Observation #1 4/8/2015

Homework Pg. 327 (Know problems 6 & 8 Pg 327 for Quiz)

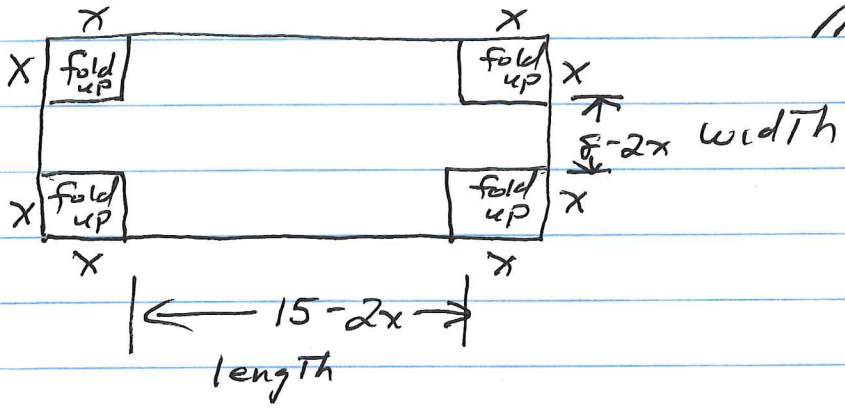
OPTIMIZATION II

went over in class

#6 Packaging

Find dimensions To Maximize Volume?

Step 1 (diagram)



Step 2: Calculate interval for optimization

$x \geq 0$ $[0, ?]$

length: $15-2x \geq 0$

$-2x \geq -15$

$x \leq \frac{15}{2}$

$7\frac{1}{2}$

width: $8-2x \geq 0$

$-2x \geq -8$

$x \leq 4$

interval for x: $[0, 4]$

Step 3 Figure out formula needed

$$V = lwh = (15-2x)(8-2x)(x)$$

$$V = f(x) = (4x^2 - 46x + 120)(x)$$

$$f(x) = 4x^3 - 46x^2 + 120x$$

$$f'(x) = 12x^2 - 92x + 120$$

$$f'(x) = 4(3x^2 - 23x + 30)$$

$$f'(x) = 4(3x-5)(x-6) = 0$$ To calc. MAX

$x = 5/3$

$x = 6$ is outside $[0, 4]$ so Throw out

$f(0) = 0$; $f(4) = 4(4)^3 - 46(4)^2 + 120(4) = 256 - 736 + 480 = 0$; $f(5/3) > 0$

Homework Pg 327

#6 Packaging (cont.)

(optimization 2)

$f(0) = 0$

$f(4) = 0$

$f(5/3) > 0$ so $x = 5/3$ is an absolute MAXIMUM

Note: for $f(5/3) = \frac{950}{27} > 0$ but just necessary to know $f(5/3)$ is the largest one. $\frac{950}{27}$ is not used.

dimensions: x = height = $5/3$ inches

length $= 15 - 2(5/3) = 15 - \frac{10}{3}$

$= 15 - 3\frac{1}{3} = 11\frac{2}{3}$ inches

width $= 8 - 2(5/3) = 8 - \frac{10}{3} = 8 - 3\frac{1}{3} = 4\frac{2}{3}$ inches

dimensions: $11\frac{2}{3}$ inches $\times$ $4\frac{2}{3}$ inches $\times$ $1\frac{2}{3}$ inches

Observation #2 4/8/2015

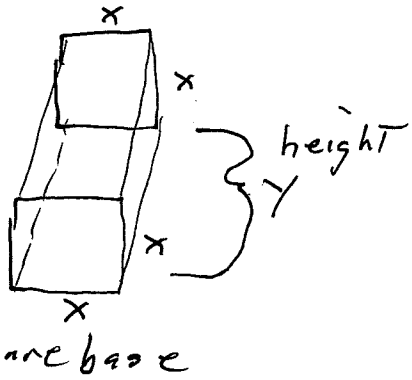
Homework Page 327

#9 Minimizing Costs

Given: An open on the top rectangular box $V = 36 in^3$ with a square base is made for pencils. Material for sides $15¢/in^2$
Material for bottom $40¢/in^2$

What should the dimensions of the cup be To minimize the construction cost?

Step 1



(Area of base)(height)

$V = Bh$

$B = x^2$

Total Area of sides : $4xy$

Step 2 The Cost of constructing the cup

$$C(x) = \underset{\text{base}}{40x^2} + \underset{\text{sides}}{15(4xy)} = 40x^2 + 60xy \text{ cents}$$

need to get rid of the y by finding a relationship with x

$$V = Bh = x^2y = 36 \text{ so } y = \frac{36}{x^2}$$

substituting

$$C(x) = 40x^2 + 60x\left(\frac{36}{x^2}\right) = 40x^2 + \frac{2160}{x}$$

$$C'(x) = 80x - \frac{2160}{x^2} = 0$$

$$80x^3 - 2160 = 0$$

$$x^3 = \frac{2160}{80} = 27 \text{ so } \boxed{x = 3}$$

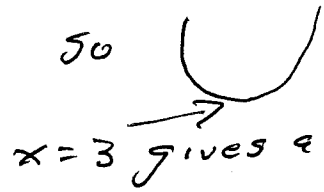
Homework Page 327

#9 Minimizing Cost

we can find if $x=3$ is a maximum or minimum by using the second derivative

$$C'(x) = 80x - \frac{2160}{x^2}$$

$$C''(x) = 80 - \frac{(2160)(-2)}{x^3} = 80 + \frac{4320}{x^3} \Big]_{x=3} > 0$$



$x=3$ gives a minimum

∴ The minimize the cost

$$x = 3$$

$$y = \frac{36}{x^2} = \frac{36}{3^2} = \frac{36}{9} = 4$$

required dimensions $3'' \times 3'' \times 4''$

Just To page 86 at end

NOTE (Did Page 8a & 8b 1ST) (Board Work)

