

Name: Key

Class: _____

M8-U8: Notes #1 - Volume of 3-D Figures - Cylinders

Date: _____

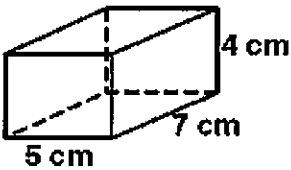
Volume – the number of cubic units needed to fill a solid.

To find the volume of a prism or cylinder, multiply the base area (B) by the height h .

A. Rectangular prisms

Formula: $V = Bh$ (what is the base in a rectangular prism?)
 $V = (\text{length})(\text{width})(\text{height})$

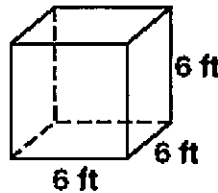
Example 1:



$$V = lwh$$
$$= (5)(7)(4)$$

Volume = 140 cm³

Example 2:



$$V = (6)(6)(6)$$
$$= 216$$

or $V = s^3$
 $= (6)^3$

Volume = 216 ft³

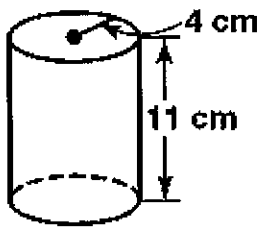
B. Cylinders – have two bases that are parallel, congruent circles.

Formula: $V = Bh$ (what is the base in a cylinder?)
 $V = (\pi r^2)h$

(Since the area of the base is a circle, the area of a circle is πr^2 . We have to multiply by its height.)

Find the volume.

Example 3:



$$V = \pi (4)^2 (11)$$
$$= \pi (16)(11)$$

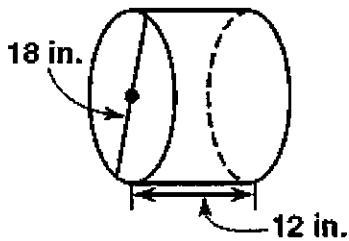
Volume = $\frac{176\pi \text{ cm}^3}{\text{exact answer}}$

Find the volume to the nearest tenth.

$$\approx 552.920307$$

Volume \approx 552.9 cm^3

Example 4: (Hint: What's the radius?)



$$d = 18 \text{ in}$$
$$r = 9 \text{ in}$$

$$V = \pi (9)^2 (12)$$
$$= \pi (81)(12)$$

Volume = $\frac{972\pi \text{ in}^3}{\text{exact answer}}$

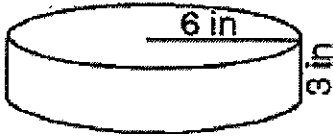
$$\approx 3053.628059$$

Volume \approx 3053.6 in^3

C. Comparing/Analyzing volumes.

Example 5:

- a) Given the following figure, find the volume (leave in terms of π).



$$\begin{aligned}V &= \pi (6)^2 (3) \\&= \pi (36)(3) \\&= 108\pi \text{ in}^3\end{aligned}$$

- b) Double the height, find the new volume (leave in terms of π).

$$\begin{aligned}V &= \pi (6)^2 (6) \\&= \pi (36)(6) \\&= 216\pi \text{ in}^3\end{aligned}$$

- c) How do the two volumes compare?

$$\frac{216\pi}{108\pi} = 2 \quad \text{The volume doubles.}$$

- d) Double the radius of the original cylinder, find the volume (leave in terms of π). How does this volume compare to the one you found in part a? Why?

$$\begin{aligned}V &= \pi (6 \cdot 2)^2 (3) \\&= \pi (12)^2 (3) \\&= \pi (144)(3) \\&= 432\pi \text{ in}^3\end{aligned}$$

$$\frac{432\pi}{108\pi} = 4$$

The volume quadrupled.

Because if you square 2 it's 4.

D. Determining missing lengths.

Example 6:

The volume of a cylinder is 405π with a diameter of 18. Find the height of the cylinder.

$$d=18, r=9$$

$$\begin{aligned} V &= \pi r^2 h \\ 405\pi &= \pi (9)^2 h \\ \frac{405\pi}{81\pi} &= \frac{81\pi h}{81\pi} \\ \boxed{5 \text{ units} = h} \end{aligned}$$

Example 7:

A can of soup contains about 553 cubic centimeters of soup. The height of the can is 11 cm. What is the approximate diameter of the can to the nearest centimeter?

$$\begin{aligned} V &= \pi r^2 h \\ \frac{553}{11\pi} &= \frac{\pi r^2 (11)}{11\pi} \\ \sqrt{16.0023061} &= \sqrt{r^2} \\ 4.000288252 &\approx r \end{aligned}$$

double radius to get a diameter.

