AIM: False Position Method (Regula Falsi) and Newton Ralphson Method algorithms with example.

False Position Method (Regula Falsi):-

Code:

```
clc
clear all
close all
y = input('Enter the Function');
a = input('Enter the Value of a:');
b = input('Enter the Value of b:');
e = input('Enter the error:');
i = 1;
fa = feval(y,a);
fb = feval(y,b);
if fa*fb > 0
    disp('No Roots');
else
    c = a-(a-b)* fa/(fa-fb);
    fc = feval(y,c);
    fprintf('\n\na\t\t\tb\t\t\tc\t\t\tf(c)\n');
    while abs(fc) > e
         d(i)=abs(fc);
        fprintf('%f\t%f\t%f\t%f\n',a,b,c,fc);

        if fa*fc < 0
            b=c;
        else
            a=c;
        end
        fa = feval(y,a);
        fb = feval(y,b);
        c = a-(a-b)* fa/(fa-fb);
        fc = feval(y,c);
        i = i + 1;

    end
    fprintf('Root is: %f\n',c);
    fprintf('Number of Iteration:%f',i)
end
plot(d)
```

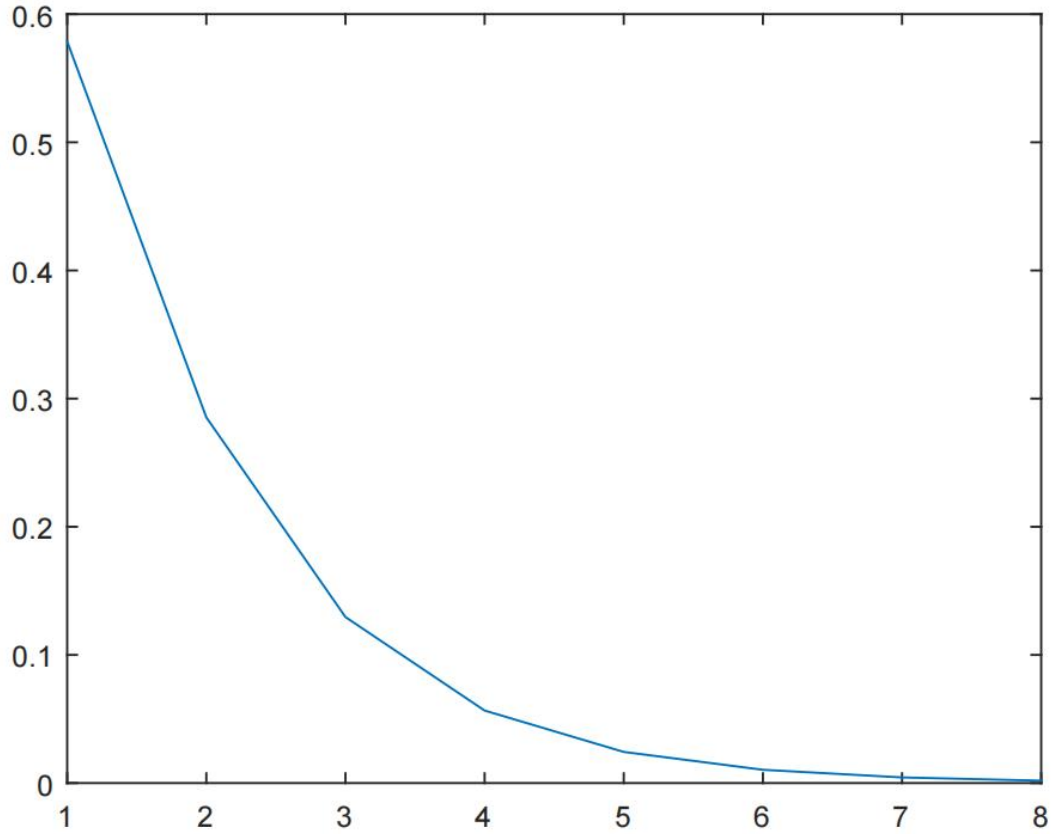
Q1) Find the root of f(x) = x^3 – x - 1 by using Bisection Method in the interval [1, 2] with a tolerance of 0.001
Output:-

