Name: Date: Period:

Volume and Surface Area of Solids (Prisms and Cylinders)

Lesson Objective SWBAT find & use volume of prisms & cylinders use formula for density, find surface area for prisms & cylinders

The volume of a solid is the number of cubic units contained in its interior.

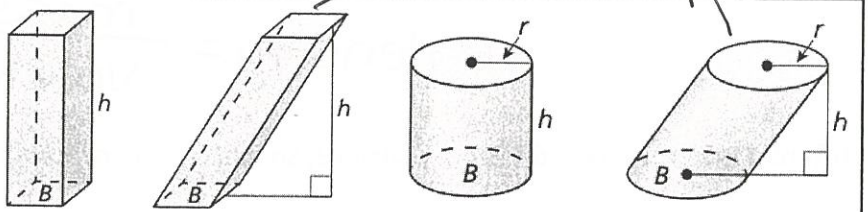
Volume is measured in cubic units, such as cm^3.

"oblique" prism or cyl...

Volume of a Prism or Cylinder

The volume V is a prism is $V = Bh$,

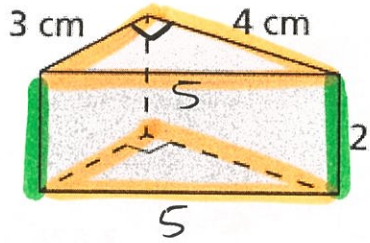
where B is the area of the base and h is the height.



≅ & // → dist. btwn bases (⊥)

Examples:

1. Find the volume.



△ is base

$B = \frac{1}{2}bh$

$= \frac{1}{2}(3)(4)$

$= 6\ cm^2$

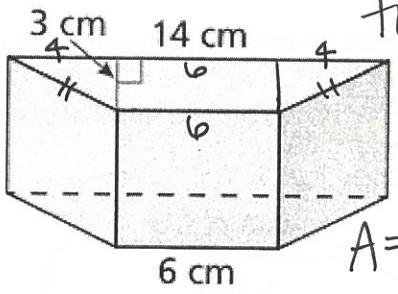
$h = 2\ cm$

$V = (B)(h)$

$V = (6)(2)$

$V = 12\ cm^3$

2. Find the volume.



trap. is base

$A = \frac{(b_1+b_2)h}{2}$

$B = \frac{(14+6)(3}{2}$

$= \frac{(20)(3)}{2}$

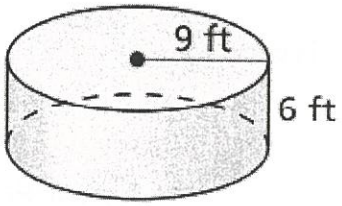
$= 30$

$h = 5$

$V = (30)(5)$

$V = 150\ cm^3$

3. Find the volume.



⊙ is base

$B = \pi(9)^2$

$= 81\pi$

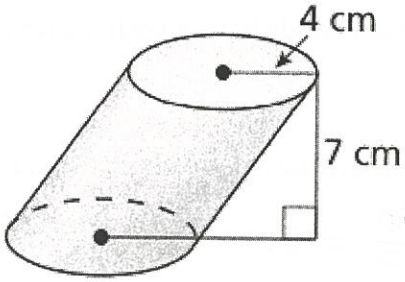
$h = 6$

$V = (81\pi)(6)$

$V = 486\pi\ ft^3$

$V \approx 1526.81\ ft^3$

4. Find the volume.



⊙ is base

$B = \pi(4)^2$

$= 16\pi$

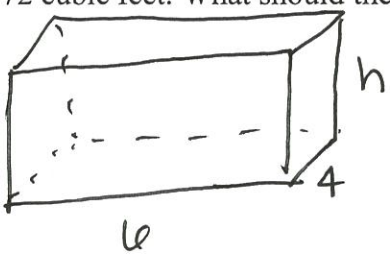
$h = 7$

$V = (16\pi)(7)$

$V = 112\pi\ cm^3$

$V \approx 351.86\ cm^3$

4. You are building a rectangular chest. You want the length to be 6 ft , the width to be 4 ft, and the volume to be 72 cubic feet. What should the height be?



$V = Bh$

$72 = (6 \cdot 4)(h)$

$h = 3$

3 ft tall

Density: Density is the amount of matter that an object has in a given unit of volume. The density is calculated by dividing its mass by its volume.

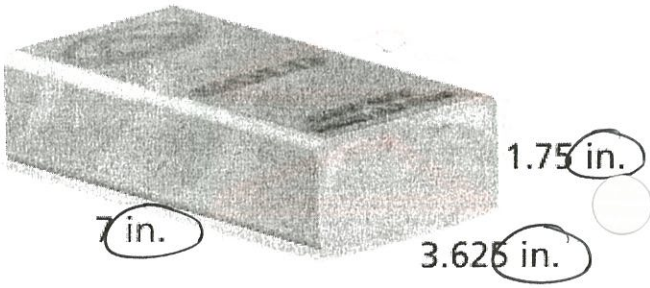
$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Different materials have different densities, so density can be used to distinguish between materials that look similar.

