QUIZ 4  
Numerical Analysis

Name: ________________________________

Time Begun: ____________________________  
Time Ended: ____________________________

Friday February 20  
Prof. Ron Buckmire

Topic: Root-finding Algorithm(s)

The idea behind this quiz is for you to give 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, $p_{n+1} = p_n - \frac{f(p_n)}{f'(p_n)}$, 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: $p_{n+1} = p_n - \frac{f(p_n)}{f'(p_0)}$

(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 $\sqrt[3]{4}$?