Assignment-5

Course: SC-374

Computational and Numerical Methods

Instructor: Prof. Arnab Kumar

Made by:

Yatin Patel – 201601454

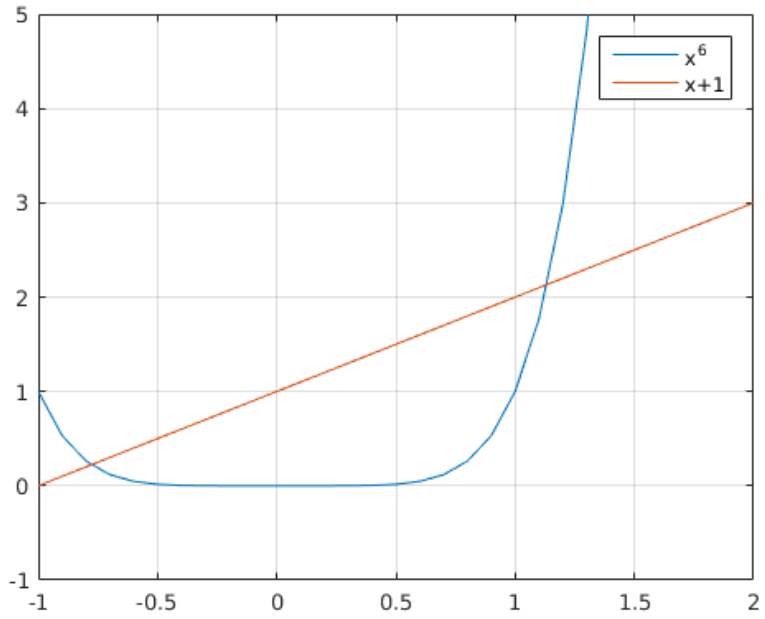
Rutvik Kothari – 201601417

Problem: 1

♦ **Statement:**

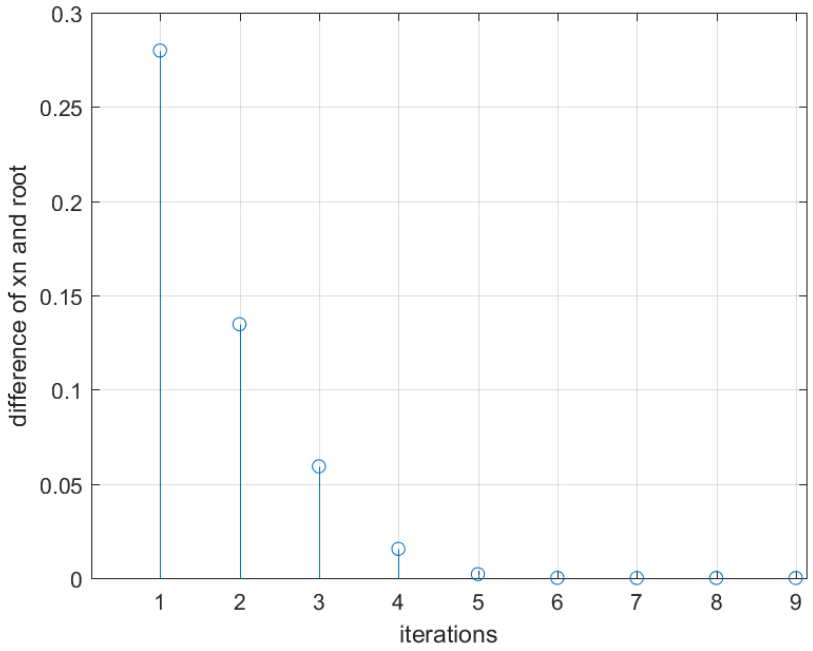
Write a code, applying the algorithm of the secant method to determine both the real roots of $f(x) = x^6 - x - 1 = 0$.

♦ **Graphs:**

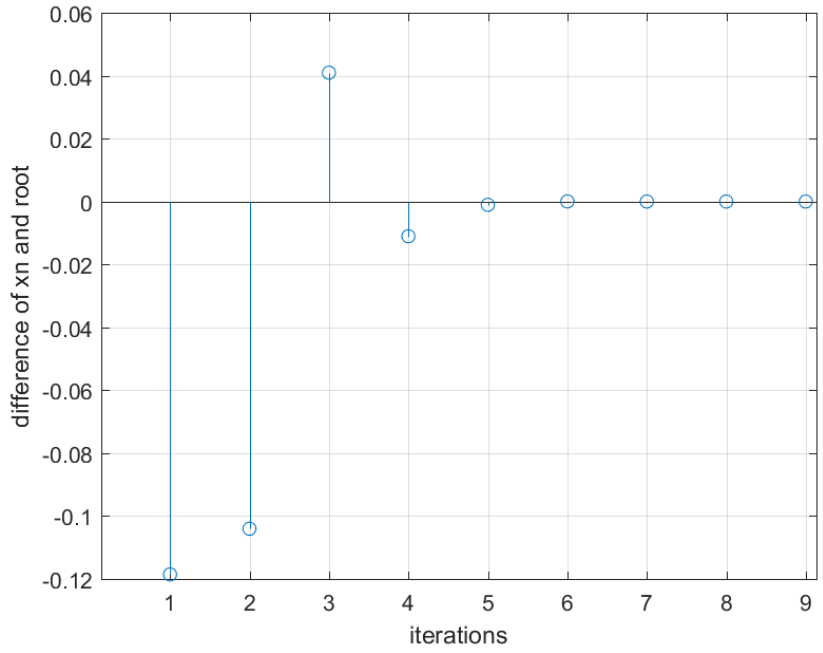


no	x_n	f_x_n	f_x_d	x_n_1
1	2	61	0	0
2	1.5	61	-52.1094	1.4147
3	1.4147	8.8906	-3.289	1.2694

4	1.2694	5.6016	-3.6869	1.194
5	1.194	1.9147	-1.2118	1.1502
6	1.1502	0.7029	-0.5377	1.1367
7	1.1367	0.1652	-0.1442	1.134



no	x_n	f_x_n	f_x_d	x_n_1
1	1	-1	0	0
2	2	-1	62	1.0161
3	1.0161	61	-61.9154	1.0307
4	1.0307	-0.9154	0.0834	1.1757
5	1.1757	-0.8319	1.2971	1.1237
6	1.1237	0.4652	-0.5759	1.1337
7	1.1337	-0.1106	0.0998	1.1348



♦ **Observations:**

Largest Root which we are getting is at x = 1.1347 .

