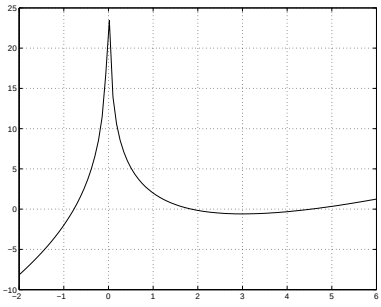
Ceng 375 Numerical Computing
Midterm
Nov 30, 2007 12.40–14.30
Good Luck!

1. (40 pts) Consider the function:

$$f(x) = 2x - 6log(x)$$

Plot of the function is given at the following figure;



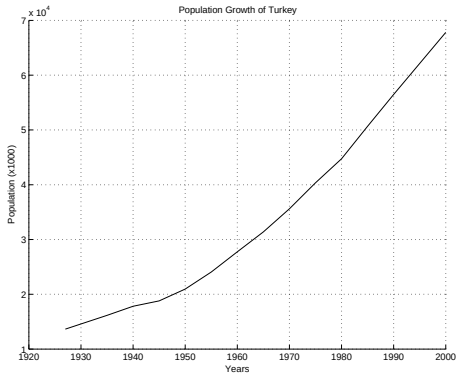
i (20 pts) Use three iterations of Newton's method to estimate only one of the roots of this function. *Hint:* $\int \frac{1}{x} dx = log(x)$

ii (10 pts) Estimate the error in your answer to part i.

iii (10 pts) Approximately how many iterations of the bisection method would have been required to achieve the same error?
Hint: Take the interval as ((initial+1)-initial)

2. (40 pts) The following table and figure are given as the population growth of Turkey between years of 1927 and 2000

years	Population
1927	13648
1935	16158
1940	17820
1945	18790
1950	20947
1955	24 064
1960	27 754
1965	31 391
1970	35 605
1975	40 347
1980	44 736
1985	50 664
1990	56 473
2000	67 804



i (10 pts) What is the relationship that the graph suggests? Use least squares method to find out the necessary parameters of this suggested formula.

ii (5 pts) Estimate the population at the years of 1995, 2007 and 2010 with least squares method.

iii (10 pts) Fit a cubic (P_3) polynomial to the given data.

iv (5 pts) Estimate the population at the years of 1995, 2007 and 2010 with fitted polynomial.

v (10 pts) Compare your results for both least squares and interpolated polynomial methods.

3. (40 pts) For the given data points;

x	y
2.1	-12.4
4.1	7.3
7.1	10.1

(a) (20 pts) Write out the Lagrangian polynomial from this table

i confirm that it reproduces the y's for each x-value.

ii interpolate with it to estimate y at $x = 3$.

iii extrapolate with it to estimate y at $x = 8$.

(b) (10 pts) Suppose in previous item that the y-value for $x = 4.1$ is mistakenly entered as 7.2 rather than 7.3. Repeat the previous item with this incorrect value. How much difference does this make?

(c) (10 pts) Expand the Lagrangian polynomials in the previous items to get the quadratics in the form $ax^2 + bx + c$. How different are the values for a,b, and c?