Enter the Function@(x) x^3 - x -1
Enter the Value of a:1
Enter the Value of b:2
Enter the error:0.001

a	b	c	f(c)
1.000000	2.000000	1.166667	-0.578704
1.166667	2.000000	1.253112	-0.285363
1.253112	2.000000	1.293437	-0.129542

1.293437	2.000000	1.311281	-0.056588
1.311281	2.000000	1.318989	-0.024304
1.318989	2.000000	1.322283	-0.010362
1.322283	2.000000	1.323684	-0.004404
1.323684	2.000000	1.324279	-0.001869

Root is: 1.324532
Number of Iteration:9.000000>>



Q2) Find the root of f(x) = x^3 - x^2 + 2 by using Bisection Method in the interval [-10, 10] with a tolerance of 0.01

Output:

Enter the Function @(x) x^3 - x^2 + 2
Enter the Value of a:-10
Enter the Value of b:10
Enter the error:0.01

a	b		c	f(c)
-10.000000	10.000000	0.980000	1.980792	
-10.000000	0.980000	0.960228	1.963329	
-10.000000	0.960228	0.940665	1.947497	
-10.000000	0.940665	0.921294	1.933196	
-10.000000	0.921294	0.902099	1.920330	
-10.000000	0.902099	0.883065	1.908814	
-10.000000	0.883065	0.864179	1.898568	
-10.000000	0.864179	0.845426	1.889519	
-10.000000	0.845426	0.826794	1.881598	
-10.000000	0.826794	0.808272	1.874744	

-10.000000	0.808272	0.789850	1.868895
-10.000000	0.789850	0.771516	1.863998
-10.000000	0.771516	0.753260	1.860000
-10.000000	0.753260	0.735075	1.856852
-10.000000	0.735075	0.716952	1.854508
-10.000000	0.716952	0.698881	1.852923
-10.000000	0.698881	0.680857	1.852056
-10.000000	0.680857	0.662871	1.851866
-10.000000	0.662871	0.644918	1.852315
-10.000000	0.644918	0.626990	1.853364
-10.000000	0.626990	0.609083	1.854977
-10.000000	0.609083	0.591190	1.857119
-10.000000	0.591190	0.573306	1.859754
-10.000000	0.573306	0.555428	1.862849
-10.000000	0.555428	0.537550	1.866370
-10.000000	0.537550	0.519669	1.870284
-10.000000	0.519669	0.501781	1.874556
-10.000000	0.501781	0.483882	1.879155
-10.000000	0.483882	0.465970	1.884047
-10.000000	0.465970	0.448043	1.889199
-10.000000	0.448043	0.430097	1.894577
-10.000000	0.430097	0.412131	1.900149
-10.000000	0.412131	0.394143	1.905881
-10.000000	0.394143	0.376133	1.911738
-10.000000	0.376133	0.358098	1.917686
-10.000000	0.358098	0.340039	1.923691
-10.000000	0.340039	0.321955	1.929717
-10.000000	0.321955	0.303846	1.935729
-10.000000	0.303846	0.285713	1.941691
-10.000000	0.285713	0.267556	1.947567
-10.000000	0.267556	0.249376	1.953320
-10.000000	0.249376	0.231175	1.958913
-10.000000	0.231175	0.212954	1.964308
-10.000000	0.212954	0.194716	1.969468
-10.000000	0.194716	0.176463	1.974356
-10.000000	0.176463	0.158197	1.978933
-10.000000	0.158197	0.139922	1.983161
-10.000000	0.139922	0.121640	1.987003
-10.000000	0.121640	0.103357	1.990422
-10.000000	0.103357	0.085075	1.993378
-10.000000	0.085075	0.066799	1.995836
-10.000000	0.066799	0.048534	1.997759
-10.000000	0.048534	0.030284	1.999111
-10.000000	0.030284	0.012055	1.999856
-10.000000	0.012055	-0.006147	1.999962
-10.000000	-0.006147	-0.024318	1.999394
-10.000000	-0.024318	-0.042450	1.998122
-10.000000	-0.042450	-0.060537	1.996113
-10.000000	-0.060537	-0.078574	1.993341
-10.000000	-0.078574	-0.096553	1.989777
-10.000000	-0.096553	-0.114467	1.985397
-10.000000	-0.114467	-0.132310	1.980178
-10.000000	-0.132310	-0.150074	1.974098
-10.000000	-0.150074	-0.167751	1.967139
-10.000000	-0.167751	-0.185335	1.959285
-10.000000	-0.185335	-0.202817	1.950522
-10.000000	-0.202817	-0.220190	1.940841

