ESO 208 PROGRAMMING ASSIGNMENT 1

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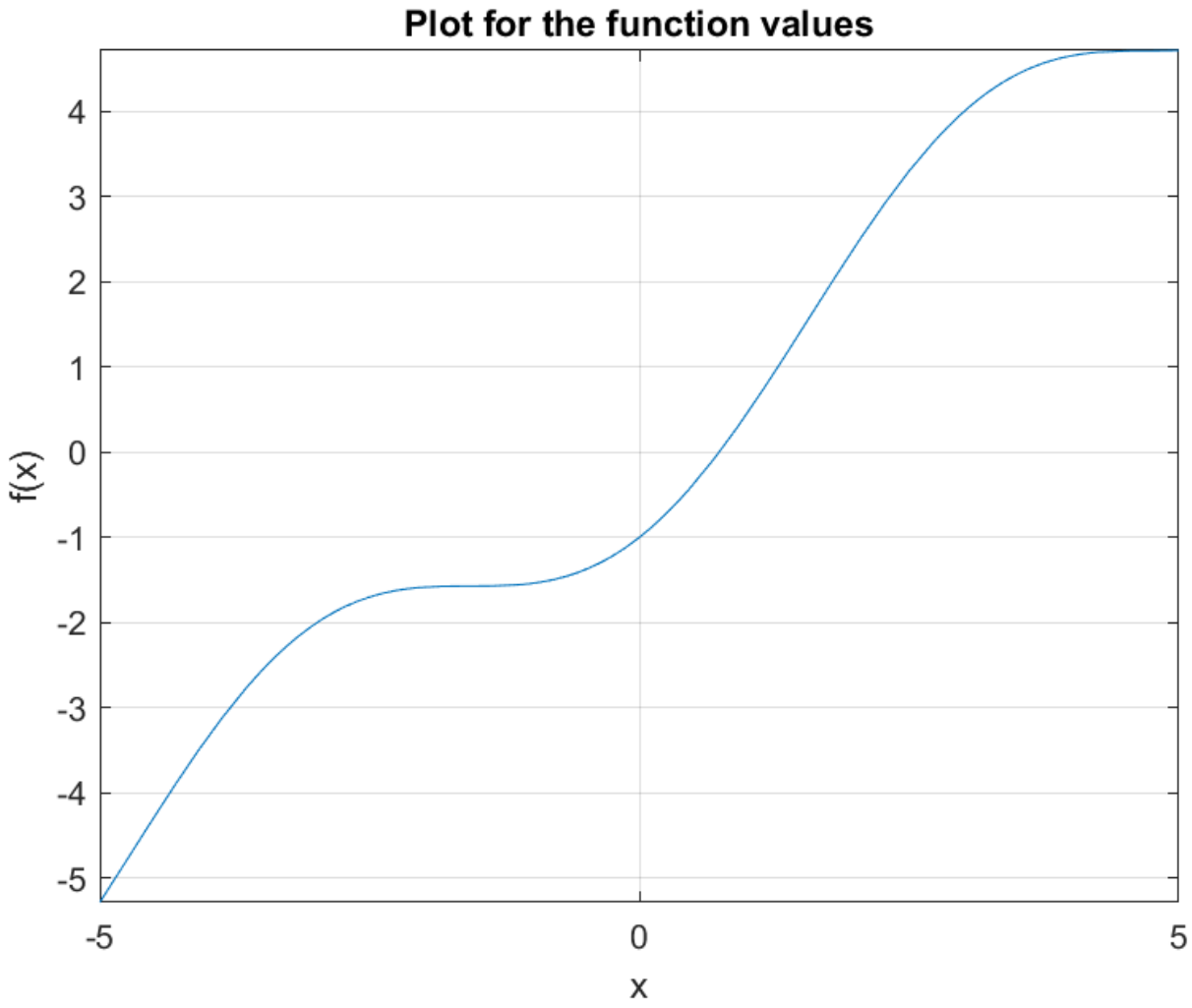
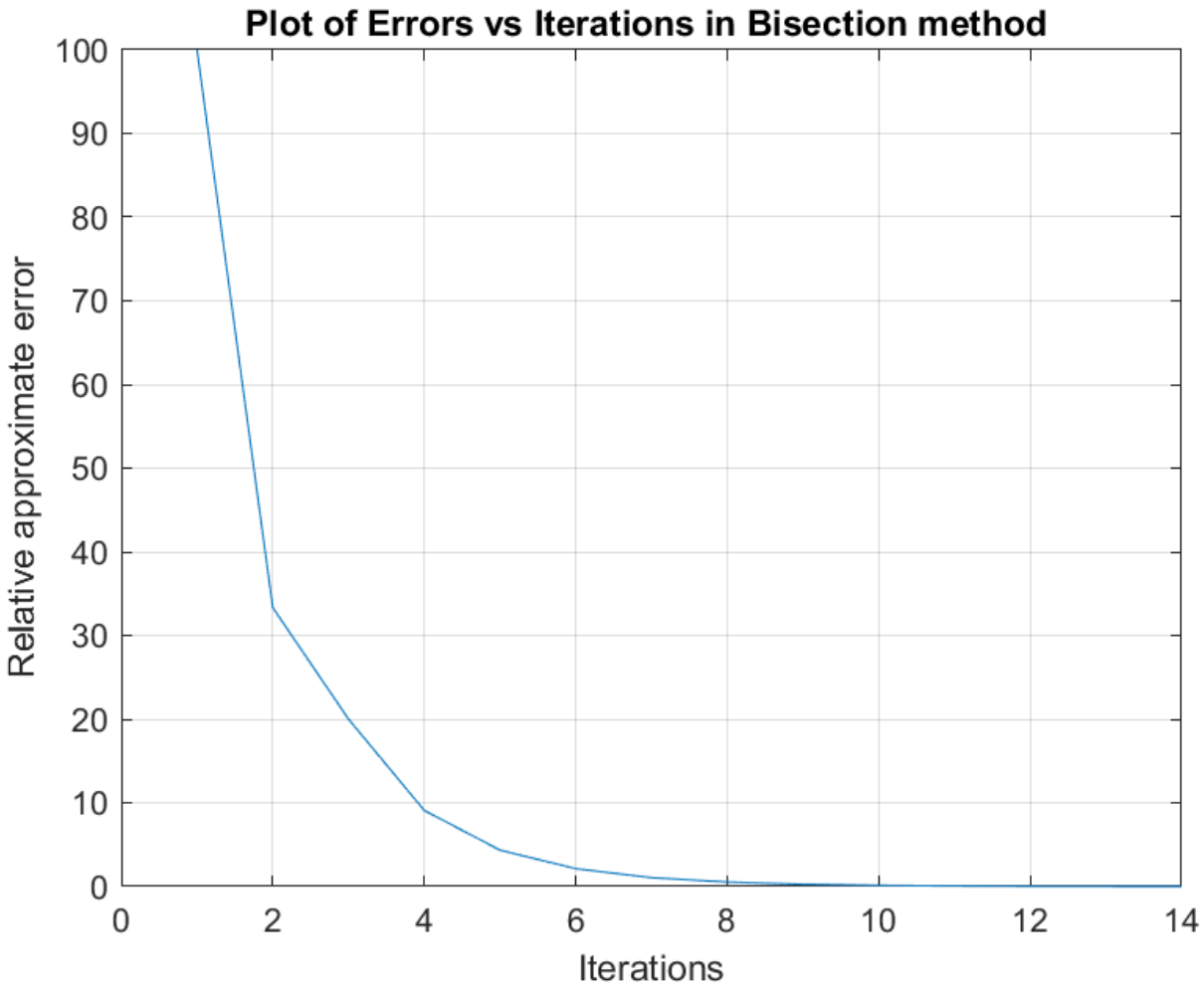
Section – J3

BISECTION METHOD:

1. F(x)=x-cos(x)

Choose the number for the selection of the method of solution:
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
1
Enter the function
x-cos(x)
Enter the lower limit of the bracket for the root:
0
Enter the upper limit of the bracket for the root:
1
Now Enter the stopping criteria
What is the allowed maximum number of iterations for the algorithm:
50
What is the maximum percentage error allowed:
0.01
The final root of the equation is: 0.739075
Execution of the program was stopped since the maximum error criteria as given in the question were met

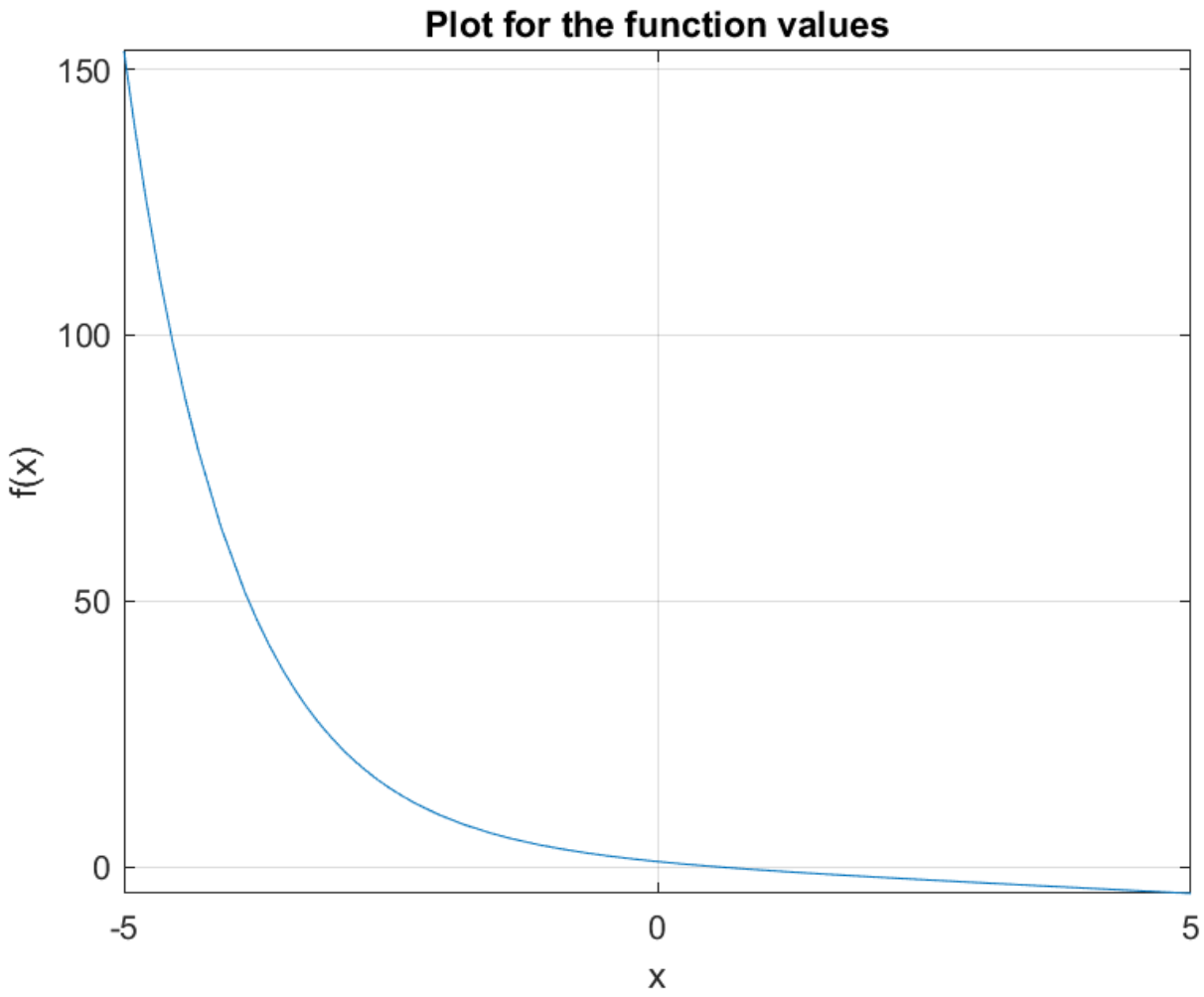

Plot for the function values
f(x)
x
4
3
2
1
0
-1
-2
-3
-4
-5
-5
0
5



2.exp(-x)-x

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
1
Enter the function
exp(-x)-x
Enter the lower limit of the bracket for the root :
0
Enter the upper limit of the bracket for the root :
1
Now Enter the stopping criteria
What is the allowed maximum number of iterations for the algorithm:
50
What is the maximum percentage error allowed:
0.01

