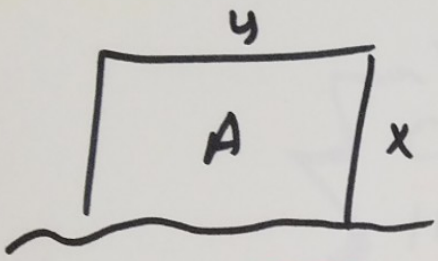
Optimization Day 2
&
Derivative of Inverses

Example:



$A = xy$

$200 = 2x + y$

$200 - 2x = y$

$A = x(200 - 2x)$

$A = x(200 - 2x)$

$A = 200x - 2x^2$

$A' = 200 - 4x$

$0 = 200 - 4x$

$4x = 200$

$x = 50$ yards

MAX

\+ | −

50

$y = 200 - 2(50)$

$y = 100$ yards

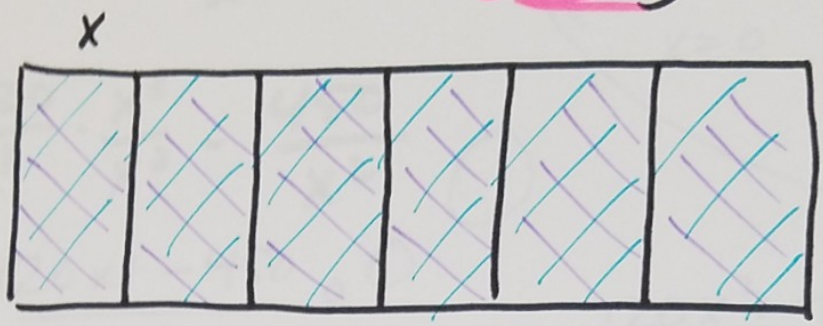
50×100

$A = 5000 \text{ yd}^2$

Example: Minimize $\$$ $A = xy$

$A_p = 10 = xy$

$y = \frac{10}{x}$



OUTSIDE: $12x + 2y$

INSIDE: $5y$

Cost = 10$\$$ OUT

Cost = 5$\$$ IN

$$\text{Cost}_{\text{TOTAL}} = 10(12x + 2y) + 5(5y)$$

$$= 10\left(12x + 2\left(\frac{10}{x}\right)\right) + 5\left(5\left(\frac{10}{x}\right)\right)$$

$$= 120x + \frac{200}{x} + \frac{250}{x}$$

$$= 120x + \frac{450}{x}$$

OK, NOW WE CAN DERIVE!

$$C'_{TOTAL} = 120 - \frac{450}{x^2}$$

$$= \frac{120}{1} \cdot \frac{x^2}{x^2} - \frac{450}{x^2}$$

$$= \frac{120x^2 - 450}{x^2}$$

WE KNOW
$x^2 = 0$ function is UNDEFINED at $x = 0$
$x = 0$

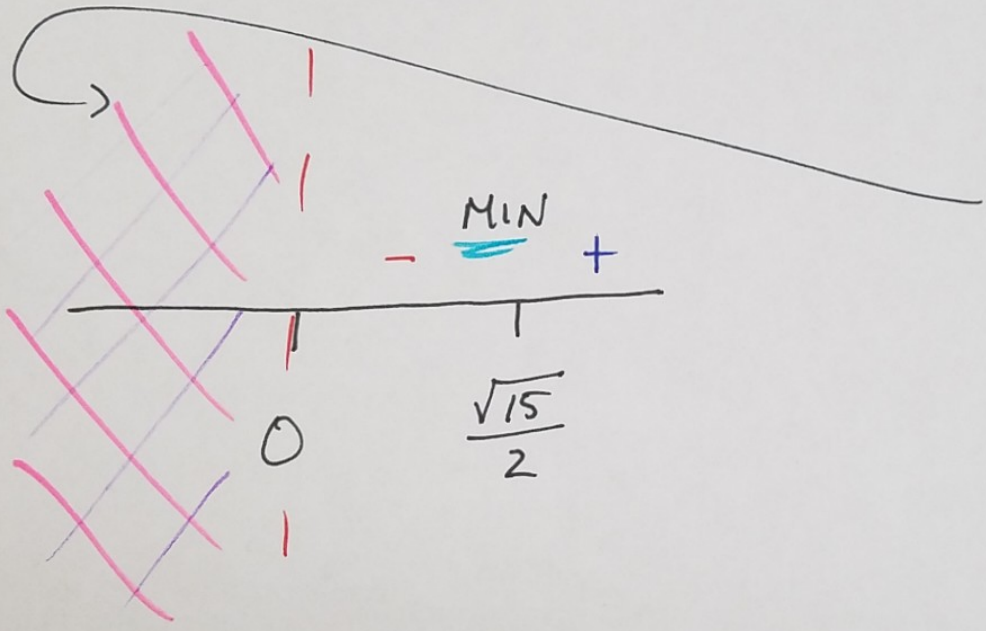
$$120x^2 - 450 = 0$$

$$120x^2 = 450$$

$$x^2 = \frac{15}{4}$$

$$x = \pm\sqrt{\frac{15}{4}}$$

CAN X HERE BE NEGATIVE?



$$Cost_{TOTAL} = 120x + \frac{450}{x}$$

$$= 120\left(\frac{\sqrt{15}}{2}\right) + \frac{450}{\left(\frac{\sqrt{15}}{2}\right)}$$

$$Cost_{TOTAL} = \$464.76$$