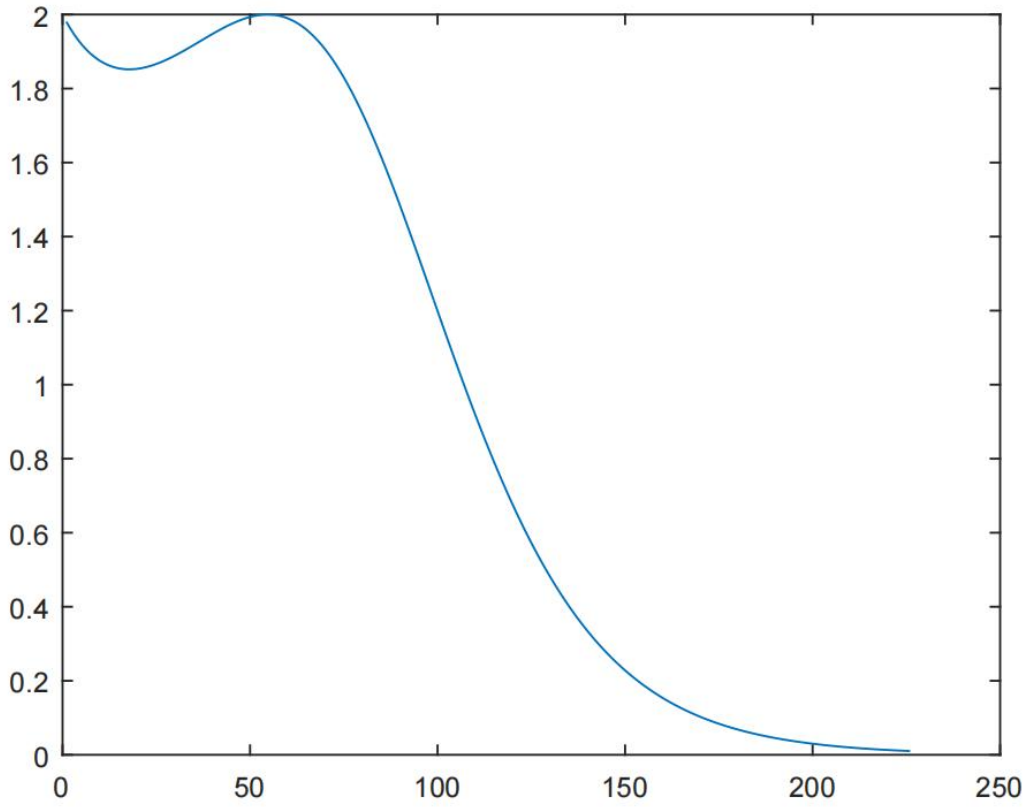
-10.000000	-0.220190	-0.237447	1.930232
-10.000000	-0.237447	-0.254579	1.918690
-10.000000	-0.254579	-0.271579	1.906215
-10.000000	-0.271579	-0.288439	1.892806
-10.000000	-0.288439	-0.305151	1.878468
-10.000000	-0.305151	-0.321709	1.863208
-10.000000	-0.321709	-0.338104	1.847035
-10.000000	-0.338104	-0.354330	1.829964
-10.000000	-0.354330	-0.370379	1.812010
-10.000000	-0.370379	-0.386245	1.793193
-10.000000	-0.386245	-0.401920	1.773535
-10.000000	-0.401920	-0.417398	1.753060
-10.000000	-0.417398	-0.432673	1.731795
-10.000000	-0.432673	-0.447739	1.709771
-10.000000	-0.447739	-0.462590	1.687020
-10.000000	-0.462590	-0.477222	1.663577
-10.000000	-0.477222	-0.491628	1.639477
-10.000000	-0.491628	-0.505804	1.614759
-10.000000	-0.505804	-0.519746	1.589462
-10.000000	-0.519746	-0.533450	1.563628
-10.000000	-0.533450	-0.546912	1.537300
-10.000000	-0.546912	-0.560128	1.510520
-10.000000	-0.560128	-0.573097	1.483332
-10.000000	-0.573097	-0.585815	1.455781
-10.000000	-0.585815	-0.598280	1.427913
-10.000000	-0.598280	-0.610491	1.399771
-10.000000	-0.610491	-0.622446	1.371402
-10.000000	-0.622446	-0.634144	1.342848
-10.000000	-0.634144	-0.645584	1.314155
-10.000000	-0.645584	-0.656767	1.285366
-10.000000	-0.656767	-0.667691	1.256523
-10.000000	-0.667691	-0.678359	1.227668
-10.000000	-0.678359	-0.688770	1.198841
-10.000000	-0.688770	-0.698925	1.170081
-10.000000	-0.698925	-0.708826	1.141427
-10.000000	-0.708826	-0.718475	1.112913
-10.000000	-0.718475	-0.727873	1.084575
-10.000000	-0.727873	-0.737023	1.056445
-10.000000	-0.737023	-0.745926	1.028556
-10.000000	-0.745926	-0.754587	1.000935
-10.000000	-0.754587	-0.763008	0.973611
-10.000000	-0.763008	-0.771191	0.946610
-10.000000	-0.771191	-0.779140	0.919956
-10.000000	-0.779140	-0.786860	0.893670
-10.000000	-0.786860	-0.794352	0.867772
-10.000000	-0.794352	-0.801622	0.842282
-10.000000	-0.801622	-0.808672	0.817216
-10.000000	-0.808672	-0.815508	0.792589
-10.000000	-0.815508	-0.822133	0.768414
-10.000000	-0.822133	-0.828552	0.744703
-10.000000	-0.828552	-0.834768	0.721465
-10.000000	-0.834768	-0.840786	0.698709
-10.000000	-0.840786	-0.846611	0.676441
-10.000000	-0.846611	-0.852247	0.654668
-10.000000	-0.852247	-0.857698	0.633394
-10.000000	-0.857698	-0.862968	0.612621
-10.000000	-0.862968	-0.868063	0.592350

