Quiz 1
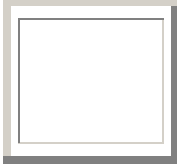
The first letter of
your LAST name

_____ _____
First Name   Last Name

Q1-1 (25 pts)	Q1-2 (20 pts)	Q1-3 (30 pts)	Q1-4 (25 pts)	Total

Note: You have 60 min. Be careful about the time allocation.
Try not to leave any problems totally blank so that I can give
you some partial credit. Good luck!

24-311   NUMERICAL METHOD   Fall 02

QUIZ 1

Date and time	9/17 (Tue), 10:30AM-11:30AM (60 min)
Weight	10 % of final grade
Coverage	lectures and reading assignments: (1) – (6) problem sets: PS1, PS2
Format	closed book, closed notes
Note	bring a basic calculator with + - x / keys (no computer allowed in quiz!)

Q1-1
(25pts)

(1) To solve an engineering problem, you first establish a mathematical model, or a governing equation, by applying a fundamental law of physics. You can then solve the equation by an analytical method or a numerical method. When you choose to use a numerical method, what are two types of errors that you should be aware of? What are the sources of each of the two types of errors?

(2) What is the rate of convergence of the Newton-Raphson method? (Linear, quadratic, cubic, quartic, …?)

(3) In what situation does the modified Newton-Raphson method converge faster than the original Newton-Raphson method?

(4) Which root finding method converges faster to the solution, false-position or secant?

Q1-2
(20pts)

Evaluate the function value at $x = 2.14$ with 3-digit arithmetic with chopping.

$$y(x) = 5.81x^2 + 0.628x + 1.08$$

Show the intermediate steps for full credit (or partial credit, if you make a mistake).

Q1-3 (1) Illustrate in the graph below how the false-position method finds a root. Start with an initial
(30pts) bracket, $2 \le x \le 7$, and iterate twice. What is the narrowed bracket (a range of x) after the
two iterations? (Hint: you do NOT need to calculate x values using the false-position
formula—just use a graphical method.)
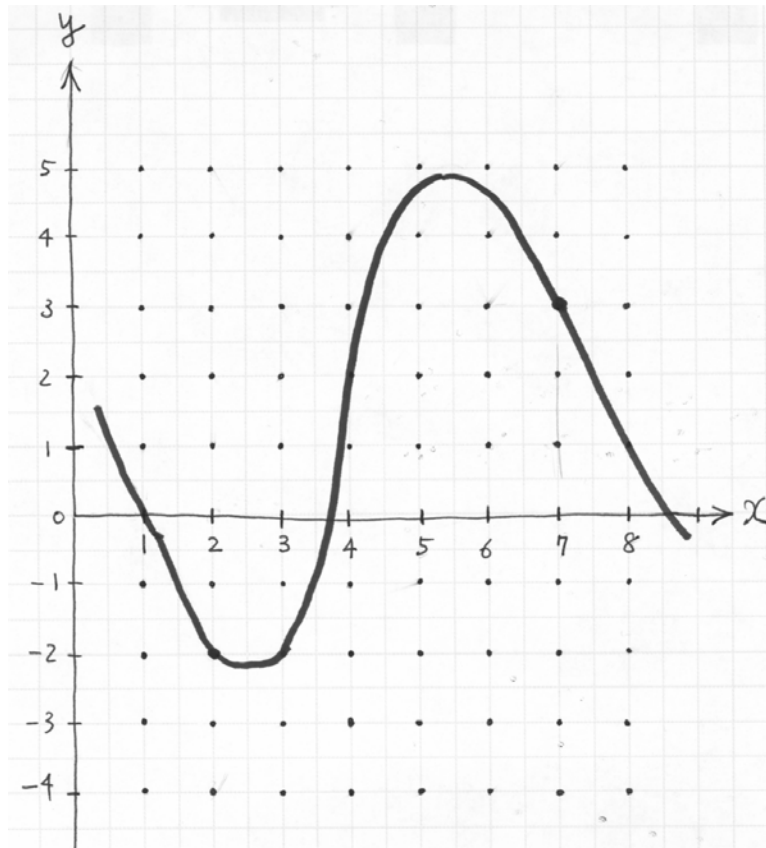
(2) Illustrate in the graph below how the secant method finds a root. Start with two initial values, $x_0 = 6$ and $x_1 = 8$, and iterate twice. What are x_2 and x_3? (Hint: you do NOT need to calculate x values using the secant formula—just use a graphical method.)
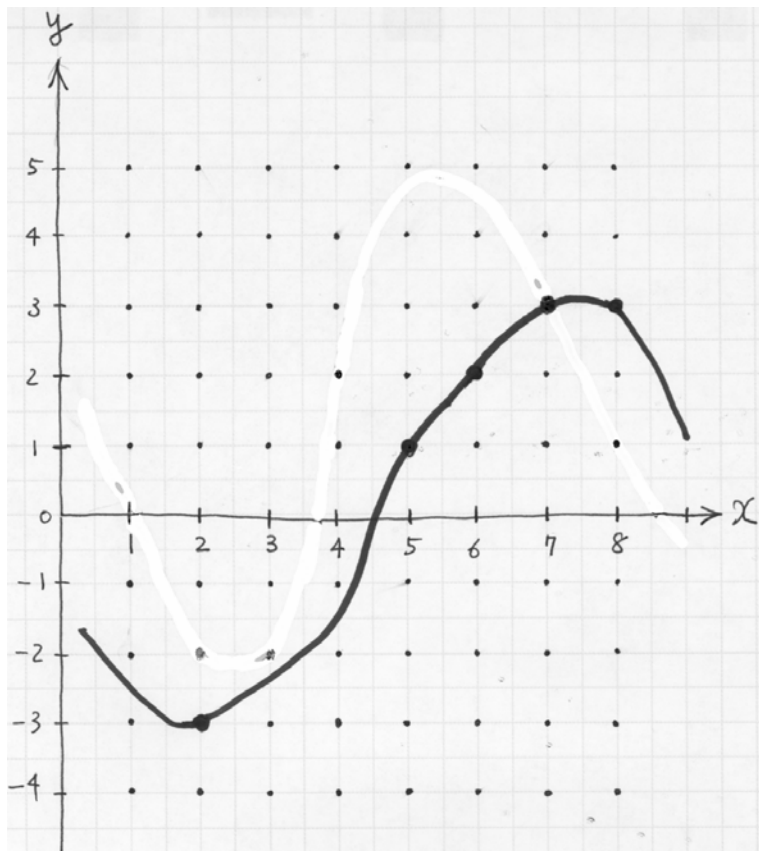
Q1-4
(25pts)

(1) Complete the following Taylor series formula for a function of one variable. The step size is $h = x_{i+1} - x_i$.

$$f(x_{i+1}) = f(x_i) + \qquad\qquad + \qquad\qquad + \cdots + \qquad\qquad + R_n$$

,

where the remainder term is defined as

$$R_n =$$

(2) Find the second order approximation of the following function using the Taylor series expansion with a base point at $x = \frac{\pi}{3}$.

$$f(x) = x + \tan(x)$$

This is the last page of Quiz 1, and this page is intentionally left blank
so that you can use it if you need more space to write your solution or do some calculations.