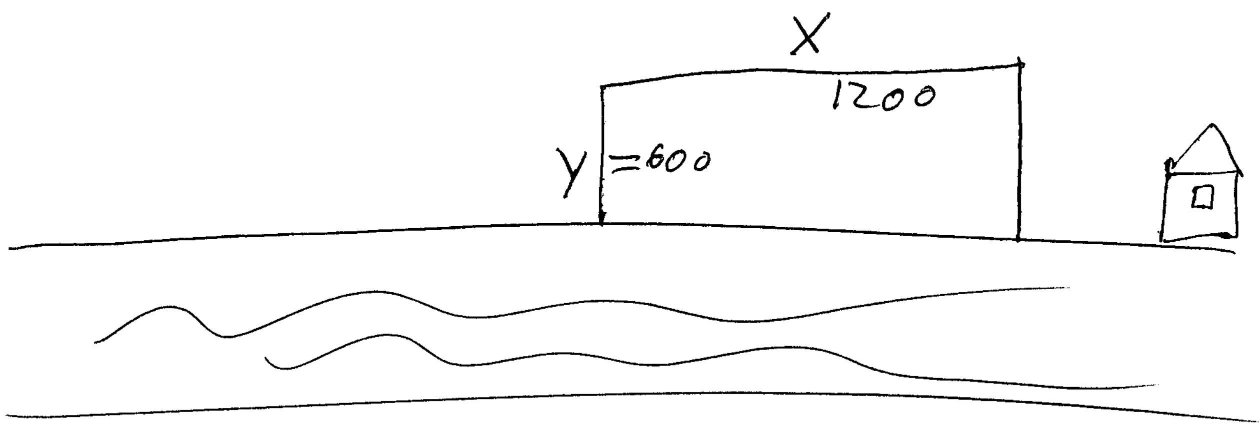


Total length of fence = 2400'

$2y + x = 2400$ $\quad x = 2400 - 2y$

or

$$y = \frac{2400 - x}{2}$$

$$A(x) = xy = x\left(\frac{2400-x}{2}\right) = 1200x - \frac{x^2}{2}$$

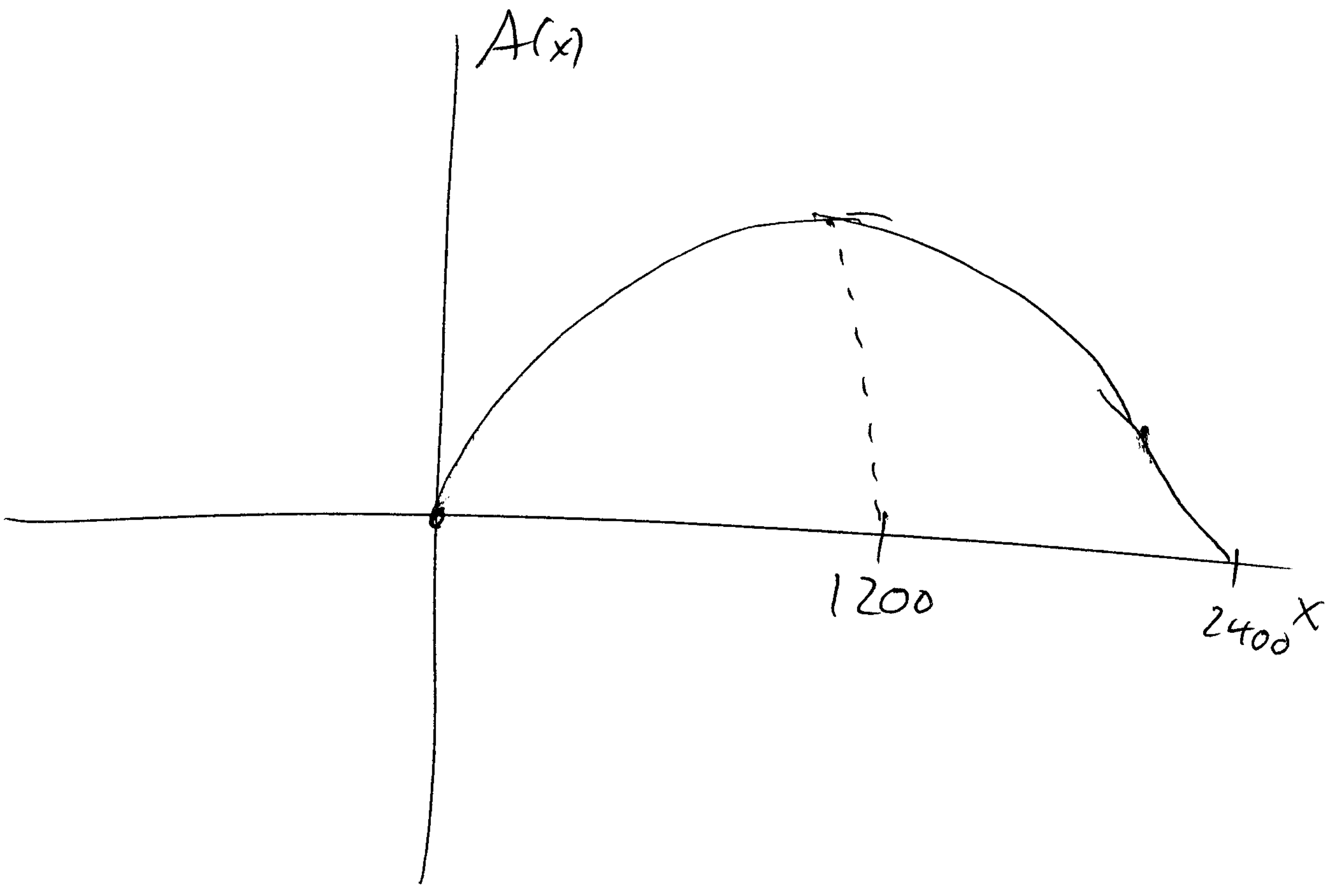
Find critical pts.