-10.000000	-0.868063	-0.872987	0.572584
-10.000000	-0.872987	-0.877744	0.553320
-10.000000	-0.877744	-0.882339	0.534557
-10.000000	-0.882339	-0.886776	0.516294
-10.000000	-0.886776	-0.891059	0.498526
-10.000000	-0.891059	-0.895193	0.481249
-10.000000	-0.895193	-0.899182	0.464459
-10.000000	-0.899182	-0.903030	0.448150
-10.000000	-0.903030	-0.906741	0.432316
-10.000000	-0.906741	-0.910320	0.416951
-10.000000	-0.910320	-0.913770	0.402047
-10.000000	-0.913770	-0.917096	0.387596
-10.000000	-0.917096	-0.920301	0.373592
-10.000000	-0.920301	-0.923390	0.360025
-10.000000	-0.923390	-0.926365	0.346886
-10.000000	-0.926365	-0.929231	0.334168
-10.000000	-0.929231	-0.931990	0.321862
-10.000000	-0.931990	-0.934648	0.309957
-10.000000	-0.934648	-0.937206	0.298445
-10.000000	-0.937206	-0.939669	0.287317
-10.000000	-0.939669	-0.942039	0.276562
-10.000000	-0.942039	-0.944320	0.266172
-10.000000	-0.944320	-0.946515	0.256137
-10.000000	-0.946515	-0.948626	0.246448
-10.000000	-0.948626	-0.950657	0.237095
-10.000000	-0.950657	-0.952611	0.228069
-10.000000	-0.952611	-0.954490	0.219361
-10.000000	-0.954490	-0.956296	0.210961
-10.000000	-0.956296	-0.958034	0.202861
-10.000000	-0.958034	-0.959704	0.195051
-10.000000	-0.959704	-0.961310	0.187522
-10.000000	-0.961310	-0.962853	0.180267
-10.000000	-0.962853	-0.964336	0.173275
-10.000000	-0.964336	-0.965762	0.166540
-10.000000	-0.965762	-0.967132	0.160053
-10.000000	-0.967132	-0.968449	0.153806
-10.000000	-0.968449	-0.969714	0.147790
-10.000000	-0.969714	-0.970929	0.141999
-10.000000	-0.970929	-0.972097	0.136425
-10.000000	-0.972097	-0.973218	0.131060
-10.000000	-0.973218	-0.974295	0.125897
-10.000000	-0.974295	-0.975330	0.120930
-10.000000	-0.975330	-0.976324	0.116151
-10.000000	-0.976324	-0.977278	0.111554
-10.000000	-0.977278	-0.978195	0.107133
-10.000000	-0.978195	-0.979075	0.102881
-10.000000	-0.979075	-0.979920	0.098793
-10.000000	-0.979920	-0.980732	0.094862
-10.000000	-0.980732	-0.981511	0.091083
-10.000000	-0.981511	-0.982259	0.087451
-10.000000	-0.982259	-0.982977	0.083959
-10.000000	-0.982977	-0.983667	0.080603
-10.000000	-0.983667	-0.984329	0.077378
-10.000000	-0.984329	-0.984964	0.074279
-10.000000	-0.984964	-0.985574	0.071302
-10.000000	-0.985574	-0.986159	0.068441
-10.000000	-0.986159	-0.986721	0.065693

