Numerical Computing Lab Session 1:

Task 1 (If more than one root kindly mention all values)

Function	Root (by visualization)
$f(x) = \cos(x) - 1.3x$	0.63
$f(x) = x\cos(x) - 2x^2 + 3x - 1$	0.3 & 1.3
$f(x) = 2x\cos(2x) - (x+1)^2$	-2.2 & -0.75

Task 2 (Bisection Method)

$$f(x) = \cos(x) - 1.3x$$

Tol	No. of Iterations	Interval	Root
0.001	10	0,1	0.624023438
0.00001	17	0,1	0.624183655

Repeat the process by selecting another interval

Tol	No. of Iterations	Interval	Root
0.001	11	-1,1	0.624023438
0.00001	18	-1,1	0.624183655

$$f(x) = x\cos(x) - 2x^2 + 3x - 1$$

Tol	No. of Iterations	Interval	Root
0.001	10	0,1	0.297851562
0.00001	17	0,1	0.297523499

Repeat the process by selecting another interval

Tol	No. of Iterations	Interval	Root

0.001	11	-1,1	0.297851562
0.00001	18	-1,1	0.297523499

$$f(x)=2x\ cos\ (2x) - (x + 1)^2$$

Tol	No. of Iterations	Interval	Root
0.001	11	-1,1	0.797851562
0.00001	18	-1,1	0.798164368

Repeat the process by selecting another interval

Tol	No. of Iterations	Interval	Root
0.001	12	-2,2	0.797851562
0.00001	19	-2,2	0.798164368

Write your Observations:

Increased tolerance will decrease the number of iterations required to find the roots and also changes the value of the root, thus increasing the accuracy.

Task 3 (Newton Raphson Method)

$$f\ (x) = cos\ (x) - 1.\ 3x$$

Tol	No. of Iterations	Starting Point	Root
0.001	3	0.5	0.624184578
0.00001	3	0.5	0.624184578

Repeat the process by selecting another interval

Tol	No. of Iterations	Starting Point	Root

0.001	3	1	0.624184580
0.00001	4	1	0.624184578

$$f(x) = x\ cos\ (x) - 2x + 3x - 1$$

Tol	No. of Iterations	Starting Point	Root
0.001	4	0.5	0.297530234
0.00001	5	0.5	0.297530234

Repeat the process by selecting another interval

Tol	No. of Iterations	Starting Point	Root
0.001	4	0	0.297530234
0.00001	4	0	0.297530234

$$f(x) = 2x\ cos\ (2x) - (x + 1)^2$$

Tol	No. of Iterations	Starting Point	Root
0.001	9	0.5	2.191072756
0.00001	14	0.5	2.191309256

Repeat the process by selecting another interval

Tol	No. of Iterations	Starting Point	Root
0.001	12	1	0.798266817
0.00001	15	1	0.798158660

Write your Observations:

If we increase the tolerance the number of iterations will also increase and we get a more accurate result.

Task 4:

Function	Root (by fsolve)

$f1(x) = \cos(x) - 1.3x$	0.624184577804122
$f2(x) = x\cos(x) - 2x^2 + 3x - 1$	1.25662332250557
$f3(x) = 2x\cos(2x) - (x+1)_2$	-0.798159961405796