$0 = A'(x) = 1200 - x \Rightarrow x = 1200$

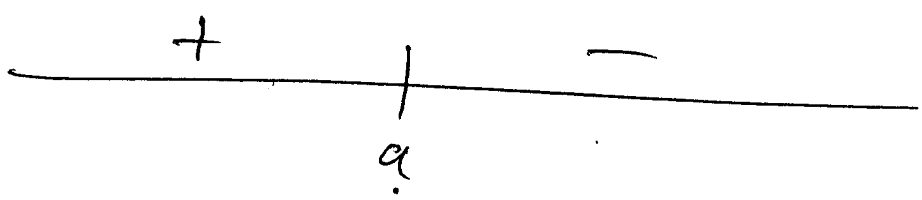
$y = 600$

$+ \quad\quad -$

1200 $\quad f'$



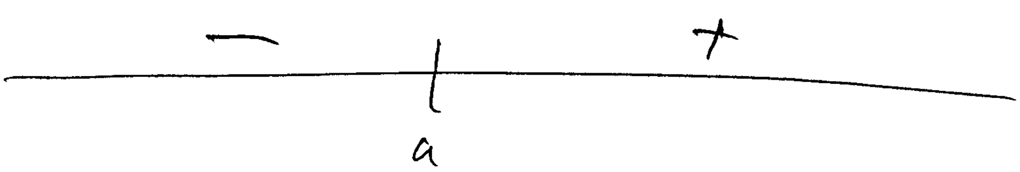
First derivative rule: If



f', then

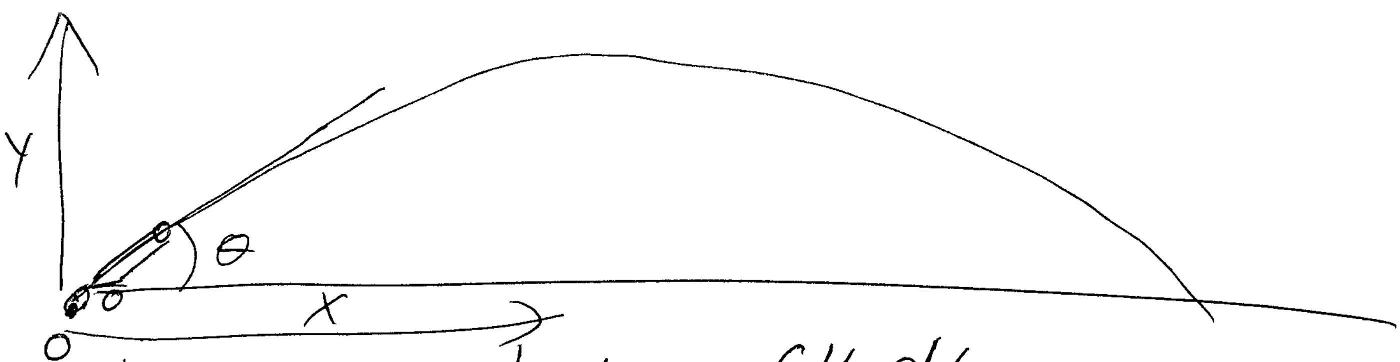
a is an absolute max

If



f', then

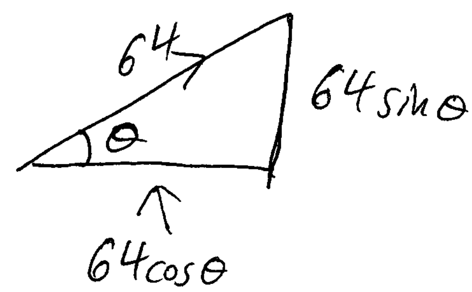
a is an absolute min



Shoot at speed 64 ft/sec

How to shoot as far as possible?

Initially, $\cancel{x=y=0}$ $x(0)=y(0)=0$



$$\frac{dx}{dt}(0) = 64\cos\theta$$

$$\frac{d^2x}{dt^2} = 0$$