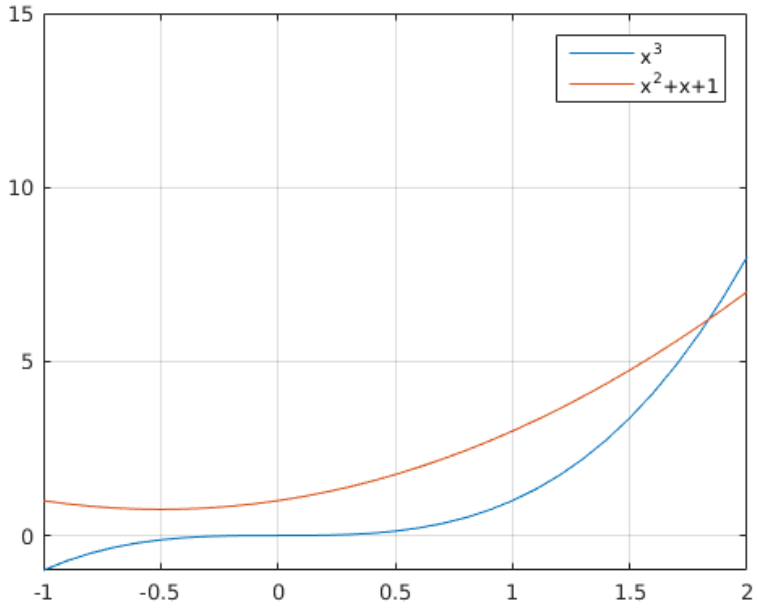
Problem: 2

♦ **Statement:**

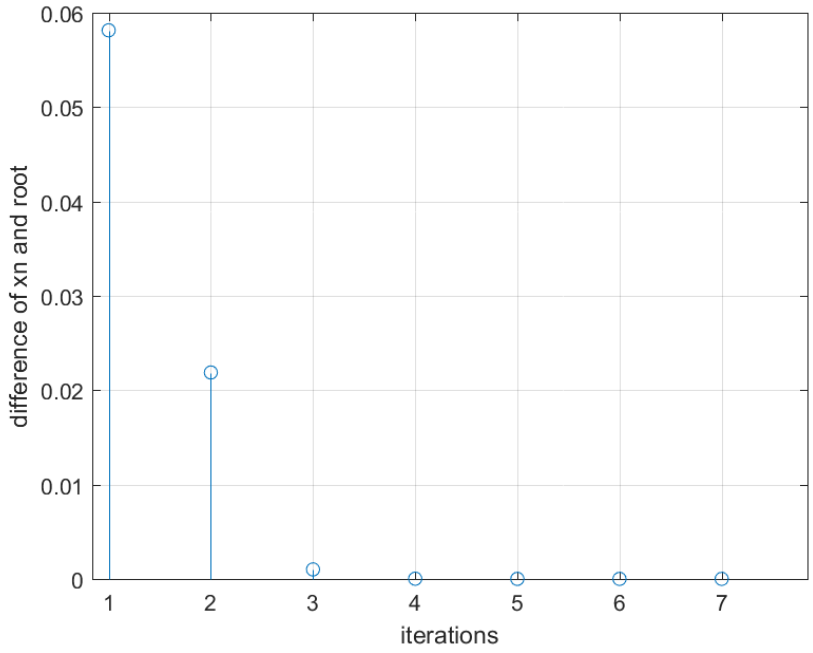
Use the bisection method to find the real roots of the following functions, using an error tolerance of € = 0.0001.

(A) $f(x) = x^3 - x^2 - x - 1 = 0$

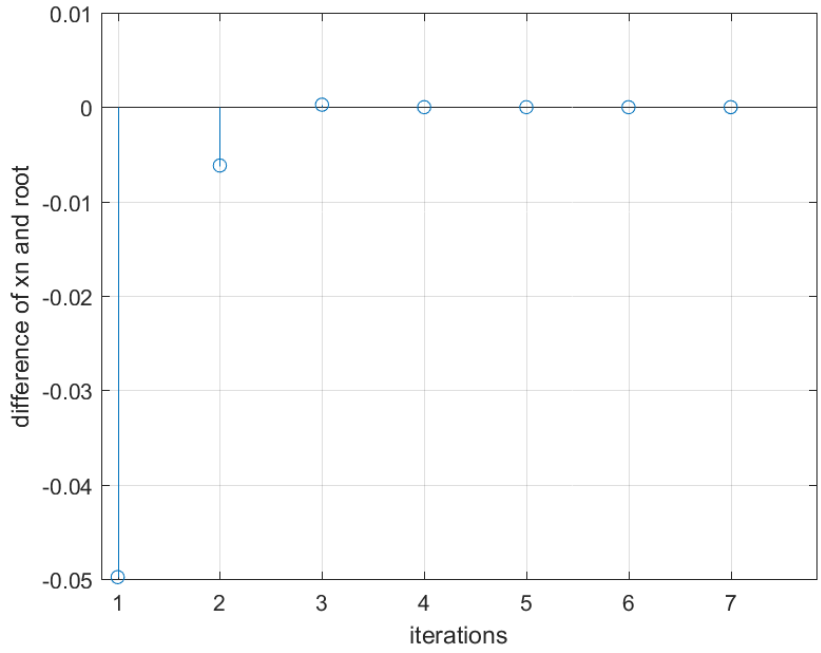
♦ **Graphs:**



no	x_n	f_x_n	f_x_d	x_n_1
1	2	1	0	0
2	2.5	1	4.875	1.8974
3	1.8974	5.875	-5.5414	1.8612
4	1.8612	0.3336	-0.2117	1.8403
5	1.8403	0.1219	-0.1164	1.8393



no	x_n	f_x_n	f_x_d	x_n_1
1	1.5	-1.375	0	0
2	2	-1.375	2.375	1.7895
3	1.7895	1	-1.2614	1.8331
4	1.8331	-0.2614	0.2277	1.8396
5	1.8396	-0.0337	0.0351	1.8393