-10.000000	-0.986721	-0.987260	0.063052
-10.000000	-0.987260	-0.987778	0.060516
-10.000000	-0.987778	-0.988274	0.058080
-10.000000	-0.988274	-0.988751	0.055740
-10.000000	-0.988751	-0.989208	0.053493
-10.000000	-0.989208	-0.989647	0.051335
-10.000000	-0.989647	-0.990069	0.049263
-10.000000	-0.990069	-0.990473	0.047273
-10.000000	-0.990473	-0.990861	0.045363
-10.000000	-0.990861	-0.991233	0.043529
-10.000000	-0.991233	-0.991590	0.041767
-10.000000	-0.991590	-0.991933	0.040077
-10.000000	-0.991933	-0.992262	0.038453
-10.000000	-0.992262	-0.992577	0.036895
-10.000000	-0.992577	-0.992880	0.035399
-10.000000	-0.992880	-0.993170	0.033964
-10.000000	-0.993170	-0.993449	0.032586
-10.000000	-0.993449	-0.993716	0.031263
-10.000000	-0.993716	-0.993972	0.029993
-10.000000	-0.993972	-0.994218	0.028775
-10.000000	-0.994218	-0.994454	0.027606
-10.000000	-0.994454	-0.994681	0.026483
-10.000000	-0.994681	-0.994898	0.025406
-10.000000	-0.994898	-0.995106	0.024373
-10.000000	-0.995106	-0.995306	0.023381
-10.000000	-0.995306	-0.995498	0.022429
-10.000000	-0.995498	-0.995682	0.021516
-10.000000	-0.995682	-0.995858	0.020640
-10.000000	-0.995858	-0.996028	0.019799
-10.000000	-0.996028	-0.996190	0.018992
-10.000000	-0.996190	-0.996346	0.018218
-10.000000	-0.996346	-0.996495	0.017476
-10.000000	-0.996495	-0.996638	0.016763
-10.000000	-0.996638	-0.996776	0.016080
-10.000000	-0.996776	-0.996908	0.015424
-10.000000	-0.996908	-0.997034	0.014794
-10.000000	-0.997034	-0.997155	0.014191
-10.000000	-0.997155	-0.997272	0.013612
-10.000000	-0.997272	-0.997383	0.013056
-10.000000	-0.997383	-0.997490	0.012523
-10.000000	-0.997490	-0.997593	0.012012
-10.000000	-0.997593	-0.997692	0.011521
-10.000000	-0.997692	-0.997786	0.011050
-10.000000	-0.997786	-0.997877	0.010599
-10.000000	-0.997877	-0.997963	0.010166