$$x(t) = (64\cos\theta)\,t$$

$$\frac{dy}{dt}(0) = 64\sin\theta \qquad \frac{d^2y}{dt^2} = -32$$

$$\frac{dy}{dt} = -32t + C \qquad C = 64\sin\theta$$

$$\frac{dy}{dt}(0) = -32(0)+C = 64\sin\theta$$

$$\frac{dy}{dt} = 64\sin\theta - 32t$$

at $t = 2\sin\theta$, top of the arc

at $t = 4\sin\theta$ hit ground.

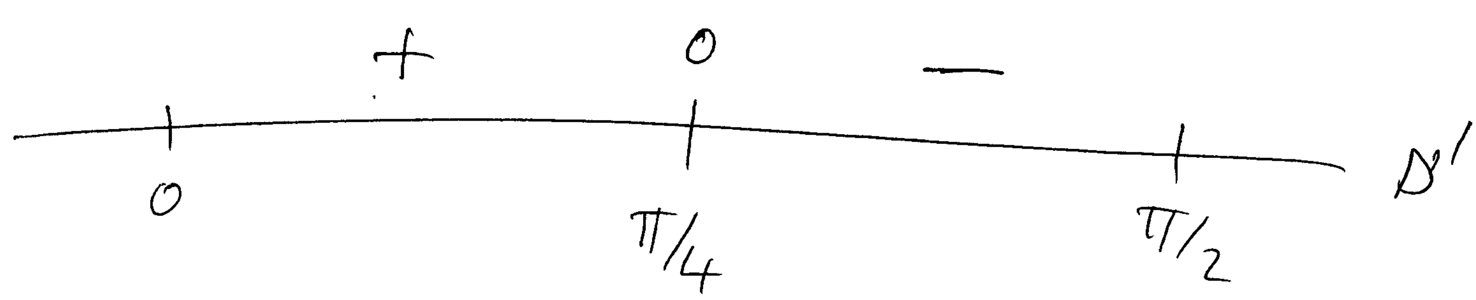
at $t = 4\sin\theta$, $x = 64\cos\theta\, t = 256 \cos\theta \sin\theta$

$D(\theta) = 256 \sin\theta \cos\theta$

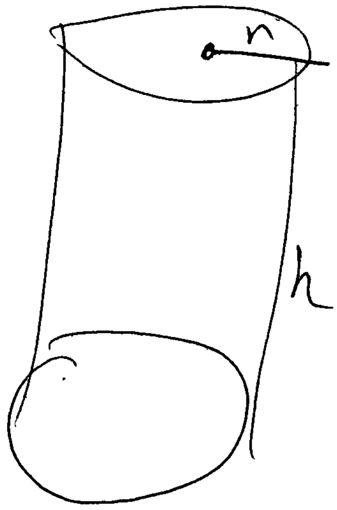
Find crit. pt.