The final root of the equation is: 0.567169
Exceution of the program was stopped since the maximum error criteria as given in the question was met

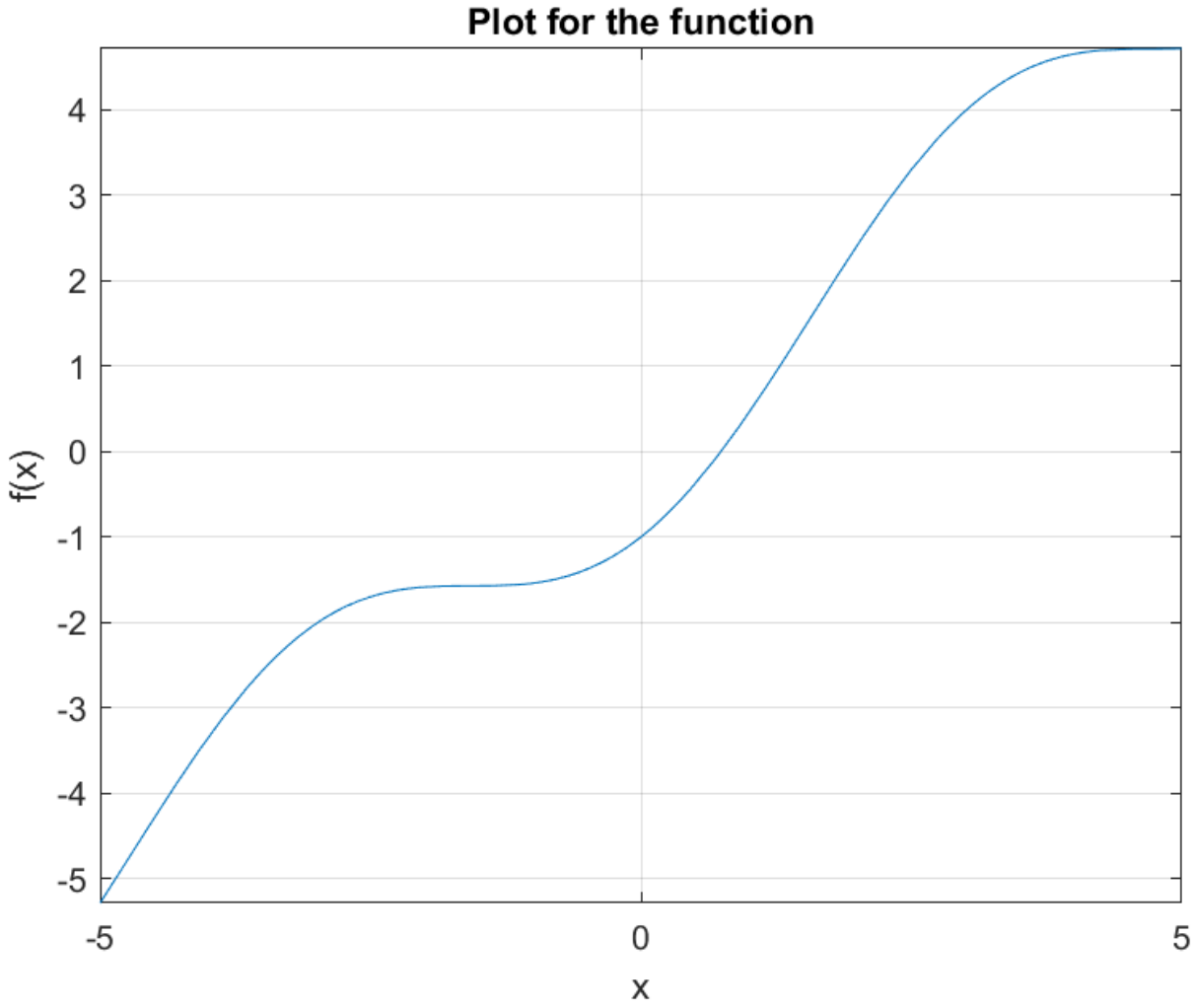


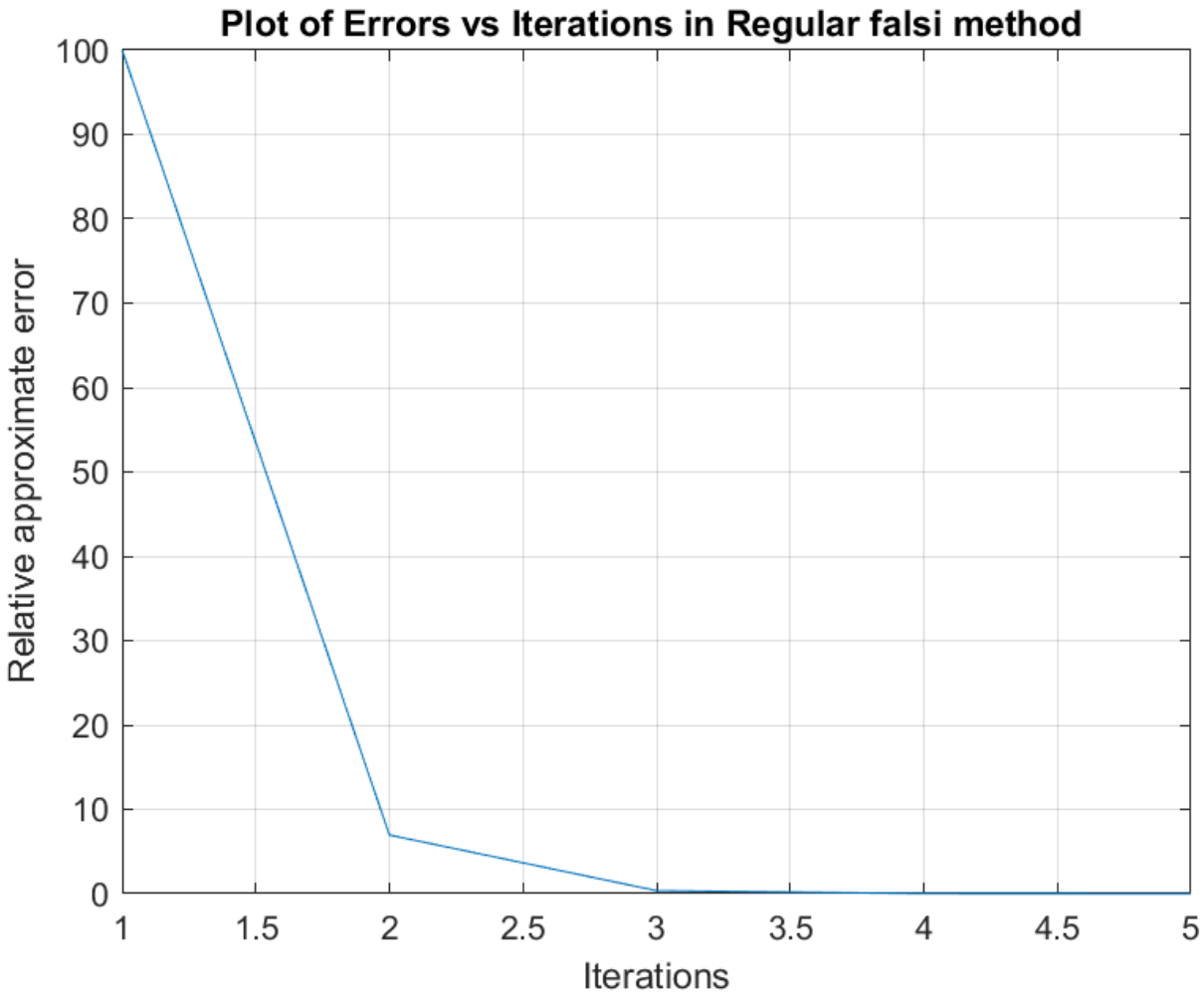
Regular falsi method :

1.x-cos(x)

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
2
Enter the function
x-cos(x)
Enter the lower limit of the bracket for the root :
0
Enter the upper limit of the bracket for the root :
1
Now Enter the stopping criteria
What is the maximum number of iterations allowed for the algorithm:
50

What is the maximum percentage error allowed:
0.01
The final root of the equation is: 0.739085
Exceution of the program was stopped since the maximum error criteria as given in the question was met

