Math 1a. §3.1 Worksheet
Derivatives of Polynomial and Exponential Functions

Fall 2005

1. Evaluate the derivative of each of the following functions.

   (a) $y = 10e^x + 6$

   (b) $h(x) = (2x - 3)(x + 2)$

   (c) $y = \dfrac{1}{x^2} - \dfrac{1}{x}$

   (d) $y = \sqrt[3]{t^2} - \sqrt[4]{t^3}$

   (e) $y = \dfrac{a}{\sqrt[4]{x^3}} - x^2$

   (f) $y = ae^v + \dfrac{b}{v} + \dfrac{c}{v^2}$

   (g) $f(t) = e^t + e^\pi + \pi^e$

   (h) $x(t) = \dfrac{1}{\sqrt[4]{x^3}} - x^2$

2. In early summer the fly population of Maine grows exponentially. The population at any time t (measured in days) can be given by $P = P_0 e^{kt}$ for some constant k. Suppose at some date, which we will designate as $t = 0$, there are 200 flies. Thirty days later, there are 900 flies.

   (a) Find P_0 and k.

   (b) The mosquito population is also growing exponentially. At time $t = 0$ there are 100 mosquitos, and the mosquito population doubles every 10 days. Write a function $M(t)$ that gives the number of mosquitos at time t.

   (c) When will the mosquito and fly populations be equal?

   (d) Find $P'(t)$. You can use the fact that $\frac{d}{dt}e^{kt} = ke^{kt}$.

   (e) Find $M'(t)$.

   (f) Find the rate at which each population is growing when the two populations are equal. Which population is growing more rapidly?