Homework Assignment 22: Due at the beginning of class 11/19/01

1. In Homework 20, the function P was used to represent the population of Kenya:

$$P(T) = 1316498.846*(1.032077091)^T,$$

where T = years since 1900 is the independent variable, and P = population is the dependent variable. On Homework 20, the function defined by the equation:

$$P'(T) = 41566.233*(1.032026464)^T.$$

was given as the derivative of the function P. Demonstrate that this second function is a reasonable one to use for the derivative of P.

In Questions 2 and 3 the function $f(x)$ will always refer to $f(x) = \log(x)$. (This is, the inverse of the function $g(x) = 10^x$.) The idea of Questions 2 and 3 is to find an equation for the derivative of $f(x) = \log(x)$.

2. The difference quotient of $f(x) = \log(x)$ is the quotient:

$$\frac{f(x+h) - f(x)}{h} = \frac{\log(x+h) - \log(x)}{h}$$

where h is a number that is very close to zero. Calculate the limit of this difference quotient (as $h \to 0$) at each of the x-values shown in the table below.

x	1	2	3	4	5
Limiting value of difference quotient at x as $h \to 0$					

3. Plot a graph of the limiting values of the difference quotients versus x. What kind of function would do a reasonable job of representing the relationship between x and the limiting values of the difference quotient? Use the regression capabilities of your calculator to find an equation for the derivative of $f(x)$.

Questions 4 and 5 will not seem to be particularly closely related to anything that you have done in class over the last few days. These questions refer to earlier material and are included on this homework assignment to help you begin your review process for the second exam.

Note: **1.** Math Xa Exam 2 will be given on Thursday November 29 from 7-9pm.
2. The exam will be given in Science Center Lecture Hall D.
3. There will be a course-wide review session on Wednesday November 28.
4. The course-wide review will be from 8:30-10:00pm in Science Center 102B.

In Questions 4 and 5, the function q will always refer to the function defined by the equation:

$$q(x) = -3x^2 + 12x + 2.$$

4. The equation defining the function q is expressed in standard form. Use the process of *completing the square* to put q into *vertex form*[1]. Use the vertex form to locate the x- and y-coordinates of the maximum value of q.

NOTE: In order to get credit on this problem you *must* show all of your working. If you simply put down a final answer - even a correct final answer - you will get no credit here.

5. Use derivatives to confirm that the x- and y- coordinate that you found in Question 4 really do correspond to the x- and y-coordinates of the maximum value of q.

[1] A resource that could be some help here is the set of solutions to Homework Assignment 12 (posted on the Math Xa web site).