$D'(\theta) = 256 \left(\cos\theta \cos\theta + \sin(\theta)(-\sin\theta) \right)$

$= 256 \left(\cos^2\theta - \sin^2\theta \right) = 256 \cos(2\theta)$



$D\left(\frac{\pi}{4}\right) = 256 \frac{\sqrt{2}}{2} \frac{\sqrt{2}}{2} = 128$



Make a cylindrical can that holds 1L, using as little metal as possible.

Area of top $= \pi r^2$

Area of bottom $= \pi r^2$

Area of side $= h \times (\text{circumference})$

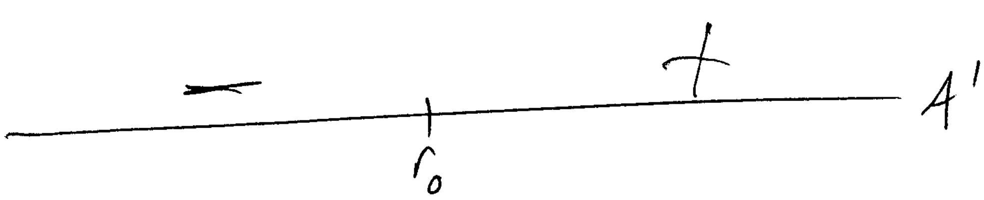
$= 2\pi r h$

Minimize $\boxed{2\pi r^2 + 2\pi r h}$

Volume $= \pi r^2 h = 1$ $\qquad h = \dfrac{1}{\pi r^2}$

$$\text{Area} = 2\pi r^2 + 2\pi r \cdot \frac{1}{\pi r^2} = 2\pi r^2 + \frac{2}{r} = A(r)$$

