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. A population of bacteria is modeled by the equation $P(t) = 100e^{0.04t}$ where P is the number of bacterial and t is measured in hours.

   (a) Find $P(0)$, $P(1)$, and $P(100)$. Give units with your answers. What do these numbers represent?

   (b) Find $P'(0)$, $P'(1)$, and $P'(100)$. Give units with your answers. What do these numbers represent?

   (c) Find $P'(0)/P(0)$, $P'(1)/P(1)$ and $P'(100)/P(100)$. What do these numbers represent?

6. Let $P(t) = P_0 e^{kt}$. Find $P'(t)/P(t)$ and use this to explain what k represents.