$x, y \quad x^2+y^2=200 \rightarrow$

$2x+2yy'=0$

$2yy'=-2x$

$y'=\frac{-2x}{2y}=\frac{-x}{y}$

$P(x,y)=xy$

$P'(x,y)=y+xy'$

$y=\sqrt{200-x^2}$

$P(x)=x\sqrt{200-x^2}$

$P'(x)=\sqrt{200-x^2}+\frac{x}{2\sqrt{200-x^2}}\cdot(-2x)$

$\frac{200-x^2-x^2}{\sqrt{200-x^2}}=0$

$200-2x^2=0$

$100=x^2$

$10=x$

36. $x^2-y^2=4$ closest to $(6,0)$

$x^2-4=y^2$

$d(x,y)=\sqrt{(x-6)^2+(y-0)^2}$

$=\sqrt{(x-6)^2+y^2}$

$y=\pm\sqrt{3^2-4}$

$=\pm\sqrt{5}$

$d(x)=\sqrt{(x-6)^2+x^2-4}$

$d'(x)=\frac{1}{2\sqrt{(x-6)^2+x^2-4}}\cdot[2(x-6)+2x]$

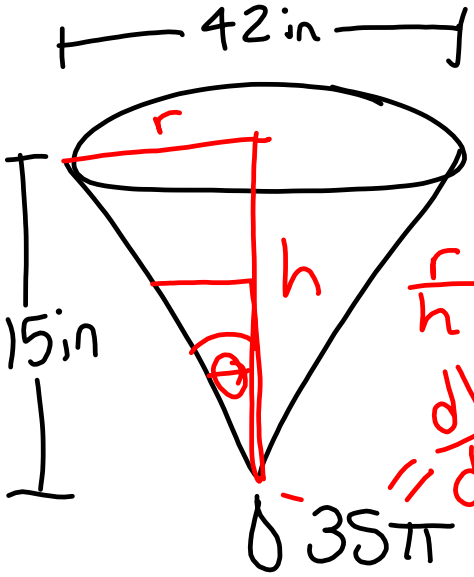
$2(x-6)+2x=0$

$4x-12=0$

$x=3$

$$s(t) = \cancel{\frac{1}{2}at^2} + V_0 t + S_0$$

$$s(t) = V_0 t + S_0$$



How fast is the depth dropping when the height is 5 inches?

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

$\frac{dV}{dt} = 35\pi \text{ in}^3/\text{sec}$

$\frac{r}{h} = \frac{21}{15} = \frac{7}{5}$

$r = \frac{7}{5}h$

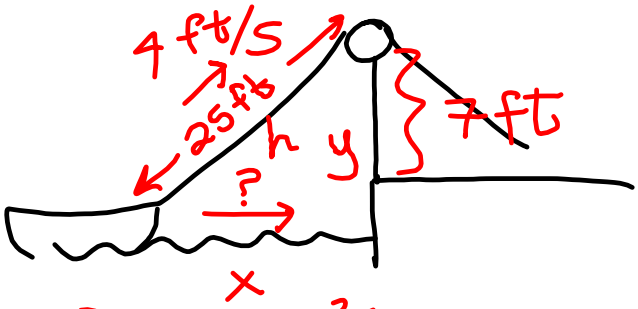
$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi\left(\frac{7}{5}h\right)^2 h$

$V = \frac{1}{3}\cdot\frac{49}{25}\pi h^3$

$\frac{dV}{dt} = \frac{49\pi}{25}h^2 \cdot \frac{dh}{dt}$

$\frac{dh}{dt} = \frac{\frac{dV}{dt}}{\frac{49\pi}{25}h^2}$



$y = 7$

$\frac{dh}{dt} = -4 \text{ ft/s}$

$\frac{dx}{dt} = ?$ when $h = 25$

$x^2 + y^2 = h^2$

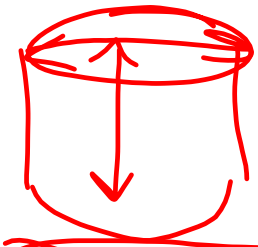
$x^2 + 49 = h^2$

$2x \cdot \frac{dx}{dt} = 2h \cdot \frac{dh}{dt}$

$\frac{dx}{dt} = \frac{h \cdot \frac{dh}{dt}}{x} = \frac{25 \cdot (-4)}{24} = \frac{25}{6} \text{ ft/s}$

$V = 512 \text{ in}^3$

$V = \pi r^2 h$

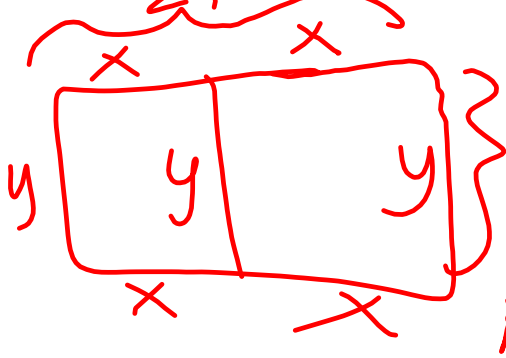


$h = d$ $512 = \pi r^2 h$

$h = 2r$ $512 = \pi r^2 (2r)$

$A = 2\pi r^2 + 2\pi r h$ $\sqrt[3]{\frac{256}{\pi}}$

$384\ m^2 = A$



$P(x,y) = 4x + 3y$

$2xy = 384$

$y = \frac{384}{2x}$

$P(x) = 4x + 3\left(\frac{384}{2x}\right)$

$P(x) = 4x + \frac{576}{x}$

$P'(x) = 4 - \frac{576}{x^2}$

$4 - \frac{576}{x^2} = 0$

$4 = \frac{576}{x^2}$

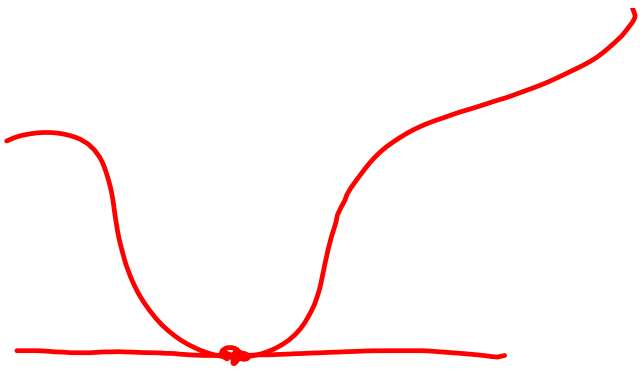
$x^2 = \frac{576}{4}$

$x = \sqrt{\frac{576}{4}}$

$= \frac{24}{2} = 12$

$x = 12$

$y = \frac{384}{24} = 16$



$x(t) = t^3 + 8t^2 - 2t + 4, \quad t > 0$

when is the particle changing direction?

$x'(t) = 3t^2 + 16t - 2$

$3t^2 + 16t - 2 = 0$

solve(3x^2+16x-2=0,x)

$t = \frac{\sqrt{70} - 8}{3}$

$x(t) = \sin^2 2t, \quad t > 0$

find distance particle travels from $t=0$ to $t=2$.

$x'(t) = \underbrace{2\sin 2t \cos 2t}_{\sin 2(2t)} \cdot 2$

$x'(t) = 2\sin 4t = 0$

$\sin 4t = 0$

$4t = 0, \pi, 2\pi, 3\pi, 4\pi$

$t = 0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi$

+ − +

$|x(\frac{\pi}{4}) - x(0)|$

$+ |x(\frac{\pi}{2}) - x(\frac{\pi}{4})|$

$+ |x(2) - x(\frac{\pi}{2})|$