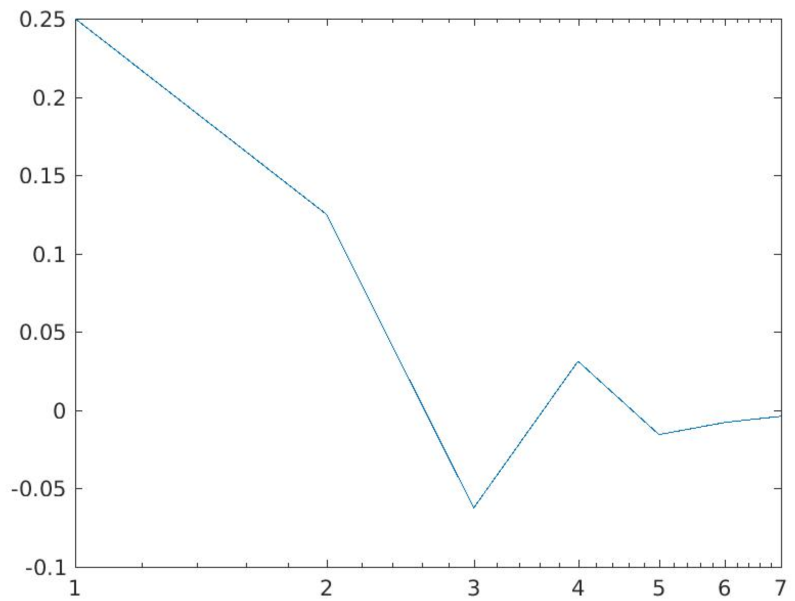
Scientific Computing
Lab 01

Problem 1:

No. of iteration(n)	x(n)	e(n)	$\log_2(e(n+1)/e(n))$
1	-3.5000000000	-	-1
2	-3.2500000000	0.25000000000	-1
3	-3.1250000000	0.12500000000	-1
4	-3.1875000000	-0.0625000000	-1
5	-3.1562500000	0.03125000000	-1
6	-3.1718750000	-0.0156250000	-1
7	-3.1796875000	-0.0078125000	-1
8	-3.1835937500	-0.0039062500	-

Semilog plot of e(n) vs n :



Problem 2: Using the Bisection method to find solution accurate to within 10^{-3} , the following solutions were obtained:

1) Solution obtained is 1.0078.
2) Solution obtained is 0.64062.
3) Solution obtained is 0.25732.
4) Solution obtained in range -3 to -2 is -2.1914 and solution obtained in range -1 to 0 is -0.79834.
5) Solution obtained in range is 0.2 to 0.3 is 0.29766 and solution obtained in range 1.2 to 1.3 is 1.2566.

Problem 3: An approximation of cuberoot of 25 correct to with in 10^{-4} using the Bisection algorithm is 2.92401885986328.

n	x(n)	f(x(n))
1	2.75000000000000	-4.20312500000000
2	2.87500000000000	-1.23632812500000
3	2.93750000000000	0.347412109375000
4	2.90625000000000	-0.452972412109375
5	2.92187500000000	-0.0549201965332031
6	2.92968750000000	0.145709514617920
7	2.92578125000000	0.0452607274055481
8	2.92382812500000	-0.00486319512128830
9	2.92480468750000	0.0201903982087970
10	2.92431640625000	0.00766150990966708
11	2.92407226562500	0.00139863452932332
12	2.92395019531250	-0.00173241100674204
13	2.92401123046875	-0.000166920917081370
14	2.92404174804688	0.000615848636442706
15	2.92402648925781	0.000224461817271759
16	2.92401885986328	2.87699394938556e-05

Problem 4:

Number of iterations in part (i) = 4 and it then blows up.

Number of iterations in part (ii) = 7
Value of f(x) for fourth iterate for part(ii) = -4.752244293114369e+113. Clearly, it has blown up.

Number of iterations in part (iii) = 7 and approximation is 1.4758
Value of f(x) for fourth iterate for part(iii) = 0.3307

Number of iterations in part (iv) = 939 and approximation is 1.4758
Value of f(x) for fourth iterate for part(iv) = -0.54808

Based on first four iterations, part(iii) gives the best approximation to the solution.

Problem 5: Using Newton's method to find solution accurate to within 10^{-5} , the folowing solutions were obtained:

1) Solution for function 1 is 1.8294.
2) Solution for function 2 is 1.3977.
3) Solution for function 3 in range 2 to 3 is 2.3707.
   Solution for function 3 in range 3 to 4 is 3.7221.
4) Solution for function 4 in range 1 to 2 is 1.4124.
   Solution for function 4 in range e to 4 is 3.0571.
5) Solution for function 5 in range 0 to 1 is 0.91001.
   Solution for function 5 in range 3 to 5 is 3.7331.
6) Solution for function 6 in range 0 to 1 is 0.58853.
   Solution for function 6 in range 3 to 4 is 3.0964.
   Solution for function 6 in range 6 to 7 is 6.285.

Problem 6: Solution by Newton method for the negative root is -14.1013.
The code has been designed to take the constant term as input to investigate the sensitivity of the root to perturbations in the constant term.

Constant term	Solution
-1.46	-8.9783
-1.47	-9.8823
-1.48	-10.9813
-1.49	-12.3492
-1.50	-14.1013
-1.51	-16.4281
-1.52	-19.6695
-1.53	-24.4984
-1.54	-32.4611

Problem 7:

- Solution by Newton method in range -1 to 0 is -0.040659.
- Solution by Newton method in range 0 to 1 is 0.9624.(but it is not obtained by taking 0.5 as initial approximation rather by 0.6 or greater approximation).
- Solution by Secant method in range -1 to 0 is 0.9624.
- Solution by Secant method in range 0 to 1 is -0.040659.

Problem 8: The code can take two initial approximations as inputs from the user and one can find root in any interval.

1) It has infinite roots.
2) It also has infinite roots.
3) It has roots 0.452, -0.189 and 11.737.
4) It has roots -0.885, -2.646, -0.47.
5) It has roots -1.856 and 1.371.