from 10/16 CONTINUED

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# MINIMUM INVENTORY COST

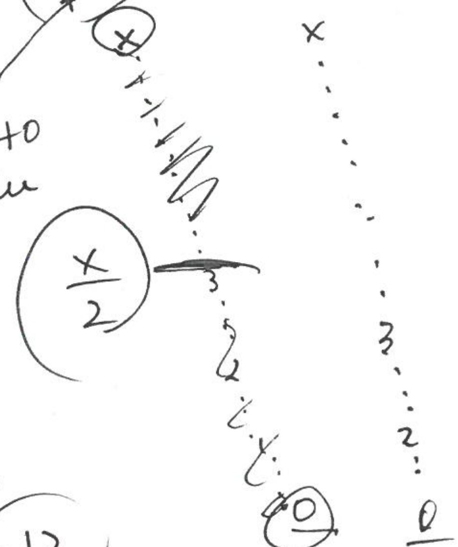
45.) let $x$ = the LOT SIZE

$$C = (\text{ON SITE}) + (\text{REORDER COST})$$

$$C = (8^{00})\left(\frac{x}{2}\right) + \underline{(5x + 10)}\left(\frac{360}{x}\right)$$

ASSUME

# of times to reorder




$N = ?$

# of times to order

$360 = x \cdot N$ (solve for N)

$N = \frac{360}{x}$ $\quad N = \frac{360}{30} = 12$

$$C = \underline{4x} + \underline{1800} + \frac{3600}{x} \leftarrow \underline{3600x^{-1}}$$

$$c' = \boxed{4 + 0 - \frac{3600}{x^2}} = 0$$

$$\frac{4}{1} = \frac{3600}{x^2}$$

$$C'' = \frac{-3600(-2 \cdot x^{-3})}{}$$

$$C'' = \frac{7200}{x^3} = +$$

∴ concave up

∴ MIN

$$4x^2 = 3600$$

$$x^2 = 900$$

$\boxed{x = 30}$ surfboards (each delivery)

$360 = 30 \cdot (??)$ ← times to reorder

$$\frac{360}{30} = ?? = 12$$

Since $r > 0$ we consider only the positive root.

$$r_1 = \sqrt{\frac{A_0}{6\pi}}$$

The second derivative $V''(r) = -6\pi r$ is negative on the interval $(0, \infty)$. Since this interval is our domain of interest, we can apply Theorem 1 to conclude that $r_1$ is the only critical number of interest and that it is the location of the global maximum. Hence the global maximum volume is

$$V_{max} = V(r_1) = -\pi(r_1)^3 + \frac{1}{2}A_0 r_1 = -\pi\left(\sqrt{\frac{A_0}{6\pi}}\right)^3 + \frac{1}{2}A_0\sqrt{\frac{A_0}{6\pi}}$$

Using this value we find the corresponding $h_1$ to be

$$h_1 = \frac{A_0 - 2\pi r_1^2}{2\pi r_1} = \frac{A_0 - 2\pi\left(\sqrt{\frac{A_0}{6\pi}}\right)^2}{2\pi\sqrt{\frac{A_0}{6\pi}}} = \sqrt{\frac{2A_0}{3\pi}} = \sqrt{\frac{2}{2}\frac{2A_0}{3\pi}} = \sqrt{\frac{4A_0}{6\pi}} = 2\sqrt{\frac{A_0}{6\pi}} = 2r_1$$

Thus the volume of a cylinder is maximized for a fixed surface area when the height is twice the radius.

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**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?*

MAX. REV

REV: $(40^{00})(40,000) = \$1,600,000$

REV $= (40.^{00} - 1\cdot x)(40,000 + 2000x)$

ticket price — people attending

* Let $x$ = # of price decreases

$R(x) = 1,600,000 + 80,000x - 40,000x - 2000x^2$

$\rightarrow R(x) = 1,600,000 + 40,000x - 2000x^2$

$R'(x) = 0 + \boxed{40,000 - 4000x} = 0$

$40,000 - 4,000x = 0$

$R''(x) = -4000$
$\therefore$ conc down
$\therefore$ max

$\frac{40,000}{4000} = \frac{4,000x}{4,000}$

$10 = x$

ticket price:
$(40 - 1\cdot(10)) = \boxed{30^{00}}$

people attending:
$(40,000 + 2000(10)) = \boxed{60,000}$

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

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Thursday, October 18



## CH 3:

### 3.1: NATURAL EXPONENTIAL FUNCTION (base "e")

$$y = e^x \qquad (y = 2^x;\ y = 5^x;\ y = 10^x)$$

$$e = \lim_{K \to \infty} \underbrace{\left(1 + \frac{1}{K}\right)^K}_{1^\infty} \approx 2.718$$