Root is: -0.998047

Number of Iteration:227.000000>>

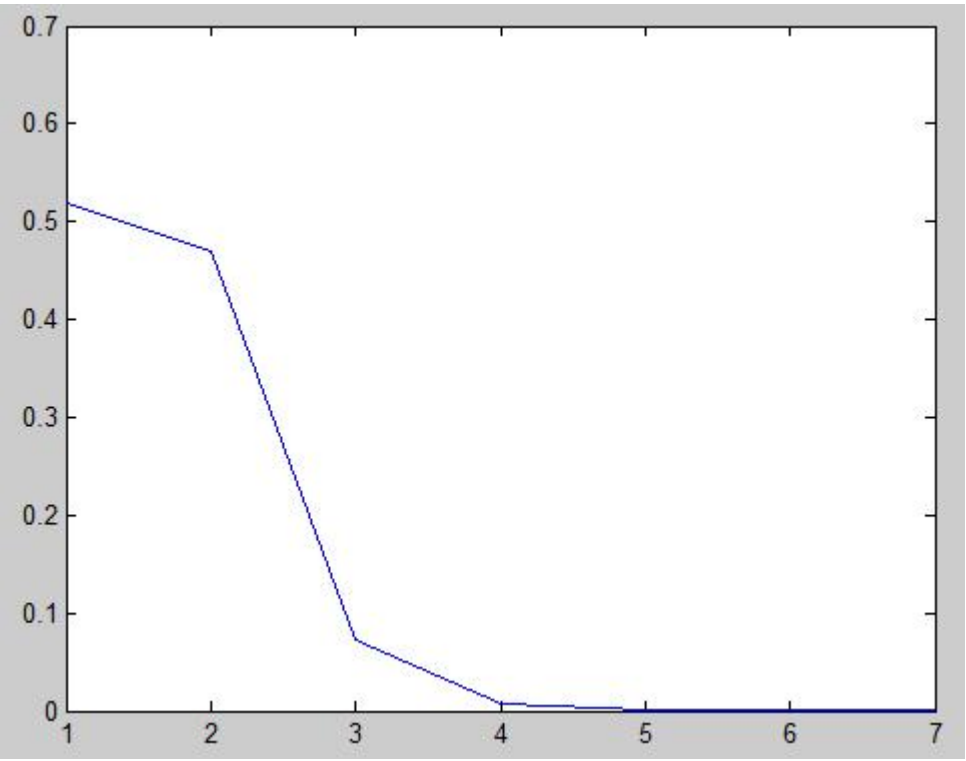


Q3) Find the root of f(x) = cos(x) – x*exp(x) by using Bisection Method in the interval [0, 1] with a tolerance of 0.00001

