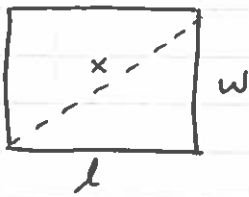


Related Rates 1

1)



MOMENT

$$l = 12 \text{ cm}$$

$$w = 5 \text{ cm}$$

$$x = 13 \text{ cm}$$

Rates

$$\frac{dl}{dt} = -2 \text{ cm/sec}$$

$$\frac{dw}{dt} = 2 \text{ cm/sec}$$

a) $A = lw$

$$\frac{dA}{dt} = l \cdot \frac{dw}{dt} + w \cdot \frac{dl}{dt}$$

$$\frac{dA}{dt} = 12(2) + 5(-2) = \underline{\underline{14 \text{ cm}^2/\text{sec}}}$$

b) $P = 2l + 2w$

$$\frac{dP}{dt} = 2 \frac{dl}{dt} + 2 \frac{dw}{dt}$$

$$\frac{dP}{dt} = 2(-2) + 2(2) = \underline{\underline{0 \text{ cm/sec}}}$$

c) $l^2 + w^2 = x^2$

$$2l \frac{dl}{dt} + 2w \frac{dw}{dt} = 2x \frac{dx}{dt}$$

$$12^2 + 5^2 = x^2$$

$$x = 13$$

$$12(-2) + 5(2) = 13 \frac{dx}{dt}$$

$$\underline{\underline{\frac{dx}{dt} = -14/13 \text{ cm/sec}}}$$

2)

MOMENT

$$r = 5 \text{ ft.}$$

RATES

$$\frac{dV}{dt} = 100\pi \text{ ft}^3/\text{min}$$

$$a) V = \frac{4}{3}\pi r^3$$

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

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

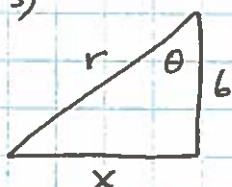
$$\underline{\underline{\frac{dr}{dt} = 1 \text{ ft}/\text{min}}}$$

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

$$\frac{dS}{dt} = 8\pi r \frac{dr}{dt}$$

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

3)

MOMENT

$$r = 10 \text{ ft}$$

$$x = 8 \text{ ft.}$$

RATES

$$\frac{dr}{dt} = -2 \text{ ft}/\text{sec}$$

$$a) x^2 + 36 = r^2$$

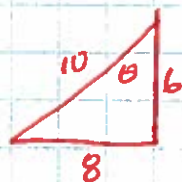
$$2x \frac{dx}{dt} = 2r \frac{dr}{dt}$$

$$8 \frac{dx}{dt} = 10(-2)$$

$$\underline{\underline{\frac{dx}{dt} = -\frac{5}{2} \text{ ft}/\text{sec}}}$$

$$b) \cos \theta = \frac{6}{r}$$

$$r \cdot \cos \theta = 6$$



$$\sin \theta = \frac{4}{5}$$

$$\cos \theta = \frac{3}{5}$$

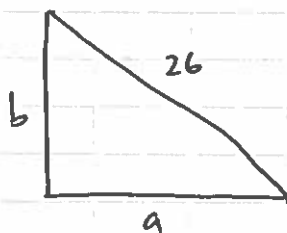
$$r \cdot \sin \theta \frac{d\theta}{dt} + \cos \theta \frac{dr}{dt} = 0$$

$$10 \left(\frac{4}{5} \right) \frac{d\theta}{dt} + \left(\frac{3}{5} \right) (-2) = 0$$

$$8 \frac{d\theta}{dt} - \frac{6}{5} = 0$$

$$\underline{\underline{\frac{d\theta}{dt} = -\frac{3}{20} \text{ rad}/\text{sec}}}$$

4)



$$a^2 + b^2 = 26^2$$

MOMENT

$$a = 10$$

$$b = 24$$

RATES

$$\frac{da}{dt} = 4 \text{ ft/sec}$$

$$2a \frac{da}{dt} + 2b \frac{db}{dt} = 0$$

$$10(4) + 24 \frac{db}{dt} = 0$$

$$\underline{\underline{\frac{db}{dt} = -\frac{5}{3} \text{ ft/sec}}}$$

5)



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

MOMENT

$$r = 1 \text{ cm}$$

RATES

$$\frac{dV}{dt} = 10 \text{ cm}^3/\text{sec}$$

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

$$10 = 4\pi \frac{dr}{dt}$$

$$\underline{\underline{\frac{dr}{dt} = \frac{5}{2\pi} \text{ cm/sec}}}$$