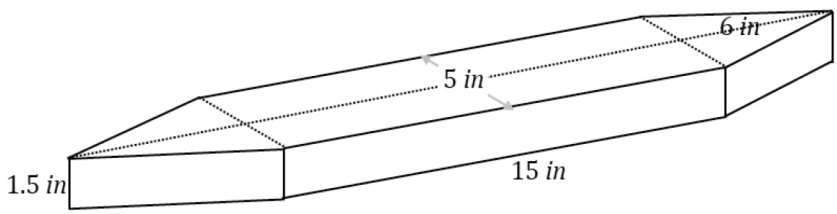
Volume of Right Prisms

Determine the volume of the following prism. Explain how you found the volume.



1. The pieces in Figure 1 are rearranged and put together to form Figure 2.

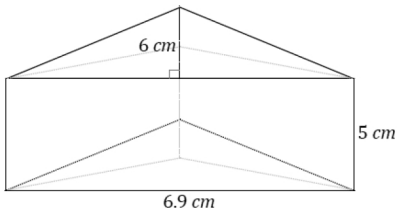


Figure 1

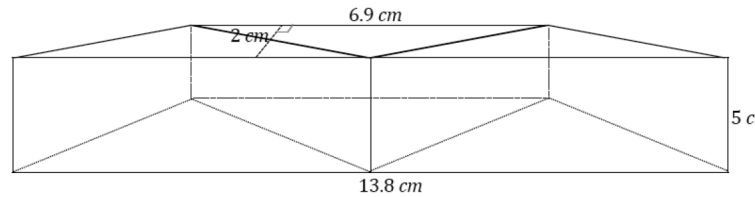


Figure 2

   a. Use the information in Figure 1 to determine the volume of the prism.
   b. Use the information in Figure 2 to determine the volume of the prism.
   c. If we were not told that the pieces of Figure 1 were rearranged to create Figure 2, would it be possible to determine whether the volumes of the prisms were equal without completing the entire calculation for each?

2. Each of two right prism containers is filled with gallons of water. The depth of the water in the first container is inches. The depth of the water in the second container is inches. If the area of the base in the first container is ft^2, find the area of the base in the second container. Explain your reasoning.

3. Two containers are shaped like right rectangular prisms. Each has the same height, but the base of the larger container is more in each direction. If the smaller container holds gallons when full, how many gallons does the larger container hold? Explain your reasoning.

4. A right prism container with the base area of ft^2 and height of ft. is filled with water until it is ft. deep. If a solid cube with edge length ft. is dropped to the bottom of the container, how much will the water rise?

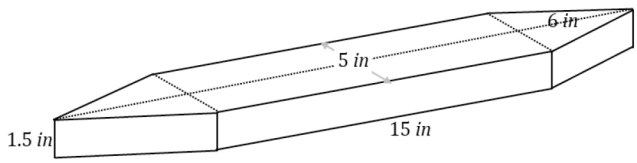
5. A right prism container with a base area of ft^2 and height ft. is filled with water until it is ft. deep. A large boulder is dropped to the bottom of the container, and the water rises to the top completely submerging the boulder and without causing overflow. Find the volume of the boulder.

6. A rectangular swimming pool is feet wide and feet long. The rectangular floor of the swimming pool is feet wide, feet deep at one end, and feet deep at the other.
   a. Sketch the swimming pool as a right prism.
   b. What kind of right prism is the swimming pool?
   c. What is the volume of the swimming pool in cubic feet?
   d. How many gallons will the swimming pool hold if each cubic feet of water is about gallons?

7. A milliliter (mL) has volume of cm^3. A mL measuring cup is filled to mL. A small stone is placed in the measuring cup. The stone is completely submerged and the water level rises to mL.
   a. What is the volume of the stone in cm^3?
   b. Describe a right rectangular prism that has the same volume as the stone.

Determine the volume of the following prism. Explain how you found the volume.

To find the volume of the prism, the base must be decomposed into triangles and rectangles, since there is no way to find the area of the base as is. The base can be decomposed into two triangles and a rectangle, and their areas must be summed to find the area of the base. Once the area of the base is determined, it should be multiplied by the height to find the volume of the entire prism.



Area of both triangles: –

Area of the rectangle:

Total area of the base:

Volume of the prism:

1. The pieces in Figure 1 are rearranged and put together to form Figure 2.

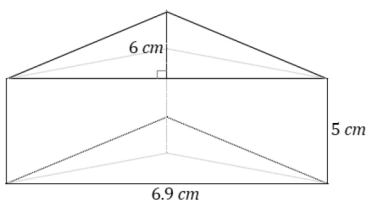


Figure 1

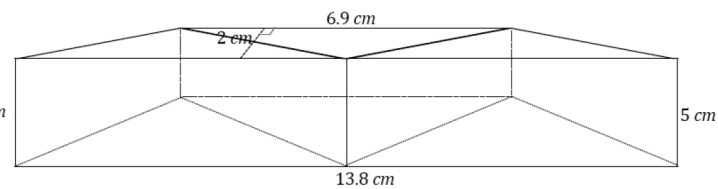


Figure 2

a. Use the information in Figure 1 to determine the volume of the prism.

