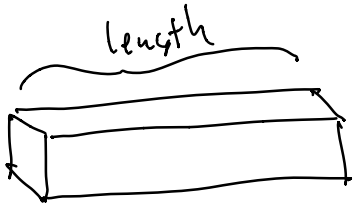
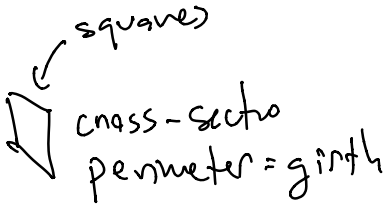
We are trying to design a box with maximum possible volume which still qualifies for a certain USPS flat rate. Rate requires that the sum of the girth and length is at most 108 inches.

Problem: find the dimensions of a box with square ends which maximizes volume





$V = lwh$ square $\Rightarrow w = h$

$V = lw^2$ $\quad l + g = 108$ $\quad g = 4w$

$V = (108 - 4w)w^2$ $\quad l + 4w = 108$

$l = 108 - 4w$

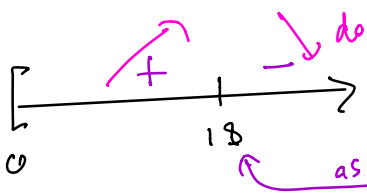
$V = 108w^2 - 4w^3$

$V = 4(27w^2 - w^3)$ $\quad V' = 4(54w - 3w^2)$

$= 4 \cdot 3(18w - w^2) = 12w(18 - w)$

Domain: w in $[0, \text{something}]$

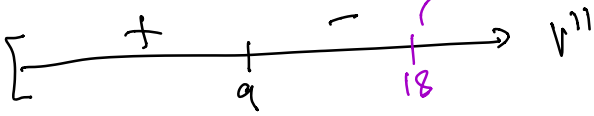
will think later about whether or not we need to know this ...



$V' = 0$ at 18 (inside domain)

as we move to right, V' gets more negative

$$V'' = 12(18-2w) = 24(9-w)$$

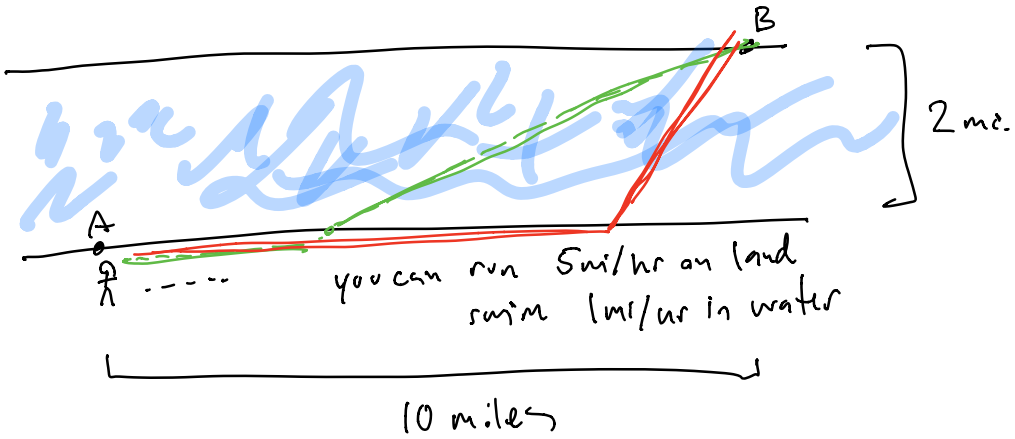


max @ $w=18$ = h

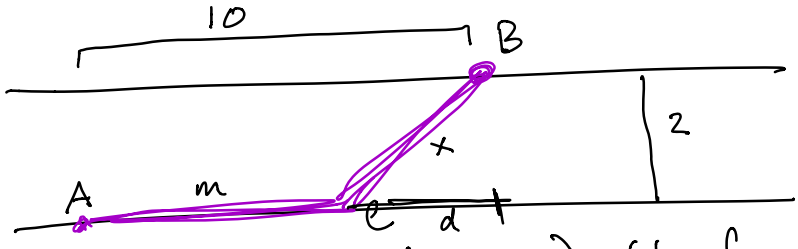
$4w + l = 108$

$l = 108 - 4w = 108 - 72$

$= 36.$



minimize time to get from A to B.



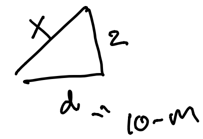
T = (time from A to C) + (time from C to B)

time from A to C = $\frac{m}{5}$ time from C to B = $\frac{x}{1}$

$T = \frac{1}{5}m + x$

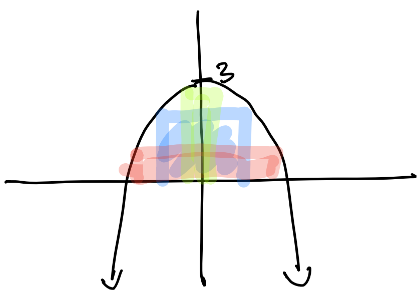
$m + d = 10$

$= \frac{1}{5}m + \sqrt{4 + (10-m)^2}$



$x^2 = 4 + (10-m)^2$

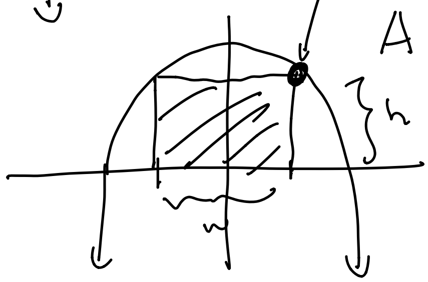
Domain m in [0,10]



find rectangle between $y = 3 - x^2$ & x-axis with largest area

$(x,y) = (x, 3-x^2)$

$A = wh$



$w = 2x$

$h = 3 - x^2$

$A = 2x(3-x^2)$ x in [0, something]

↑ x-int of parabola w/ x-axis