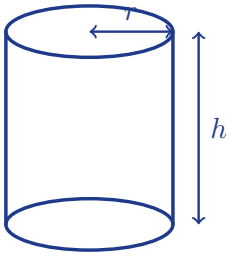
Volume of Cylinders

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 $\pi r^2 = 3.14 \times 25 = 78.5\ cm^2$. Now imagine stacking that circle $10\ cm$ high: $V = 78.5 \times 10 = 785\ cm^3$. 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 $\pi \approx 3.14$.

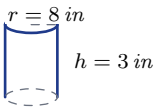
Think It Through: Be careful—the problem gives the *diameter*, not the radius! Divide first: $r = \frac{8}{2} = 4\ in$. Now find the base area: $3.14 \times 4^2 = 3.14 \times 16 = 50.24\ in^2$. Multiply by the height: $50.24 \times 12 = 602.88\ in^3$.

Answer: $602.88\ in^3$

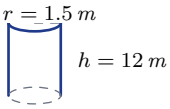
Practice Problems

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

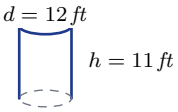
1. Find the volume of a cylinder with radius $3\ cm$ and height $7\ cm$. _____
2. Find the volume of a cylinder with radius $6\ in$ and height $10\ in$. _____
3. Find the volume of a cylinder with diameter $10\ m$ and height $4\ m$. _____
4. Find the volume of a cylinder with radius $2\ ft$ and height $9\ ft$. _____
5. Find the volume of a cylinder with diameter $14\ cm$ and height $5\ cm$. _____
6. Find the volume of a cylinder with radius $8\ in$ and height $3\ in$. _____



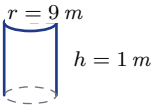
7. Find the volume of a cylinder with radius $1.5\ m$ and height $12\ m$. _____



8. Find the volume of a cylinder with diameter $6\ ft$ and height $8\ ft$. _____
9. Find the volume of a cylinder with radius $10\ cm$ and height $10\ cm$. _____
10. Find the volume of a cylinder with diameter $20\ in$ and height $6\ in$. _____
11. Find the volume of a cylinder with radius $4\ m$ and height $15\ m$. _____
12. Find the volume of a cylinder with radius $7\ cm$ and height $2\ cm$. _____
13. Find the volume of a cylinder with diameter $12\ ft$ and height $11\ ft$. _____



14. Find the volume of a cylinder with radius $5\ in$ and height $5\ in$. _____
15. 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

16. 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 $\pi \approx 3.14$. _____

17. 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

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

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: $90 \times 60 + \pi(30)^2 = 5{,}400 + 2{,}827.4 \approx 8{,}227.4\ m^2$; inside lane $= 2(90) + 2\pi(30) \approx 368.5\ m$; unwatered: $\approx 2{,}827.4\ m^2$.
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 $90 \times 60 = 5{,}400\ m^2$ plus the circle area $\pi(30)^2 \approx 2{,}827.4\ m^2$. Add them to get about $8{,}227.4\ m^2$. 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 $2{,}827.4\ m^2$.

17. Answer: Rectangle + semicircle: $4{,}800 + \frac{1}{2}\pi(30)^2 \approx 4{,}800 + 1{,}413.7 = 6{,}213.7\ cm^2$; medallion: $\pi(10)^2 \approx 314.2$; colored: $\approx 5{,}899.5\ cm^2$.
Split the window into a rectangle and a semicircle. The rectangle area is $60 \times 80 = 4{,}800\ cm^2$. The arch is a semicircle with radius $30\ cm$, so its area is $\frac{1}{2}\pi(30)^2 \approx 1{,}413.7\ cm^2$. Adding gives a total window area of about $6{,}213.7\ cm^2$. 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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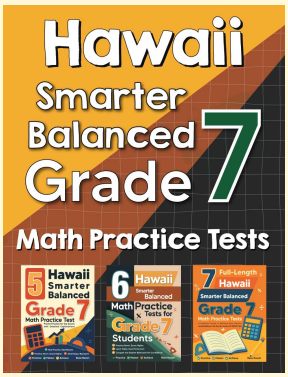

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