## Homework Assignment 15: Due at the beginning of class 10/31/01


Figure 1: Map of the African nation of Kenya.

Figure 1[1] shows the location of the eastern African nation of Kenya. Table 1 (below) gives the population of the African nation of Kenya[2] for 1900-1998[3]. Question 1 refers to the data contained in this table.

| Year | Population |
|---|---|
| 1900 | 1,352,000 |
| 1910 | 1,837,000 |
| 1920 | 2,496,000 |
| 1930 | 3,392,000 |
| 1940 | 4,610,000 |
| 1950 | 6,265,000 |
| 1960 | 8,115,000 |
| 1970 | 11,498,000 |
| 1980 | 16,632,000 |
| 1990 | 24,368,000 |
| 1998 | 29,295,000 |

Table 1: Population of Kenya, 1990-1998.

[1] Image source: CIA World Factbook, 2001.
[2] Image source: CIA World Factbook, 2001.
[3] Source: http://www.library.uu.nl/wesp/populstat/Africa/kenyac.htm

**1.** Find an equation to describe the population of Kenya as a function of time. You should provide evidence to confirm that the function you find does a reasonable job of representing the data in Table 1.

**2.** Use the function that you found in Question 1 to complete the table given below.

| h | −0.1 | −0.001 | −0.000001 | 0.000001 | 0.001 | 0.1 |
|---|---|---|---|---|---|---|
| Difference Quotient at t=1960 | | | | | | |

Note that if the function that you found in Question 1 is named *f*, then the difference quotient of *f* at $t = 1960$ is:

$$\frac{f(1960+h)-f(1960)}{h},$$

where *h* is a small number (i.e. close to zero).

**3.** Using your results from Questions 1 and 2, find an equation for the tangent line based at 1960. Using the same set of axes graph the function that you found in Question 1 and the tangent line you have calculated here.

**4.** The calculation that you performed in Question 2 estimated the derivative of the function from Question 1 at the point $t = 1960$. Perform similar calculations to estimate the derivative at:

- $t = 1920$
- $t = 1940$
- $t = 1980$.

For this question, you should turn in the table that you made for $t = 1920$ and your estimates of the derivative for 1920, 1940 and 1980.

**5.** Use the regression capabilities of a graphing calculator to find an equation for the derivative as a function of time.

**Hint:** Enter "year" as the *x*-value into your calculator and "derivative" as the *y*-value into your calculator. Perform a STATPLOT to get an idea of what sort of function might do a reasonable job of representing the relationship, and then run the appropriate regression(s).