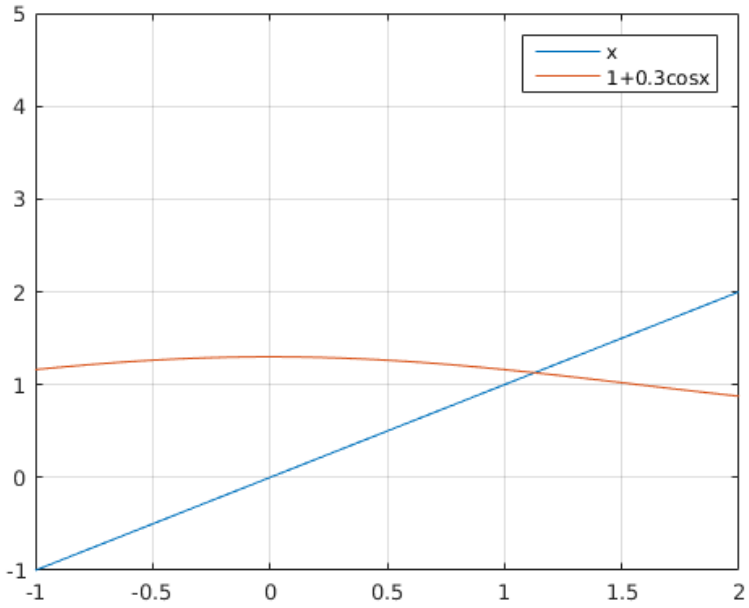


♦ **Observations:**

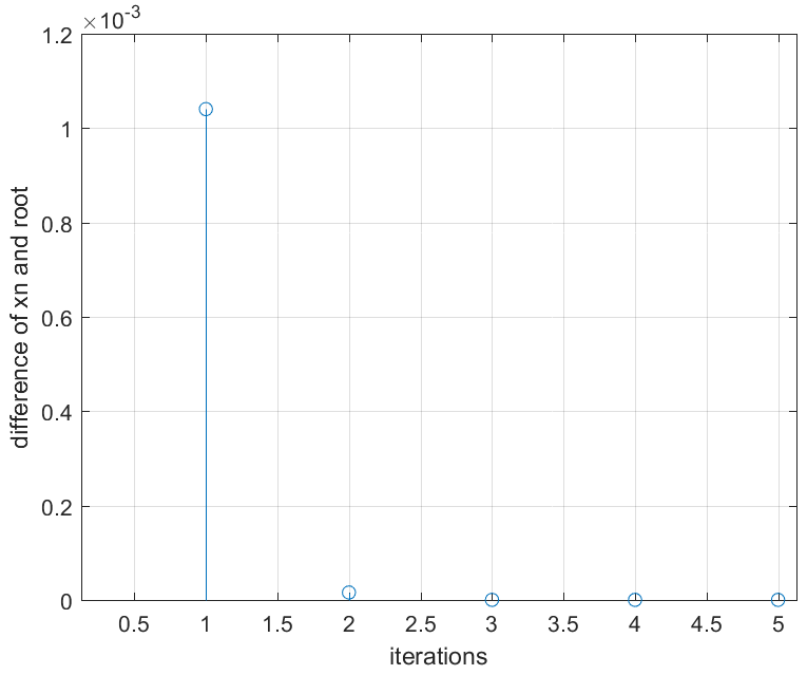
Root which we are getting is at x = 1.8393 .

(B) $\boldsymbol{f(x) = x - 1 - 0.3cosx = 0}$

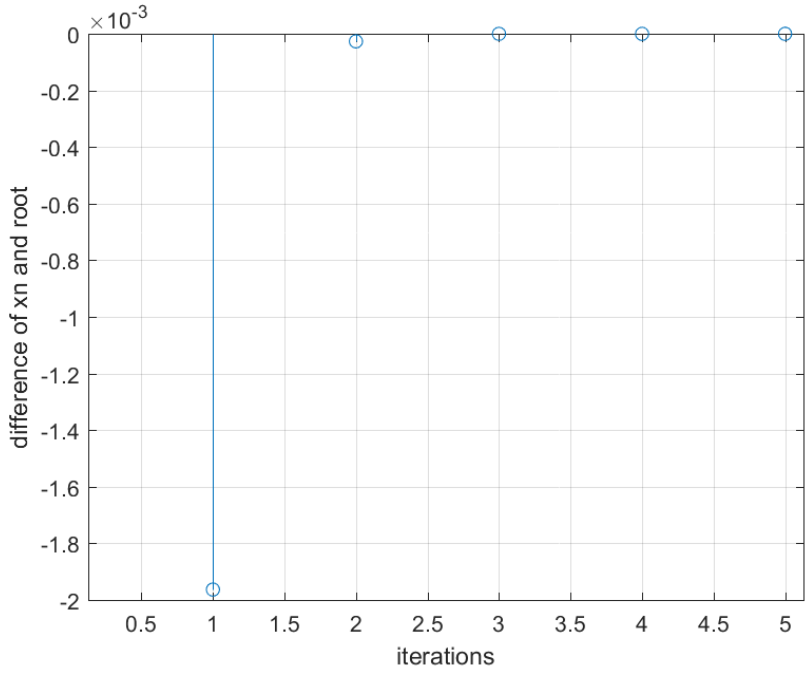
♦ **Graphs:**



no	x_n	f_x_n	f_x_d	x_n_1
1	1.5	0.4788	0	0
2	2	0.4788	0.6461	1.1295
3	1.1295	1.1248	-1.1235	1.1284



no	x_n	f_x_n	f_x_d	x_n_1
1	1	-0.1621	0	0
2	1.5	-0.1621	0.6409	1.1265
3	1.1265	0.4788	-0.4813	1.1284

