4.5,5.2

Thursday, July 02, 2009
7:15 AM

p293/ #13b

$C(x) = 72000 + 60x$ $\qquad$ x : TV's

$p = 200 - \frac{x}{30}$

(0) maximize profit

(1) profit = \$ in − \$ out

$P(x) = \underbrace{xp}_{R(x)} - C(x) = x\left(200 - \frac{x}{30}\right) - (72000 + 60x)$

$P(x) = 200x - \frac{x^2}{30} - 72000 - 60x$

$P(x) = -\frac{x^2}{30} + 140x - 72000$ maximize

(2) downward parabola, max occurs at $x = \frac{-b}{2a}$

$x = \frac{-140}{2 \cdot \frac{-1}{30}} = \frac{-140}{-1/15} = 140 \cdot 15 = 2100$ TV's

(3) for max. profit

production level $x = 2100$ TV's

max profit is $P(2100) =$ ______

& price per TV is $p = 200 - \frac{2100}{30} = 200 - 70 = \cancel{140}$ \$130

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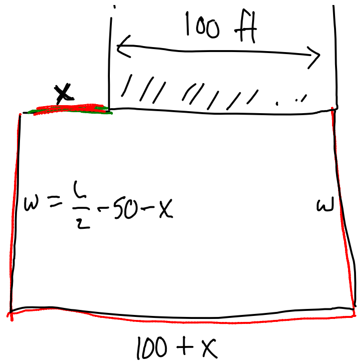
$x \geq 0$



L feet of fence

maximize area

$$2w + x + 100 + x = L$$
$$2w = L - 100 - 2x$$
$$w = \frac{L - 100 - 2x}{2} = \frac{L}{2} - 50 - x$$

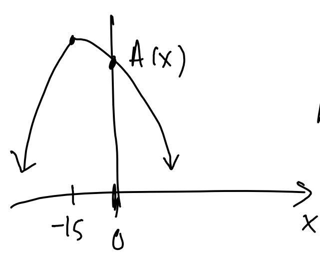
$$A(x) = (\text{length})(\text{width})$$
$$A(x) = (100 + x)\left(\frac{L}{2} - 50 - x\right)$$

maximize for $x \geq 0$

(A) if $L = 240$

$A(x) = (100 + x)(\cancel{140}^{120} - 50 - x)$

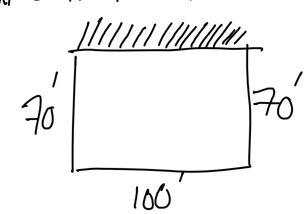
$A(x) = (100 + x)(70 - x)$ vtx at $x = -15$ (halfway b/w zeros)



max at $x = 0$

want max for $x \geq 0$

dimensions will be



(B) $L = 400$

$$A(x) = (100 + x)\left(\frac{400}{2} - 50 - x\right)$$
$$= (100 + x)(150 - x)$$

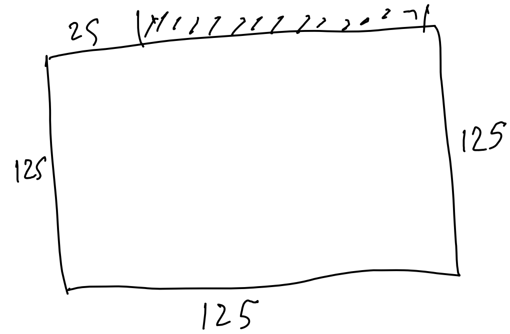
zeros at 150, -100

average zeros to get

$x = \frac{150 + (-100)}{2} = 25$

max. Area will have $x = 25$

100

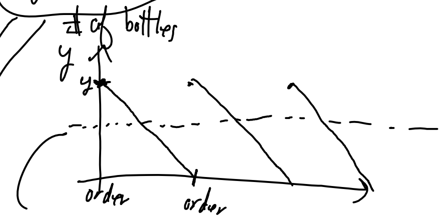


(28) uniform annual demand for 200 bottles

$10 bottle storage per year, $40 place an order

x = # of times to order, each time you would order

$$y = \frac{200}{x} \text{ bottles}$$



on average there are $y/2$ bottles on hand

order costs

$= 40x$

Storage costs

$$= 10 \cdot \frac{y}{2} = \frac{10}{2} \cdot y = 5y = 5 \cdot \frac{200}{x} = \frac{1000}{x}$$

