MA 121-002

Thursday, February 21

- TEST #2: TUESDAY, FEBRUARY 26th
  (1.6 → 2.5)

- today (more 2.5; 3.1; test review)

3.1: NATURAL EXPONENTIAL FUNCTION

$y = e^x$

$y' = ??$

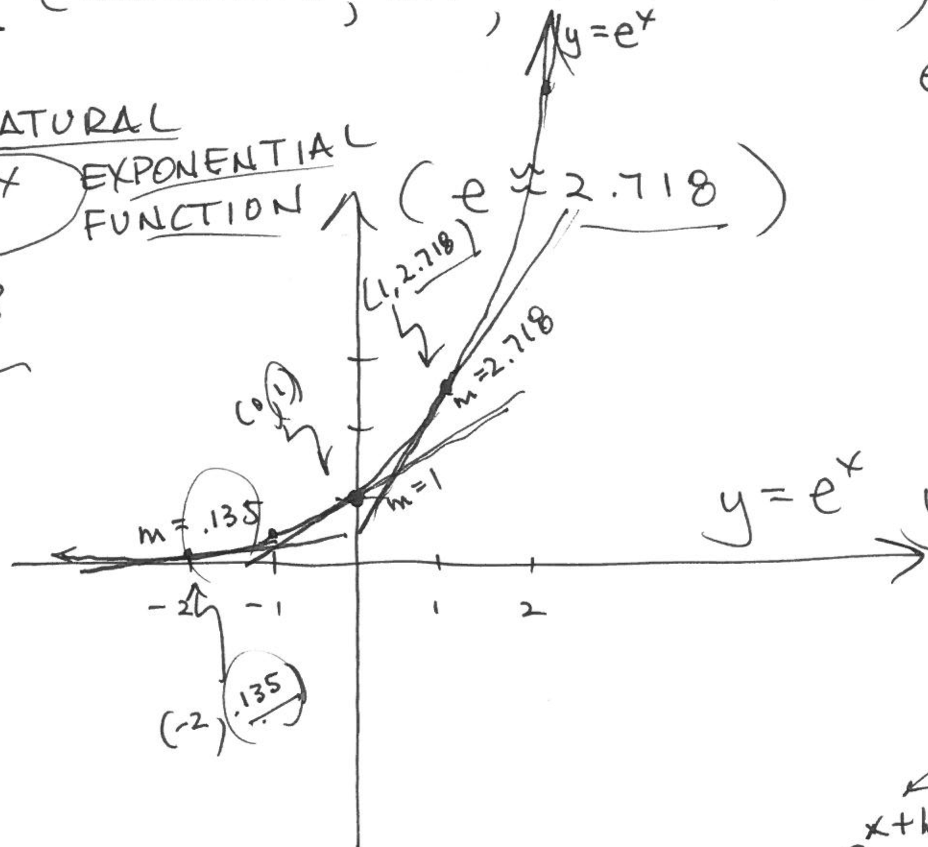
$(e \approx 2.718)$

$e^{-2} = \frac{1}{e^2} \approx .135$

$e^{-1} = \frac{1}{e} \approx .367$

$e^2 \approx 7.39$

x	y
-2	$e^{-2} \approx .135$
-1	$e^{-1} \approx .367$
0	$e^0 = 1$
1	$e^1 \approx 2.718$
2	$e^2 \approx 7.39$



$y = e^x \quad y' = e^x$

$e^{x+h} = e^x \cdot e^h$

$y = e^x \quad y' = m_{TAN} = ?? = e^x$ (+)

$$y' = \lim_{h\to 0} \frac{e^{x+h} - e^x}{h} = \lim_{h \to 0} \frac{e^x \cdot e^h - e^x}{h}$$

$$y' = \lim_{h\to 0} \frac{\boxed{e^x}(e^h - 1)}{h} = e^x \cdot \boxed{\lim_{h\to 0} \frac{e^h - 1}{h}} \to 1$$

