TEAM ASSIGNMENT 2

MAT 305 FALL 2009

1. Directions

The groups for this assignment are

Group 1	Group 2	Group 3
Daniel Johnson	Lorrin Debenport	Jamie Lambert
Jessica Jones	Sabrina Duckworth	Audrey Magee
Adam Seyfarth	Stradford Goins	Tyler McCleery
	Clinton Hartfield	Jonathan Yarber
Group 4		**Group 5**
Chesley Henson		Benjamin Benson
John Lopez		Jessica Brown
Deidre Rose		Amanda Pegram
Blake Watkins		Robert Satchfield

Solve the following problems in a Sage worksheet. Unless you find it infeasible, your responses to instructions 2 and 3 should appear in the same worksheet as your response to instruction 4. Remember that shift-clicking on the blue line above a computational cell creates a new text cell, and double-clicking on a text cell allows you to edit that text cell. If you find it useful, control-clicking creates a computational cell after the computational cell currently highlighted.

Each group should submit one worksheet. Submit the worksheet by sharing the worksheet with my account (`mat305_fa2009`) at

`https://sage.st.usm.edu:8000/`

If you wish, you may share with all the members of the group who are registered at that website, but this is not necessary.

The due date for this assignment is

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2. The Assignment

An important problem in mathematics is that of *root finding:* that is, given a function $f(x)$, finding any roots of f in an interval. Exact methods exist for many functions:

- In the case of a linear function $f(x) = ax + b$ this is easy.
  - If $a \neq 0$, then $x = -b/a$.
  - If $a = 0$, then there is no solution.
- In the case of a quadratic function $f(x) = ax^2 + bx + c$ this is relatively easy.
  - If $a \neq 0$, then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
  - If $a = 0$, then you are really in the case of a line.

In other cases it's somewhat harder. Sometimes you learn exact methods, but in cases where an exact method is either too slow, too unwieldy, or simply impossible, we need a method to approximate the roots. In class, I gave an example of the Method of Bisection.

Isaac Newton developed a simple method that works for many functions, and is based on techniques of differentiation. We don't always study it, but it appears in most Calculus textbooks. Newton's method is still used and studied today. In this assignment, you will design and implement a function that uses Newton's method to approximate a root of a function.

1. Take a Calculus book and read the relevant section on Newton's method. I can't describe every text, but
   - in the grey Thomas textbook, it appears in Chapter 4, Section 7, starting on page 299;
   - in the black Stewart textbook used for Honors Calculus two years ago, it appears in Chapter 4, Section 8, starting on page 334;
   - in the blue Stewart textbook used for Calculus now, it appears in Chapter 4, Section 6, starting on page 236.
2. Write a brief description of Newton's method that should explain the concept to someone who knows precalculus, but not Calculus. Avoid Calculus jargon such as *limit*, *derivative*, or *continuous*. Don't even try to explain such concepts. *Use only terms and concepts from precalculus.* Besides explaining the steps of the method, do not neglect to touch on the following.
   - What criteria must the function f satisfy?
   - What criteria must the root satisfy?
   - What criteria must the initial guess satisfy?
   - When do you decide to stop approximating?
3. Write pseudocode for a program to implement Newton's method. Be sure to format the pseudocode properly.
4. Write a Sage function that implements Newton's method. Choose a handful ($\sim$5) of exercises from your Calculus text to use as examples of how the function works. Be sure to indicate the text and exercise number.