

Department of Mathematics  
Indian Institute of Technology Guwahati  
**MA572: Lab Assignment 3**

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1. The equation  $(x - 1.1)^2(x + 1) = 0$  has a double root at  $\xi = 1.1$ . Write a program to compute an approximate root to  $\xi$  by using the standard Newton's formula as well as the modified Newton's formula. Determine the order of convergence numerically for both the cases. Compute the order of convergence with the formula

$$p = \frac{\log_{10} \left( \frac{|e_{n+2}|}{|e_{n+1}|} \right)}{\log_{10} \left( \frac{|e_{n+1}|}{|e_n|} \right)}, \quad n = 0, 1, 2, \dots$$

where  $e_n = \xi - x_n$ . Take  $TOL = 10^{-3}$  and  $x_0 = 1$ .

2. Write a MATLAB program to compute an approximate solution of the following nonlinear system

$$\begin{aligned} f_1(x_1, x_2) &:= \sin(x_1 x_2) + x_1 - x_2 = 0, \\ f_2(x_1, x_2) &:= x_2 \cos(x_1 x_2) + 1 = 0, \end{aligned}$$

using Newton's method. Take the starting value  $[x_1^0, x_2^0] = [1, 2]$  and use stopping criteria for accepting the solution is  $TOL = 10^{-3}$ . Print the solutions at each iteration step as per the following format.

<i>Iteration</i>	$x_1$	$x_2$	$f_1(x_1, x_2)$	$f_2(x_1, x_2)$
1				
2				
$\vdots$				