Math 16B: Short Calculus II
Winter 2018, Section 3
Homework Sheet 2
Due: Monday, January 22, 2018

Submit your solutions to the following problems in lecture on the due date above. Present your work in a clean and organized fashion, either on a printed copy of this document (preferred) or a separate sheet of paper. As stated in the syllabus, late submissions will **not** be accepted.

1. Find the derivatives of the following functions.

(a) $f(x) = \dfrac{\ln(x)}{e^x}$ quotient rule

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

(b) $f(x) = \ln(x^2(x+1)^3)$. chain rule product rule

$$f'(x) = \frac{1}{x^2(x+1)^3} \cdot \frac{d}{dx}\left[x^2(x+1)^3\right]$$

$$= \frac{1}{x^2(x+1)^3}\left(2x(x+1)^3 + x^2(3(x+1)^2(1))\right)$$

2. Using properties of logarithms, write the following using only a single logarithm.

$3(\ln(x+2) - 4\ln(2x^3) + \ln(x^2+1))$

$$= 3(\ln(x+2) - \ln(2x^3)^4 + \ln(x^2+1))$$

$$= 3\left(\ln\left(\frac{x+2}{(2x^3)^4}\right) + \ln(x^2+1)\right)$$

$$= 3\ln\left(\frac{(x+2)(x^2+1)}{(2x^3)^4}\right)$$

$$= \ln\left[\left(\frac{(x+2)(x^2+1)}{(2x^3)^4}\right)^3\right]$$

3. Find the half-life of a radioactive substance for which 99% remains after 1 year.

$R(t) = Ce^{-kt}$

C = initial amount

$R(1) = 0.99C$

$0.99C = Ce^{-k(1)}$

$0.99 = e^{-k}$

$\ln(0.99) = -k$

$k = -\ln(0.99)$

$R(t) = Ce^{t\cdot\ln(0.99)}$

$\frac{1}{2}C = Ce^{t\ln(0.99)}$

$\frac{1}{2} = e^{t\ln(0.99)}$

$\ln(\frac{1}{2}) = t\cdot 0.99$

$$t = \frac{\ln(\frac{1}{2})}{\ln(0.99)} \text{ yrs}$$