

**1990 AB4**  
**Solution**

$$(a) \frac{dV}{dt} = \frac{4}{3} \cdot 3\pi r^2 \frac{dr}{dt}$$

$$\text{Therefore when } r = 10, \frac{dr}{dt} = 0.04$$

$$\frac{dV}{dt} = 4\pi 10^2 (0.04) = 16\pi \text{ cm}^3/\text{sec}$$

$$(b) V = 36\pi \Rightarrow 36 = \frac{4}{3}r^3 \Rightarrow r^3 = 27 \Rightarrow r = 3$$

$$A = \pi r^2$$

$$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$$

$$\text{Therefore when } V = 36\pi, \frac{dr}{dt} = 0.04$$

$$\frac{dA}{dt} = 2\pi \cdot 3(0.04) = \frac{6\pi}{25} = 0.24\pi \text{ cm}^2/\text{sec}$$

$$(c) \frac{dV}{dt} = \frac{dr}{dt}$$

$$4\pi r^2 \frac{dr}{dt} = \frac{dr}{dt} \Rightarrow 4\pi r^2 = 1$$

$$\text{Therefore } r^2 = \frac{1}{4\pi} \Rightarrow r = \frac{1}{2\sqrt{\pi}} \text{ cm}$$