$$d \approx 8.000576504$$

$$\boxed{d \approx 8 \text{ cm}}$$

Example 8:

The Robert's family uses a container shaped like a cylinder to recycle aluminum cans. It has a diameter of 1.5 feet and a volume of $2.25\pi \text{ ft}^3$. If the container is filled half way to the top, what is the height that the cans reach?

$$d=1.5, r=.75$$

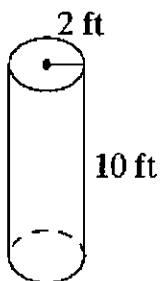
$$\begin{aligned} V &= \pi r^2 h \\ 2.25\pi &= \pi (.75)^2 h \\ \frac{2.25\pi}{.5625\pi} &= \frac{.5625\pi h}{.5625\pi} \\ 4 \text{ ft} &= h \end{aligned}$$

Since it's only filled $\frac{1}{2}$ it reaches up 2ft.

Additional Practice:

Find the volume of each solid. Show all work.

1.



$$\begin{aligned} V &= \pi r^2 h \\ &= \pi (2)^2 (10) \\ &= 40\pi \end{aligned}$$

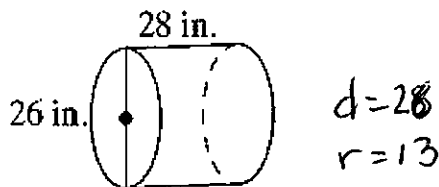
Volume = $40\pi \text{ ft}^3$

Find the volume to the nearest tenth.

$$\approx 125.6637061$$

Volume \approx 125.7 ft^3

2.



$$\begin{aligned} V &= \pi (13)^2 (28) \\ &= \end{aligned}$$

Volume = $4732\pi \text{ in}^3$

$$\approx 14866.01644$$

Volume \approx 14866.0 in^3

3. A scented candle is in the shape of a cylinder, with a radius of 4cm and a height of 12cm.

a) Find the volume (leave in terms of π).

$$\begin{aligned} V &= \pi (4)^2 (12) \\ &= 192\pi \text{ cm}^3 \end{aligned}$$

b) Double the radius, find the new volume (leave in terms of π).

$$\begin{aligned} V &= \pi (4 \cdot 2)^2 (12) \\ &= \pi (8)^2 (12) \\ &= \pi (64)(12) \\ &= 768\pi \text{ cm}^3 \end{aligned}$$

c) How do the two volumes compare?

$$\frac{768\pi}{192\pi} = 4$$

The volume quadrupled.

4. A cylindrical cake takes up 32π cubic inches. The diameter of the cake is 8 inches, what is the height of the cake?

$$d = 8, r = 4$$

$$V = \pi r^2 h$$

$$32\pi = \pi(4)^2 h$$

$$\frac{32\pi}{16\pi} = \frac{16\pi h}{16\pi}$$

$$\boxed{2 \text{ in} = h}$$

5. The human eye contains "rods", primarily responsible for night vision, which have an approximate diameter and length of 2.0×10^{-7} meters and 4.0×10^{-5} meters respectively. What is the approximate volume of the solid?

$$V = \pi r^2 h$$

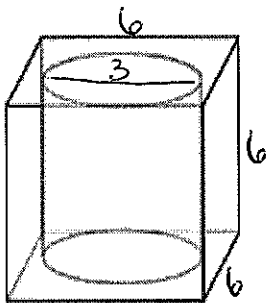
$$d = 2.0 \times 10^{-7}, r = 1.0 \times 10^{-7}$$

$$= \pi(1.0 \times 10^{-7})^2 (4.0 \times 10^{-5})$$

$$\boxed{V = 4 \times 10^{-19} \pi \text{ m}^3}$$

$$\text{or } 1.256637061 \times 10^{-18} \text{ m}^3$$

6. Nate uses a cube shaped bead with side lengths measuring 6mm. Each bead has a circular hole in the middle. The diameter of the circular hole is 3mm. Find the volume of the bead.



[not drawn to scale]

$$V_{\text{cube}} = s^3$$

$$= (6)^3$$

$$= 216$$

$$V_{\text{cy}} = \pi r^2 h$$

$$= \pi(1.5)^2(6)$$

$$= 13.5\pi$$

$$\text{Volume} = \underline{216 - 13.5\pi \text{ mm}^3}$$

Find the volume to the nearest tenth.

$$\approx 173.5884992$$

$$\text{Volume} \approx \underline{173.6 \text{ mm}^3}$$