

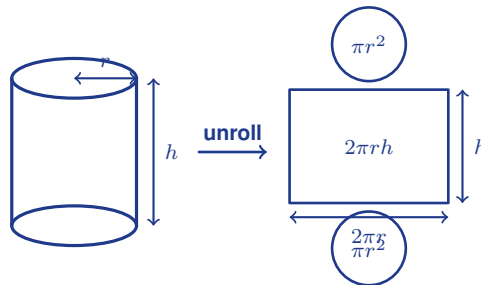
# Surface Area of Cylinders

Name: \_\_\_\_\_

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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  $r = 3\text{ cm}$  and  $h = 10\text{ cm}$ . 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:  $2 \times 3.14 \times 3^2 = 2 \times 3.14 \times 9 = 56.52\text{ cm}^2$ . Next, picture unrolling the curved side into a rectangle whose width is the circumference:  $2 \times 3.14 \times 3 \times 10 = 188.4\text{ cm}^2$ . Add them up:  $56.52 + 188.4 = 244.92\text{ cm}^2$ .

**Answer:**  $244.92\text{ cm}^2$

② A can has a diameter of  $8\text{ cm}$  and a height of  $12\text{ cm}$ . 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:  $r = \frac{8}{2} = 4\text{ cm}$ . Then apply the lateral-area formula:  $LA = 2\pi rh = 2 \times 3.14 \times 4 \times 12 = 301.44\text{ cm}^2$ . Imagine peeling the label off the can—that is the lateral surface!



 **Answer:**  $301.44 \text{ cm}^2$

### 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  $4 \text{ cm}$  and height  $6 \text{ cm}$ .

2. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $5 \text{ in}$  and height  $10 \text{ in}$ .

3. Find the total surface area of a cylinder \_\_\_\_\_ with diameter  $10 \text{ m}$  and height  $7 \text{ m}$ .

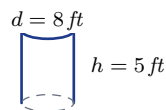
4. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $2 \text{ ft}$  and height  $9 \text{ ft}$ .

5. Find the total surface area of a cylinder \_\_\_\_\_ with diameter  $14 \text{ cm}$  and height  $3 \text{ cm}$ .

6. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $7 \text{ in}$  and height  $4 \text{ in}$ .

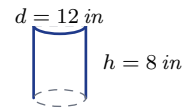
7. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $1 \text{ m}$  and height  $15 \text{ m}$ .

8. Find the total surface area of a cylinder \_\_\_\_\_ with diameter  $8 \text{ ft}$  and height  $5 \text{ ft}$ .



9. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $6 \text{ cm}$  and height  $6 \text{ cm}$ .

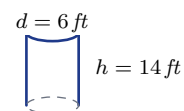
10. Find the total surface area of a cylinder \_\_\_\_\_ with diameter  $12 \text{ in}$  and height  $8 \text{ in}$ .



11. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $3 \text{ m}$  and height  $11 \text{ m}$ .

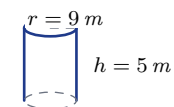
12. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $10 \text{ cm}$  and height  $2 \text{ cm}$ .

13. Find the total surface area of a cylinder \_\_\_\_\_ with diameter  $6 \text{ ft}$  and height  $14 \text{ ft}$ .






14. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $8 \text{ in}$  and height  $1 \text{ in}$ .

15. Find the total surface area of a cylinder \_\_\_\_\_ with radius  $9 \text{ m}$  and height  $5 \text{ m}$ .



### Study Tips

-  Surface area has **two parts**: the circles on top and bottom ( $2\pi r^2$ ) plus the curved side ( $2\pi r h$ ). 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  $4 \text{ cm}$  and a height of  $10 \text{ cm}$ . 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  $6\text{ cm}$  and a height of  $9\text{ cm}$ . How much paper is needed for one label? \_\_\_\_\_



## Answer Keys

- |  |  |
|--|--|
| <p>1) 251.2</p> <p>2) 471</p> <p>3) 376.8</p> <p>4) 138.16</p> <p>5) 439.6</p> <p>6) 483.56</p> <p>7) 100.48</p> <p>8) 226.08</p> <p>9) 452.16</p> | <p>10) 527.52</p> <p>11) 263.76</p> <p>12) 753.6</p> <p>13) 320.28</p> <p>14) 452.16</p> <p>15) 791.28</p> <p>16) <math>301.44 \text{ cm}^2</math></p> <p>17) <math>169.56 \text{ cm}^2</math></p> |
|--|--|

### 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:  $\frac{150}{360} \times 2\pi(12) = \frac{5}{12} \times 24\pi = 10\pi \approx 31.4 \text{ m}$ ; area:  $\frac{150}{360} \times \pi(144) = 60\pi \approx 188.5 \text{ m}^2$ ; 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  $12 \text{ m}$  is  $2\pi(12) = 24\pi$ , so the arc length is  $\frac{5}{12} \cdot 24\pi = 10\pi \approx 31.4 \text{ m}$ . The full circle area is  $\pi(12)^2 = 144\pi$ , so the watered area is  $\frac{5}{12} \cdot 144\pi = 60\pi \approx 188.5 \text{ m}^2$ . Multiply by the water cost,  $188.5 \times 0.05$ , to get about  $\$9.42$ .

**17. Answer:**  $20 \text{ min} = \frac{1}{3}$  of circle; arc =  $\frac{1}{3} \times 2\pi(14) \approx 29.3 \text{ cm}$ ; area =  $\frac{1}{3} \times \pi(196) \approx 205.3 \text{ cm}^2$ ;  $1 \text{ hr} = 2\pi(14) \approx 87.96 \text{ cm}$ .

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



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