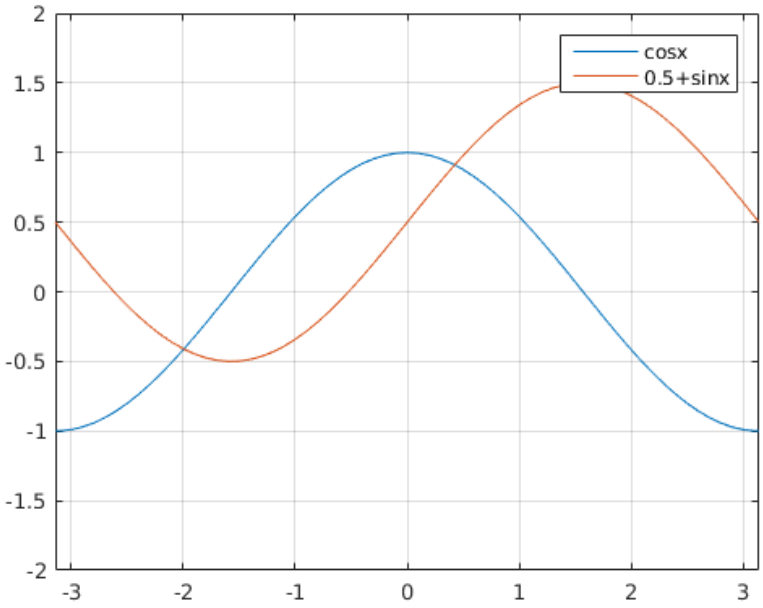


♦ **Observations:**

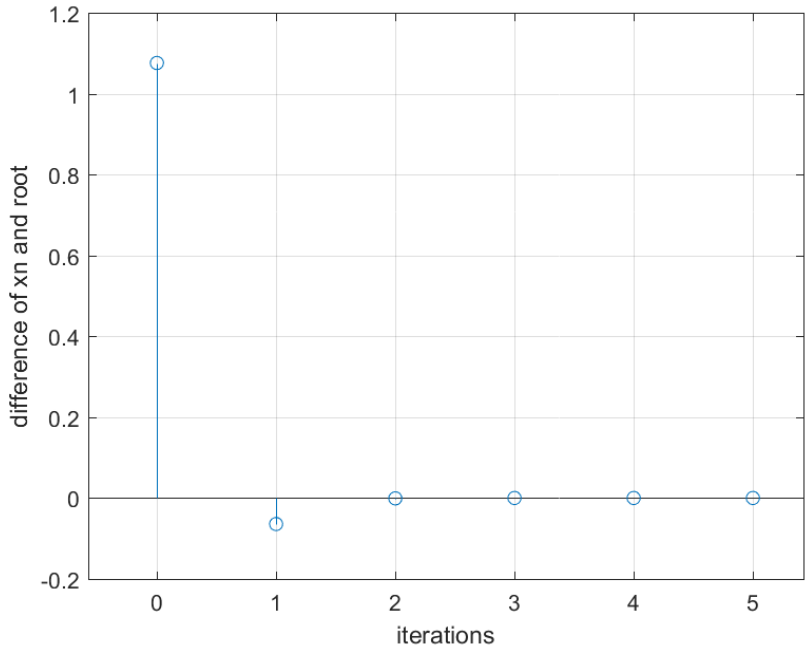
Root which we are getting is at x = 1.1284 .

(C) $\boldsymbol{f(x) = cosx - sinx - 0.5 = 0}$

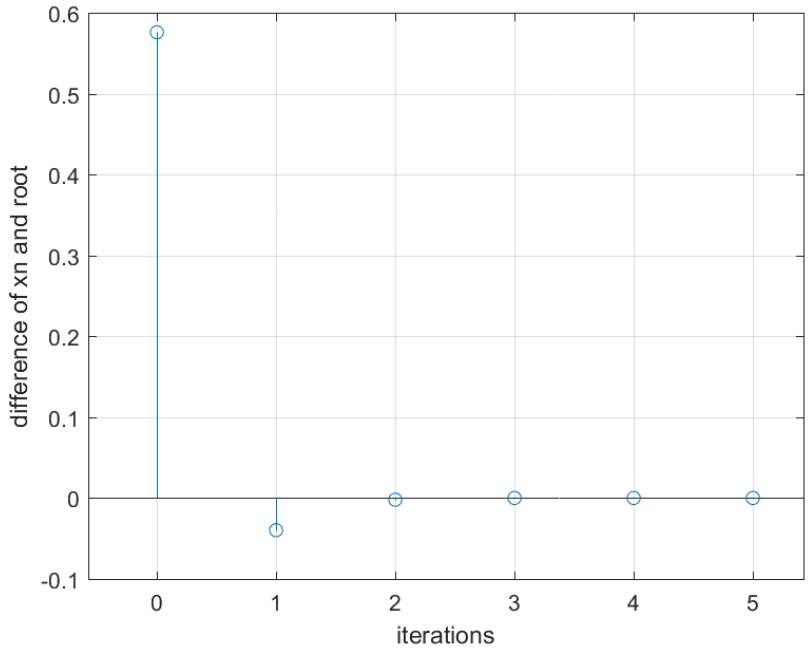
♦ **Graphs:**



no	x_n	f_x_n	f_x_d	x_n_1
1	1	-0.8012	0	0
2	1.5	-0.8012	-0.6256	0.3597
3	0.3597	-1.4268	1.5108	0.4231
4	0.4231	0.084	-0.0828	0.424



no	x_n	f_x_n	f_x_d	x_n_1
1	0	0.5	0	0
2	1	0.5	-1.3012	0.3843
3	0.3843	-0.8012	0.8534	0.4219
4	0.4219	0.0522	-0.0494	0.424

