Calculus Section 5.4 ex Properties and Derivative
-Develop properties of the natural exponential function
-Differentiate natural exponential functions

Homework: page 352 #’s 1, 3, 5, 11, 13, 15, 33-47 odd, 67, 83

**Definition of the Natural Exponential Function (ex)**
The function f(x) = ln(x) has an inverse because it passes the horizontal line test. The inverse of f(x) = ln(x) is the exponential function g(x) = ex. Because ln(x) and ex are inverses, it holds that: ln(ex) = x and eln(x) = x.

**Solving Exponential and Logarithmic Equations**1) 7 = ex + 1 2) ln(2x – 3) = 5

**Review of Exponent Rules**1) 
2) 

**Examples)**e4(e2) = $\frac{e^{5}}{e^{2}}$= $\frac{e}{e^{5}}$= e0 =

**Properties of the Natural Exponential Function**1) Domain: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2) ex is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on its domain.

3) ex is concave \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on its entire domain.

4)  and 

**Derivative of the Natural Exponential Function**Let *u* be a differentiable function of x.

1. $\frac{d}{dx}\left[e^{x}\right]=$ 2) $\frac{d}{dx}\left[e^{u}\right]=$

 **Examples)**1)  2)  3) $\frac{d}{dx}\left[x^{2}e^{4x}\right]$

**Example)**The projected population y (in thousands) of California from 2015 through 2030 can be modeled by $y=34,696e^{0.0097t}$ where t represents the year, with t = 15 corresponding to 2015. At what rate will the population be changing in 2020?

**Example)**Determine $\frac{dy}{dx}$ for the function $y^{2}=2e^{xy}$