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Numerical Computing Lab Session 1:

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

Function	Root (by visualization)
$f_1(x) = cos\,(x) - 1.3x$	0.624
$f_2(x) = xcos\,(x) - 2x^2 + 3x - 1$	0.298 , 1.257
$f_3(x) = 2x\,cos\,(2x) - (x+1)^2$	-2.191, -0.798

Task 2 (Bisection Method)

$$f_1(x) = cos\,(x) - 1.3x$$

Tol	No. of Iterations	Interval	Root
0.001	15	[-10, 10]	0.624389648
0.00001	21	[-10, 10]	0.624189377

Repeat the process by selecting another interval

Tol	No. of Iterations	Interval	Root
0.001	14	[-5, 5]	0.624389648
0.00001	20	[-5, 5]	0.624189377

$$f_2(x) = x\,cos\,cos\,(x) - 2x^2 + 3x - 1$$

Tol	No. of Iterations	Interval	Root
0.001	10	[-0.5, 0.5]	0.297851562
0.00001	17	[-0.5,0.5]	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

$$f_3(x) = 2x\ cos\ (2x)\ - (x+1)^2$$

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:

There is a slight difference between the roots at the same interval whereas number of iterations increase with number of tolerance decreases

Task 3 (Newton Raphson Method)

$$f_1(x) = cos\,(x)\ - 1.3x$$

Tol	No. of Iterations	Starting Point	Root
0.001	6	-1	0.624184605
0.00001	7	-1	0.624184578

Repeat the process by selecting another interval

Tol	No. of Iterations	Starting Point	Root
0.001	10	-1.5	0.624184578
0.00001	10	-1.5	0.624184578

$$f_2(x) = xcos\,(x) - 2x^2 + 3x - 1$$

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	-0.5	0.297530062
0.00001	5	-0.5	0.297530234

$$f_3(x) = 2x\ cos\,(2x) - (x+1)^2$$

Tol	No. of Iterations	Starting Point	Root
0.001	3	-1.25	-0.798160100
0.00001	4	-1.25	-0.798159961

Repeat the process by selecting another interval

Tol	No. of Iterations	Starting Point	Root
0.001	3	-2.25	-2.191308012
0.00001	3	-2.25	-2.191308012

Write your Observations:

The Newton Raphson Method perform much better than bisection in terms of finding root in less no of iterations with minimal difference between Root at difference value of tolerance.

Task 4:

Function	Root (by fsolve)
$f_1(x) = cos\ cos\ (x)\ - 1.3x$	0.62418458 at -1
$f_2(x) = x\ cos\ cos\ (x)\ - 2x^2 + 3x - 1$	0.29753023 at 0
$f_3(x) = 2x\ cos\ cos\ (2x)\ - (x+1)^2$	-0.79815996 at 1