$h = .1$: $\frac{e^{.1} - 1}{.1} \approx \boxed{1.05}$

$h = .001$: $\frac{e^{.001} - 1}{.001} \approx \boxed{1.0005}$

$h = .000001$: $\frac{e^{.000001} - 1}{.000001} \approx \boxed{1.0000005}$

$$y = e^{x} \qquad y' = e^{x} \cdot (1)$$

$$y = e^{(5 \cdot x)} \qquad y' = e^{5x} \cdot 5 = 5 \cdot e^{5x}$$

$$y = x \cdot e^{x^2} \qquad y' = \underline{x} \cdot (\underline{e^{x^2} \cdot 2x}) + e^{x^2} \cdot (1)$$

prod. rule

in general . . . .

$$y = e^{u} \qquad y' = e^{u} \cdot \underline{du}$$

chain rule part

Example 25. *When the ticket price is $40, the average attendance at the football game is 40,000 people. It has been determined that for every $1 decrease in the ticket price, an additional 2000 people will purchase tickets and attend the game. Under this arrangement, what price should be charged per ticket to maximize the revenue for the university? How many fans will attend the game at this price? What is the maximum revenue?*

$\$1{,}600{,}000^{\underline{00}}$

let x = number of ~~increa~~ decreases in ticket price

$$REV = \underbrace{(40^{\underline{00}} - 1^{\underline{00}}x)}_{\text{ticket price}}\underbrace{(40{,}000 + 2{,}000x)}_{\#\text{ in attendance}}$$

$x = 1$
$(39)(42{,}000)$
$x = 2$
$(38)(44{,}000)$

$$R = (40 - x)(40{,}000 + 2{,}000x)$$

$$R = 1{,}600{,}000 + 80{,}000x - 40{,}000x - 2{,}000x^2$$

$$R = 1{,}600{,}000 + 40{,}000x - 2{,}000x^2$$

$$R' = 0 + 40{,}000 - 4{,}000x = 0$$

$$\boxed{40{,}000 - 4{,}000x} = 0$$

$$\frac{40{,}\cancel{000}}{4{,}\cancel{000}} = \frac{4{,}\cancel{000}x}{4{,}\cancel{000}}$$

$R'' = -4000$
$\therefore$ C. DOWN
$\therefore$ MAX

$$x = 10$$

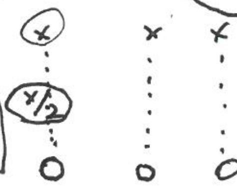
TICKET PRICE: $(40 - 10) = 30^{\underline{00}}$

\# OF PEOPLE: $(40{,}000 + 2{,}000(10)) = 60{,}000$

REV: $(30^{\underline{00}})(60{,}000) = \$1{,}800{,}000^{\underline{00}}$

#3.) MIN INVEN. COST

# of times to reorder



let x = lot size

$$\boxed{COST = (4)\left(\frac{x}{2}\right) + (.50x + 1)\left(\frac{200}{x}\right)}$$

on site ↑ ↗ reorder cost

$N \cdot x = 200$

$N = \frac{200}{x}$

$N = \frac{200}{10} = 20$

$$C = 2x + \left(\frac{200}{\cancel{x}} \cdot \frac{1\cancel{x}}{2} + \frac{200}{x}\right)$$

$200x^{-1}$

$$\boxed{C = \underline{2x} + \underline{100} + \underline{\frac{200}{x}}}$$

$$\underline{C' = 0}$$

NEW: 2/21/19

$$C' = 2 + 0 + (200)(-1 \cdot x^{-2})$$

$$C' = \boxed{2 - \frac{200}{x^2} = 0}$$

$-200x^{-2}$

$$\frac{2}{1} = \frac{200}{x^2}$$

$$200 = 2x^2$$

$$100 = x^2$$

$\cancel{x = 10}$

$\boxed{x = 10}$

max or min??

$$\left[\begin{array}{l} C'' = 0 - 200(-2x^{-3}) \\ C'' = \dfrac{400}{x^3} = + \quad \therefore C.\ UP \quad \therefore MIN \end{array}\right]$$