Monday April 13th, 2015 Math 111 Sec 4

* Handback Quiz; Collect Gnats Mult., Handout Review Sheet

Board Word (Sections 5.4 & 5.5)

Memorize last four derivative rules of Math 111.

Rule 1 $f(x) = e^x$; $f'(x) = e^x$

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

Rule 3 $f(x) = \ln|x|$; $f'(x) = \frac{1}{x}$

Rule 4 $f(x) = \ln g(x)$; $f'(x) = \frac{g'(x)}{g(x)}$ where $g(x) > 0$

(Group 1)

Sec 5.4 #2 Pg 376

① $f(x) = e^x$

$f'(x) =$

② use Product Rule

$f(x) = 3e^x$

$f'(x) =$

$f'(x) = 3e^x + e^x(0) = \boxed{3e^x}$

Monday April 13th (Group 1)

#6 Pg 376

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

$f'(x) =$

$\boxed{f'(x) = 2e^x - 2x}$ OR $\boxed{= 2(e^x - x)}$

(4) $f(u) = (2x^3 + 13)(7x^2 - 13)$

$f'(u) =$

$f'(u) = (2x^3+13)(14x) + (7x^2-13)(6x^2)$

$= 28x^4 + 182x + 42x^4 - 78x^2$

$= 70x^4 - 78x^2 + 182x$

$= 2x(35x^3 - 39x + 91)$

#8 Pg 376

(5) $f(u) = u^2 e^{-u}$

$f'(u) =$

$f'(u) = u^2(-e^{-u}) + e^{-u}(2u)$

$\boxed{f'(u) = ue^{-u}(2-u)}$

Sec 5.5
Pg 387
#2

⑥ $f(x) = \ln 5x$

$f'(x) =$

$$f'(x) = \frac{5}{5x} = \boxed{\frac{1}{x}}$$

Pg 387
#4

⑦ $f(x) = \ln(2x+1)$

$f'(x) =$

$$\boxed{f'(x) = \frac{2}{(2x+1)}}$$

last prob. group 1

Pg 387
#30

⑧ $g(t) = t^2 \ln(e^{2t}+1)$

$g'(t) = ?$

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

one can factor out a (2) and a (t)

answer $$g'(t) = 2t\left[t\left(\frac{e^{2t}}{e^{2t}+1}\right) + \ln(e^{2t}+1)\right]$$

OR (book answer if you like) $$g'(t) = 2t\left[\frac{te^{2t} + (e^{2t}+1)\ln(e^{2t}+1)}{e^{2t}+1}\right]$$

Carry up handout of Rules of Derivatives

① $f(x) = \ln|x|$

$f'(x) =$

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

Sec 5.5 Pg 387 #1

② $f(x) = 5 \ln x$ (Hint: use product rule)

$f'(x) =$

$f'(x) = 5\left(\frac{1}{x}\right) + \ln x\,(0)$

$\boxed{f'(x) = \frac{5}{x}}$

Pg 387 #12

③ Note Rule #4

$f(x) = \ln(3x^2 - 2x + 1)$

$f'(x) =$

$f'(x) = \frac{6x - 2}{3x^2 - 2x + 1} = \boxed{\frac{2(3x-1)}{\cancel{(3x-1)(x-1)}} \quad 3x^2 - 2x + 1}$

④ $f(x) = \dfrac{(x^7+1)}{(x^{11}-1)}$; $f'(x) =$

$$f'(x) = \frac{(x^{11}-1)(7x^6) - (x^7+1)(11x^{10})}{(x^{11}-1)^2}$$

Sec 5.4
Pg 376
#10

⑤ $f(x) = \dfrac{x}{e^x}$; $f'(x)$

$$f'(x) = \frac{e^x(1) - x(e^x)}{(e^x)^2} = \frac{e^x(1-x)}{e^x e^x} = \boxed{\frac{(1-x)}{e^x}}$$

Sec 5.5
Pg ~~376~~ 387
#18

⑥ $f(x) = \dfrac{3\ln x}{x^2}$; $f'(x) =$

$$f'(x) = \frac{x^2\left(\frac{3}{x}\right) - (3\ln x)(2x)}{(x^2)^2} = \frac{3x^2 - 6x^2\ln x}{x^4}$$

$$f'(x) = \frac{3x^2(1-2\ln x)}{x^5} = \boxed{\frac{3(1-2\ln x)}{x^3}}$$

Sec 5.5
Pg 387
#32

(7) $g(t) = \dfrac{t}{\ln t}$; $g'(t) =$

book answer

$$g'(t) = \frac{\ln t\,(1) - t\left(\frac{1}{t}\right)}{(\ln t)^2} = \boxed{\frac{(\ln t - 1)}{(\ln t)^2}}$$

answer

I'd accept either answer OR $\boxed{\dfrac{1}{\ln t} - \dfrac{1}{(\ln t)^2}}$

Sec 5.4 group 2 last prob.
Pg 376
#30

(8) Find $f''(t)$

$$f(t) = 3e^{-2t} - 5e^{-t} \text{ ; } f'(t) =$$

$$f'(t) = 3(e^{-2t})(-2) - 5e^{-t}(-1)$$

$$f'(t) = -6e^{-2t} + 5e^{-t} \text{ ; } f''(t) =$$

$$f''(t) = (-6)(e^{-2t})(-2) + 5e^{-t}(-1)$$

book answer → $\boxed{f''(t) = 12e^{-2t} - 5e^{-t}}$ or $\boxed{e^{-t}(12e^{-t} - 5)}$

Group 3 Look at 4 Rules on Handout

find second derivative

(Product Rule)

sec 5.5 Pg 387 #40 ① $g(x) = e^{2x} \ln x$; $g'(x) =$

$$g'(x) = e^{2x}\left(\frac{1}{x}\right) + \ln x\left[(e^{2x})(2)\right]$$

$$g'(x) = e^{2x}x^{-1} + \ln x\,(2e^{2x})$$

$$g''(x) =$$

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

$$+ \ln x\,(4e^{2x}) + (2e^{2x})\left(\frac{1}{x}\right)$$

Note: because $2e^{2x}(2)$

$$g''(x) = -\frac{e^{2x}}{x^2} + \frac{2e^{2x}}{x} + 4\ln x\,(e^{2x}) + \frac{2e^{2x}}{x}$$

final answer

$$\boxed{g''(x) = \frac{e^{2x}(4x - 1 + 4x^2\ln x)}{x^2}}$$