observation #4 Section 5.4

Group * To board

$f(x) = e^x$ Rule #1

$$\boxed{f'(x) = e^x}$$

Product Rule

practice: $f(x) = (x^3+1)(3x^2)$

$f'(x) = (x^3+1)(6x) + (3x^2)(3x^2)$

1. $= 6x^4 + 6x + 9x^4$

$= 15x^4 + 6x$

$= 3x(5x^3+2)$

$f(x) = x^2 e^x$

2. $f'(x) = x^2 e^x + e^x(2x)$

$= x^2 e^x + 2x e^x$

$= x e^x (x+2)$

$3x(x^2+2)^{1/2}$ OR $3x\sqrt{x^2+2}$

$g(t) = (x^2+2)^{3/2}$

$g'(t) = \frac{3}{2}(x^2+2)^{1/2}(2x)$

General Power Rule

4. 3. $f(x) = (x^3+1)^4$

$f'(x) = 4(x^3+1)^3(3x^2)$

$= 12x^2(x^3+1)^3$

5. $g(t) = (e^t+2)^{3/2}$

$g'(t) = \frac{3}{2}(e^t+2)^{1/2}(e^t) = \frac{3e^t(e^t+2)^{1/2}}{2}$

observation #5 section 5.4

Rule 2 The Chain Rule for Exponential Functions

group 2 To board

$$\frac{d}{dx}\left(e^{f(x)}\right) = \left(e^{f(x)}\right)\left(f'(x)\right)$$

6. $f(x) = e^{2x}$

$f'(x) = e^{2x}(2)$

$f'(x) = 2e^{2x}$

7. $y = e^{-3x}$

$y' = e^{-3x}(-3)$

$y' = -3e^{-3x}$

8. $g(t) = e^{(2t^2+t)}$

$g'(t) = e^{(2t^2+t)}(4t+1)$

$g'(t) = (4t+1)\left(e^{2t^2+t}\right)$

Product Rule & Chain Rule

9. $y = xe^{-2x}$

$y' = x\left(e^{-2x}\right)(-2) + e^{-2x}(1)$

$y' = e^{-2x}(1-2x)$

Observation #5 section 5.4

#10. Quotient Rule followed by Chain Rule

$$g(t) = \frac{e^t}{(e^t + e^{-t})}$$

$$g'(t) = \frac{(e^t + e^{-t})(e^t) - e^t(e^t + e^{-t}(-1))}{(e^t + e^{-t})^2}$$

$$g'(t) = \frac{e^{2t} + e^0 - e^t(e^t - e^{-t})}{(e^t + e^{-t})^2}$$

$$g'(t) = \frac{e^{2t} + 1 - e^{2t} + 1}{(e^t + e^{-t})^2}$$

$$g'(t) = \frac{2}{(e^t + e^{-t})^2}$$

(Start board work with these)

practice
$$\begin{array}{r} 21011 \\ \times\ 10120 \\ \hline \end{array}$$
in class with fingers

practice
$$\begin{array}{r} 12 \\ \times\ 31 \\ \hline \end{array} \qquad \begin{array}{r} 102 \\ \times\ 310 \\ \hline \end{array}$$
in class with fingers

GNATS TO 2 People by Monday (Turn in Two names with their Comments)

practice at blackboard

(Group 3)

$$\begin{array}{r} 21 \\ \times 13 \\ \hline 273 \end{array} \qquad \begin{array}{r} 64 \\ \times 11 \\ \hline 704 \end{array} \qquad \begin{array}{r} 52 \\ \times 35 \\ \hline 1820 \end{array} \qquad \begin{array}{r} 210 \\ \times 104 \\ \hline 21,840 \end{array}$$

practice outside class before Teaching

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 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1
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12 . . . 6789 . . . 321
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Observation #3 4/8/2015

1. $(e^x)(e^x) = e^{x+x} = e^{2x}$

if $y = e^x$

substituting

$(y)(y) = y^2$

(group 3)

2. Homework 5.1

#25 $3^{2x} - 12 \cdot 3^x + 27 = 0$

let $y = 3^x$

gives $y^2 - 12y + 27 = 0$

$(y-3)(y-9) = 0$

$y = 3 \; ; \; y = 9$

(group 1)

$3^x = 3 \quad ; \quad 3^x = 9$

answers $x = 1$ $\quad$ $x = 2$

#26 $2^{2x} - 4 \cdot 2^x + 4 = 0$

let $y = 2^x$

$y^2 - 4y + 4 = 0$

$(y-2)(y-2) = 0$

$y = 2$

$2^x = 2$ so $x = 1$

answer