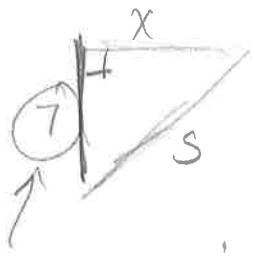
used after deriv.

13.



plug in prior to deriv. b/c it won't change in the next moment.

moment $s = 10$ mi

$\frac{ds}{dt} = 300$ mph

$100 = 49 + x^2$

$-49 \quad -49$

$\sqrt{51} = x$

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

$\left|\frac{dx}{dt}\right| = ?$

$0 + 2x\frac{dx}{dt} = 2s\frac{ds}{dt}$

$2\sqrt{51}\frac{dx}{dt} = 2(10)(300)$

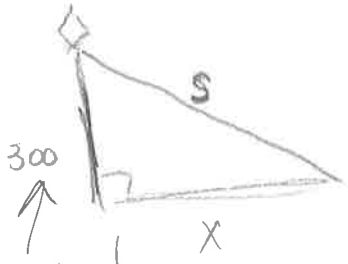
$2\sqrt{51}\frac{dx}{dt} = 6000$

$\sqrt{51}\frac{dx}{dt} = 3000$

$\frac{dx}{dt} = \frac{3000}{\sqrt{51}}$

≈ 420.084 mph

14.



constant won't change in the next moment

$\frac{dx}{dt} = 25$ ft/sec

moment

$s = 500$

$300^2 + x^2 = s^2$

$\frac{ds}{dt} = ?$

$0 + 2x\frac{dx}{dt} = 2s\frac{ds}{dt}$

$x\frac{dx}{dt} = s\frac{ds}{dt}$

$400(25) = 500\frac{ds}{dt}$

$\frac{ds}{dt} = 20$ ft/sec

16. $\frac{dV}{dt} = 10 m^3/min$

$h = \frac{3}{8} d$

$d = 2r$

$h = \frac{3}{8}(2r)$

$h = \frac{3}{4} r$

$r = \frac{4}{3} h$

d = base diameter

h = height

r = base radius

moment

h = 4m } change in t4 next moment

$V = \frac{1}{3} \pi r^2 \cdot h$

$V = \frac{1}{3} \pi \left(\frac{4}{3}h\right)^2 \cdot h$

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

$V = \frac{16}{27} \pi h^3$

$\frac{dV}{dt} = 3\left(\frac{16}{27} \pi h^2\right) \frac{dh}{dt}$

$\frac{dV}{dt} = \frac{16}{9} \pi h^2 \frac{dh}{dt}$

$10 = \frac{16}{9} \pi (4)^2 \frac{dh}{dt}$

$10 = \frac{16}{9} \pi (16) \frac{dh}{dt}$

a. $\frac{dh}{dt} = ?$

$\frac{dh}{dt} = \frac{45}{128\pi}$ m/min

$\frac{dh}{dt} = \frac{1125}{32\pi}$ cm/min

b. $r = \frac{4}{3} h$ $\frac{dr}{dt} = ?$

$\frac{dr}{dt} = \frac{4}{3} \frac{dh}{dt}$

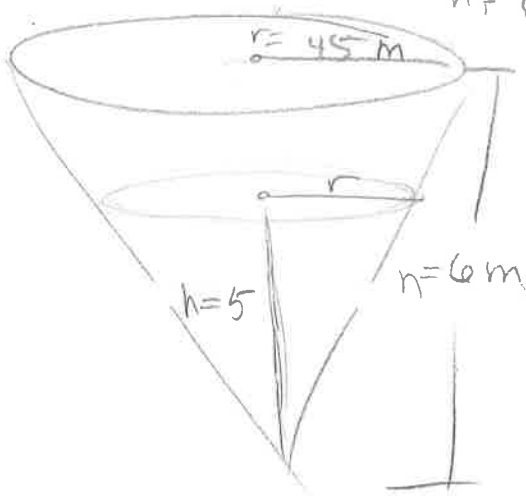
$\frac{dr}{dt} = \frac{4}{3}\left(\frac{1125}{32\pi}\right) = \frac{375}{8\pi}$ cm/min ≈ 14.921 cm/min

17. $\frac{dV}{dt} = -50 m^3/min$

$V = \frac{1}{3}\pi r^2 h$

$r = 45 m$

$h = 6$



moment $r = 37.5$ when $h = 5$

$\frac{r}{5} = \frac{45}{6}$

$r = 37.5$

a. $\frac{dh}{dt} = ?$

$V = \frac{1}{3}\pi(7.5h)^2 h$

$= \frac{1}{3}(56.25)\pi h^3$

$V = 18.75\pi h^3$

$\frac{dV}{dt} = 56.25\pi h^2$

$-50 = 56.25\pi(5)^2$

$\frac{dh}{dt} = \frac{-8}{(225\pi)} m/min$

convert to cm

$\frac{dh}{dt} = \frac{-32}{(9\pi)} cm/min$

$\frac{dh}{dt} \approx -1.132 cm/min$

$\frac{r}{h} = \frac{45}{6}$

$r = \frac{45}{6}h$

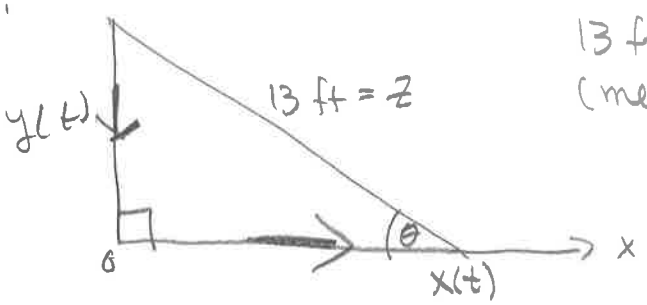
$r = 7.5h$

b. $r = 7.5h$ $\frac{dr}{dt} = ?$

$\frac{dr}{dt} = 7.5\frac{dh}{dt}$

$\frac{dr}{dt} \approx 8.488 cm/min$

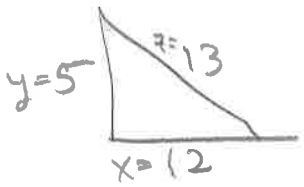
19.



13 ft ladder is constant
(meaning... the length will never change)

moment

$x = 12$ ft $\frac{dx}{dt} = 5$ ft/sec



because it is constant

$x^2 + y^2 = 13^2$

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

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

a. $\frac{dy}{dt} = ?$ $12(5) + 5\frac{dy}{dt} = 0$

$5\frac{dy}{dt} = -60$

$\frac{dy}{dt} = -12$ ft/sec

b. $A = \frac{1}{2}xy$ $\frac{dA}{dt} = \frac{1}{2}\left(y\frac{dx}{dt} + x\frac{dy}{dt}\right)$

$= \frac{1}{2}\left(5(5) + 12(-12)\right)$

$= -119/2$ ft^2/sec

$= -59.5$ ft^2/sec

c. $\cos\theta = \frac{x}{13}$

$\cos\theta = \frac{12}{13}$

$13\cos\theta = x$

$\theta = \cos^{-1}\left(\frac{12}{13}\right)$

$\theta \approx .395$ (store this value)

$-13\sin\theta\frac{d\theta}{dt} = \frac{dx}{dt}$

$-13\sin(.395)\frac{d\theta}{dt} = 5$

$\frac{d\theta}{dt} \approx -1$ rad/sec