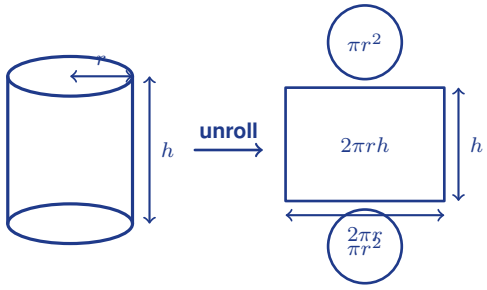
Surface Area of Cylinders

Name: _____	Date: _____	Score: _____ / 17

The **surface area** of a cylinder is the total area of everything on the outside: two circular bases plus the curved surface that wraps around them. Here is a great trick: imagine "unrolling" the curved part into a rectangle—its width equals the circumference of the base ($2\pi r$) and its height equals the height of the cylinder. That gives the formula $SA = 2\pi r^2 + 2\pi rh$, where the first term covers both bases and the second covers the lateral surface. If you only need the lateral area—like finding how much paper wraps a label—use just $LA = 2\pi rh$. As always, double-check that you are using the radius, not the diameter!



Key Concepts & Quick Review

Surface Area of a Cylinder:

$$SA = 2\pi r^2 + 2\pi rh$$

$2\pi r^2$ area of the two circular bases
$2\pi rh$ lateral (curved) surface area

Lateral area only (open-top or label-area problems): $LA = 2\pi rh$.

Use $\pi \approx 3.14$ unless told otherwise. Surface area is measured in *square* units (cm^2, in^2, etc.).

Examples

① Find the total surface area of a cylinder with $r = 3\ cm$ and $h = 10\ cm$. Use $\pi \approx 3.14$.

Think It Through: A cylinder's surface area has two parts: the two circular bases and the curved side (lateral area). First, the bases: $2 \times 3.14 \times 3^2 = 2 \times 3.14 \times 9 = 56.52\ cm^2$. Next, picture unrolling the curved side into a rectangle whose width is the circumference: $2 \times 3.14 \times 3 \times 10 = 188.4\ cm^2$. Add them up: $56.52 + 188.4 = 244.92\ cm^2$.

Answer: $244.92\ cm^2$

② A can has a diameter of $8\ cm$ and a height of $12\ cm$. Find the lateral surface area only.

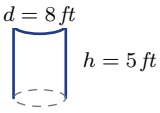
Think It Through: The question asks for the lateral area only—that is the curved part, not the top or bottom circles. First find the radius: $r = \frac{8}{2} = 4\ cm$. Then apply the lateral-area formula: $LA = 2\pi rh = 2 \times 3.14 \times 4 \times 12 = 301.44\ cm^2$. Imagine peeling the label off the can—that is the lateral surface!

Answer: $301.44\ cm^2$

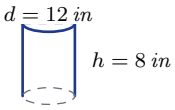
Practice Problems

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

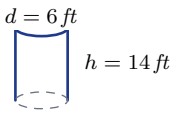
1. Find the total surface area of a cylinder with radius $4\ cm$ and height $6\ cm$. _____
2. Find the total surface area of a cylinder with radius $5\ in$ and height $10\ in$. _____
3. Find the total surface area of a cylinder with diameter $10\ m$ and height $7\ m$. _____
4. Find the total surface area of a cylinder with radius $2\ ft$ and height $9\ ft$. _____
5. Find the total surface area of a cylinder with diameter $14\ cm$ and height $3\ cm$. _____
6. Find the total surface area of a cylinder with radius $7\ in$ and height $4\ in$. _____
7. Find the total surface area of a cylinder with radius $1\ m$ and height $15\ m$. _____
8. Find the total surface area of a cylinder with diameter $8\ ft$ and height $5\ ft$. _____



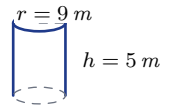
9. Find the total surface area of a cylinder with radius $6\ cm$ and height $6\ cm$. _____
10. Find the total surface area of a cylinder with diameter $12\ in$ and height $8\ in$. _____