For example, table salt and sugar look alike. However, table salt has a density of 2.16 grams per cubic centimeter, while sugar has a density of 1.58 grams per cubic centimeter.

Example:

5. The diagram shows the dimensions of a standard gold bar at Fort Knox. Gold has a density of 19.3 grams per cubic centimeter. Find the mass of a standard gold bar to the nearest gram.



$D = \frac{\text{Mass}}{\text{Vol}}$

$19.3 = \frac{\text{Mass}}{727.82}$ → ≈14047 g

$V = (7)(3.625)(1.75)$

$V = 44.41 \text{ in}^3 \times \frac{16.39 \text{ cm}^3}{1 \text{ in}^3}$

$V = 727.82 \text{ cm}^3$

Mass = 14046.9 grams

Similar Solids: Two solids of the same type with equal ratios of corresponding linear measures, such as height or radii, are called similar solids.

→ The ratio of the corresponding linear measures of two similar solids is called the scale factor

→ If two similar solids have a scale factor of k, then the ratio of their volumes is equal to k^3.

Example:

6. Cylinder A and cylinder B are similar. Find the volume of cylinder B.

$K = \frac{B}{A} = \frac{6}{3} = 2$

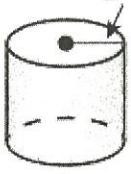
$\frac{\text{Vol. B}}{\text{Vol. A}} = (2)^3$

$\frac{x}{45\pi} = 8$ → $x = 360\pi \text{ cm}^3$, $x \approx 1130.97 \text{ cm}^3$

$K = \frac{A}{B} = \frac{3}{6} = \frac{1}{2}$

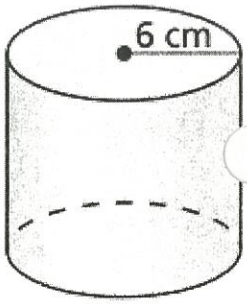
$\frac{\text{Vol. A}}{\text{Vol. B}} = \left(\frac{1}{2}\right)^3$