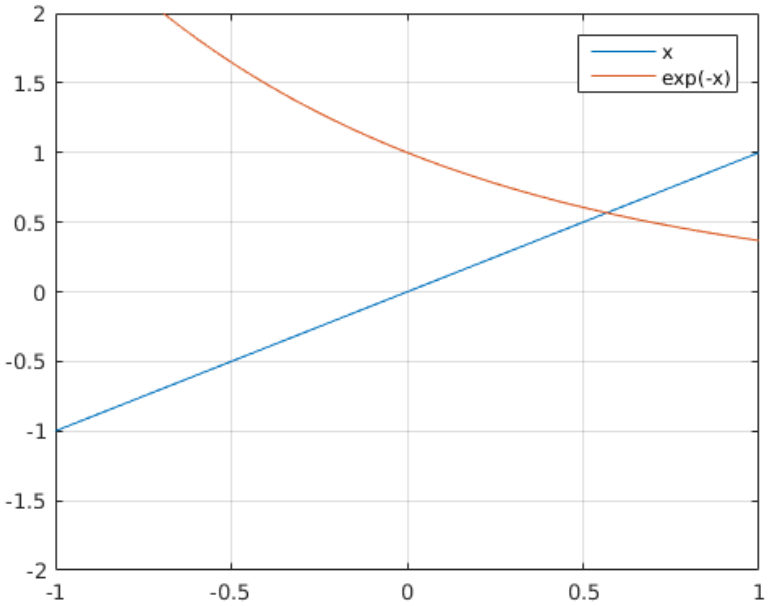


♦ **Observations:**

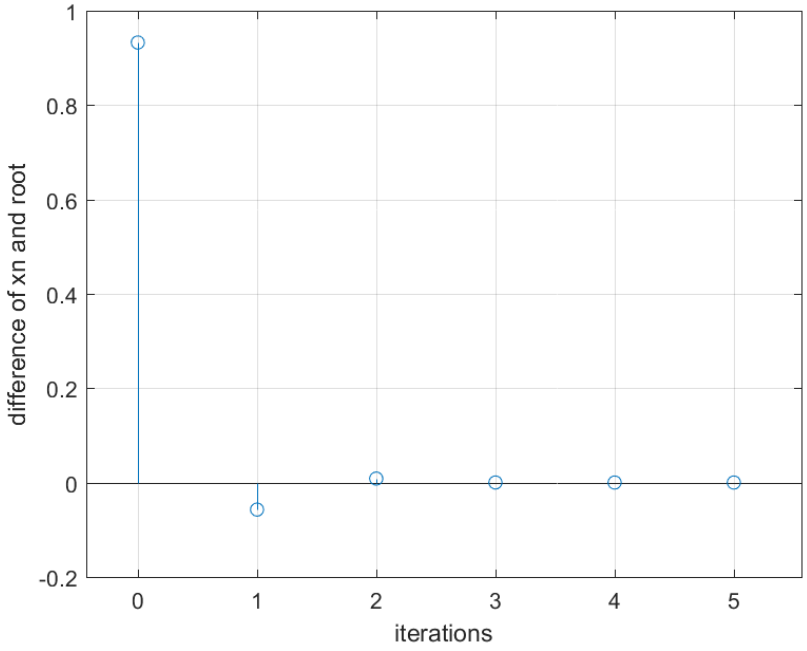
Root which we are getting is at x = 0.4241 .

(D) $\boldsymbol{f(x) = x - e^{-x} = 0}$

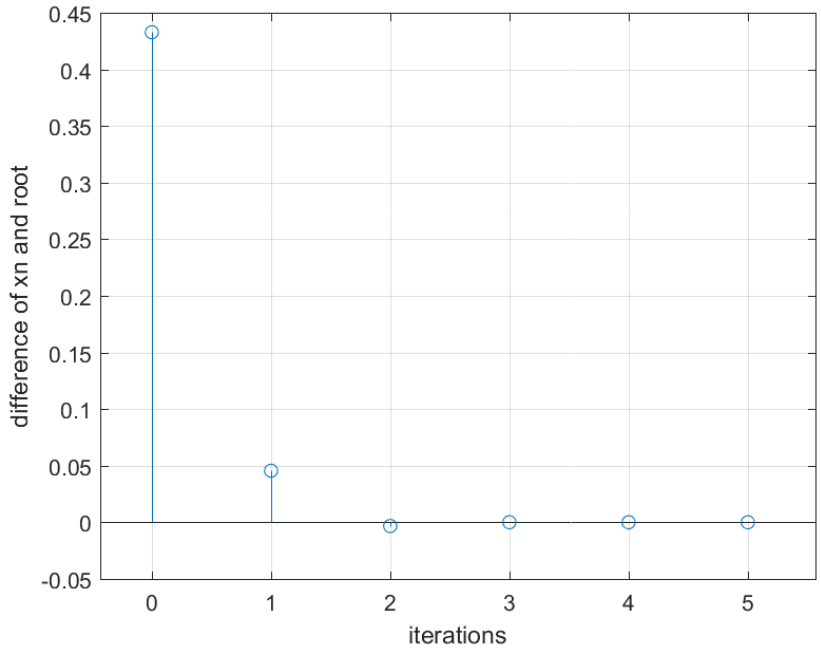
♦ **Graphs:**



no	x_n	f_x_n	f_x_d	x_n_1
1	1	0.6321	0	0
2	1.5	0.6321	0.6447	0.5098
3	0.5098	1.2769	-1.3677	0.5756
4	0.5756	-0.0908	0.104	0.5672



no	x_n	f_x_n	f_x_d	x_n_1
1	0	-1	0	0
2	1	-1	1.6321	0.6127
3	0.6127	0.6321	-0.5613	0.5638
4	0.5638	0.0708	-0.076	0.5672

