VOLUME OF A PRISM

Volume is a three-dimensional concept. It measures the amount of interior space of a three-dimensional figure based on a cubic unit, that is, the number of 1 by 1 by 1 cubes that will fit inside a figure.

The volume of a prism is the area of either base \((B)\) multiplied by the height \((h)\) of the prism.

\[ V = (\text{Area of base}) \cdot (\text{height}) \quad \text{or} \quad V = Bh \]

For additional information, see the Math Notes box in Lesson 9.2.1 of the Core Connections, Course 1 text.

Example 1

Find the volume of the square prism below.

The base is a square with area \((B)\)
\[ 8 \cdot 8 = 64 \text{ units}^2. \]

Volume \(= B(h)\)
\[ = 64(5) \]
\[ = 320 \text{ units}^3 \]

Example 2

Find the volume of the triangular prism below.

The base is a right triangle with area
\[ \frac{1}{2} (5)(7) = 17.5 \text{ units}^2. \]

Volume \(= B(h)\)
\[ = 17.5(9) \]
\[ = 157.5 \text{ units}^3 \]

Example 3

Find the volume of the trapezoidal prism below.

The base is a trapezoid with area \(\frac{1}{2} (7 + 15) \cdot 8 = 88 \text{ units}^2.\)

Volume \(= B(h)\)
\[ = 88(10) \]
\[ = 880 \text{ units}^3 \]

Example 4

Find the height of the prism with a volume of 132.5 cm\(^3\) and base area of 25 cm\(^2\).

Volume \(= B(h)\)
\[ 132.5 = 25(h) \]
\[ h = \frac{132.5}{25} \]
\[ h = 5.3 \text{ cm} \]
Problems

Calculate the volume of each prism. The base of each figure is shaded.

1. rectangular prism  
   ![](image1.png)  
   2. right triangular prism  
   ![](image2.png)  
   3. rectangular prism  
   ![](image3.png)  

4. right triangular prism  
   ![](image4.png)  

5. trapezoidal prism  
   ![](image5.png)  

6. triangular prism with  
   $B = 15\frac{1}{2}$ cm$^2$  
   ![](image6.png)  

7. Find the volume of a prism with base area 32 cm$^2$ and height 1.5 cm.

8. Find the height of a prism with base area 32 cm$^2$ and volume 176 cm$^3$.

9. Find the base area of a prism with volume 47.01 cm$^3$ and height 3.2 cm.

Answers

1. 12 ft$^3$  
2. 168 cm$^3$  
3. 240 in.$^3$  
4. 64.8 cm$^3$  
5. 324 ft$^3$

6. $127\frac{7}{8}$ cm$^3$  
7. 48 cm$^3$  
8. 5.5 cm  
9. 14.7 cm$^2$
SURFACE AREA OF A PRISM

The surface area of a prism is the sum of the areas of all of the faces, including the bases. Surface area is expressed in square units.

For additional information, see the Math Notes boxes in Lessons 9.2.1 and 9.2.2 of the Core Connections, Course 1 text.

Example

Find the surface area of the triangular prism at right.

Step 1: Area of the 2 bases: \(2 \left( \frac{1}{2} \times (6 \text{ cm})(8 \text{ cm}) \right) = 48 \text{ cm}^2\)

Step 2: Area of the 3 lateral faces
   - Area of face 1: \((6 \text{ cm})(7 \text{ cm}) = 42 \text{ cm}^2\)
   - Area of face 2: \((8 \text{ cm})(7 \text{ cm}) = 56 \text{ cm}^2\)
   - Area of face 3: \((10 \text{ cm})(7 \text{ cm}) = 70 \text{ cm}^2\)

Step 3: Surface Area of Prism = sum of bases and lateral faces:
\[ SA = 48 \text{ cm}^2 + 42 \text{ cm}^2 + 56 \text{ cm}^2 + 70 \text{ cm}^2 = 216 \text{ cm}^2 \]
Problems

Find the surface area of each prism.

1.

2.

3.

4.

5. The pentagon is equilateral.

6.

Answers

1. 314 mm$^2$

2. 192 cm$^2$

3. 210 ft$^2$

4. 192 cm$^2$

5. 344 ft$^2$

6. 408 cm$^2$