VOLUME of Rectangular Prisms

- Volume is the measure of ________________ occupied by a solid region.

**The formula for the volume of a rectangular prism is:**

\[ V = l \times w \times h \]

*Study Tip:

When measuring volume, the units will be “cubed.” A cubic centimeter (cm³) is a cube whose edges all measure 1 centimeter.

Examples:

Find the **volume** of each rectangular prism. Round to the nearest tenth if necessary.

1. [Diagram of rectangular prism with dimensions 7.5 in. x 4 in. x 2 in.]

2. [Diagram of rectangular prism with dimensions 4 cm x 9 cm x 5.1 cm]

3. Find the **volume** of a fish tank that is 8 feet long and 5 feet wide, if the height is 5.5 feet?
You try!!

1. A rectangular prism measuring 10 m and 7 m along the base and 12 m tall.

2. A square prism measuring 6 km along each edge of the base and 5 km tall.

3. A cube measuring 9 in along each edge.

5. A rectangular prism measuring 10 m and 7 m along the base and 12 m tall.

6. A square prism measuring 6 km along each edge of the base and 5 km tall.

7. A cube measuring 9 in along each edge.
The volume of a solid is the measure of space occupied by it. It is measured in cubic units such as cubic centimeters (cm³) or cubic inches (in³). The volume of the figure at the right can be shown using cubes.

It takes 12 · 2 or 24 cubes to fill the box. So, the volume of the box is 24 cubic meters.

A rectangular prism is a solid figure that has two parallel and congruent sides, or bases, that are rectangles. To find the volume of a rectangular prism, multiply the area of the base and the height, or find the product of the length \( \ell \), the width \( w \), and the height \( h \).

\[ V = Bh \] or \[ V = \ell wh \]

**Example 1**

Find the volume of the rectangular prism.

\[ V = \ell wh \quad \text{Volume of a rectangular prism} \]
\[ V = 5 \cdot 6 \cdot 8 \quad \text{Replace } \ell \text{ with } 5, \ w \text{ with } 6, \text{ and } h \text{ with } 8. \]
\[ V = 240 \quad \text{Multiply.} \]

The volume is 240 cubic inches.

**Exercises**

Find the volume of each rectangular prism. Round to the nearest tenth if necessary.

1. \( \ell = 4 \text{ m}, \ w = 3 \text{ m}, \ h = 7 \text{ m} \)
2. \( \ell = 9 \text{ cm}, \ w = 10 \text{ cm}, \ h = 7 \text{ cm} \)
3. \( \ell = 2.7 \text{ ft}, \ w = 2 \text{ ft}, \ h = 3 \text{ ft} \)
Find the volume of each rectangular prism. Round to the nearest tenth if necessary.

1. 2. 3. 4. 5. 6. 7. 8. 9.

1. 3 cm 7 cm
   3 cm

2. 10 in. 6 in.
   5 in.

3. 6 m 4 m
   4 m

4. 12 mm
   3 mm 5 mm

5. 9.5 in.
   2.8 in.
   7 in.

6. 9 cm
   3 cm
   7.2 cm

7. 4 \frac{3}{4} ft
   2 \frac{1}{2} ft 4 ft

8. 9.6 in.
   4.8 in.
   15 in.

9. 4.5 cm
   1.2 cm
   1.5 cm
Notes: Surface Area of Rectangular Prisms & Cubes

- The **sum of the areas** of all the surfaces, or ______________, contained in a three-dimensional figure (solid) is called the _________________.

  - Rectangular prisms are made up of 6 rectangular faces.
  - We have to **find the areas** of all six faces.
  - Then **add them together** to find the **surface area** of the solid.

**The formula for the Surface Area of a RECTANGULAR PRISM is:**

\[
l = \text{length} \quad w = \text{width} \quad h = \text{height}
\]

Examples: Find the surface area of each rectangular prism.
You Try!! Find the surface area of each rectangular prism.

1)

![Rectangular Prism 1](image)

2)

![Rectangular Prism 2](image)

3)

![Rectangular Prism 3](image)

4)

![Rectangular Prism 4](image)

How would you find the surface area of a Pyramid?

- A square-based Pyramid is made up of five faces: **four triangles and one square.**
- Find the area of these shapes and add them together!
Find the surface area of the rectangular prism.

You can use the net of the rectangular prism to find its surface area. There are three pairs of congruent faces in a rectangular prism:

- top and bottom
- front and back
- two sides

**Faces** | **Area**
--- | ---
top and bottom | \((4 \cdot 3) + (4 \cdot 3) = 24\)
front and back | \((4 \cdot 2) + (4 \cdot 2) = 16\)
two sides | \((2 \cdot 3) + (2 \cdot 3) = 12\)

Sum of the areas: \(24 + 16 + 12 = 52\)

Alternatively, replace \(\ell\) with 4, \(w\) with 3, and \(h\) with 2 in the formula for surface area.

\[
S = 2\ell w + 2\ell h + 2wh
\]

\[
= 2 \cdot 4 \cdot 3 + 2 \cdot 4 \cdot 2 + 2 \cdot 3 \cdot 2
\]

Follow order of operations.

\[
= 24 + 16 + 12
\]

\[
= 52
\]

So, the surface area of the rectangular prism is 52 square meters.

**EXERCISES**

Find the surface area of each rectangular prism.

1. 

2. 

3. 

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Practice: Skills

Surface Area of Rectangular Prisms

Find the surface area of each rectangular prism. Round to the nearest tenth if necessary.

1. 

2. 

3. 

4. 

5. 

6. 

7. 

8. 

9. 

10. A cube has a surface area of 126 square feet. What is the area of one face?

11. Find the surface area of a rectangular prism that has a length of 8 inches, a width of 3 inches, and a height of 6 inches.