

Volume of Cylinders

Name: _____

Date: _____

Score: _____ / 17

Think of a soup can or a drinking glass—that is a **cylinder**! Its volume tells you how much fits inside, and the formula is $V = \pi r^2 h$: find the area of the circular base (πr^2) and multiply by the height. This is the exact same idea as prism volume (base area \times height), except the base happens to be a circle. One common trap: make sure you are using the *radius*, not the diameter—if the problem gives you the diameter, divide by 2 first. Answers come in *cubic* units because you are measuring three-dimensional space!



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

Key Concepts & Quick Review

Volume of a Cylinder:

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

where r = radius of the circular base and h = height.

If given the diameter, divide by 2 first: $r = \frac{d}{2}$.

Use $\pi \approx 3.14$ (or the π button on your calculator) unless told otherwise.

Units: Volume is measured in *cubic* units (cm^3 , in^3 , ft^3 , etc.).

Examples

① Find the volume of a cylinder with radius 5 *cm* and height 10 *cm*. Use $\pi \approx 3.14$.

Think It Through: The base of this cylinder is a circle with radius 5 *cm*, so its area is $\pi r^2 = 3.14 \times 25 = 78.5 \text{ cm}^2$. Now imagine stacking that circle 10 *cm* high: $V = 78.5 \times 10 = 785 \text{ cm}^3$. That is all there is to cylinder volume—base area times height!

Answer: 785 cm^3

② A cylinder has a diameter of 8 *in* and a height of 12 *in*. Find its volume. Use $\pi \approx 3.14$.

Think It Through: Be careful—the problem gives the *diameter*, not the radius! Divide first: $r = \frac{8}{2} = 4 \text{ in}$. Now find the base area: $3.14 \times 4^2 = 3.14 \times 16 = 50.24 \text{ in}^2$. Multiply by the height: $50.24 \times 12 = 602.88 \text{ in}^3$.

Answer: 602.88 in^3



Practice Problems

Find the volume of each cylinder. Use $\pi \approx 3.14$. Round to the nearest hundredth.

- Find the volume of a cylinder with radius _____
3 cm and height 7 cm.
- Find the volume of a cylinder with radius _____
6 in and height 10 in.
- Find the volume of a cylinder with diame- _____
ter 10 m and height 4 m.
- Find the volume of a cylinder with radius _____
2 ft and height 9 ft.
- Find the volume of a cylinder with diame- _____
ter 14 cm and height 5 cm.
- Find the volume of a cylinder with radius _____
8 in and height 3 in.



- Find the volume of a cylinder with radius _____
1.5 m and height 12 m.

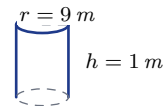


- Find the volume of a cylinder with diame- _____
ter 6 ft and height 8 ft.

- Find the volume of a cylinder with radius _____
10 cm and height 10 cm.
- Find the volume of a cylinder with diame- _____
ter 20 in and height 6 in.
- Find the volume of a cylinder with radius _____
4 m and height 15 m.
- Find the volume of a cylinder with radius _____
7 cm and height 2 cm.
- Find the volume of a cylinder with diame- _____
ter 12 ft and height 11 ft.



- Find the volume of a cylinder with radius _____
5 in and height 5 in.
- Find the volume of a cylinder with radius _____
9 m and height 1 m.



Study Tips

- Always check whether you are given the **radius** or the **diameter**. Forgetting to divide the diameter by 2 is the most common mistake.
- Think of a cylinder as a stack of circles. The base area (πr^2) times the height gives the total volume.
- Volume answers are always in **cubic units**. Don't forget the exponent 3!

Word Problems

- A soup can has a radius of 4 cm and a height of 11 cm. How many cubic centimeters of soup does it hold? Use $\pi \approx 3.14$. _____
- A cylindrical water tank has a diameter of 6 ft and a height of 8 ft. How many cubic feet of water can it hold? Use $\pi \approx 3.14$. _____



Answer Keys

- | | |
|---|---|
| <p>1) 197.82 cm^3</p> <p>2) $1,130.4 \text{ in}^3$</p> <p>3) 314 m^3</p> <p>4) 113.04 ft^3</p> <p>5) 769.3 cm^3</p> <p>6) 602.88 in^3</p> <p>7) 84.78 m^3</p> <p>8) 226.08 ft^3</p> <p>9) $3,140 \text{ cm}^3$</p> | <p>10) $1,884 \text{ in}^3$</p> <p>11) 753.6 ft^3</p> <p>12) 307.72 cm^3</p> <p>13) $1,243.44 \text{ ft}^3$</p> <p>14) 392.5 in^3</p> <p>15) 254.34 m^3</p> <p>16) 552.64 cm^3</p> <p>17) 226.08 ft^3</p> |
|---|---|

Step-by-Step Explanations

Strategy: For Area & Perimeter of Composite Figures with Circles, break the figure into familiar parts, add included areas, subtract holes or removed pieces, and trace only the outside for perimeter. A quick boundary trace keeps area pieces and perimeter edges from getting mixed together.

Practice 1: Find the total area and perimeter. **Answer:** $A=65.12$; $P=30.56$

In the opening example, separate straight-sided pieces from circular pieces so each formula is used in the right place.

Practice 15: Find the area left after the quarter circle is removed. **Answer:** 15.38

For the end-of-set item, trace the outside edge for perimeter and count only the arcs and sides that are actually exposed.

Word-problem notes:

16. Answer: Total: $90 \times 60 + \pi(30)^2 = 5,400 + 2,827.4 \approx 8,227.4 \text{ m}^2$; inside lane = $2(90) + 2\pi(30) \approx 368.5 \text{ m}$; unwatered: $\approx 2,827.4 \text{ m}^2$.

The track shape is a rectangle with two semicircular ends, which together make one full circle of radius 30 m . So the enclosed area is the rectangle area $90 \times 60 = 5,400 \text{ m}^2$ plus the circle area $\pi(30)^2 \approx 2,827.4 \text{ m}^2$. Add them to get about $8,227.4 \text{ m}^2$. For the inside lane length, use the two long straight sections, 2×90 , plus the full circular part $2\pi(30)$. The sprinkler waters only the rectangle, so the unwatered part is exactly the two semicircular ends, which total about $2,827.4 \text{ m}^2$.

17. Answer: Rectangle + semicircle: $4,800 + \frac{1}{2}\pi(30)^2 \approx 4,800 + 1,413.7 = 6,213.7 \text{ cm}^2$; medallion: $\pi(10)^2 \approx 314.2$; colored: $\approx 5,899.5 \text{ cm}^2$.

Split the window into a rectangle and a semicircle. The rectangle area is $60 \times 80 = 4,800 \text{ cm}^2$. The arch is a semicircle with radius 30 cm , so its area is $\frac{1}{2}\pi(30)^2 \approx 1,413.7 \text{ cm}^2$. Adding gives a total window area of about $6,213.7 \text{ cm}^2$. The clear medallion has diameter 20 cm , so radius 10 cm and area about 314.2 cm^2 . Subtract that from the total to get the colored glass area.



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