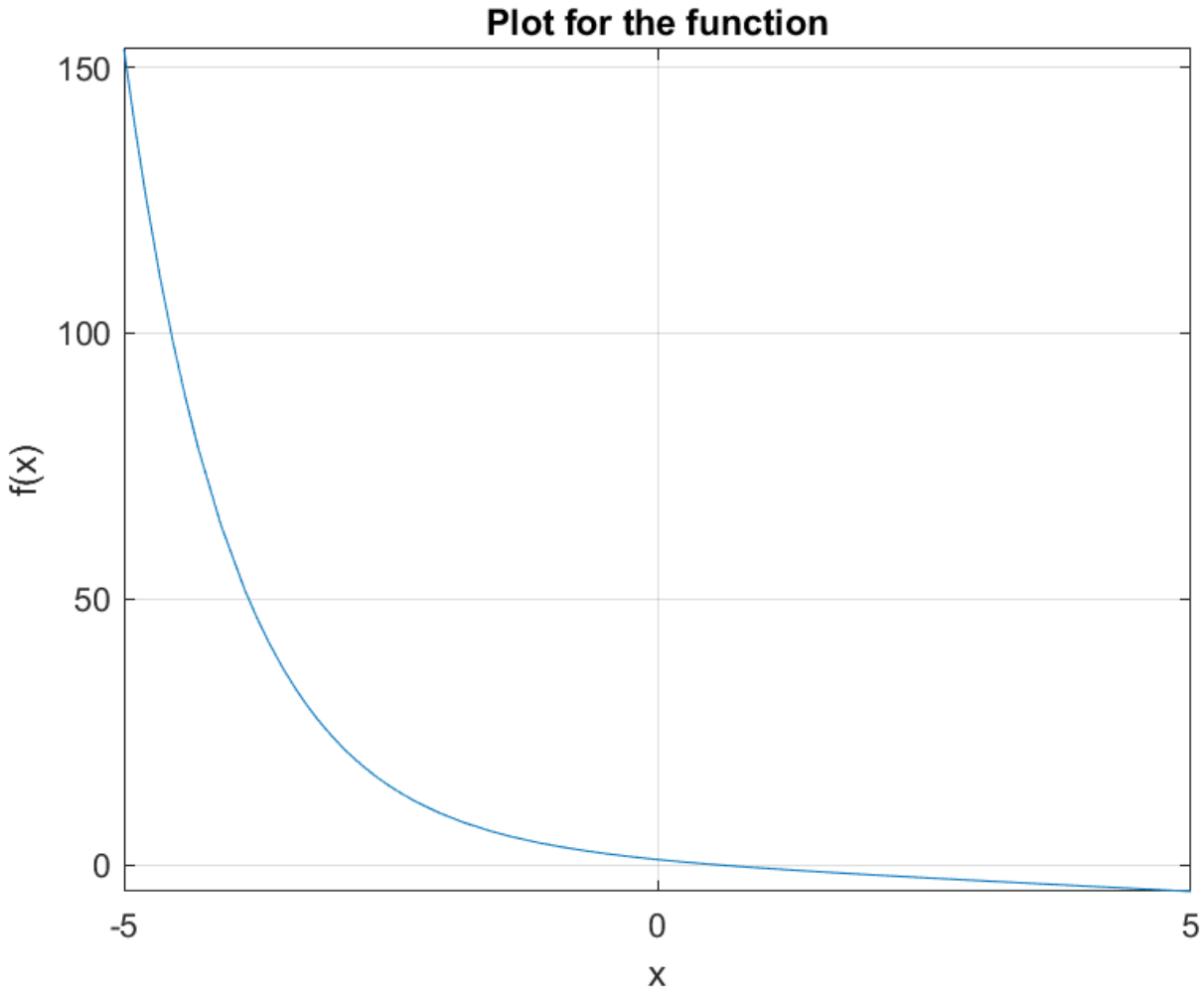


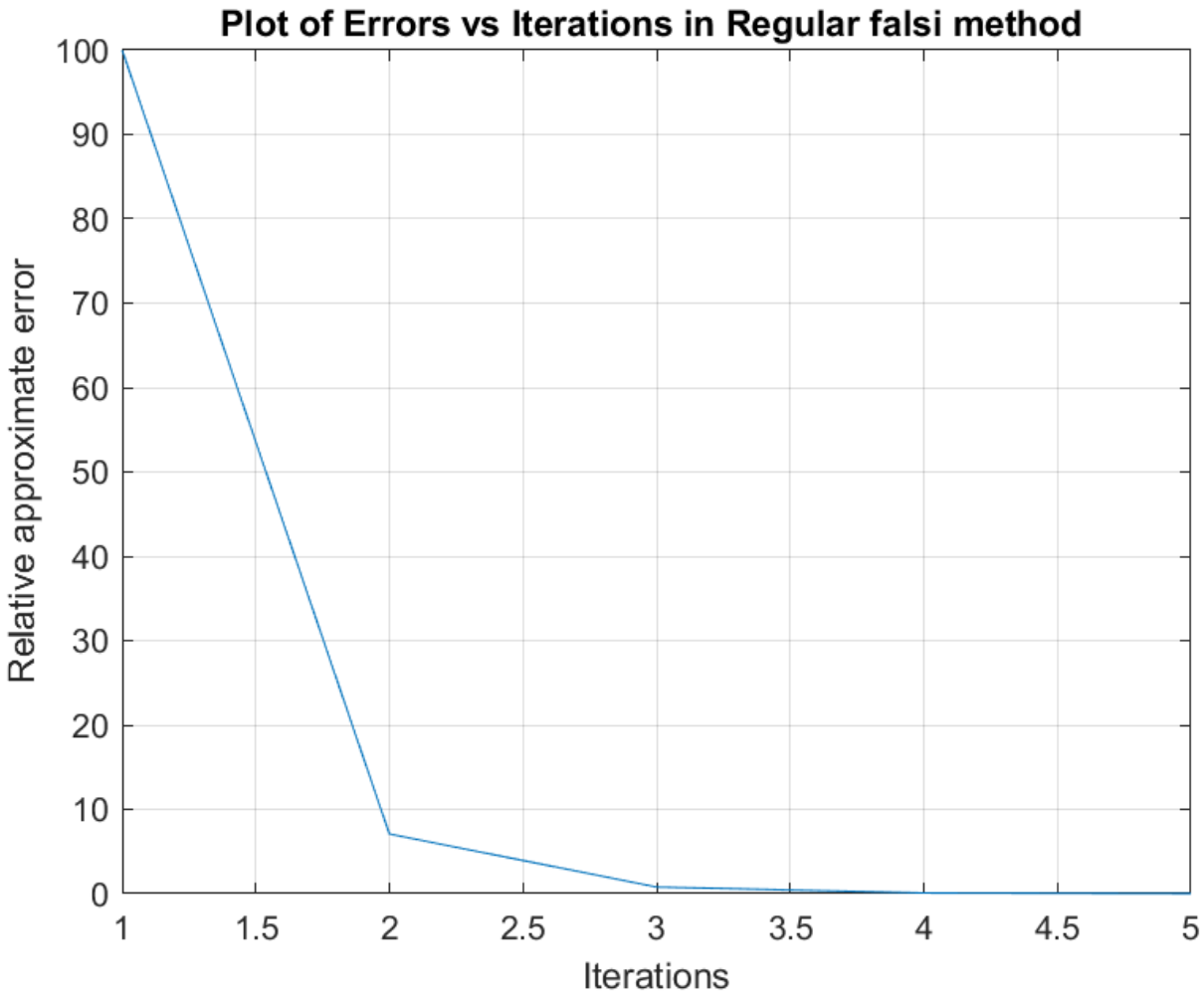


2.exp(-x)-x

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
2
Enter the function
exp(-x)-x
Enter the lower limit of the bracket for the root :
0
Enter the upper limit of the bracket for the root :
1
Now Enter the stopping criteria
What is the maximum number of iterations allowed for the algorithm:
50
What is the maximum percentage error allowed:
0.01
The final root of the equation is: 0.567150

Exceution of the program was stopped since the maximum error criteria as given in the question was met



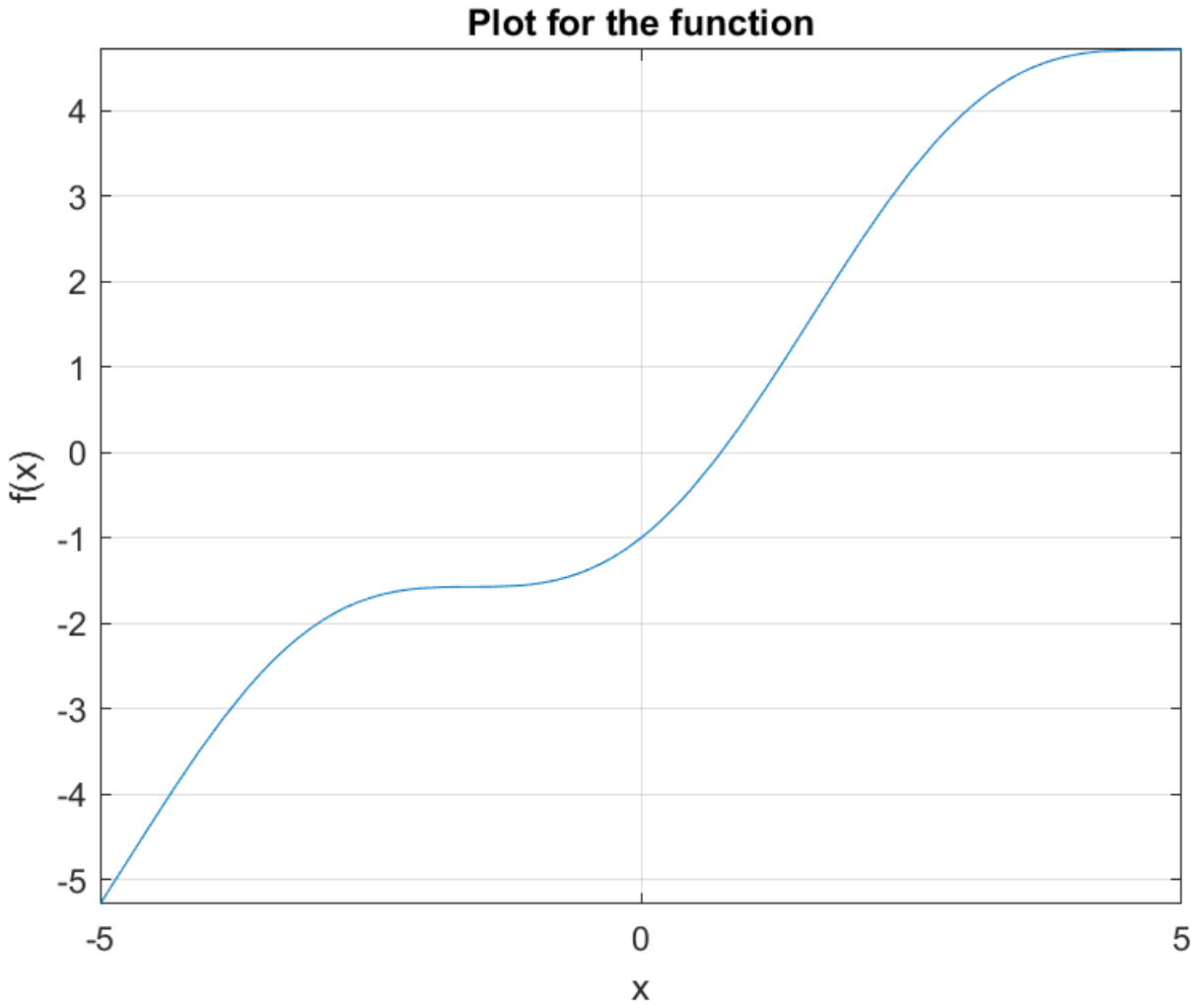


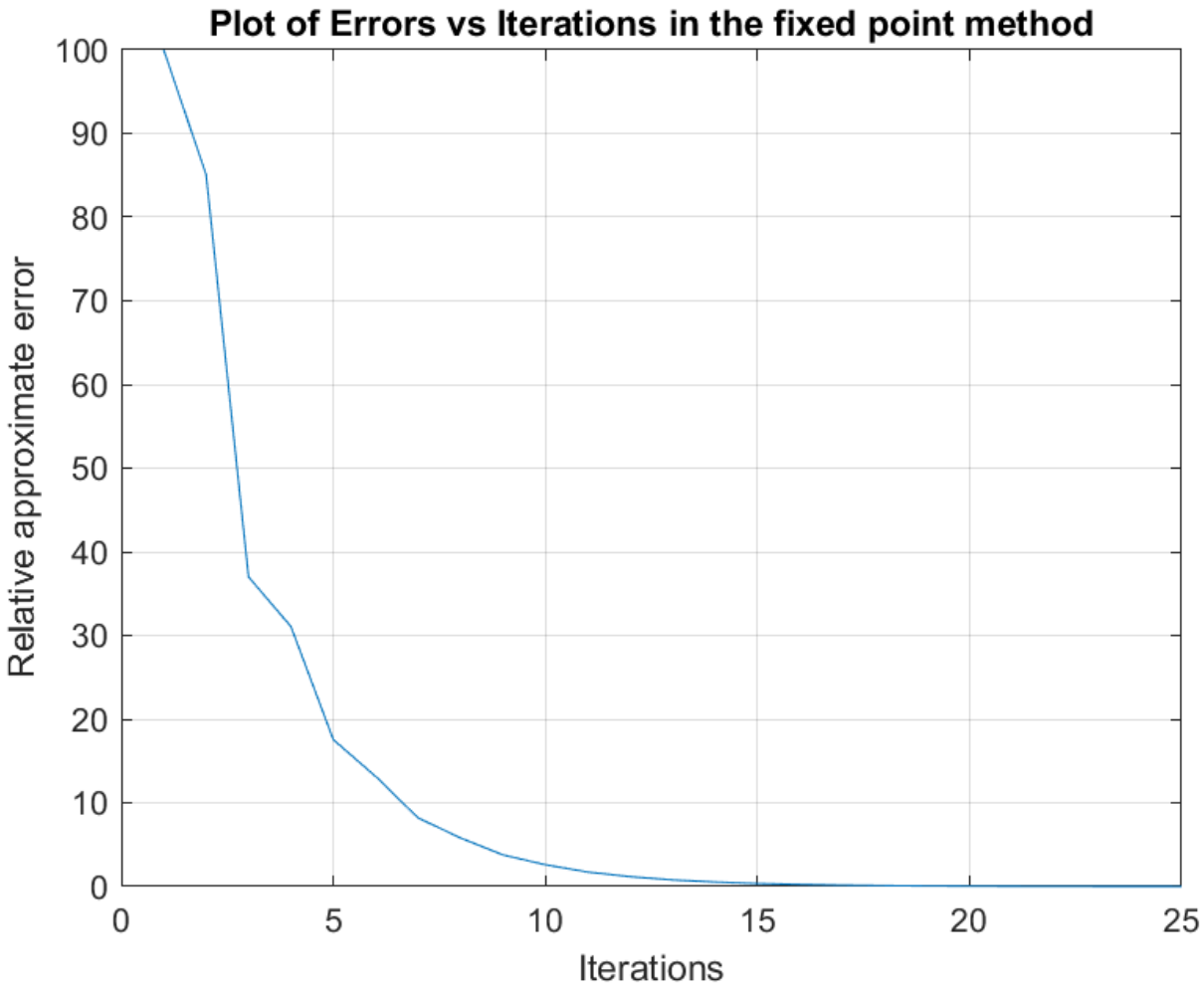
Fixed point method

1.x-cos(x)

