CHAPTER 9: Optimizing Measurements
9.6 Minimize the Surface Area of a Cylinder
Minimizing the Surface Area of a Cylinder with a Given Volume

The minimum surface area for a given volume of a cylinder occurs when its height equals its diameter.
The dimensions of the cylinder of minimum surface area for a given volume can be found by solving the formula $V = 2\pi r^3$ for r. The height will be $2r$.

Example:

a) The Azores Pineapple Company packages 500 cm^3 of pineapple chunks in a cylindrical can designed for a minimum surface area for the given volume. Find the radius of the can.

b) How much metal is needed to make the can?

Solution:

a)
$$\begin{aligned} V &= 2\pi r^3 \\ 500 &= 2\pi r^3 \\ \frac{500}{2\pi} &= \frac{2\pi r^3}{2\pi} \\ 79.6 &= r^3 \\ 4.3 &= r \end{aligned}$$

The radius of the can with minimum surface area is 4.3 cm.

b)
$$\begin{aligned} V &= 6\pi r^3 \\ &= 6\pi\left(4.3\right)^3 \\ &= 348.5 \end{aligned}$$

The area of metal required is 348. cm^2.

Practice:

1. a) Canada Cargo Lines operates a fleet of ships that are fuelled from cylindrical tanks of bunker oil. Each tank holds 1000 m^3 of oil. If the tank has been designed for minimum surface area for the given volume, find the radius of the tank.

b) Find the area of sheet steel needed to construct each tank.

Answers:

1. a) 5.4 m b) 549.7 m^2