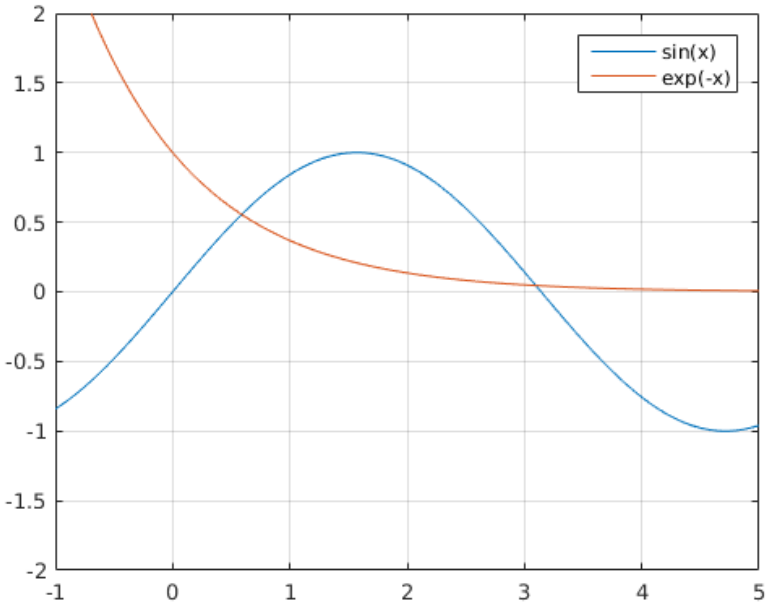


♦ **Observations:**

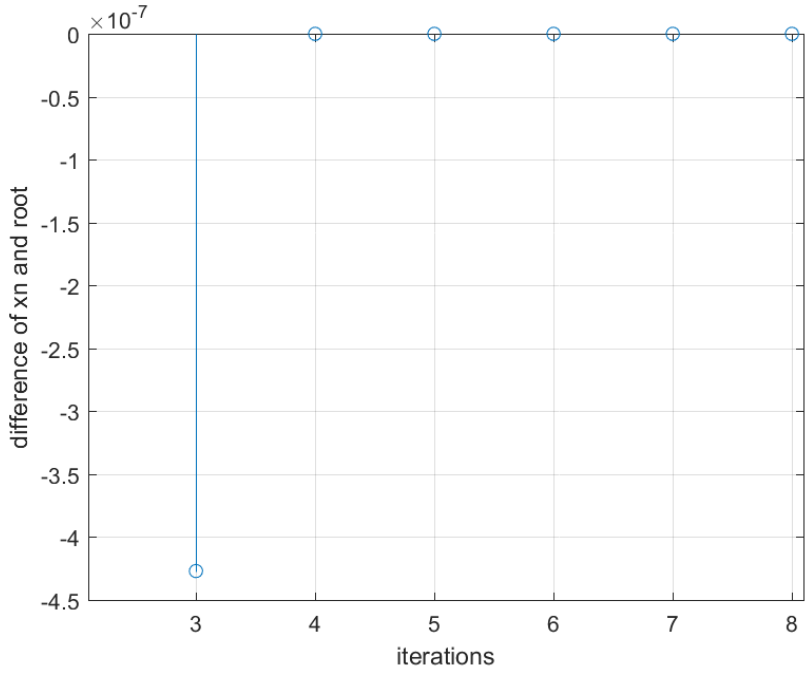
Root which we are getting is at x = 0.5672 .

(E) $\boldsymbol{f(x) = e^{-x} - sinx = 0}$

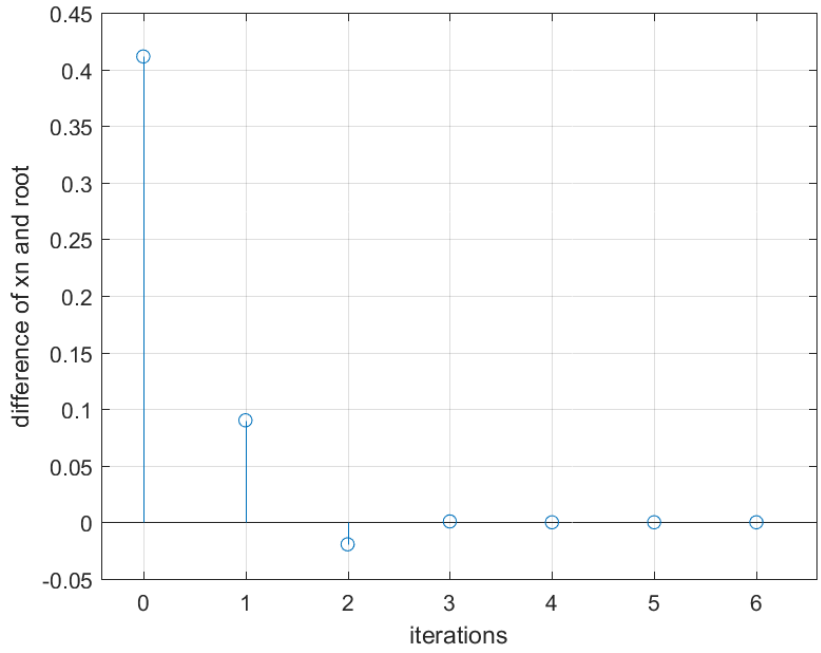
♦ **Graphs:**



no	x_n	f_x_n	f_x_d	x_n_1
1	3	-0.0913	0	0
2	4	-0.0913	0.8665	3.1054
3	3.1054	0.7751	-0.7665	3.0953
4	3.0953	0.0086	-0.0096	3.0964



no	x_n	f_x_n	f_x_d	x_n_1
1	0	1	0	0
2	1	1	-1.4736	0.6786
3	0.6786	-0.4736	0.3532	0.5691
4	0.5691	-0.1204	0.1476	0.5893
5	0.5893	0.0272	-0.0282	0.5885



