

SECTION 3-9: DERIVATIVES OF EXPONENTIAL FUNCTIONS AND LOGARITHMS

1. Quick Review Differentiation:

(a) Find dy/dx for $x^2 - y^3 = x \sin(y)$.

(b) Find y' for $y = x(\sin(x))^{-1}$

(c) Find y' for $y = x \sin^{-1}(x)$

2. Let $f(x) = e^x$. **Estimate** $f'(x)$ (a.k.a. the slope of the tangent line) using the slope of a secant line 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 $P(t) = P_0 e^{kt}$. Write $P'(t)$ 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 bacterial.

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

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