CYLINDERS – VOLUME AND SURFACE AREA 10.1.2

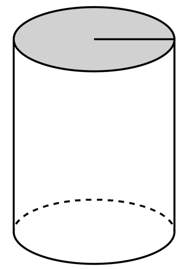
VOLUME OF A CYLINDER

The volume of a cylinder is the area of its base multiplied by its height:

$$V = B \cdot h$$

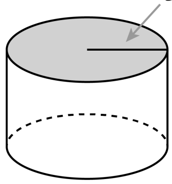
Since the base of a cylinder is a circle of area $A = r^2\pi$, we can write:

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



For additional information, see the Math Notes box in Lesson 10.1.2 of the *Core Connections, Course 3* text.

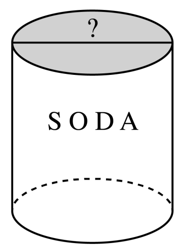
Example 1



Find the volume of the cylinder above.
Use a calculator for the value of π.

$$\begin{aligned} \text{Volume} &= r^2\pi h \\ &= (3)^2\pi(4) \\ &= 36\pi \\ &\approx 113.10 \text{ ft}^3 \end{aligned}$$

Example 2



The soda can above has a volume of 355 cm^3 and a height of 12 cm. What is its diameter? Use a calculator for the value of π.

$$\begin{aligned} \text{Volume} &= r^2\pi h \\ 355 &= r^2\pi(12) \\ \tfrac{355}{12\pi} &= r^2 \\ 9.42 &\approx r^2 \\ r &\approx 3.07 \end{aligned}$$

diameter = $2r \approx 2(3.07) \approx 6.14$ cm

Problems

Find the volume of each cylinder.

1. $r = 5$ cm, $h = 10$ cm
2. $r = 7.5$ inches, $h = 8.1$ inches
3. diameter = 10 cm, $h = 5$ cm
4. base area = 50 cm^2, $h = 4$ cm
5. $r = 17$ cm, $h = 10$ cm
6. $d = 29$ cm, $h = 13$ cm

Find the missing part of each cylinder.

7. If the volume is 5175 ft^3 and the height is 23 ft, find the diameter.

8. If the volume is 26,101.07 $inches^3$ and the radius is 17.23 inches, find the height.

9. If the circumference is 126 cm and the height is 15 cm, find the volume.

Answers

1.	785.40 cm^3	2.	1431.39 $in.^3$	3.	392.70 cm^3
4.	200 cm^3	5.	9079.20 cm^3	6.	8586.76 cm^3
7.	16.93 ft	8.	28 inches	9.	18,950.58 cm^3

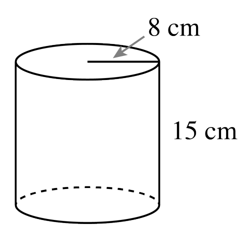
SURFACE AREA OF A CYLINDER

The surface area of a cylinder is the sum of the two base areas and the lateral surface area. The formula for the surface area is:

$$\text{SA} = 2r^2\pi + \pi dh \quad \text{or} \quad \text{SA} = 2r^2\pi + 2\pi rh$$

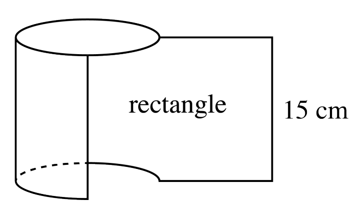
where r = radius, d = diameter, and h = height of the cylinder. For additional information, see the Math Notes box in Lesson 10.1.3 of the *Core Connections, Course 3* text.

Example 1



Find the surface area of the cylinder at right.
Use a calculator for the value of π.

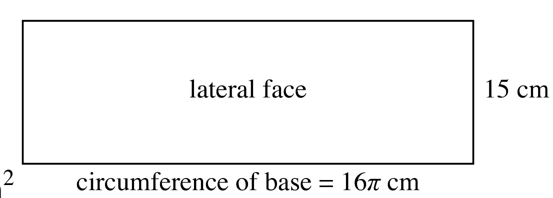
Step 1: Area of the two circular bases



$$2[(8\text{ cm})^2\pi] = 128\pi\text{ cm}^2$$

Step 2: Area of the lateral face

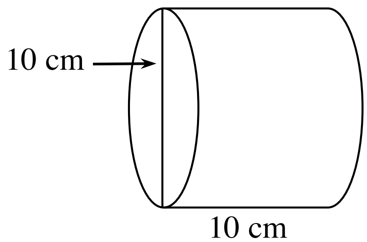
$$\pi(16)15 = 240\pi\text{ cm}^2$$



Step 3: Surface area of the cylinder

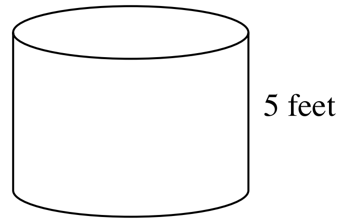
$$128\pi\text{ cm}^2 + 240\pi\text{ cm}^2 = 368\pi\text{ cm}^2 \approx 1156.11\text{ cm}^2$$

Example 2



$$\begin{aligned}\text{SA} &= 2r^2\pi + 2\pi rh\\ &= 2(5)^2\pi + 2\pi \cdot 5 \cdot 10\\ &= 50\pi + 100\pi\\ &= 150\pi \approx 471.24 \text{ cm}^2\end{aligned}$$

Example 3



If the volume of the tank above is 500π ft^3, what is the surface area?

$$\begin{aligned}\text{V} &= \pi r^2 h\\ 500\pi &= \pi r^2(5)\\ \tfrac{500\pi}{5\pi} &= r^2\\ 100 &= r^2\\ 10 &= r\end{aligned}$$

$$\begin{aligned}\text{SA} &= 2r^2\pi + 2\pi rh\\ &= 2 \cdot 10^2\pi + 2\pi(10)(5)\\ &= 200\pi + 100\pi\\ &= 300\pi \approx 942.48 \text{ ft}^2\end{aligned}$$

Problems

Find the surface area of each cylinder.

1. $r = 6$ cm, $h = 10$ cm
2. $r = 3.5$ in., $h = 25$ in.
3. $d = 9$ in., $h = 8.5$ in.
4. $d = 15$ cm, $h = 10$ cm
5. base area = 25, height = 8
6. volume = 1000 cm^3, height = 25 cm

Answers

1. 603.19 cm^2
2. 626.75 in.^{2}
3. 367.57 in.^{2}
4. 824.69 cm^2
5. 191.80 un.^{2}
6. 640.50 cm^2

