

Project #3

Math 121-H

Due Monday, November 29, 2004

Summary:

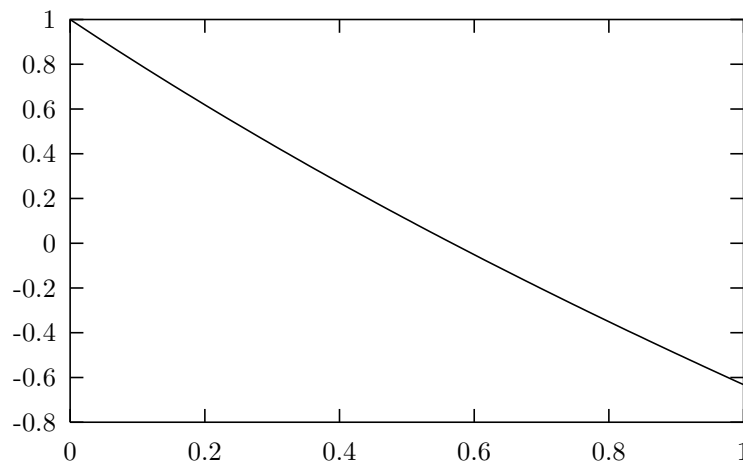
You will examine two common methods for finding roots for an equation and use an example in comparing and contrasting them.

Goals:

- Gain an understanding of how calculators and computers solve for numeric approximations of roots.
- Gain an understanding of how the Intermediate Value Theorem and the derivative are applied in numerical analysis.

Instructions:

You will find a solution to the equation $f(x) = e^{-x} - x = 0$. Here is a graph of $y = e^{-x} - x$:



Your TI-89 calculator can quickly find the numerical value for the root, so it is not the destination that you are interested in but rather the journey.

How does the TI-89 find a solution? There are two main techniques commonly used to approximate solutions:

- Bisection Method
- Newton's Method

Both methods are discussed in our Larson text (page 76 and Section 3.8).

For the bisection method, you will need a starting interval where $f(x) = e^{-x} - x$ takes values of opposite signs. Start with $[a, b] = [0, 1]$.

For Newton's method, you will need an initial estimate. Start with $x_1 = 0$.

You are to apply both methods until you know the root to four decimal places. You will want to summarize your work in tables for each method; please use an *Excel* spreadsheet.

Sections:

Your project should include the following:

- Title, name, class, etc.
- A brief introduction to the project.
- A description of the bisection method, including its underlying assumption of the Intermediate Value Theorem.
- A brief description of Newton's method, including its underlying assumptions about $f(x)$.
- *Excel* spreadsheet containing tables for the results of both methods in approximating the solution. The table for the bisection method should contain columns for the current left endpoint, the current right endpoint, and the value of the function at the midpoint. The table for Newton's Method should contain the same kinds of columns as shown in Section 3.8 of our text.
The spreadsheet should have your name and "Project #3" on it.
- A conclusion describing which method was quicker, which method was easier, and which method you preferred.