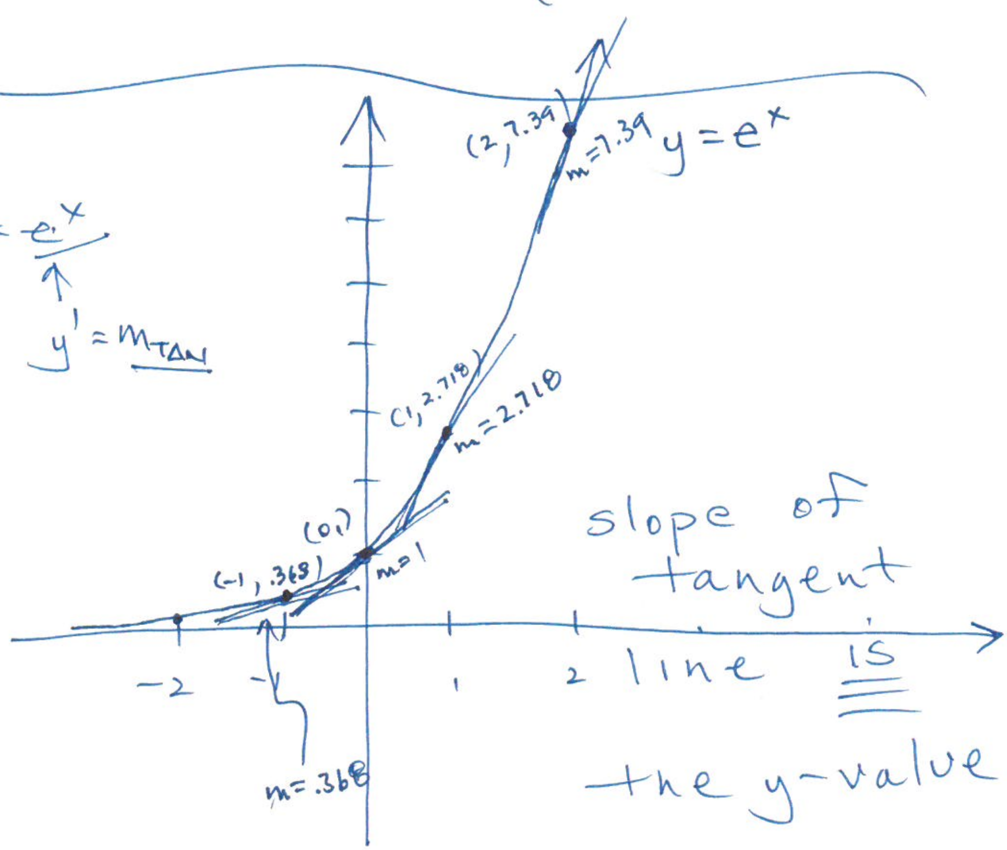
| $K = 100$ | $K = 10{,}000$ | $K = 10{,}000{,}000$ |
|---|---|---|
| $\left(1+\frac{1}{100}\right)^{100}$ | $\left(1+\frac{1}{10{,}000}\right)^{10{,}000}$ | $\left(1+\frac{1}{10{,}000{,}000}\right)^{10{,}000{,}000}$ |
| $\approx 2.704$ | $\approx 2.7181$ | $\approx 2.718$ |

$y = e^x$

| x | y |
|---|---|
| -2 | $e^{-2} \approx .135$ |
| -1 | $e^{-1} \approx .368$ |
| 0 | $e^0 = 1$ |
| 1 | $e^1 \approx 2.718$ |
| 2 | $e^2 \approx 7.389$ |

$y = e^x$

$y' = m_{TAN}$




slope of tangent line IS the y-value

$\boxed{y = \boxed{e^{x}}}$ $\quad y' = ?? = e^x$

$$y' = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

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

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

$$y' = \lim_{h \to 0} \frac{e^x \left[e^h - 1\right]}{h}$$

$$y' = e^x \cdot \lim_{h \to 0} \left[\frac{e^h - 1}{h}\right]$$

$1$

$$y' = e^x \cdot 1$$

$$y' = e^x$$

$h = .01$

$$\frac{e^{.01} - 1}{.01} \approx 1.005$$

$h = .00001$

$$\frac{e^{.00001} - 1}{.00001} \approx 1.000005$$

chain rule

ex:

$y = e^x$

$y = e^x$

$$y = e^{5x}$$

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

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

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

$$y = e^{3x^2 - 5x + 1}$$

$$y' = e^{3x^2 - 5x + 1} \cdot (6x - 5)$$

$$y' = (6x - 5)\, e^{3x^2 - 5x + 1}$$

# 3.2: INVERSE OF THE NATURAL EXPONENTIAL FUNCTION

$$y = e^x$$

INV: (switch $x$ & $y$)

$$x = e^y$$ exponential form

(solve for $y$ ...)

