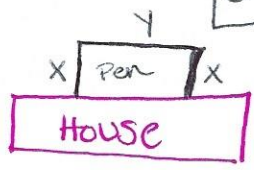


Optimization Practice from July 25

#3



1500 yards of material to work with

$A = xy$

$1500 = 2x + y \Rightarrow 1500 - 2x = y$

$A(x) = x(1500 - 2x) = 1500x - 2x^2$

$1500 - 2(375) = y = 750 \text{ yards}$

$A'(x) = 1500 - 4x$

$1500 - 4x = 0$

$1500 = 4x$

$1500/4 = x$

$x = 375 \text{ yards}$

1	375	400
$A'(1) = 1500 - 4(1) = 1496$	Relative Max	$A'(400) = 1500 - 4(400) = -100$

#4

$C(x) = (x-10)^2 + 12x$

$C'(x) = 2(x-10) \cdot 1 + 12 = 2x - 20 + 12 = 2x - 8$

$2x - 8 = 0 \Rightarrow 2x = 8 \Rightarrow x = 8/2 = 4$

$C(0) = (0-10)^2 + 12(0) = 100 + 0 = 100$

0	4	5
$C'(0) = 2(0) - 8 = -8$	Relative Minimum	$C'(5) = 2(5) - 8 = 2$

$C(4) = (4-10)^2 + 12(4) = (-6)^2 + 48 = 36 + 48 = 84$

#5

$0 \leq x \leq 20000$

$P(x) = -0.02x^2 + 300x - 200000$

$P'(x) = -0.04x + 300$

$-0.04x + 300 = 0 \Rightarrow 300 = 0.04x$

$300/0.04 = x$

$x = 7500$

0	7500	20000
$P'(0) = (+)$	Relative Max Absolute	$P'(20000) = (-)$

$P(0) = -200000$

$P(7500) = 925000$

$P(20000) = -794200000$

7500 units to get maximum profit.

Optimization Practice 2

①  $P(x) = -10x^2 + 1760x - 50000$   
 $P'(x) = -20x + 1760$

$0 = -20x + 1760$   $20x = 1760$   
 $x = 88$

	1	88	100
⊕			⊖
↗		max	↘

$P(1) = \$ -50,000$   
 $P(88) = \$ 27,440$   
 $P(100) = \$ 26,000$

88 units will give you a max profit of \$27,440

②

$f(t) = 0.136t^2 + 0.127t + 18.1$   
 $f'(t) = 0.272t + 0.127$

$0 = 0.272t + 0.127$   
 $-0.272t = 0.127$

$t = \frac{0.127}{-0.272} = -0.4669$

not within our interval, so now check the end points.

$f(0) = 18.1$

$f(4) = 20.784$

when 2009 lowest rate is 18.1, and @ 2013 highest rate 20.784

③  $R(x) = px = \left(\frac{100000}{250+x} - 100\right)(x) = \frac{100000x}{250+x} - 100x$   
 $p = \frac{100000}{250+x} - 100$

$R'(x) = -100 + \left(-\frac{1000000x}{(250+x)^2}\right) + \frac{100000}{(250+x)}$

$0 = 100(250+x)^2 + 250000000$   
 $-250000000 = 100(250+x)^2$   
 $+250000 = (250+x)^2$

$\pm\sqrt{250000} = 250+x$   
 $-250 \pm \sqrt{250000} = x$

$x = -200$   
 $x = -468.11$

$= -100 - \frac{1000000x}{(250+x)^2} + \frac{100000}{(250+x)}$   
 $= -100(250+x)^2 - 1000000x + 100000(250+x)$   
 $= -100(250+x)^2 - 1000000x + 250000000 + 100000x$   
 $= -100(250+x)^2 + 250000000$