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
3
Enter the function given in the question
x-cos(x)
Enter the second function given in the question
cos(x)
Enter the first starting point for initiating the algorithm:
0
Now Enter the stopping criteria

What is the maximum number of iterations allowed for the algorithm:
50
What is the maximum percentage error allowed:
0.01
The final root of the equation is: 0.739106
Exceution of the program was stopped since the maximum error criteria as given in the question was met

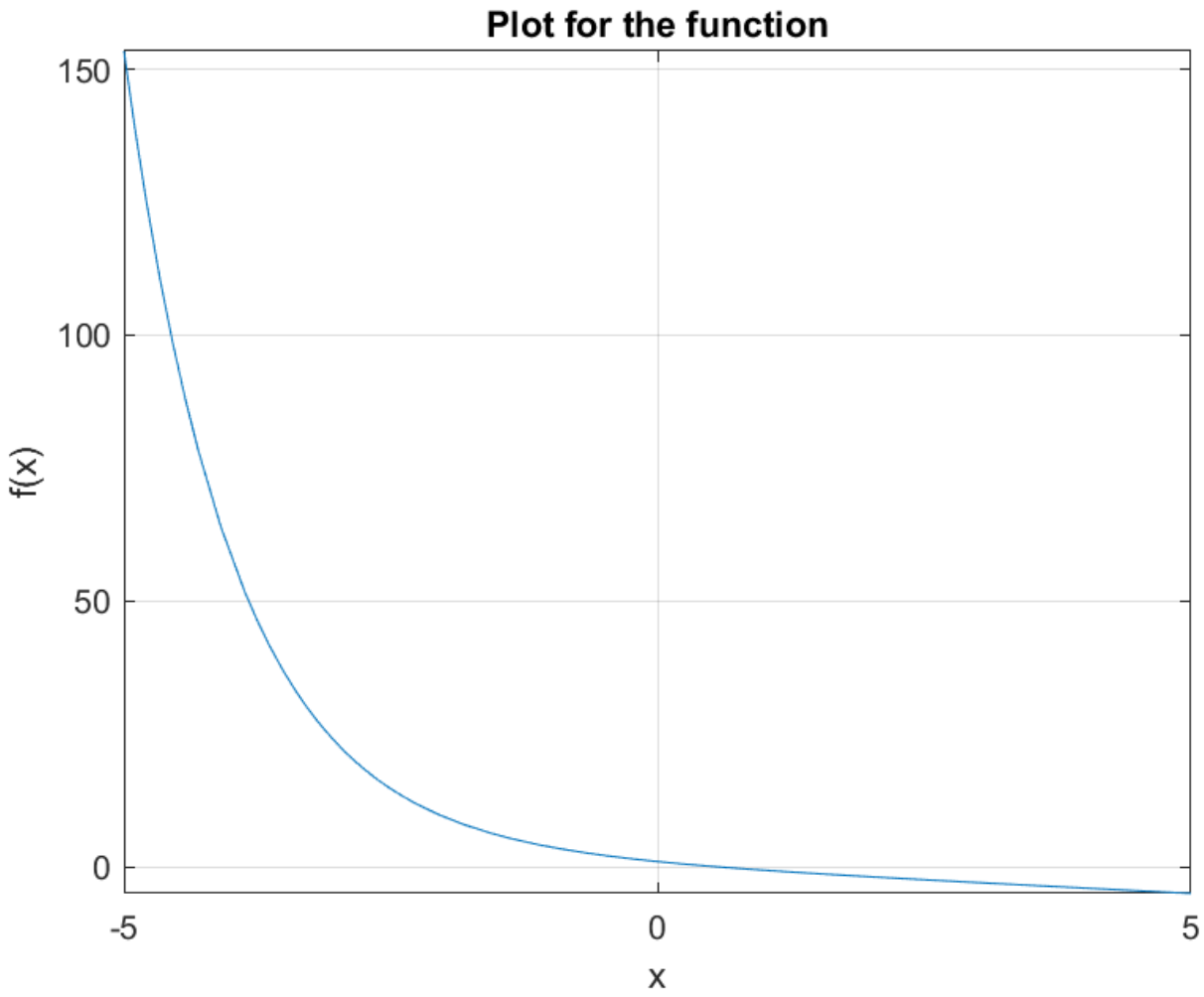


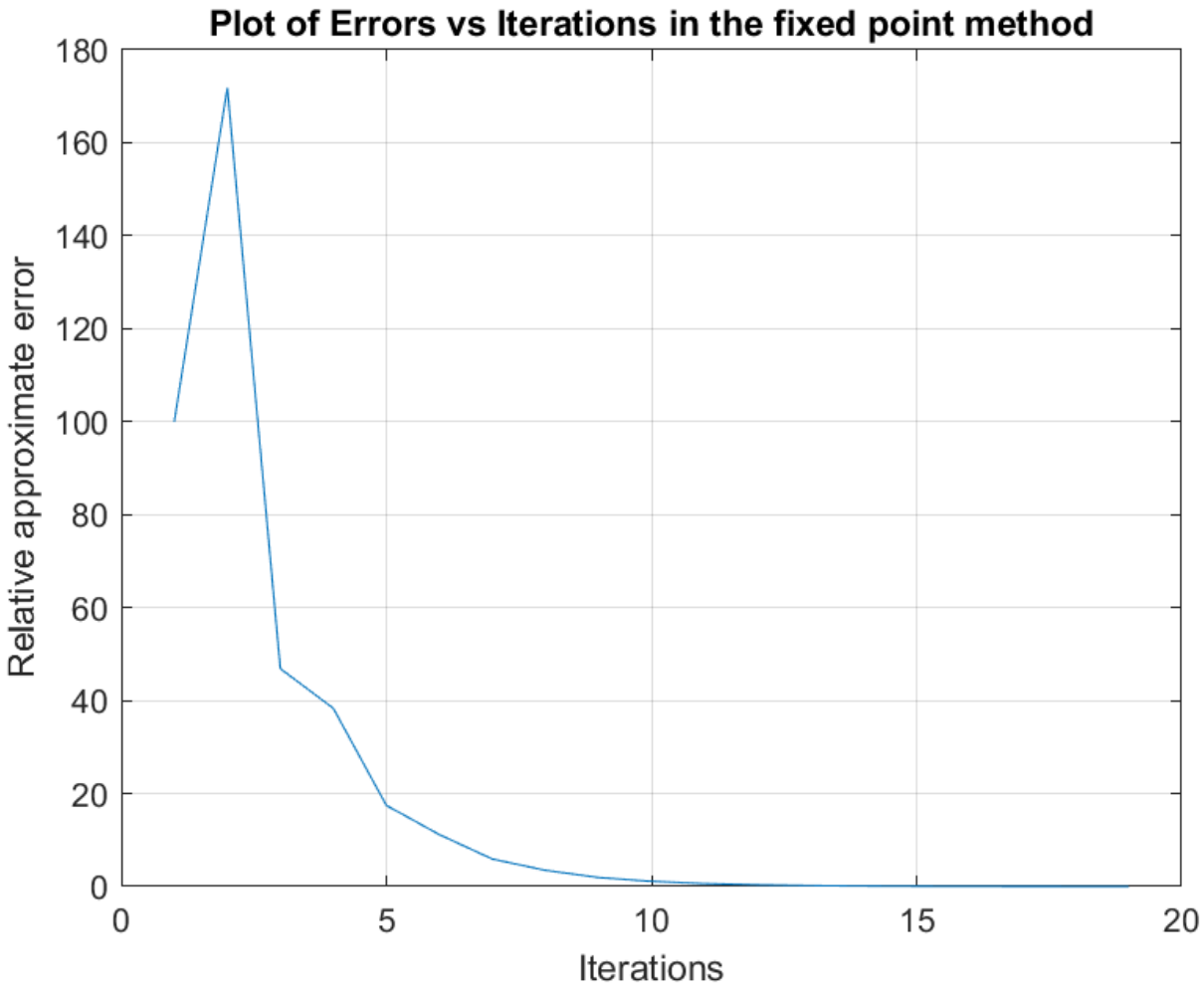


2.exp(-x)-x

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
3
Enter the function given in the question
exp(-x)-x
Enter the second function given in the question
exp(-x)
Enter the first starting point for initiating the algorithm:
0
Now Enter the stopping criteria
What is the maximum number of iterations allowed for the algorithm:
50
What is the maximum percentage error allowed:
0.01

The final root of the equation is: 0.567157
Exceution of the program was stopped since the maximum error criteria as given in the question was met



