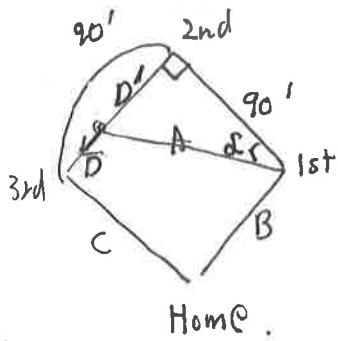


#9.



$$\frac{dD'}{dt} = 18 \frac{\text{feet}}{\text{sec.}}$$

$$D' = 90 - 22.5 = 67.5 \text{ feet}$$

Related Rate Q.S  
Answers.

$$a) 1) 90^2 + D'^2 = A^2$$

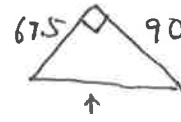
$$2) 2D \cdot \frac{dD}{dt} = 2A \cdot \frac{dA}{dt}$$

$$D' = 67.5 \text{ feet.}$$

3) calculation

$$\Rightarrow (67.5)(18) = (112.5) \cdot \frac{dA}{dt}$$

$$\Rightarrow \frac{dA}{dt} = 10.8 \frac{\text{ft}}{\text{sec}}$$



$$\sqrt{90^2 + 67.5^2} = 112.5 = A$$

$$b) \tan \theta = \frac{D'}{90}$$

$$\sec^2 \theta \cdot \frac{d\theta}{dt} = \frac{1}{90} \left( \frac{dD'}{dt} \right)$$

calculation

$$\left( \sec^2 (.6435) \right) \left( \frac{d\theta}{dt} \right) = \left( \frac{1}{90} \right) (18)$$

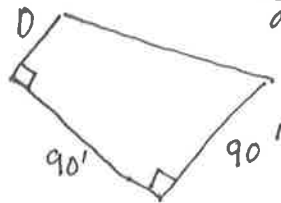
$$\frac{d\theta}{dt} \approx 0.128 \frac{\text{rad}}{\text{sec}}$$



$$\theta = \arctan \left( \frac{67.5}{90} \right)$$

$$\approx 0.6435 \text{ rad.}$$

c)



$$\frac{dD}{dt} = -18 \frac{\text{feet}}{\text{sec.}}$$

$$\text{Area of Trapezoid} = \left( \frac{1}{2} \right) (b_1 + b_2) \cdot h$$

$$A = \left( \frac{1}{2} \right) (D + 90) \cdot 90 = 45D + (45)(90)$$

$$\frac{dA}{dt} = 45 \cdot \frac{dD}{dt}$$

Calculation:

$$\frac{dA}{dt} = (45)(-18) = -810 \frac{\text{ft}^3}{\text{sec}}$$

#10.

2



$$\frac{dV}{dt}$$

$$\begin{aligned} a) \quad V &= \pi h^2 \left( R - \frac{h}{3} \right) \\ &= \pi \left[ R h^2 - \frac{1}{3} h^3 \right] \end{aligned}$$

$$\frac{dV}{dt} = \pi \left[ R(2h) \frac{dh}{dt} - \frac{1}{3} (3h^2) \frac{dh}{dt} \right]$$

$$\frac{dV}{dt} = 4 \frac{\text{in}^3}{\text{sec}}$$

 $\rightarrow$ 

$$h = 2''$$

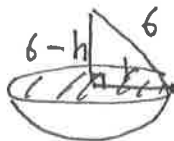
$$R = 6$$

$$4 = \pi \left[ (6)(2)(2) \cdot \frac{dh}{dt} - (2)^2 \cdot \frac{dh}{dt} \right]$$

$$4 = \pi \left[ 24 \cdot \frac{dh}{dt} - 4 \frac{dh}{dt} \right] = \pi \left( 20 \frac{dh}{dt} \right)$$

$$\frac{dh}{dt} = \frac{4}{(\pi)(20)} = \boxed{\frac{1}{5\pi} \frac{\text{in}}{\text{sec}}}$$

b)



$$\Rightarrow 6^2 = (6-h)^2 + r^2$$

$$r = 6^2 - (6-h)^2 = 36 - (36 - 12h + h^2)$$

$$\boxed{r = 12h - h^2}$$

$$c) \quad A = \pi r^2 \Rightarrow A = \pi (12h - h^2)$$

$$\frac{dA}{dt} = \pi \left( 12 \frac{dh}{dt} - 2h \cdot \frac{dh}{dt} \right)$$

$$\text{calculation} \quad \frac{dA}{dt} = \pi \left( 12 \left( \frac{1}{5\pi} \right) - 4 \left( \frac{1}{5\pi} \right) \right)$$

$$= \left( \frac{1}{5} \right) (8) = \boxed{\frac{8}{5} \frac{\text{in}^2}{\text{sec}}}$$