Department of Mathematics
Indian Institute of Technology Guwahati
MA322: Lab Assignment 2

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1. 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.

Iteration	x_1	x_2	$f_1(x_1, x_2)$	$f_2(x_1, x_2)$
1				
2				
$\vdots$				

2. 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 ξ 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

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

where $e_n = \xi - x_n$.