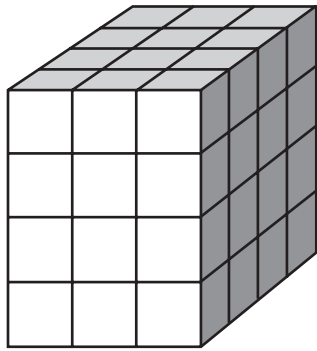


Lesson 24: Volume of Rectangular Prisms

Volume (V) is the amount of space inside a solid. Volume is measured in cubic units (units^3). To measure the volume of a rectangular prism, you can fill it with cubes whose sides are 1 unit in width, length, and height.

▶ Example

Determine the volume of the rectangular prism below.



The prism is made up of a collection of cubes. Each cube has a width, length, and height of 1 unit. Therefore, the volume of the prism will be equal to the number of unit cubes that compose it.

To find the number of cubes, you need to determine the length, width, and height of the prism. The prism is 3 cubes long, 4 cubes wide, and 4 cubes high. So, there are 12 cubes on each of the 4 levels of the prism.

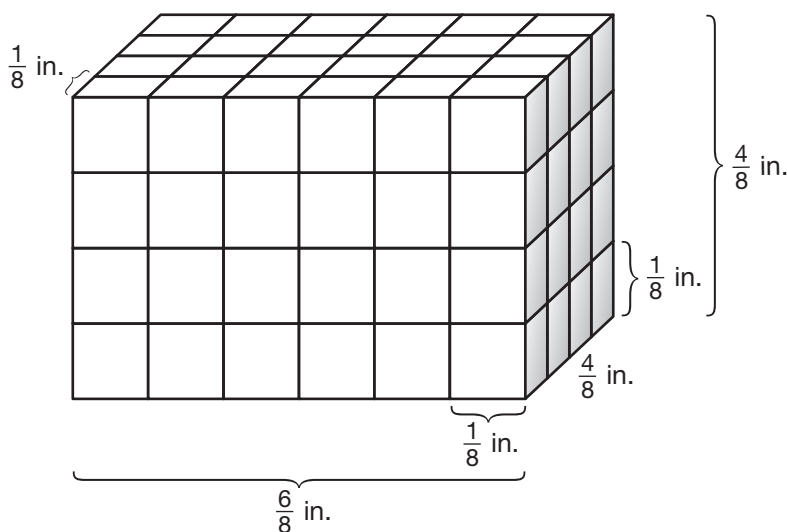
Therefore, the volume is $12 \times 4 = 48$ cubic units or 48 units^3 .

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

▶ Example

A rectangular prism has a length of $\frac{6}{8}$ in., a width of $\frac{4}{8}$ in., and a height of $\frac{4}{8}$ in. What is the volume of the rectangular prism?

In the illustration below, the rectangular prism is drawn so that it is made up of cubes that are $\frac{1}{8}$ in. in length, width, and height. Each cube has a volume of $\frac{1}{512}$ in.³. Because the length of the prism is $\frac{6}{8}$ in., the prism is 6 cubes long. Because its width is $\frac{4}{8}$ in., the prism is 4 cubes wide. Because its height is $\frac{4}{8}$ in., the prism is 4 cubes tall.



You can now use the model to find the volume of the prism. The prism has 6 by 4 by 4 cubes. Each of the 4 rows has 24 cubes, a total of ninety-six $\frac{1}{512}$ in.³ cubes. Multiply the number of cubes by the volume of each cube to find the total volume:

$$\begin{aligned} V &= 96 \times \frac{1}{512} \\ &= \frac{96}{512} \\ &= \frac{3}{16} \end{aligned}$$

Therefore, the volume is equal to $\frac{3}{16}$ in.³.

You can also determine the volume of a rectangular prism by multiplying the edge lengths of the prism. The formula for finding the volume of a rectangular prism is $V = lwh$, where V is volume, l is length, w is width, and h is height. You can also use $V = Bh$, where B is the area of the base of the prism and h is its height. Whether you use a diagram showing unit cubes or one of these formulas, the product will be the same.

▶ Example

Use the example of the rectangular prism from the previous page. Find the volume using a formula.

$$V = lwh$$

$$V = \left(\frac{6}{8}\right) \left(\frac{4}{8}\right) \left(\frac{4}{8}\right) \text{ in.}^3 \quad \text{Substitute the length, width, and height.}$$

$$V = \frac{6 \times 4 \times 4}{8 \times 8 \times 8} \text{ in.}^3 \quad \text{Multiply across the numerators and denominators.}$$

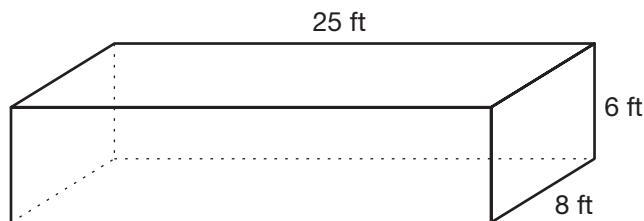
$$V = \frac{96}{512} \text{ in.}^3 \quad \text{Find the product.}$$

$$V = \frac{3}{16} \text{ in.}^3 \quad \text{Simplify.}$$

The area of the rectangular prism is the same for either method.

▶ Example

What is the volume of the swimming pool shown below?



The area of the base of a rectangular prism is the product of the length and the width. The base is $25 \text{ ft} \times 8 \text{ ft} = 200 \text{ ft}^2$. Now use the formula $V = Bh$.

$$V = Bh$$

$$V = (200 \text{ ft}^2)(6 \text{ ft}) \quad \text{Substitute the base and height.}$$

$$V = 1200 \text{ ft}^3 \quad \text{Multiply.}$$

The volume of the swimming pool is 1200 ft^3 .