$\boxed{y}$ is the power to which "e" is raised to get $x$

$$y = \log_e x$$

$$\boxed{y = \ln x}$$ log form

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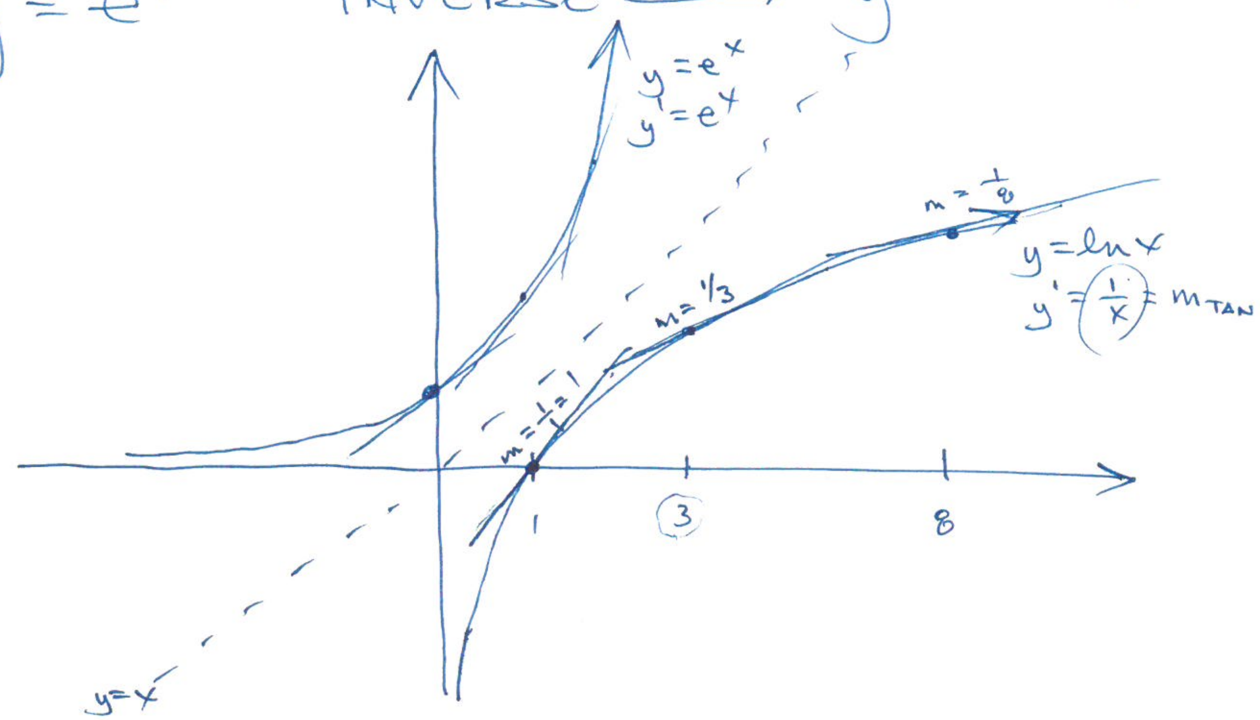
$y = e^x$ INVERSE $\longrightarrow$ $y = \ln x$



$\boxed{f(x) = \ln x}$ find $y'$: $(f'(x))$

rewrite in exponential form:

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

$$\frac{\cancel{e^{f(x)}} \cdot f'(x)}{\cancel{e^{f(x)}}} = \frac{1}{e^{f(x)}}$$

$$f'(x) = \frac{1}{e^{f(x)}} = \frac{1}{x}$$

$$\boxed{f(x) = \ln x \qquad f'(x) = \frac{1}{x}}$$

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$\ln(ab) = \ln a + \ln b$

ex:

$y = \ln x$

$y' = \frac{1}{x}$

$y = \ln(4x) \longrightarrow y = \ln 4 + \ln x$

$y' = \frac{1}{\cancel{4}x} \cdot \cancel{4} = \frac{1}{x}$ $\quad y' = 0 + \frac{1}{x}$

$$y = \ln(x^2+6x-11)$$

$$y' = \frac{1}{x^2+6x-11} \cdot (2x+6) = \frac{2x+6}{x^2+6x-11}$$

$$y = \ln(\ln x) \qquad y' = \frac{1}{\ln x} \cdot \frac{1}{x}$$

$\ln x \cdot (x)$

$$y' = \frac{1}{x \cdot \ln x}$$

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TEST #2 RESULTS

| | | |
|---|---|---|
| A's | 90 (44.8%) | 65.7% |
| B's | 42 (20.9%) | |
| C's | 28 (13.9%) | |
| D's | 21 (10.4%) | 20.4% |
| F's | 20 (10.0%) | |

AVE: 82.53