Enter the Function @(x) cos(x) - x*exp(x)
Enter the Value of a:0
Enter the Value of b:1
Enter the error:0.00001

a	b		c	f(c)
0.000000	1.000000	0.314665	0.519871	
0.314665	1.000000	0.446728	0.203545	
0.446728	1.000000	0.494015	0.070802	
0.494015	1.000000	0.509946	0.023608	
0.509946	1.000000	0.515201	0.007760	
0.515201	1.000000	0.516922	0.002539	
0.516922	1.000000	0.517485	0.000829	
0.517485	1.000000	0.517668	0.000271	
0.517668	1.000000	0.517728	0.000088	
0.517728	1.000000	0.517748	0.000029	

Root is: 0.517754
Number of Iteration:11.000000>>



Newton Ralphson:

Code:

```
clc
clear all
close all
f = @(x) x^3 - x -1;
g = @(x) 3*x^2-1;
a = input('Enter the Initial Guess (a): ');
e = input('Enter the Error Tolerance: ');
n = input('Enter the Number of Iteration:');
step = 1;
fa = feval(f,a);
while abs(fa) > e
    err(step)=abs(fa);
    fa = feval(f,a);
    ga = feval(g,a);
    if ga == 0
        disp('Mathematical Error');
        break;
    end
    b = a - fa/ga;
    fprintf('step=%d\ta=%f\tf(a)=%f\n ',step ,a,fa);
    a = b;
    if step > n
        disp('Not Convergent');
        break;
    end
    step = step + 1;
end

fprintf('Root is: %f\n',a);
fprintf('Number of Iterations: %d\n',step);
```

```
plot(err);
```

Q1)Find the root of f(x)=x^3 – x – 1 by using Newton Ralphson position method in the interval [1,2] with a tolerance of 0.001

Enter the function:@(x) x^3-x-1
Enter the derivative of y function:@(x)3*x^2-1
Enter the value of a:1
Enter the error0.01
Enter the maximum number of iteration:15
step=1 a=1.000000 f(a)=-1.000000
step=2 a=1.500000 f(a)=0.875000
step=3 a=1.347826 f(a)=0.100682
step=4 a=1.325200 f(a)=0.002058
Root is 1.324718

Q2) Find the root of f(x) = x^3-x^2+2 by using Newton Ralphson method in the interval [-1,1] with a tolerance of 0.01

Enter the function:@(x)x^3-x^2+2
Enter the derivative of y function:@(x) 3*x^2-2*x
Enter the value of a:-10
Enter the error0.01
Enter the maximum number of iteration:15
step=1 a=-10.000000 f(a)=-1098.000000
step=2 a=-6.568750 f(a)=-324.580032
step=3 a=-4.292320 f(a)=-95.505774
step=4 a=-2.796693 f(a)=-27.695808
step=5 a=-1.843567 f(a)=-7.664544
step=6 a=-1.291500 f(a)=-1.822157
step=7 a=-1.051329 f(a)=-0.267318
step=8 a=-1.001995 f(a)=-0.009990
Root is -1.000003

Q3)Find the root of f(x)=cos(x)-x*exp(x) by using Newton Ralphson method in the interval [0,1] with a tolerance of 0.00001

Enter the function:@(x)cos(x)-x*exp(x)
Enter the derivative of y function:@(x)(-sin(x))-x*exp(x)-exp(x)
Enter the value of a:0
Enter the error0.00001
Enter the maximum number of iteration:15
step=1 a=0.000000 f(a)=1.000000
step=2 a=1.000000 f(a)=-2.177980
step=3 a=0.653079 f(a)=-0.460642
step=4 a=0.531343 f(a)=-0.041803
step=5 a=0.517910 f(a)=-0.000464
step=6 a=0.517757 f(a)=-0.000000
Root is 0.517757

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Roll Number: 22052118