$$A'(r) = 4\pi r - \frac{2}{r^2} = 0 \implies 4\pi r^3 = 2$$

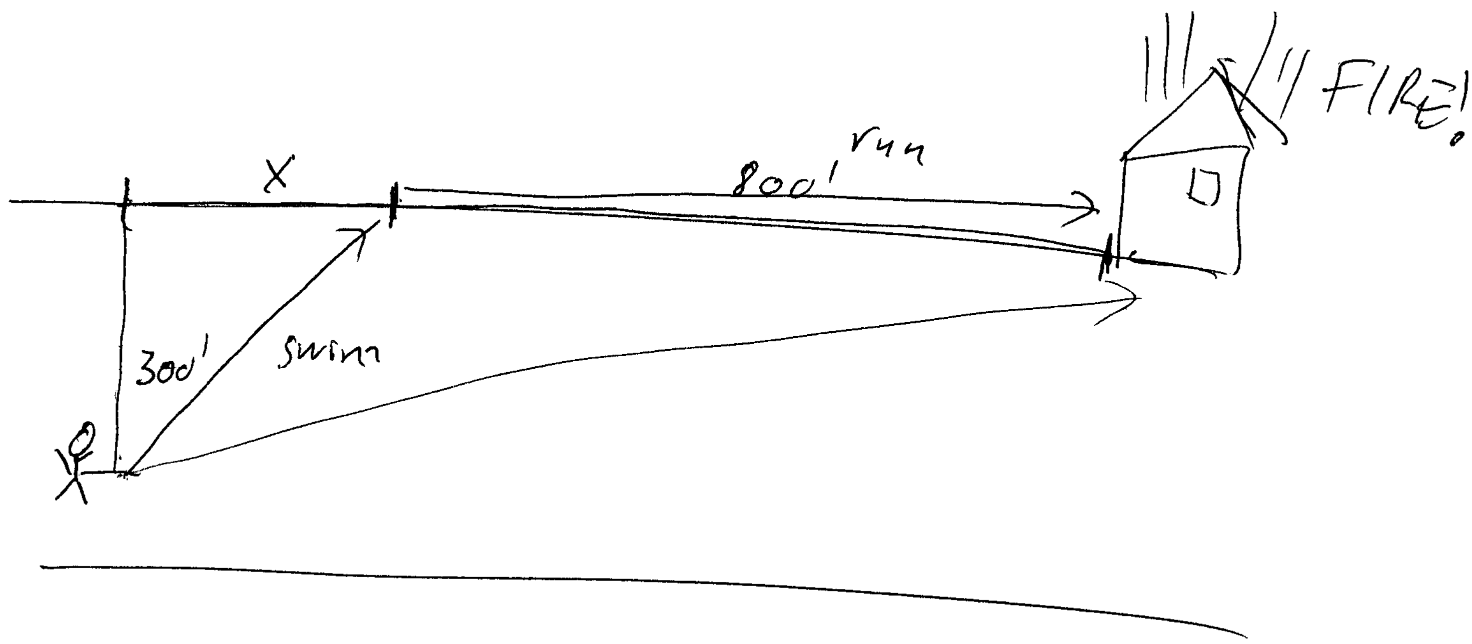


$$r^3 = \frac{1}{2\pi}$$

$$r_0 = \sqrt[3]{1/2\pi} = r_0$$

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

1) Define your variables
2) Express everything in terms of those variables
3) Use info to eliminate all but one variable. Express goal in terms of that variable.
4) Take derivative and set $=0$.
5) If necessary make sign chart of f'.



Swims at 6'/sec

runs at 8'/sec

swim distance $= \sqrt{300^2 + x^2}$

Swim time $= \sqrt{300^2+x^2}\,/6$

run distance $= 800-x$

run time $= \dfrac{800-x}{8}$

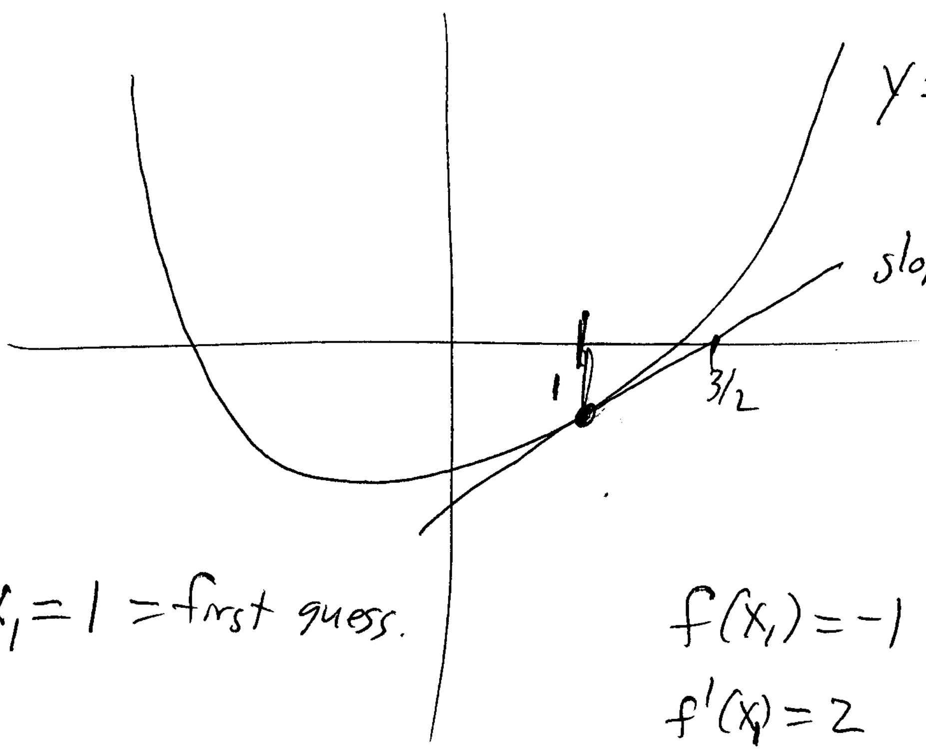
total time $= \dfrac{\sqrt{300^2+x^2}}{6} + \dfrac{800-x}{8} = f(x)$

Rate $\times$ time = distance

time $= \dfrac{\text{distance}}{\text{rate}}$

Find $\sqrt{2}$

Find a solution to $x^2 - 2 = 0$



$y = x^2 - 2 = f(x)$

slope $= \quad f'(x) = 2x$

$x_1 = 1$ = first guess.

