p. 251 # 4

$\frac{d}{dt}(P = RI^2)$

P = power
R = resistance
I = current

(a)

$\frac{dP}{dt} = 2IR\frac{dI}{dt} + I^2\frac{dR}{dt}$

$u = R \quad v = I^2$

$\frac{du}{dt} = \frac{dR}{dt} \quad \frac{dv}{dt} = 2I\frac{dI}{dt}$

(b) P constant

$0 = 2IR\frac{dI}{dt} + I^2\frac{dR}{dt}$

$I^2\frac{dR}{dt} = \frac{-2IR\frac{dI}{dt}}{I^2} = -\frac{2R}{I}\frac{dI}{dt}$

#6 $\frac{d}{dt}(A = \frac{1}{2}ab\sin\theta)$

$\frac{dA}{dt} = \frac{1}{2}\left[\left(b\frac{da}{dt} + a\frac{db}{dt}\right)\sin\theta + ab\cos\theta\frac{d\theta}{dt}\right]$

$v = \sin\theta$

$\frac{dv}{dt} = \cos\theta\frac{d\theta}{dt}$

$u = ab$

$\frac{du}{dt} = \frac{da}{dt}\cdot b + a\cdot\frac{db}{dt}$

#11. surface area of sphere:

$$S = 4\pi r^2$$

volume of sphere:

$$\frac{d}{dt}\left(V = \frac{4}{3}\pi r^3\right)$$

#13 distance:

$$s^2 = x^2 + 7^2$$

#15 volume of cylinder

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

#11

$S = 4\pi r^2$ $\qquad$ $V = \frac{4}{3}\pi r^3$

$\frac{dS}{dt} = 8\pi r \frac{dr}{dt}$ $\qquad$ $\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$

a.) $100\pi = 4\pi (5)^2 \cdot \frac{dr}{dt}$

$\frac{dr}{dt} = 1$ ft/min

b.) $\frac{dS}{dt} = 8\pi (5)(1)$

$\frac{dS}{dt} = 40\pi$ ft^2/min

#12 $\frac{dV}{dt} = k \cdot S$ ← constant of proportionality

Show that $\frac{dr}{dt}$ is a constant

rate

k constant

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

$$S = 4\pi r^2$$

$$4\pi r^2 \cdot \frac{dr}{dt} = k \cdot 4\pi r^2$$

$$\frac{dr}{dt} = k$$