Volume: –

b. Use the information in Figure 2 to determine the volume of the prism.

Volume: –

c. If we were not told that the pieces of Figure 1 were rearranged to create Figure 2, would it be possible to determine whether the volumes of the prisms were equal without completing the entire calculation for each?

Both prisms have the same height, so as long as it can be shown that both bases have the same area both prisms must have equal volumes. We could calculate the area of the triangle base and the trapezoid base and find that they are equal in area and be sure that both volumes are equal.

2. **Each of two right prism containers is filled with gallons of water. The depth of the water in the first container is inches. The depth of the water in the second container is inches. If the area of the base in the first container is ft^2, find the area of the base in the second container. Explain your reasoning.**

We know that the volume of each of the two containers is gallons; therefore, the volumes must be equal. In order to find the volume of the first container, we could multiply the area of the base (ft^2) by the height (inches). To find the volume of the second container we would also multiply the area of its base, which we will call (area in ft^2) and the height (inches). These two expressions must equal each other since both containers have the same volume.

Therefore, the area of the second container will be ft^2. Note: The units for the volume are ft. ft. in. in this computation. Converting the inches to feet would make the computation in ft^3, but it will not change the answer for .

3. **Two containers are shaped like right rectangular prisms. Each has the same height, but the base of the larger container is more in each direction. If the smaller container holds gallons when full, how many gallons does the larger container hold? Explain your reasoning.**

The larger container will hold gallons because each side length of the base is times larger than the smaller container's dimensions. Therefore, the area of the larger container's base is or times larger than the smaller container. Because the height is the same in both containers, the volume of the larger container must be times larger than the smaller container. gal. gal.

4. **A right prism container with the base area of ft^2 and height of ft. is filled with water until it is ft. deep. If a solid cube with edge length ft. is dropped to the bottom of the container, how much will the water rise?**

The volume of the cube is ft^3. Let the number of feet the water will rise be . Then the volume of the water over the ft. mark is ft^3 because this represents the area of the base (ft^2) times the height ( ). Because the volume of the cube is ft^3, ft^3 must equal ft^3.

Therefore, the water will rise – ft. or inches.

5. **A right prism container with a base area of ft^2 and height ft. is filled with water until it is ft. deep. A large boulder is dropped to the bottom of the container, and the water rises to the top completely submerging the boulder and without causing overflow. Find the volume of the boulder.**

The increase in volume is the same as the volume of the boulder. The height of the water increases ft. Therefore, the increase in volume is ft^2 (area of the base) multiplied by ft. (the change in height).

ft^2 ft. ft^3

Because the increase in volume is ft^3, the volume of the boulder is ft^3.

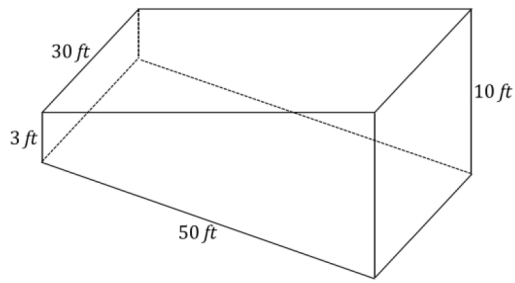
6. **A right prism container with a base area of ft^2 and height ft. is filled with water until it is ft. deep. A solid cube is dropped to the bottom of the container and the water rises to the top. Find the length of the cube.**

When the cube is dropped into the container, the water rises foot, which means the volume increase cubic feet.

Therefore, the volume of the cube must be cubic feet. We know that the length, width, and height of a cube are equal, so the length of the cube is feet because ft. ft. ft. ft^3, which is the volume of the cube.

7. A rectangular swimming pool is feet wide and feet long. The rectangular floor of the swimming pool is feet wide, feet deep at one end, and feet deep at the other.

a. Sketch the swimming pool as a right prism.



b. What kind of right prism is the swimming pool?

The swimming pool is a right trapezoidal prism.

c. What is the volume of the swimming pool in cubic feet?

_____

d. How many gallons will the swimming pool hold if each cubic feet of water is about gallons?

gal. gal. The pool will hold gal.

8. A milliliter (mL) has volume of cm^3. A mL measuring cup is filled to mL. A small stone is placed in the measuring cup. The stone is completely submerged and the water level rises to mL.

a. What is the volume of the stone in cm^3?

When the stone is dropped into the measuring cup, the increase in volume is mL . We know that mL has a volume of cm^3; therefore, the stone has a volume of cm^3.

b. Describe a right rectangular prism that has the same volume as the stone.

Answers will vary. Possible answers are listed below.

cm cm cm

cm cm cm

cm cm cm

cm cm cm