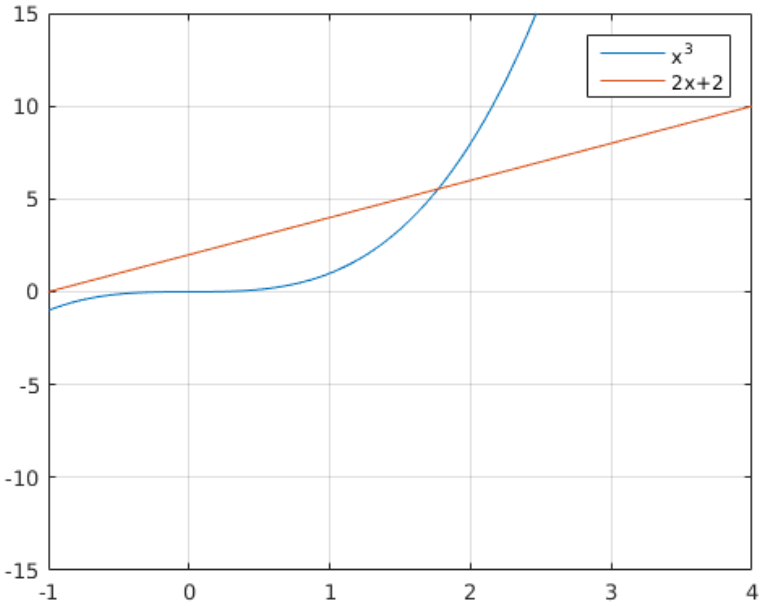
♦ **Observations:**

Root which we are getting is at x = 0.5885 .

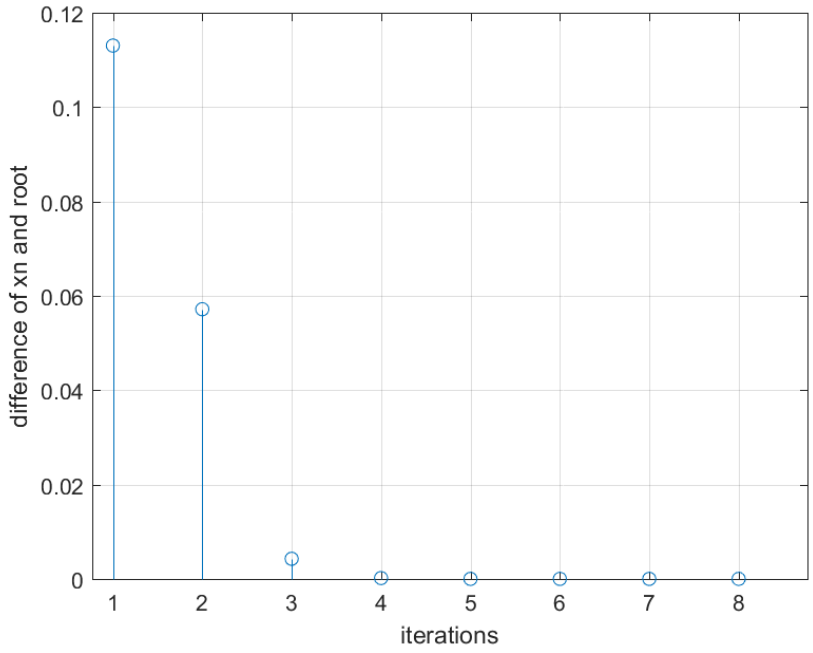
Root which we are getting is at x = 3.0964 .

(F) $f(x) = x^3 - 2x - 2 = 0$

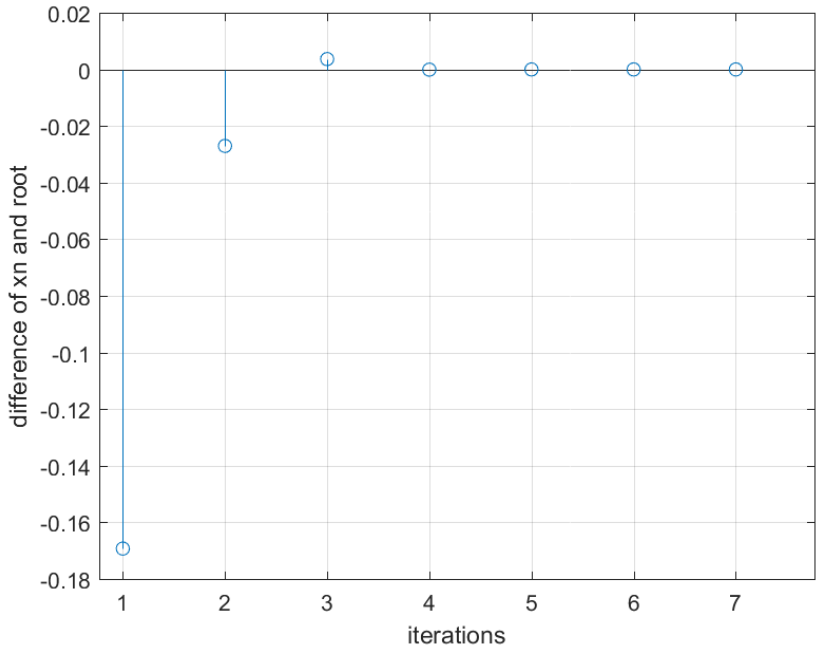
♦ **Graphs:**



no	x_n	f_x_n	f_x_d	x_n_1
1	2	2	0	0
2	3	2	17	1.8824
3	1.8824	19	-18.0951	1.8265
4	1.8265	0.9049	-0.4649	1.7735
5	1.7735	0.4401	-0.4085	1.7695
6	1.7695	0.0316	-0.0303	1.7693



no	x_n	f_x_n	f_x_d	x_n_1
1	1	-3	0	0
2	2	-3	5	1.6
3	1.6	2	-3.104	1.7423
4	1.7423	-1.104	0.9081	1.773
5	1.773	-0.1959	0.223	1.7692

