Math 370 Spring 2009

QUIZ 4 Numerical Analysis

Name: _____

Friday February 20
Prof. Ron Buckmire

Time Begun: _____
Time Ended: _____

Topic : Root-finding Algorithm(s)

The idea behind this quiz is for you togive you an opportunity to demonstrate your understanding of Newton's Method and another associated rootfinding algorithm.

Reality Check:

EXPECTED SCORE : _____**/10** ACTUAL SCORE : _____**/10**

Instructions:

0. Please look for a hint on this quiz posted to `faculty.oxy.edu/ron/math/370/09/`
1. Once you open the quiz, you have **30 minutes** to complete, please record your start time and end time at the top of this sheet.
2. You may use the book or any of your class notes. You must work alone.
3. If you use your own paper, please staple it to the quiz before coming to class. If you don't have a stapler, buy one. QUIZZES WITH UNSTAPLED SHEETS WILL NOT BE GRADED.
4. After completing the quiz, sign the pledge below stating on your honor that you have adhered to these rules.
5. Your solutions must have enough details such that an impartial observer can read your work and determine HOW you came up with your solution.
6. Relax and enjoy...
7. **This quiz is due on Monday February 23**, in class. NO LATE OR UNSTAPLED QUIZZES WILL BE ACCEPTED.

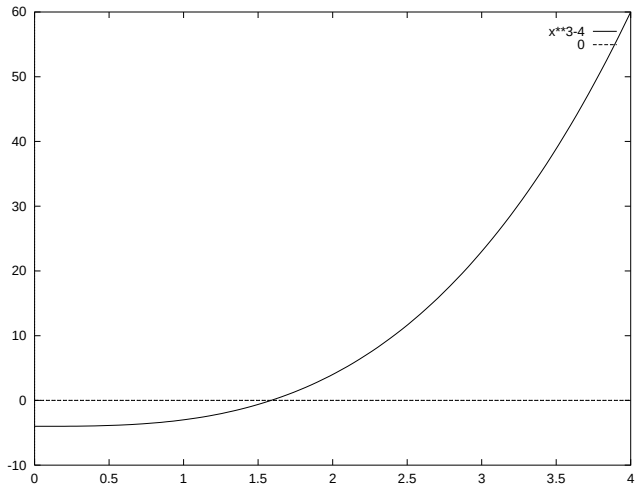
Pledge: I, _____, pledge my honor as a human being and Occidental student, that I have followed all the rules above to the letter and in spirit.

1. *[4 pts]* Use **Newton's Method**, $p_{n+1} = p_n - \dfrac{f(p_n)}{f'(p_n)}$, to obtain the value of $\sqrt[3]{4}$ to within 3 decimal places by finding the root of $f(x) = x^3 - 4$ using an initial guess of $p_0 = 4$. Show the details of your calculation of p_1, p_2 and p_3 and then just the values of the subsequent p_n values until convergence.

2. Consider a new method of finding a root of an equation, called **The Lazy Newton** or "Fixed Slope" method. This is similar to Newton's Method except that instead of taking the derivative at EVERY step, one computes the derivative once at the point of the initial guess p_0 and uses only that derivative in every subsequent iteration.

   The general formula for the **Lazy Newton** method is: $p_{n+1} = p_n - \dfrac{f(p_n)}{f'(p_0)}$

(a) *[4 pts]* Indicate on the graph of the function $f(x) = x^3 - 4$ below what the first few approximations to the root, p_1, p_2, p_3 will look like, using the Lazy Newton method, given that $p_0 = 4$. In the space below also indicate how you computed values for p_1, p_2 and p_3.



(b) *[2 pts]* Use Lazy Newton's Method to find the value of $\sqrt[3]{4}$ to within 3 decimal places. Which method do you expect to be faster, Newton's or Lazy Newton's? Which one "converges" faster to $\sqrt[3]{4}$?