SECTION 3-9: DERIVATIVES OF EXPONENTIAL FUNCTIONS AND LOGARITHMS

1. Recall the definition of the derivative:

2. Let $f(x) = e^x$. **Estimate** $f'(x)$ (a.k.a. the slope of the tangent line) using the limit definition for each of the values below. (Use a calculator!)

   (a) $f'(0)$

   (b) $f'(1)$

   (c) $f'(2)$

   (d) $f'(-1)$

3. Derivative Rules for Exponential Functions

4. Examples: Find the derivatives.

(a) $y = x^4 e^x$

(b) $y = e^{x^2}$

(c) $y = 5^{-x}$

(d) $f(x) = x^5 + 5^x$

5. Let $P(t) = P_0 e^{kt}$. Find $P'(t)$ and then write it in terms of $P(t)$.

6. A population of bacteria has an initial population of 200 bacteria. The population is growing at a rate of 4 % per hour.

(a) Write an exponential function $P(t)$ that relates the total population as a function of t where the units of t should be hours and the units of P should be number of bacteria.

(b) Find and interpret $P'(1)$.

(c) Find and interpret $P'(100)$.

(d) Find $P'(1)/P(1)$ and $P'(100)/P(100)$. What do you observe?