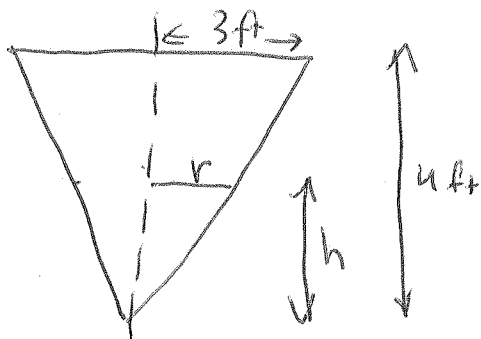


Calculus Related Rates Practice Problems

1)



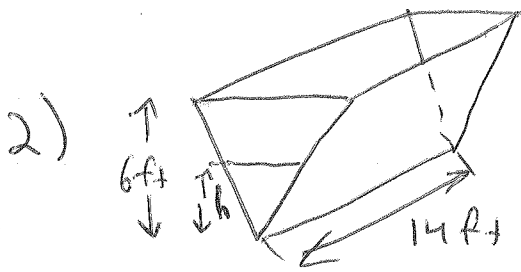
$$d = 2 \text{ in} \quad \frac{dV}{dt} = 5 \text{ in}^3/\text{s} \quad \text{Want } \frac{dh}{dt}$$

$$V = \frac{1}{3} \pi r^2 h \quad \text{need in terms of } h \quad \text{similar } \Delta\text{'s } \frac{3}{r} = \frac{4}{h}$$
$$r = \frac{3}{4} h$$

$$V = \frac{1}{3} \pi \left(\frac{3}{4} h\right)^2 h \rightarrow V = \frac{1}{3} \pi \frac{9}{16} h^3 \rightarrow V = \frac{9}{48} \pi h^3$$

$$\frac{dV}{dt} = \frac{9}{48} \pi (3) h^2 \frac{dh}{dt} \rightarrow 5 = \frac{27}{48} \pi (2)^2 \frac{dh}{dt}$$

$$\frac{dh}{dt} = 0.708 \text{ in/s}$$



$$\frac{dV}{dt} = 2 \text{ ft}^3/\text{min} \quad h = 3 \text{ ft}$$

Find ~~the~~ $\frac{dh}{dt}$

$$V = \frac{1}{2}whl, \quad V = 7wh$$

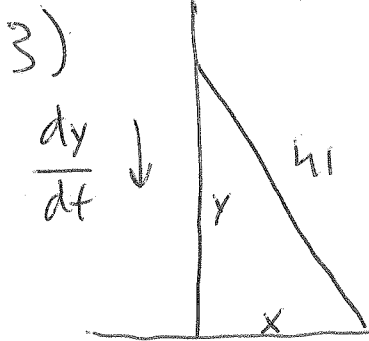
w in terms of h $\frac{w}{h} = \frac{3}{6}$

$$w = \frac{1}{2}h$$

$$V = 7\left(\frac{1}{2}h\right)(h), \quad V = \frac{7}{2}h^2$$

$$\frac{dV}{dt} = \frac{14}{2}h \frac{dh}{dt} \rightarrow 2 = 7(3) \frac{dh}{dt}$$

$$\frac{dh}{dt} = .095 \text{ ft/min}$$



$$\frac{dx}{dt} = 4 \text{ ft/s} \quad @ y = 9$$

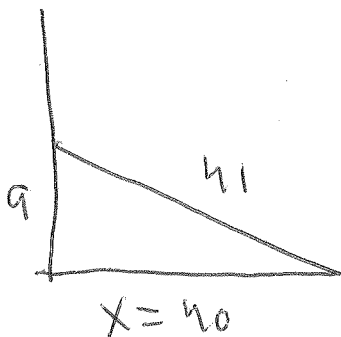
$$x^2 + y^2 = 41^2$$

$$2x \frac{dx}{dt} + 2y \frac{dy}{dt} = 0$$

$$2(40)(4) + 2(9) \frac{dy}{dt} = 0$$

$$18 \frac{dy}{dt} = -320$$

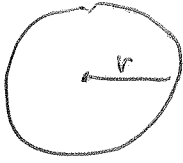
$$\frac{dy}{dt} = -17.8 \text{ ft/s}$$



$$x^2 + 9^2 = 41^2$$

$$x = 40$$

4)



$$\frac{dV}{dt} = 20 \text{ ft}^3/\text{min}$$

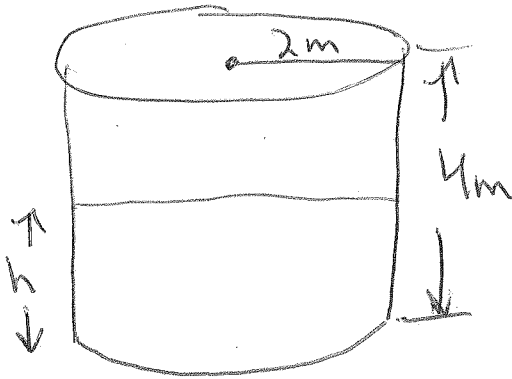
a) radius = 1 ft find $\frac{dr}{dt}$ $V = \frac{4}{3}\pi r^3$

$$\frac{dV}{dt} = \frac{4}{3}\pi r^2 \frac{dr}{dt}, \quad 20 = 4\pi(1)^2 \frac{dr}{dt}, \quad \frac{dr}{dt} = \boxed{1.59 \text{ ft}/\text{min}}$$

b) $r = 2 \text{ ft}$

$$20 = 4\pi(2)^2 \frac{dr}{dt} = \boxed{.4 \text{ ft}/\text{min}}$$

5)



$$\frac{dV}{dt} = 2 \text{ m}^3/\text{min} \quad h = 3$$

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

$$V = 4\pi h$$

$$\frac{dV}{dt} = 4\pi \frac{dh}{dt}$$

$$2 = 4\pi \frac{dh}{dt}, \quad \frac{dh}{dt} = \boxed{.16 \text{ m}/\text{min}}$$