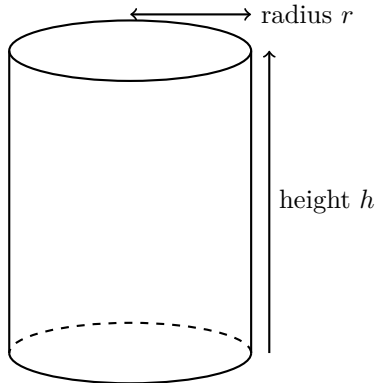


Question 4

A right circular cylinder has a height of 12 cm, and its radius is measured to be 5 cm with a possible error of 0.1 cm.

- (a) Use differentials to approximate the maximum error in the calculated volume of the cylinder.
- (b) Estimate the relative error and percentage error in the volume.



Question 4 - Solution

The volume of a right circular cylinder is given by:

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

Given: $r = 5$ cm, $dr = 0.1$ cm, $h = 12$ cm

(a) Use differentials to approximate the error:

$$dV = \frac{dV}{dr} \cdot dr = 2\pi r h \cdot dr$$

$$dV = 2\pi(5)(12)(0.1) = 12\pi \text{ cm}^3 \approx \boxed{37.70 \text{ cm}^3}$$

(b) Estimate the relative error and percentage error:

$$V = \pi r^2 h = \pi(5)^2(12) = 300\pi \approx 942.48 \text{ cm}^3$$

$$\text{Relative error} = \frac{dV}{V} = \frac{12\pi}{300\pi} = \frac{12}{300} = 0.04$$

$$\text{Percentage error} = 0.04 \times 100 = \boxed{4\%}$$

Final Answer:

- Maximum error in volume: $\boxed{37.70 \text{ cm}^3}$
- Relative error: $\boxed{0.04}$
- Percentage error: $\boxed{4\%}$