

Finding the Volume of Rectangular Prisms

Grade 6 math · Lesson · Standards: 6.G.A.2

Quick answer: The volume of a rectangular prism is the number of unit cubes that fill it. Multiply length, width and height, $V = lwh$, or multiply the base area by the height, $V = Bh$. With fractional edges, pack with unit-fraction cubes or multiply the fractions. Answer in cubic units.

Standards: 6.G.A.2 · **Level:** Grade 6

What is volume, and how do unit cubes measure it?

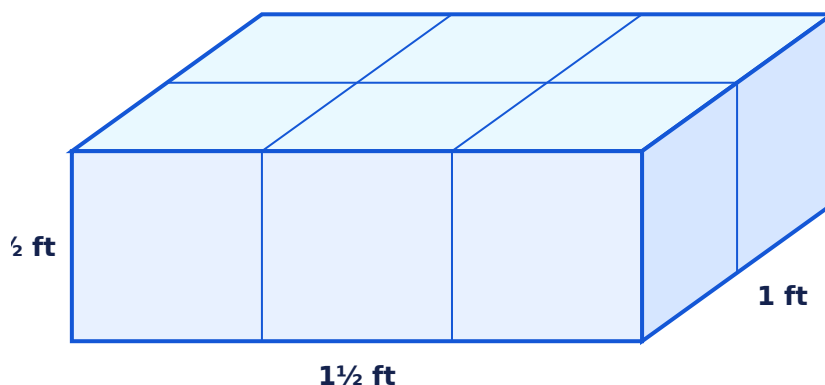
Volume describes the room inside a solid. Measure it by counting identical cubes that fill the solid completely, leaving no gaps and no overlaps.

Vocabulary

A **unit cube** is a cube measuring one unit on every edge, so it takes up 1 cubic unit. The **volume** of a solid equals the count of unit cubes inside it, reported in cubic units like in^3 , ft^3 or cm^3 .

How do you measure volume when the edges are fractions?

Fill the prism with smaller cubes whose edge is a unit fraction, such as $\frac{1}{2}$ or $\frac{1}{4}$. A cube with edges of $\frac{1}{2}$ foot has volume $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$ cubic foot. The prism below is $1\frac{1}{2}$ ft by 1 ft by $\frac{1}{2}$ ft, so it holds $3 \times 2 \times 1 = 6$ of these cubes.



A prism packed with cubes whose edges are $\frac{1}{2}$ ft: 3 by 2 by 1 cubes.

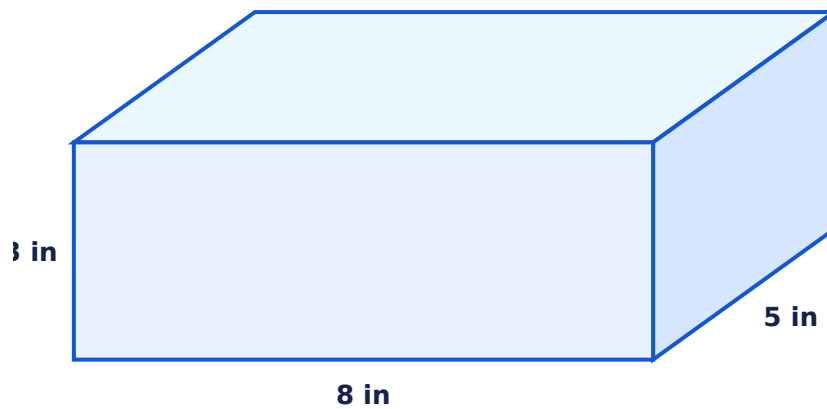
Total volume: $6 \times \frac{1}{8} = \frac{3}{4}$ cubic foot. Multiplying the edges gives the same result: $1\frac{1}{2} \times 1 \times \frac{1}{2} = \frac{3}{4}$.

What are the volume formulas for a rectangular prism?

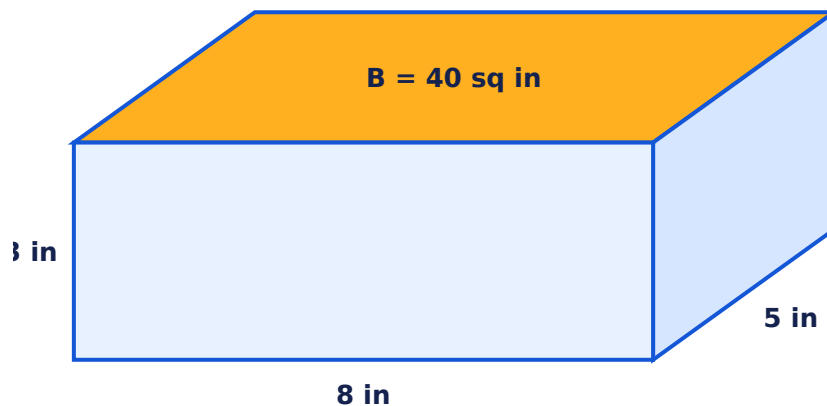
Volume formulas

$$V = l \times w \times h \quad \text{or} \quad V = B \times h$$

B is the area of the base. Either multiply the base area by the height or multiply all three edges together.



A box 8 in long, 5 in wide and 3 in tall.



The shaded base has area $B = 40$ square inches.

Method: volume of a prism

1. Write the length, width and height with the same unit.
2. Choose $V = lwh$, or $V = Bh$ if the base area is given.
3. Multiply, using fraction or decimal multiplication as needed.
4. Write the answer in cubic units.

Worked example

A planter box is $2\frac{1}{2}$ ft long, $1\frac{1}{2}$ ft wide and $\frac{3}{4}$ ft deep. Find its volume.

$$V = \frac{5}{2} \times \frac{3}{2} \times \frac{3}{4} = \frac{45}{16} = 2\frac{13}{16} \text{ cubic feet.}$$

Common mistake

Writing square units for volume, or adding the three edges instead of multiplying them. Volume is always cubic units.

Mathbot's tip

Picture one layer first: base area tells how many cubes cover the floor. Then stack as many layers as the height says.

Key points to remember

- Volume counts unit cubes and is measured in cubic units such as ft^3 .
- $V = lwh$ and $V = Bh$ give the same volume for a right rectangular prism.
- A cube with edge $\frac{1}{2}$ has volume $\frac{1}{8}$ cubic unit.
- All edges must use the same unit before multiplying.

Finding the Volume of Rectangular Prisms: frequently asked questions

What is a unit cube?

A unit cube has edges one unit long, so its volume is 1 cubic unit. Cubes with smaller edges, such as $\frac{1}{2}$ foot, can also be used as a measuring unit.

Why is a cube with edge $\frac{1}{2}$ foot worth $\frac{1}{8}$ cubic foot?

Eight such cubes fit in a 1 foot by 1 foot by 1 foot cube, because $2 \times 2 \times 2 = 8$. Each small cube is therefore one eighth of a cubic foot.

What does B mean in $V = Bh$?

B is the area of the base of the prism, found by multiplying two of its edges. The height h is the edge perpendicular to the base.

Can I multiply fractions to get volume?

Yes. Multiplying the three edge lengths works for whole numbers, fractions and decimals. The result matches counting unit-fraction cubes.

How do I find a missing edge when the volume is known?

Divide the volume by the product of the two known edges. For $V = 180$ with $l = 9$ and $w = 5$, the height is $180 \div 45 = 4$.