

Math 1071Q Derivative Worksheet (4.1-4.4)

Name:

**Problem 1.** Use product rule to differentiate the following expressions.

(a)  $(x^2 + 2x + 4)(x^3 + 2x)$

$$(2x+2)(x^3+2x) + (x^2+2x+4)(3x^2+2)$$

(b)  $\ln(x)(x^2 + x)$

$$\frac{1}{x}(x^2+x) + \ln x(2x+x)$$

**Problem 2.** Use quotient rule to differentiate the following expressions.

(a)  $\frac{-3x^8 - x}{e^x + \ln(x)}$

$$\frac{(e^x + \ln x)(-24x^7 - 1) - (-3x^8 - x)(e^x + \frac{1}{x})}{(e^x + \ln x)^2}$$

(b)  $\frac{e^x - \ln(x)}{e^x + \ln(x)}$

$$\frac{(e^x + \ln x)(e^x - \frac{1}{x}) - (e^x - \ln x)(e^x + \frac{1}{x})}{(e^x + \ln x)^2}$$

**Problem 3.** Use chain rule to compute the following expressions.

(a)  $e^{x-e^x}$

$$(1-e^x)e^{x-e^x}$$

(b)  $\ln(e^x - x^2)$

$$\frac{e^x - 2x}{e^x - x^2}$$

(c)  $\sqrt[3]{\ln(x)}$

$$\frac{1}{3} \frac{1}{x} (\ln x)^{-\frac{2}{3}}$$

(d)  $\left(\frac{x^3+1}{x^3-1}\right)^8$

$$8 \left(\frac{x^3+1}{x^3-1}\right)^7 \frac{(x^3-1)(3x^2) - (x^3+1)(3x^2)}{(x^3-1)^2}$$

**Problem 4.** Use whatever rules you see fit to differentiate the following expressions.

(a)  $\frac{\ln(2x)}{x^4}$

$$\frac{x^4 \frac{2}{2x} - \ln(2x)(4x^3)}{x^8}$$

(b)  $(x^2 + x)(x^3 + 2x)^8$

$$(2x+1)(x^3+2x)^8 + (x^2+x) \cdot 8(3x^2+2)(x^3+2x)^7$$