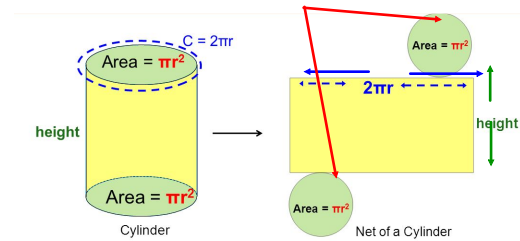


A cylinder is a three dimensional solid with identical parallel circular bases. The lateral surface is curved and extends from one base to the other base.

The volume of a cylinder is the same as a prism:

$$V = A_{\text{base}} \times \text{height}$$

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



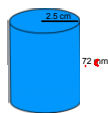
The net of a cylinder shows two circular bases and the lateral surface unfolds to reveal a simple rectangle. So, the surface area of a cylinder is:

$$S.A._{\text{cylinder}} = 2A_{\text{circle}} + A_{\text{rectangle}}$$

The height of the rectangle is the height of the prism, while the length of the rectangle is the circumference of the circular base. Therefore,

$$\begin{aligned} S.A._{\text{cylinder}} &= 2A_{\text{circle}} + A_{\text{rectangle}} \\ &= 2\pi r^2 + 2\pi r h \end{aligned}$$

Example 1: Calculate the volume and surface area of the following cylinder.

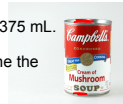


$$\begin{aligned} V &= \pi r^2 \times h \\ V &= 3.14 (2.5^2) \times 7.2 \\ V &= 3.14 (6.25) \times 7.2 \\ V &= 141.3 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} S.A. &= 2\pi r^2 + 2\pi r h \\ S.A. &= 2(3.14)(2.5^2) + 2(3.14)(2.5)(7.2) \\ S.A. &= 2(3.14)(6.25) + 2(3.14)(2.5)(7.2) \\ S.A. &= 39.25 + 113.04 \\ S.A. &= 152.29 \text{ cm}^2 \end{aligned}$$

Example 2: A can of soup has a volume of 375 mL.

a) If the height of the can is 12 cm determine the radius of the can. (Note: 1 mL = 1cm³)



$$\begin{aligned} V &= \pi r^2 \times h \\ \frac{375}{12} &= \frac{(3.14) r^2 \times 12}{12} \\ \frac{31.25}{3.14} &= \frac{3.14 \times r^2}{3.14} \\ \sqrt{9.95} &= \sqrt{r^2} \\ 3.15 &= r \end{aligned}$$

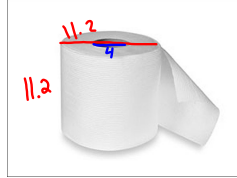
\therefore the radius of the can is 3.15 cm

b) How much paper is required to make the soup label?

$$\begin{aligned} S.A. &= 2\pi r^2 + A_{\text{rectangle}} \\ S.A. &= A_{\text{rectangle}} \\ S.A. &= 2\pi r \times h \\ S.A. &= 2(3.14)(3.15)(12) \\ S.A. &= 237.38 \text{ cm}^2 \\ \therefore \text{ we would need } 237.38 \text{ cm}^2 &\text{ of paper} \end{aligned}$$

Example 3: A roll of toilet paper has a height and diameter of 11.2cm. If the inner cardboard roll is 4cm in diameter, what is the volume of toilet paper on the roll?

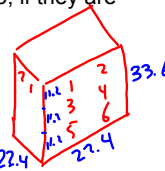
$$\begin{array}{l} \text{total} \\ V = \pi r^2 h \\ V = 3.14(5.6^2)(11.2) \\ V = 3.14(31.36)(11.2) \\ V = 1102.86 \text{ cm}^3 \end{array} \quad \begin{array}{l} \text{Card board} \\ V = \pi r^2 h \\ V = 3.14(2^2)(11.2) \\ V = 3.14(4)(11.2) \\ V = 140.67 \text{ cm}^3 \end{array}$$



$$\begin{array}{l} \text{Paper volume} = 1102.86 - 140.67 \\ = 962.19 \text{ cm}^3 \end{array} \quad \therefore \text{there is } 962.19 \text{ cm}^3 \text{ of toilet paper}$$

Example 4: How much plastic would be required to package 12 toilet paper rolls from example 3, if they are arranged in a 2 by 3 by 2 orientation?

$$\begin{array}{l} \text{S.A.} = \text{rectangular prism} \\ \text{S.A.} = 2A_{\text{base}} + A_{\text{rectangles}} \\ \text{S.A.} = 2(22.4 \times 22.4) + A_{\text{rectangles}} \\ \text{S.A.} = 1003.52 + A_{\text{rectangles}} \\ \text{S.A.} = 1003.52 + 33.6 \times 22.4 \times 4 \\ \text{S.A.} = 1003.52 + 3010.56 \\ \text{S.A.} = 4014.08 \text{ cm}^2 \end{array}$$



\therefore we would need 4014.08 cm^2 of plastic to cover a $2 \times 3 \times 2$ set of toilet paper rolls.

Practice Questions:

Handout!