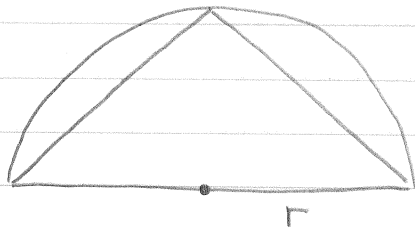


DIFFERENTIATION FRQ



A = area of semi circle

$$\frac{dA}{dt} = 1 \text{ cm}^2/\text{sec} \text{ when } r = 3 \text{ cm}$$

(a) WANT: $\frac{dr}{dt}$ (when $r = 3 \text{ cm}$)

$$A = \frac{1}{2} \pi r^2$$

$$\frac{d}{dt}(A) = \frac{d}{dt}(\frac{1}{2} \pi r^2)$$

$$\frac{dA}{dt} = \frac{1}{2} \pi \cdot 2r \frac{dr}{dt}$$

$$\frac{dr}{dt} = \frac{1}{\pi r} \cdot \frac{dA}{dt}$$

$$\text{When } r = 3 \text{ cm} \quad \frac{dr}{dt} = \frac{1}{\pi \cdot 3} \cdot 1 = \frac{1}{3\pi} \text{ cm/sec}$$

(b) P = perimeter of semi circle

WANT: $\frac{dP}{dt}$ (when $r = 3 \text{ cm}$)

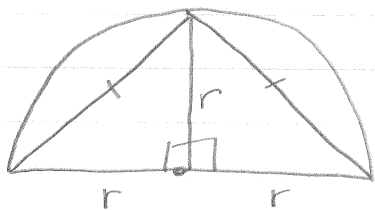
$$P = \frac{1}{2}(2\pi r) + 2r = \pi r + 2r$$

$$\frac{d}{dt}(P) = \frac{d}{dt}(\pi r + 2r)$$

$$\frac{dP}{dt} = \pi \cdot \frac{dr}{dt} + 2 \cdot \frac{dr}{dt}$$

$$\text{When } r = 3 \text{ cm} \quad \frac{dP}{dt} = \pi \cdot \frac{1}{3\pi} + 2 \cdot \frac{1}{3\pi} = \frac{\pi + 2}{3\pi} \text{ cm/sec}$$

c)



Let K = area of isosceles triangle

WANT: $\frac{dK}{dt}$ (when $r = 3$ cm)

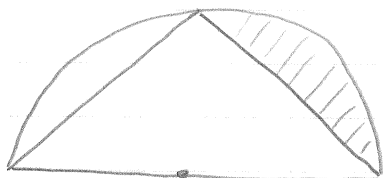
$$K = \frac{1}{2}(2r)(r) = r^2$$

$$\frac{d}{dt}(K) = \frac{d}{dt}(r^2)$$

$$\frac{dK}{dt} = 2r \frac{dr}{dt}$$

$$\text{When } r = 3 \text{ cm } \frac{dK}{dt} = 2(3)\left(\frac{1}{3\pi}\right) = \frac{2}{\pi} \text{ cm}^2/\text{sec}$$

d)



Let M = area of shaded region

WANT: $\frac{dM}{dt}$ (when $r = 3$ cm)

$$M = \frac{1}{2} \left(\frac{1}{2} \pi r^2 - r^2 \right) = \frac{1}{4} \pi r^2 - \frac{1}{2} r^2$$

$$\frac{d}{dt}(M) = \frac{d}{dt} \left(\frac{1}{4} \pi r^2 - \frac{1}{2} r^2 \right)$$

$$\frac{dM}{dt} = \frac{1}{4} \pi \cdot 2r \frac{dr}{dt} - \frac{1}{2} \cdot 2r \frac{dr}{dt}$$

$$\text{When } r = 3 \text{ cm } \frac{dM}{dt} = \frac{1}{2} \pi (3) \left(\frac{1}{3\pi} \right) - (3) \left(\frac{1}{3\pi} \right)$$

$$\frac{dM}{dt} = \frac{1}{2} - \frac{1}{\pi} \text{ cm}^2/\text{sec}$$