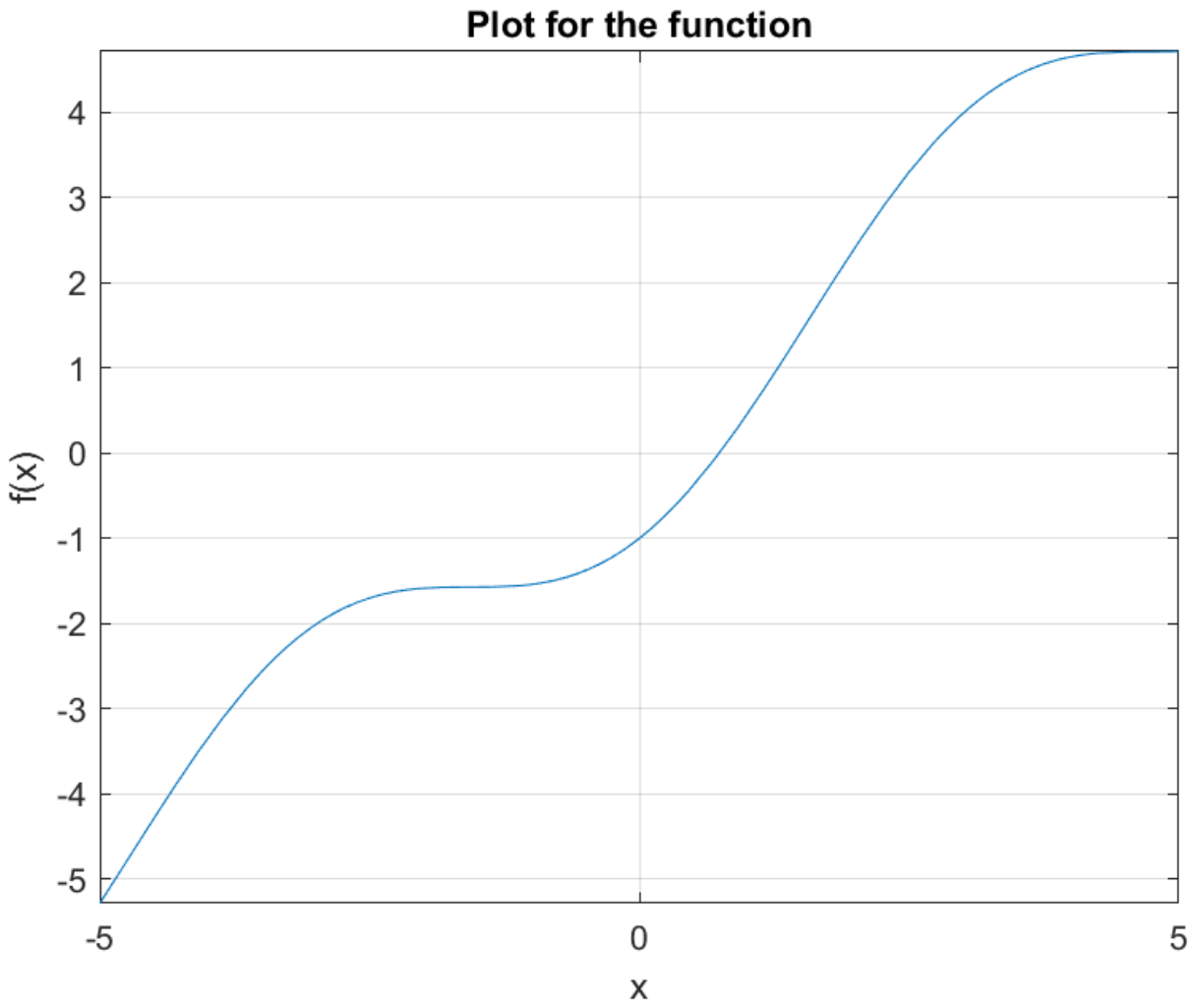


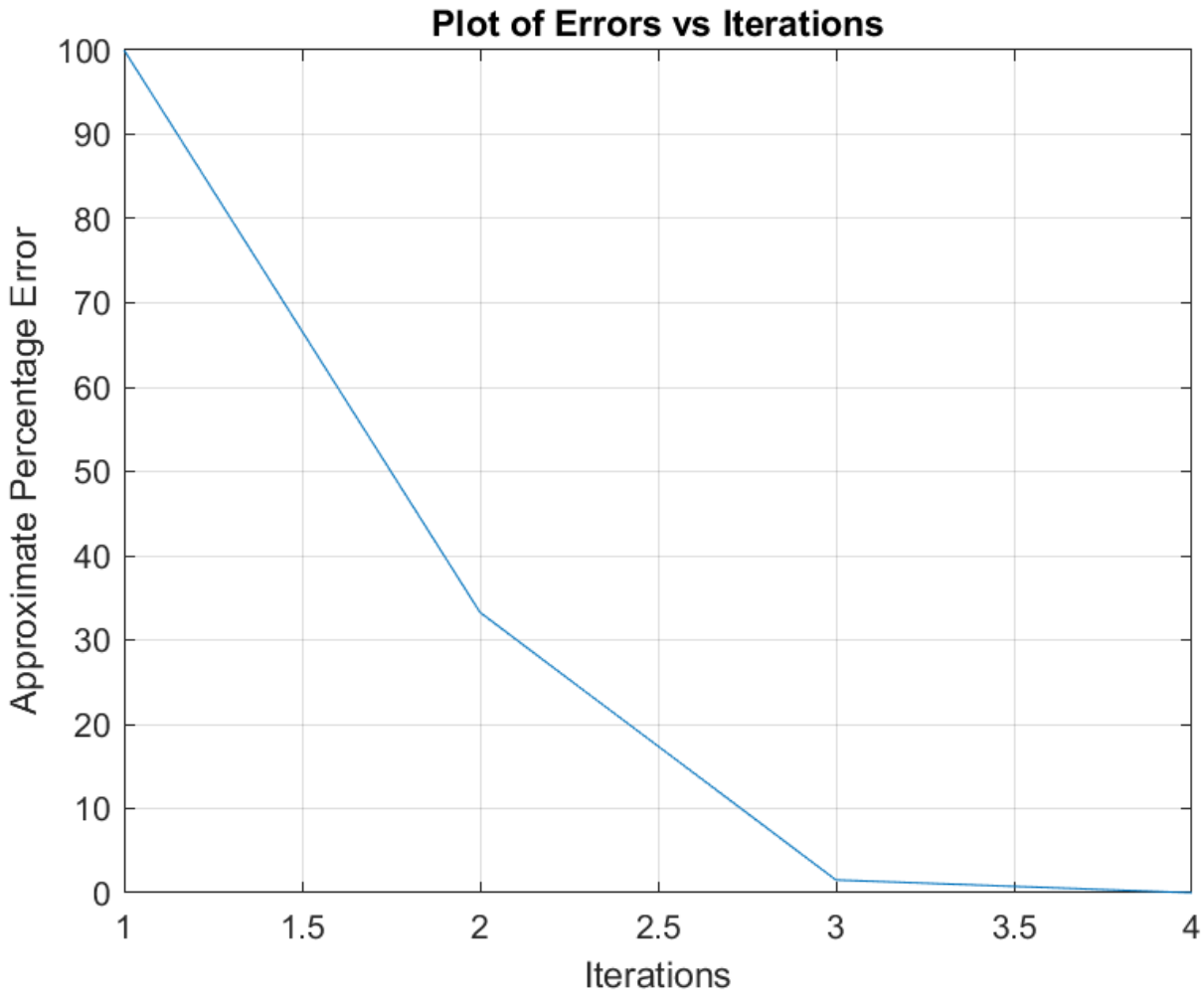
4.NEWTON RAPHSON METHOD

1.x-cos(x)

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
4
Enter the function
x-cos(x)
Enter the first derivative of the function
1+sin(x)
Enter the starting value for initiating the algorithm:
0
Now Enter the stopping criteria
What is the maximum number of iterations allowed for the algorithm:

50
What is the maximum percentage error allowed:
0.01
The final root of the equation is: 0.739085
Exceution of the program was stopped since the maximum error criteria as given in the question was met

