# 1984 ABS

Related Rates
Day #3 notes

$\frac{dV}{dt} = 28\pi$ units$^3$/sec

when $r = 3$ units, $V = 12\pi$ units$^3$ and $\frac{dr}{dt} = \frac{1}{2}$ unit/sec

a) Find $\frac{dA}{dt}$ when $r = 3$ units

$$A = \pi r^2$$

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

$$\frac{dA}{dt} = \pi \cdot 2(3)\left(\frac{1}{2}\right) = 3\pi \text{ units}^2/\text{sec}$$

b) Find $\frac{dh}{dt}$ when $r = 3$ units

$$V = \frac{1}{3}\pi r^2 h$$

$$\frac{dV}{dt} = \frac{1}{3}\pi\left[r^2 \cdot \frac{dh}{dt} + h \cdot 2r\frac{dr}{dt}\right]$$

$$28\pi = \frac{1}{3}\pi\left[3^2 \cdot \frac{dh}{dt} + (4) \cdot 2 \cdot 3 \cdot \frac{1}{2}\right]$$

$$28\pi = \frac{1}{3}\pi\left[9\frac{dh}{dt} + 12\right]$$

$$28\pi = 3\pi\frac{dh}{dt} + 4\pi$$

$$24\pi = 3\pi\frac{dh}{dt}$$

$$\frac{dh}{dt} = 8 \text{ units/sec}$$

$$V = \frac{1}{3}\pi r^2 h$$

$$12\pi = \frac{1}{3}\pi(3)^2 \cdot h$$

$$12\pi = 3\pi h$$

$$h = 4$$

c) Find $\frac{dA}{dh}$ when $r = 3$ units

$$\frac{dA}{dh} = \frac{\frac{dA}{dt}}{dh/dt} = \frac{3\pi}{8} \text{ units}$$