Cylinder A

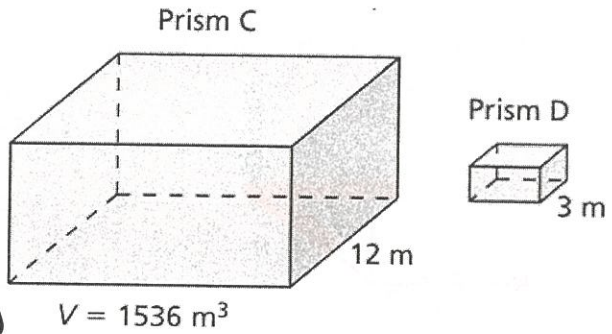


$V = 45\pi \text{ cm}^3$

Cylinder B



7. Prism C and prism D are similar. Find the volume of prism D.



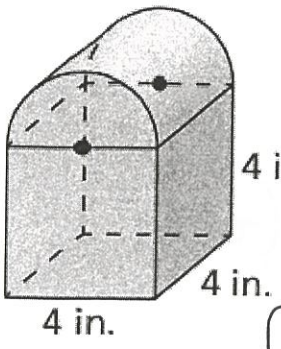
$K = \frac{C}{D} = \frac{12}{3} = 4$

$\frac{\text{Vol. C}}{\text{Vol. D}} = (4)^3$

$\frac{1536}{x} = \frac{64}{1}$ → $64x = 1536$

$x = 24\ m^3$

8. Find the volume of the figure.



$\frac{1}{2}$ cyl. + cube

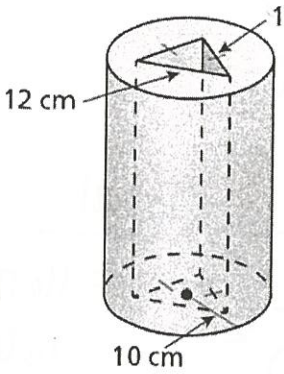
$\frac{1}{2}Bh + (4)(4)(4)$

$\frac{1}{2}(\pi(2)^2 \cdot 4) + 64$

$V = 8\pi + 64\ in^3$

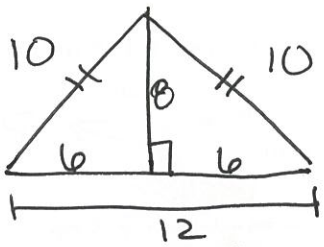
$V \approx 89.13\ in^3$

9. Find the volume of the figure.



cyl − Δ prism

$Bh - Bh$

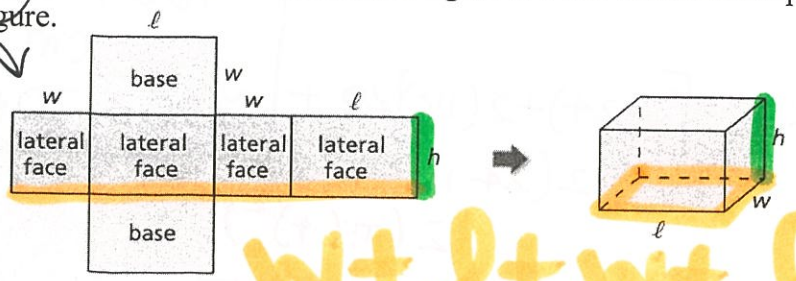


$(\pi(10)^2 \cdot 32) - (\frac{1}{2}(12)(8) \cdot 32)$

$V = 3200\pi - 1536\ cm^3$

$V \approx 8517.10\ cm^3$

Net: A net for a three-dimensional figure is a two-dimensional pattern that can be folded to form a three-dimensional figure.



$w + \ell + w + \ell$ = perimeter of base (P)

Lateral Area: The sum of the areas of the lateral faces of a prism EXCEPT for the base(s)

↳ Ph

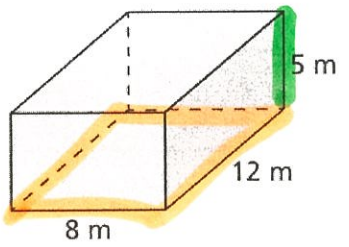
Surface Area: The TOTAL AREA of all faces and curved surfaces in a 3-D figure.

☆ *You can think about it this way*: Say the solid was dropped into and fully submerged in a bucket of paint. The amount of paint used to cover it represents the surface area!

➔ *PRISM/CYLINDER:* Lateral Area + Area of 2 Bases ⟶ $Ph + 2B$

Example:

10. Draw the net for the figure then find its surface area.



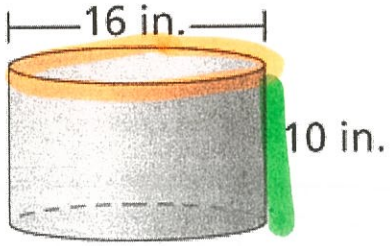
$SA = Ph + 2B$

$= (8+12+8+12)(5) + 2(8 \cdot 12)$

$= 200 + 192$

$= 392 \text{ m}^2$

11. Draw the net for the figure then find its surface area.



$SA = Ph + 2B$

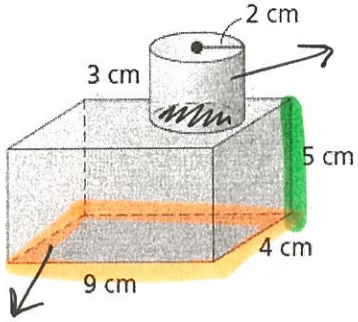
$= (2\pi(8) \cdot 10) + 2(\pi(8)^2)$

$= 160\pi + 128\pi$

$= 288\pi \text{ in}^2$

$\approx 904.78 \text{ in}^2$

12. Find the surface area of the figure.



$Ph + B = 2\pi(2) \cdot 3 + \pi(2)^2$

$= 12\pi + 4\pi$

$= 16\pi$

$Ph + 2B - \odot = (9+4+9+4)(5) + 2(9 \cdot 4) - \pi(2)^2$

$= 130 + 72 - 4\pi$

$= 202 - 4\pi$

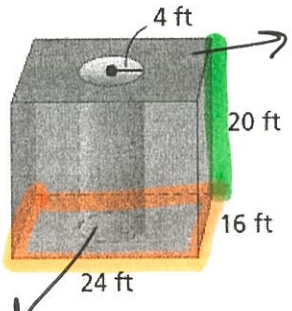
Total SA

$= 16\pi + 202 - 4\pi$

$= 202 + 12\pi \text{ cm}^2$

$\approx 239.70 \text{ cm}^2$

13. Find the surface area of the figure.



$Ph + 2B - 2\odot = (2 \cdot 24) + 2(16)20 + 2(24 \cdot 16) - 2(\pi(4)^2)$

$= 1600 + 768 - 32\pi$

$= 2368 - 32\pi$

inside: Ph (cyl)

$= 2\pi(4)(20)$

$= 160\pi$

Total SA

$= 160\pi + 2368 - 32\pi$

$= 2368 + 128\pi \text{ ft}^2 \approx 2770.12 \text{ ft}^2$