King Abdulla II School for Information Technology
Department of Computer Science
Numerical Analysis - MidTerm - Spring 2013

Student Name: Student ID: Section:

Q1 (2 Points) let $a = 0.471 * 10^{-2}$ and $b = 0.869 * 10^{4}$. Use 3 digits arithmetic to show that the computed value $a + b$ is equal to b.

Q2 (4 Points) Consider the linear system

$$AX = \begin{vmatrix} 4 & -1 & 2 \\ 0 & 3 & 1 \\ 0 & 0 & 2 \end{vmatrix} \begin{vmatrix} x_1 \\ x_2 \\ x_3 \end{vmatrix} = \begin{vmatrix} 7 \\ 5 \\ 4 \end{vmatrix} = B$$

(a) Use back substitution to solve the system

(b) Compute $det(A)$

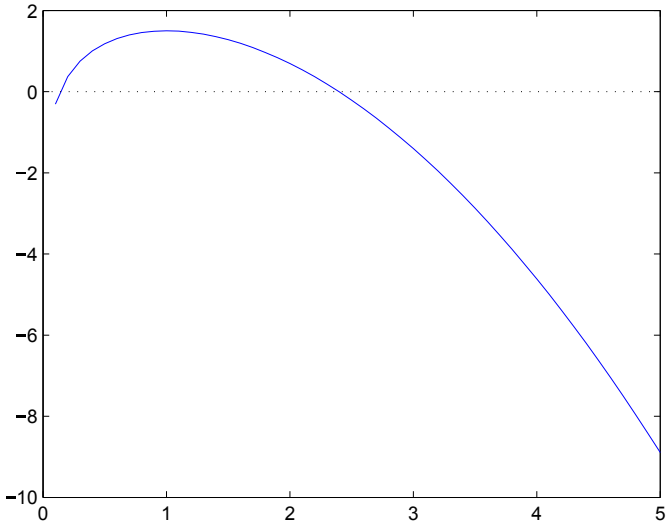
Q3 (2 Points) Let

$$X = \begin{vmatrix} 3 \\ -5 \\ 0 \end{vmatrix}, \text{ and } Y = \begin{vmatrix} 2 \\ 1 \\ -3 \end{vmatrix}$$

Compute
(a) $\|X\| =$

(b) $XY =$

Q4 (4 Points) Consider the function $f(x) = lnx + 2 - \frac{x^2}{2}$ whose graph is given below.



(a) On the graph, illustrate how Newton-Raphson method locates p_1 starting with $p_0 = 4$.

(b) With $p_0 = 1$, will Newton-Raphson method converge to a root?

Q5 (4 Points) Consider the fixed point iteration

$$p_{k+1} = 2p_k - \alpha p_k^2, \qquad \text{for } k = 0, 2, ...$$

where $\alpha > 0$ is given. Show that the iteration converges for any initial guess p_0 satisfying $0 < p_0 < \frac{2}{\alpha}$

Q6 (6 Points) Consider approximating the positive root of $x^2 - 3 = 0$.

(a) Using the bisection method and starting with the interval $[1.5, 2.5]$, how many iterations would be necessary to ensure the root is bracketed in an interval of length less that 10^{-3}?.

(b) Using the method of fixed point iterations, $p_n = g(p_{n-1})$ with $g(x) = \frac{3}{x}$, will convergence occur starting with the initial guess $p_0 = 2$?

(c) Starting with $p_0 = 2.0$. Use Newton-Raphson method to compute p_1 and p_2.