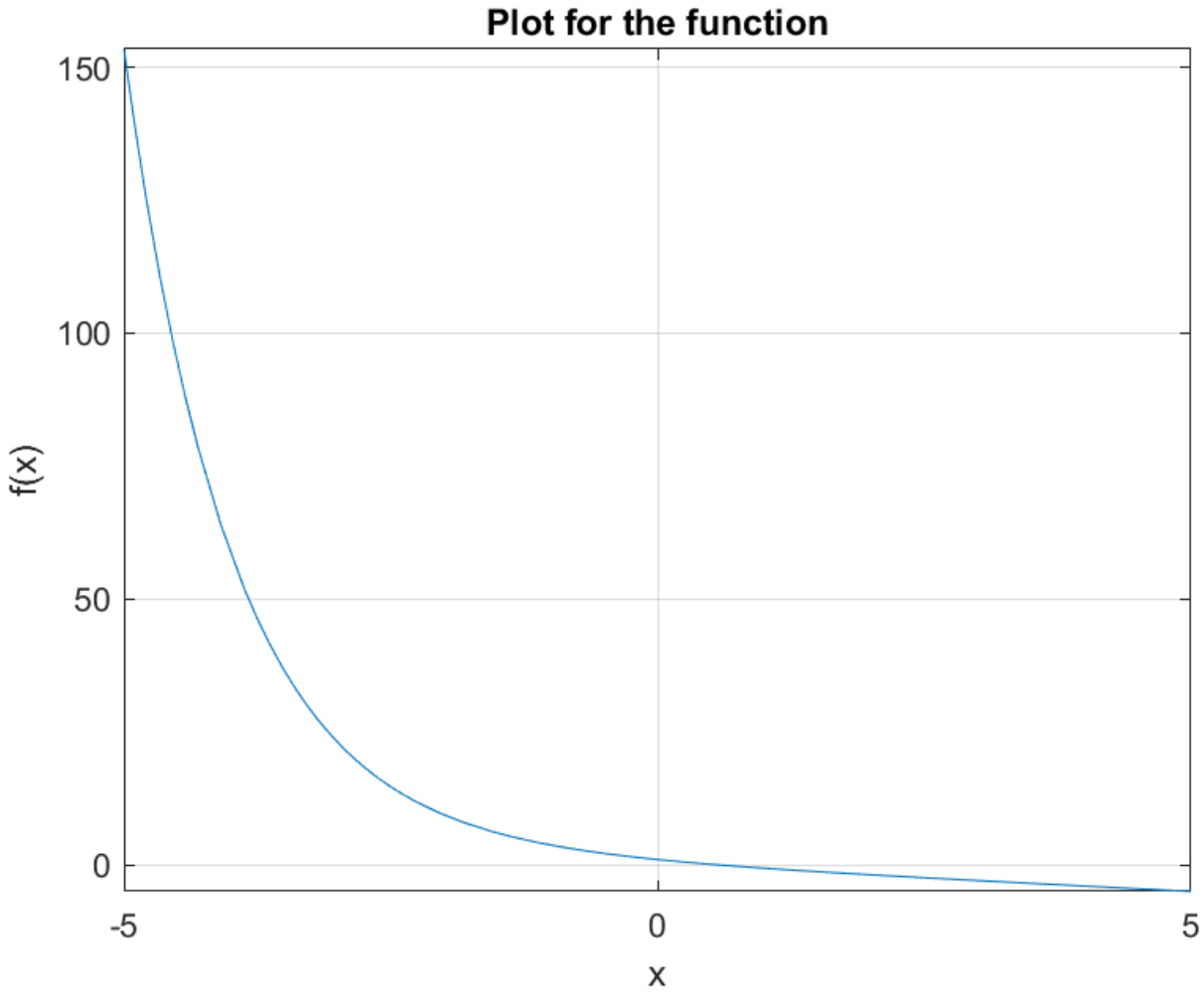


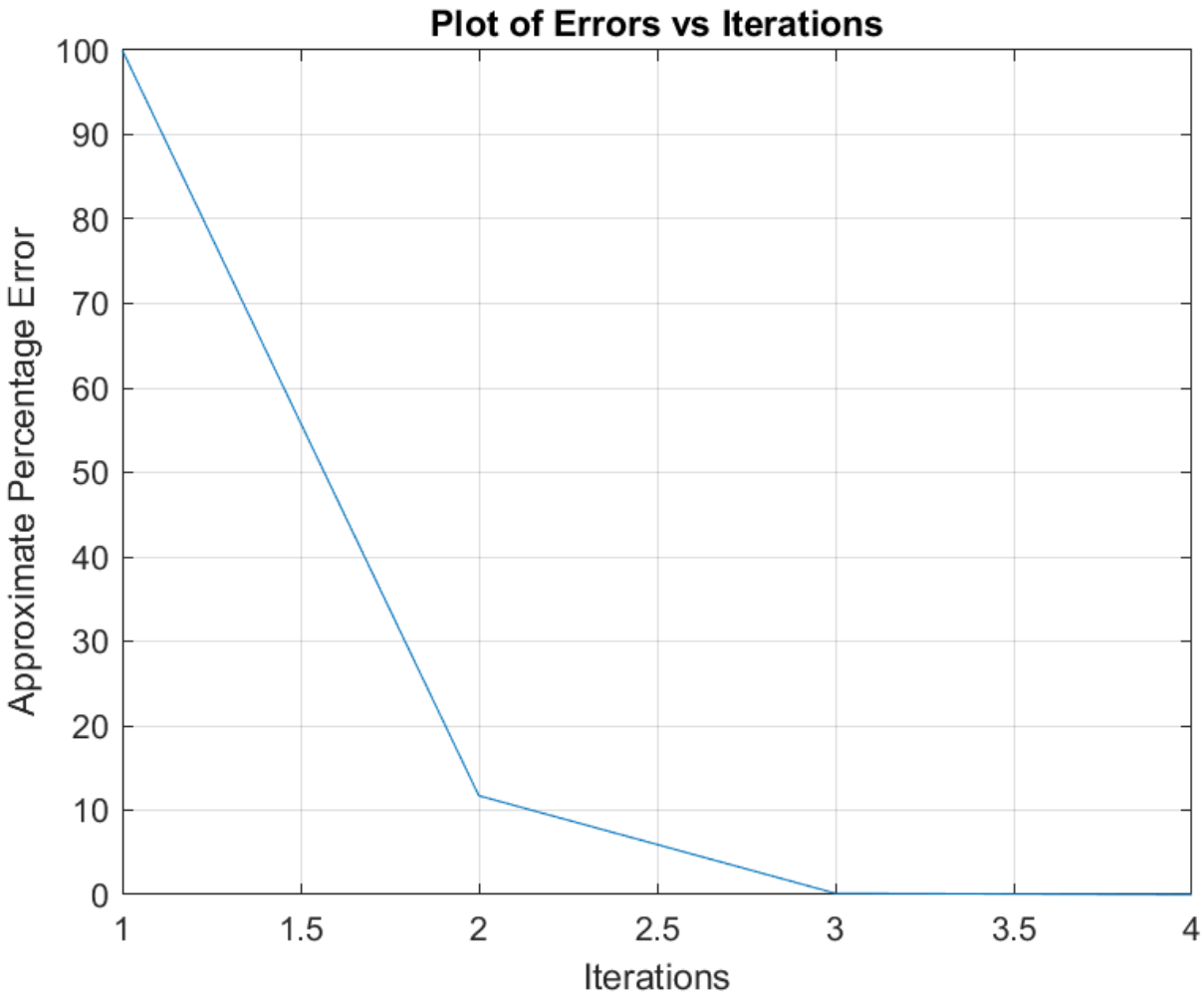


2.exp(-x)-x

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
4
Enter the function
exp(-x)-x
Enter the first derivative of the function
-1*exp(-x)-1
Enter the starting value for initiating the algorithm:
0
Now Enter the stopping criteria
What is the maximum number of iterations allowed for the algorithm:
50
What is the maximum percentage error allowed:
0.01
The final root of the equation is: 0.567143

Exceution of the program was stopped since the maximum error criteria as given in the question was met



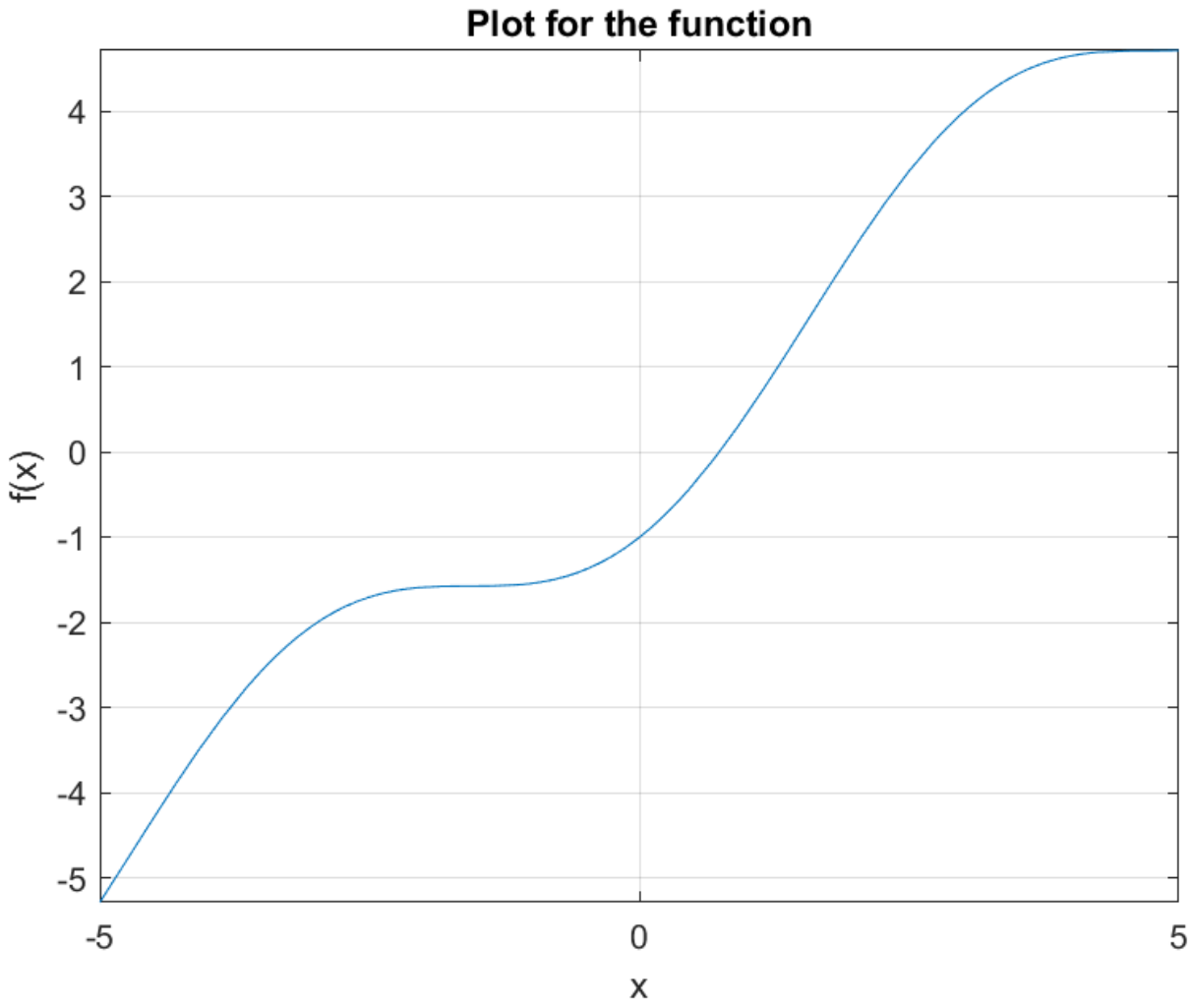


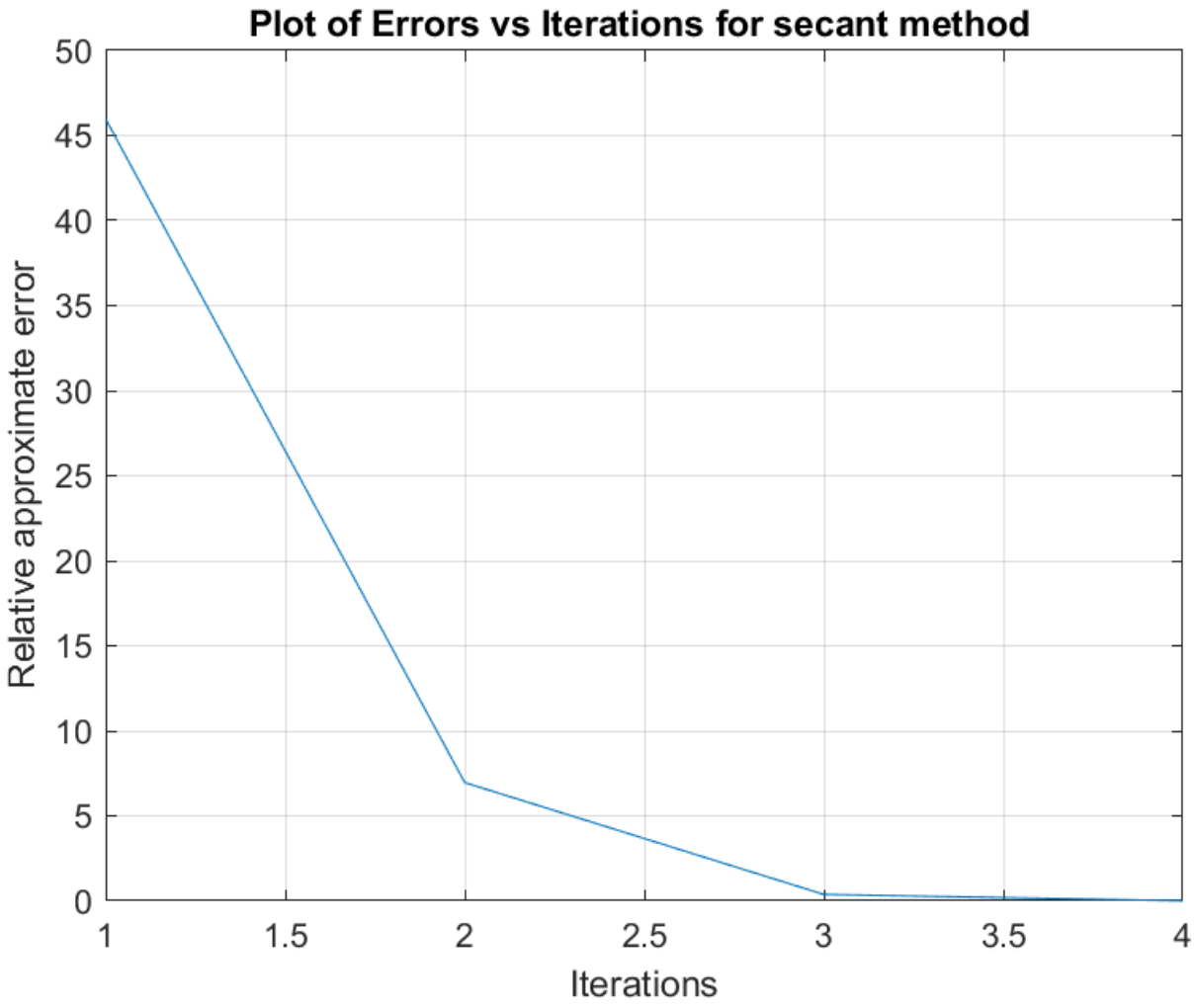
5.SECANT METHOD

1.x-cos(x)

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
5
Enter the function
x-cos(x)
Enter the first starting point for initiating the algorithm:
0
Enter the second starting point for initiating the algorithm:
1
Now Enter the stopping criteria
Enter the maximum number of iterations for the algorithm:
50
Enter the maximum percentage error allowed:
0.01

The final root of the equation is: 0.739085
Exceution of the program was stopped since the maximum error criteria as given in the question was met