$C(x)$ = orders + storage

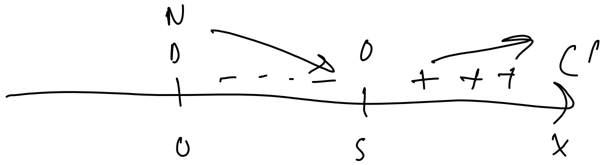
$$C(x) = 40x + \frac{1000}{x} \qquad x > 0 \qquad (0, \infty)$$

to optimize C' + sign chart

$$C'(x) = 40 - \frac{1000}{x^2} = \frac{40x^2 - 1000}{x^2} = \frac{10(4x^2 - 100)}{}$$

X^2

$$= \frac{10 \cdot 4(x^2-25)}{x^2} = \frac{40(x-5)(x+5)}{x^2}$$



So C has an abs min. at $x=5$

Place 5 orders per year!

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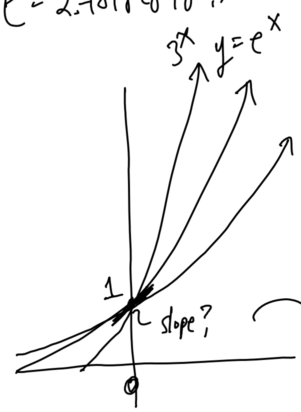
§5.2 Derivative of e^x

$$f(x)=e^x, \quad f'(x) = \lim_{h\to 0}\frac{f(x+h)-f(x)}{h} = \lim_{h\to 0}\frac{e^{x+h}-e^x}{h} = \lim_{h\to 0}\frac{e^x e^h - e^x}{h}$$

$$= \lim_{h\to 0} e^x\left(\frac{e^h-1}{h}\right) = e^x \lim_{h\to 0}\frac{e^h-1}{h} = e^x \cdot 1 = e^x$$

slope of e^x at $x=0$

$e = 2.718182818\ldots$



$a=0$

$$m = \lim_{h\to 0}\frac{f(a+h)-f(a)}{h} = \lim_{h\to 0}\frac{f(0+h)-f(0)}{h} = \lim_{h\to 0}\frac{e^h-e^0}{h}$$

$$= \lim_{h\to 0}\frac{e^h-1}{h} = f'(0) = 1$$

natural base

$$\frac{d}{dx}e^x = e^x$$

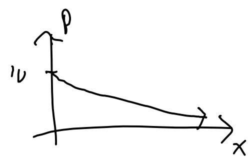
Chain Rule $\quad \frac{d}{dx}e^{f(x)} = e^{f(x)}\, f'(x)$

Ex. Let $g(x) = e^{x^2+5}$, $\quad g'(x) = e^{x^2+5}\cdot 2x$

Ex. Let $g(x) = \dfrac{e^{2x} - 3x^2}{5x+2}$

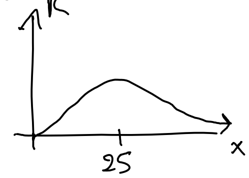
$$g'(x) = \frac{(5x+2)\left(e^{2x}\cdot 2 - 6x\right) - \left(e^{2x} - 3x^2\right)(5)}{(5x+2)^2}$$

Ex. #60 pg 323 $\quad p = 10e^{-.04x}$



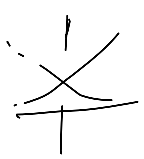
maximize revenue

$$R(x) = xp = x\left(10e^{-.04x}\right) = 10xe^{-.04x}$$



$$R'(x) = 10x\left(e^{-.04x}(-.04)\right) + 10e^{-.04x}$$

$x \geq 0$

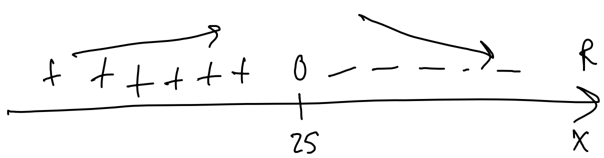


$$= \underbrace{10e^{-.04x}}_{+}\left[-.04x + 1\right] = 0$$

$-.04x + 1 = 0$

$.04x = 1$

$x = 1/.04 = 25$



max rev. at $x = 25$