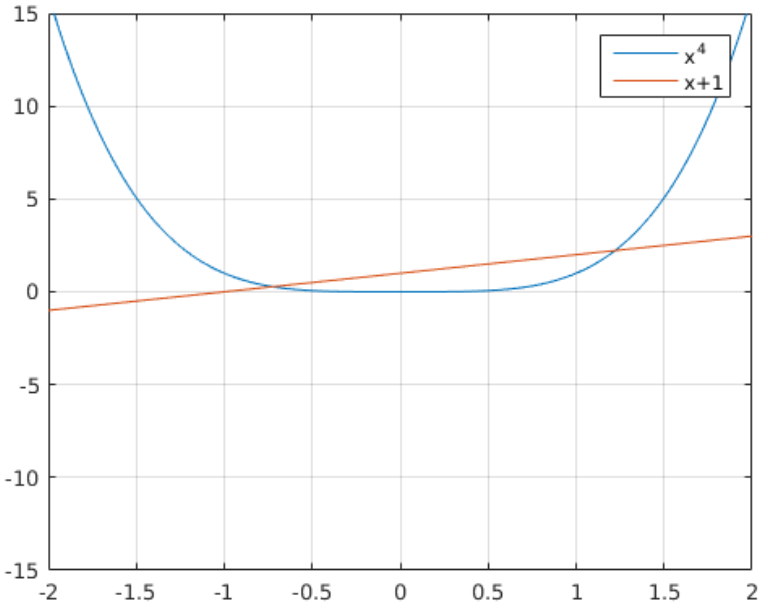


♦ **Observations:**

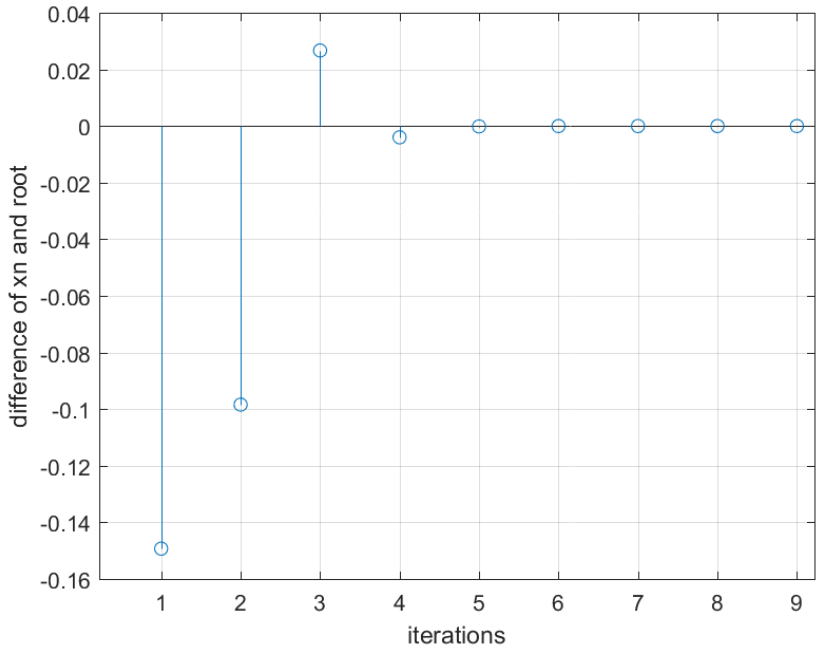
Root which we are getting is at x = 1.7693 .

(G) $f(x) = x^4 - x - 1 = 0$

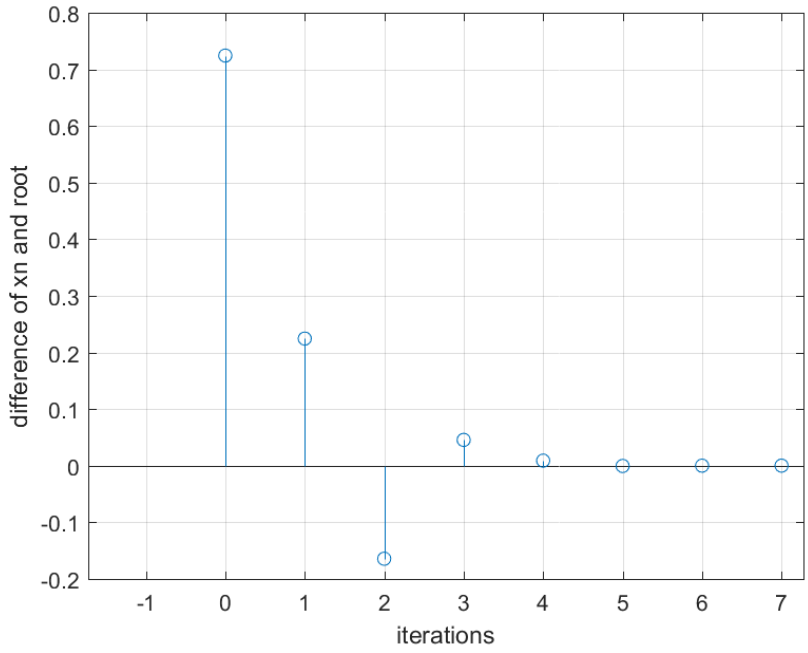
♦ **Graphs:**



no	x_n	f_x_n	f_x_d	x_n_1
1	1	-1	0	0
2	2	-1	14	1.0714
3	1.0714	13	-13.7536	1.1223
4	1.1223	-0.7536	0.2178	1.2474
5	1.2474	-0.5358	0.7098	1.2168
6	1.2168	0.1741	-0.1989	1.2206
7	1.2206	-0.0249	0.0239	1.2207



no	x_n	f_x_n	f_x_d	x_n_1
1	-1	1	0	0
2	0	1	-2	-0.5
3	-0.5	-1	0.5625	-0.8889
4	-0.8889	-0.4375	0.9507	-0.679
5	-0.679	0.5132	-0.6217	-0.7156
6	-0.7156	-0.1085	0.0864	-0.725
7	-0.725	-0.0222	0.0234	-0.7245



♦ **Observations:**

Smallest Root which we are getting is at x = -0.7245 .

Largest Root which we are getting is at x = 1.2207 .