$f(x_1) = -1$

$f'(x_1) = 2$

$x_2 = 1 + \frac{1}{2} = \frac{3}{2}$ $\qquad f(x_2) = 1/4 \qquad f'(x_2) = 3$

$x_3 = \frac{3}{2} - \frac{(1/4)}{3} = \frac{3}{2} - \frac{1}{12} = \frac{17}{12}$

$f\left(\frac{17}{12}\right) = \frac{1}{144}$

$f'\left(\frac{17}{12}\right) = \frac{17}{6}$

$x_4 = \frac{17}{12} - \frac{1/144}{17/6} = \frac{577}{408}$

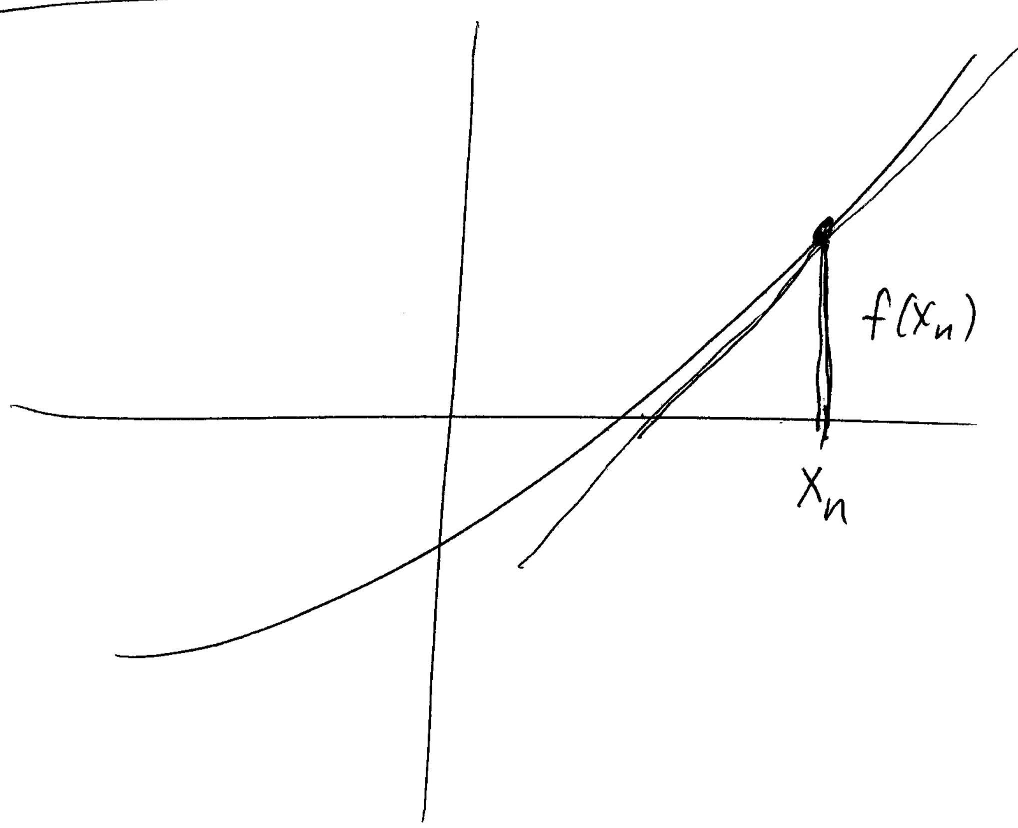
$\approx 1.41421568 6$

$x_5 = \frac{577}{408} - \frac{(\text{overshoot})}{f'(x_5)} = \frac{665857}{470832}$

Idea: Find solutions to $f(x)=0$

ϕ First guess $= x_1$

$$\boxed{x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}}$$



slope $= f'(x_n)$

$= \frac{\text{rise}}{\text{run}}$

run $= \frac{\text{rise}}{\text{slope}}$