11. Find the total surface area of a cylinder with radius $3\ m$ and height $11\ m$. _____
12. Find the total surface area of a cylinder with radius $10\ cm$ and height $2\ cm$. _____
13. Find the total surface area of a cylinder with diameter $6\ ft$ and height $14\ ft$. _____



14. Find the total surface area of a cylinder with radius $8\ in$ and height $1\ in$. _____
15. Find the total surface area of a cylinder with radius $9\ m$ and height $5\ m$. _____



Study Tips

- Surface area has **two parts**: the circles on top and bottom ($2\pi r^2$) plus the curved side ($2\pi rh$). Don't forget either one!
- If a problem asks for a "label" or "wrapper" area, that is the **lateral area** only — no bases.
- Surface area uses **square** units; volume uses **cubic** units. Mixing them up is a common mistake.

Word Problems

16. A coffee mug (open on top) has a radius of $4\ cm$ and a height of $10\ cm$. What is the total outer surface area (one base + lateral)? Use $\pi \approx 3.14$. _____

17. A company is making labels that wrap around a tin can. The can has a diameter of $6\ cm$ and a height of $9\ cm$. How much paper is needed for one label? _____

Answer Keys

1) 251.2
2) 471
3) 376.8
4) 138.16
5) 439.6
6) 483.56
7) 100.48
8) 226.08
9) 452.16
10) 527.52
11) 263.76
12) 753.6
13) 320.28
14) 452.16
15) 791.28
16) $301.44\ cm^2$
17) $169.56\ cm^2$

Step-by-Step Explanations

Strategy: For Parts of a Circle, name the circle part first: radius, diameter, chord, arc, sector, segment, tangent, or secant, because vocabulary guides the calculation. Circle vocabulary answers should match the exact part shown in the diagram.

Practice 1: Find arc length. **Answer:** 9.42
At the beginning of the practice, name the part shown first, then use arc or sector formulas only when a measure is requested.

Practice 15: Is the diameter also a chord? **Answer:** yes
For the second model problem, name the part shown first, then use arc or sector formulas only when a measure is requested.

Word-problem notes:

16. Answer: Arc: $\frac{150}{360} \times 2\pi(12) = \frac{5}{12} \times 24\pi = 10\pi \approx 31.4\,m$; area: $\frac{150}{360} \times \pi(144) = 60\pi \approx 188.5\,m^2$; cost: $\approx \$9.42$.
The sprinkler covers a sector, so use the fraction $\frac{150}{360} = \frac{5}{12}$ of a full circle. The full circumference for radius $12\,m$ is $2\pi(12) = 24\pi$, so the arc length is $\frac{5}{12} \cdot 24\pi = 10\pi \approx 31.4\,m$. The full circle area is $\pi(12)^2 = 144\pi$, so the watered area is $\frac{5}{12} \cdot 144\pi = 60\pi \approx 188.5\,m^2$. Multiply by the water cost, 188.5×0.05, to get about $\$9.42$.

17. Answer: $20\,min = \frac{1}{3}$ of circle; arc $= \frac{1}{3} \times 2\pi(14) \approx 29.3\,cm$; area $= \frac{1}{3} \times \pi(196) \approx 205.3\,cm^2$; $1\,hr = 2\pi(14) \approx 87.96\,cm$.
In $20\,min$, the minute hand travels $\frac{20}{60} = \frac{1}{3}$ of a full turn. Since the hand length is $14\,cm$, that is the radius of the circle traced by the tip. So the distance traveled is one third of the full circumference: $\frac{1}{3} \cdot 2\pi(14) \approx 29.3\,cm$. The swept area is one third of the full circle area: $\frac{1}{3} \cdot \pi(14)^2 \approx 205.3\,cm^2$. In one full hour, the tip travels one complete circumference, $2\pi(14) \approx 87.96\,cm$.

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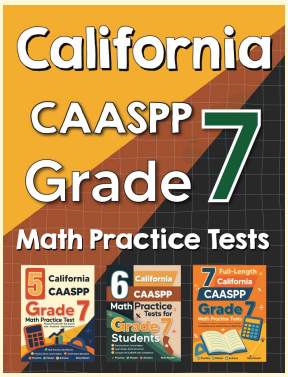

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