Scientific Computing

Report - Lab 3

1. Let f(x) = e^x − x − 1. Compute the approximate order of convergence of both Newton's and Modified Newton's methods in finding a zero of f in the interval [− 1 , 1].

Iteration Number	Newton's Method		Modified Newton's Method	
	Error	Alpha	Error	Alpha
1	-0.418023		-0.119955	
2	-0.194492		-0.00230437	
3	-0.0940957	0.94894	-8.84E-07	1.9901
4	-0.0463101	0.976412	-3.07E-11	1.30545
5	-0.0229763	0.988636		
6	-0.0114442	0.99442		
7	-0.00571118	0.997234		
8	-0.00285287	0.998623		
9	-0.00142576	0.999313		
10	-0.000712709	0.999657		
11	-0.000356312	0.999829		
12	-0.000178146	0.999914		
13	-8.91E-05	0.999957		

Approximate order of convergence of Newton's Method is ~ 1.
Approximate order of convergence of Modified Newton's Method is ~ 2.

2. Compute the approximate order of convergence of the fixed point iteration in finding the fixed point of the function cos(x) in [0 ,π/2].

Fixed point's Method		
Iteration Number	Error	Alpha
1	0.0531378	
2	0.0355771	
3	0.0240524	0.975775
4	0.016159	1.01606
5	0.0109034	0.989071
6	0.00733595	1.00731
7	0.00494543	0.995053
8	0.00332953	1.00332
9	0.00224361	0.997758
10	0.00151096	1.00151
11	0.00101796	0.998983
12	0.000685637	1.00068
13	4.62E-04	0.999539
14	0.000311117	1.00031
15	0.000209579	0.999791
16	0.000141172	1.00014
17	9.51E-05	0.999905
18	6.41E-05	1.00006
19	4.32E-05	0.999957
20	2.91E-05	1.00003
21	1.96E-05	0.99998
22	1.32E-05	1.00001
23	8.88E-06	0.999991
24	5.98E-06	1.00001
25	4.03E-06	0.999996
26	2.72E-06	1
27	1.83E-06	0.999998
28	1.23E-06	1
29	8.30E-07	0.999999

Approximate order of convergence of the fixed point iteration is ~ 1.

3. Let f(x) = (x-1)*(x-6)*(x-8), compare the approximate order of convergence of both secant and Newton's method in finding the root of f in the interval [0, 2].

Iteration Number	Newton's Method		Secant's Method	
	Error	Alpha	Error	Alpha
1	0.673684		0.0851064	
2	0.115319		0.0131438	
3	0.00430203	1.86318	3.94E-04	1.87826
4	6.33E-06	1.983	1.78E-06	1.53881
5	1.37E-11	1.99966	2.40E-10	1.65048

Approximate order of convergence of Newton's method is ~2.
Approximate order of convergence of Secant's method is ~2.