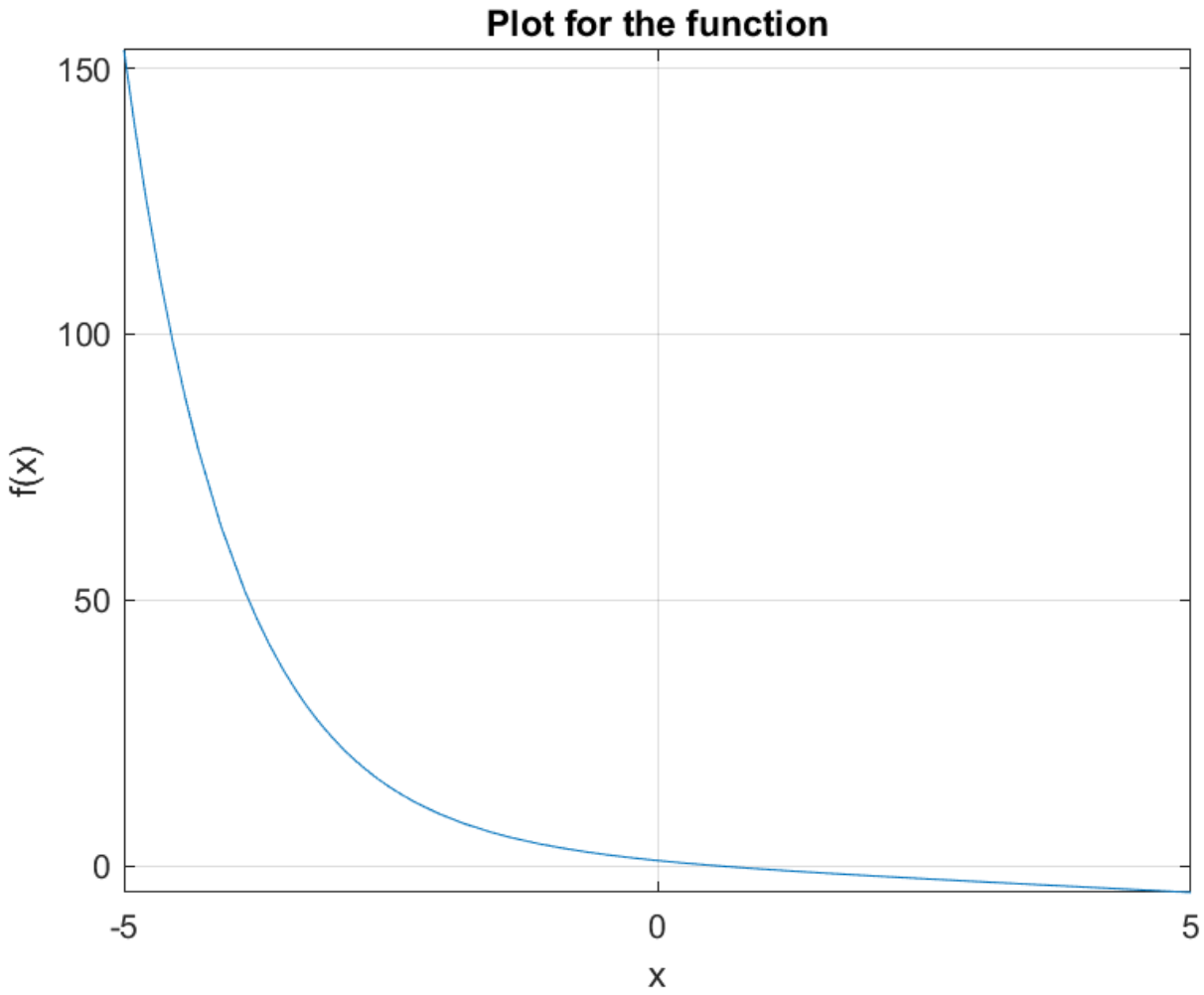


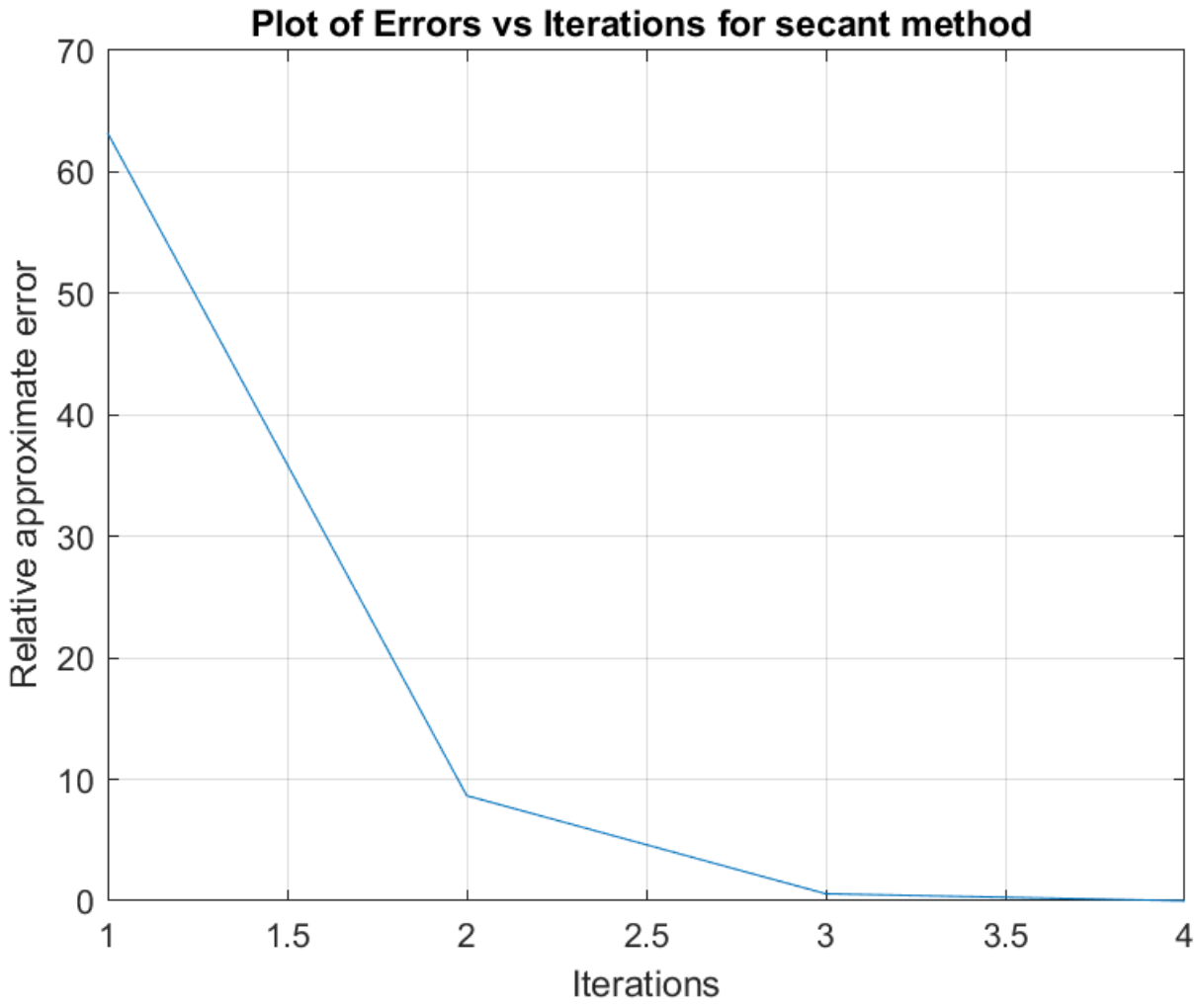


2.exp(-x)-x

Choose the number for the selection of method of solution :
Bisection-1,
False Position-2,
Fixed Point Method-3,
Newton-Raphson-4,
Secant Method-5
5
Enter the function
exp(-x)-x
Enter the first starting point for initiating the algorithm:
0
Enter the second starting point for initiating the algorithm:
1
Now Enter the stopping criteria
Enter the maximum number of iterations for the algorithm:
50
Enter the maximum percentage error allowed:

0.01
The final root of the equation is: 0.567143
Exceution of the program was stopped since the maximum error criteria as given in the question was met





Question 2

(a)Muller method :

Test polynomial:

$f(x) = x^4 - 7.4x^3 + 20.44x^2 - 24.184x + 9.6448 = 0$

Choose the method of solution by selecting number shown with method:

Muller Method-1,

Bairstow Method-2

1

Enter the polynomial whose roots are to be calculated :

x*x*x*x-7.4*x*x*x+20.44*x*x-24.184*x+9.6448

What is the first starting value for initializing the algorithm:

-1

What is the second starting value for initializing the algorithm:

0

What is the third starting value for initializing the algorithm:

1

Now Enter the stopping criteria

What is the allowed maximum number of iterations for the algorithm:

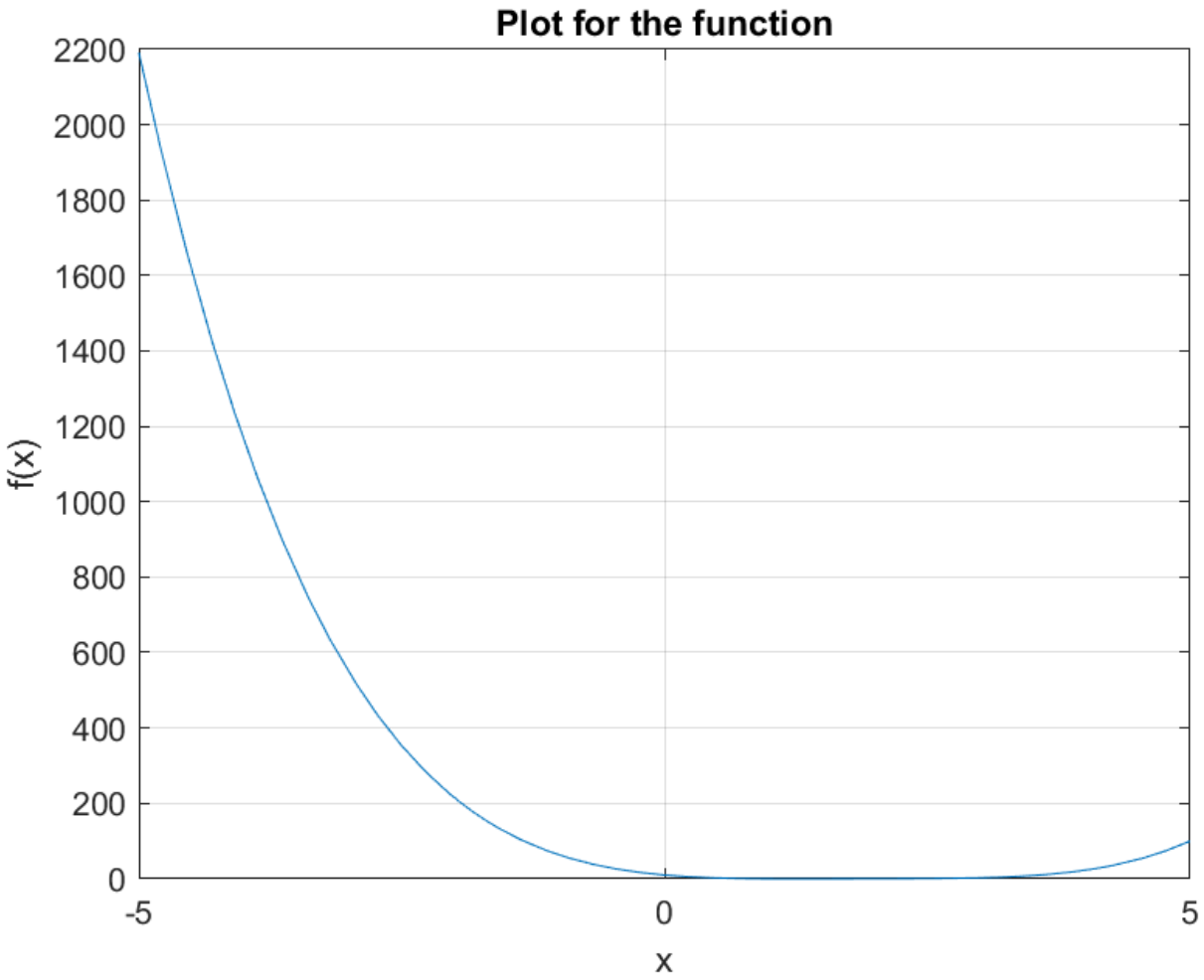
50

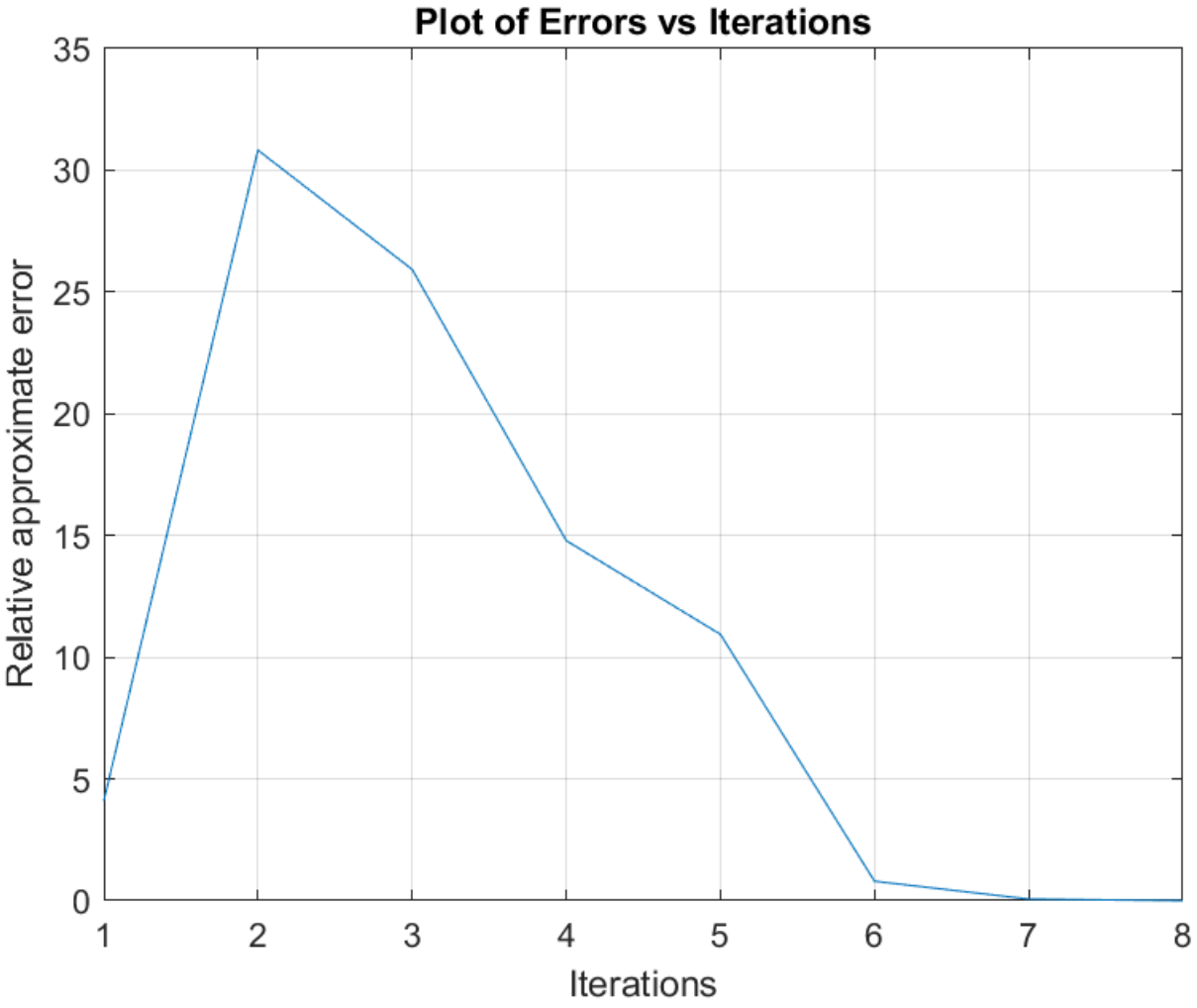
What is the maximum percentage error allowed:

0.01

The first root of the equation is: 2.200000

Exceution of the program was stopped since the maximum error criteria as given in the question was met


Plot for the function
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
f(x)
-5
0
5
x



(b) Bairstow Method

1.(r=4, s=-5)

Choose the method of solution by selecting number shown with method:

Muller Method-1,

Bairstow Method-2

2

What is the polynomial for which we have to find: x^4-7.4*x^3+20.44*x^2-24.184*x+9.6488

What is the starting value of r: 4

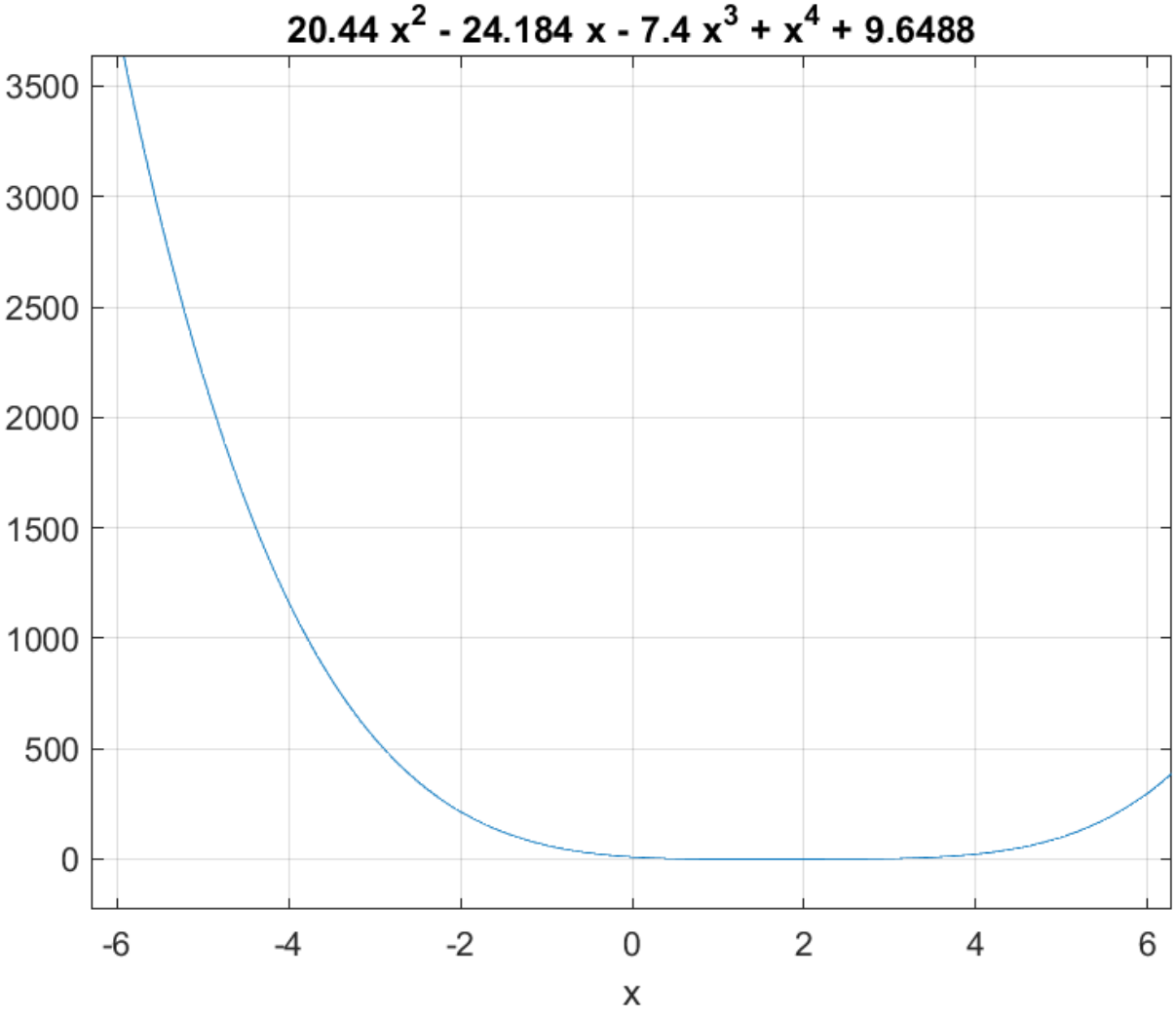
What is the starting value of s: -5

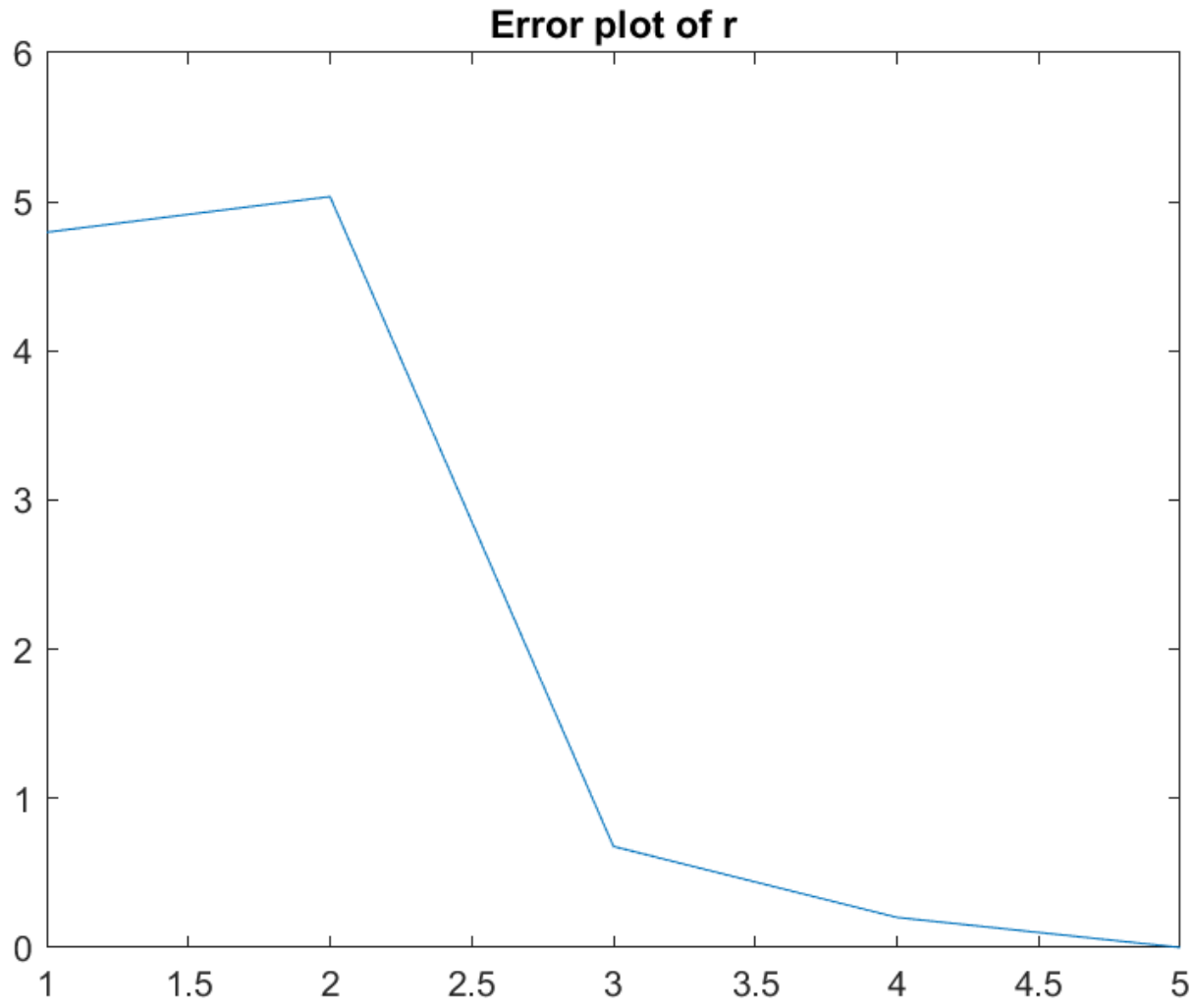
What is the allowed Value of relative error: 0.01

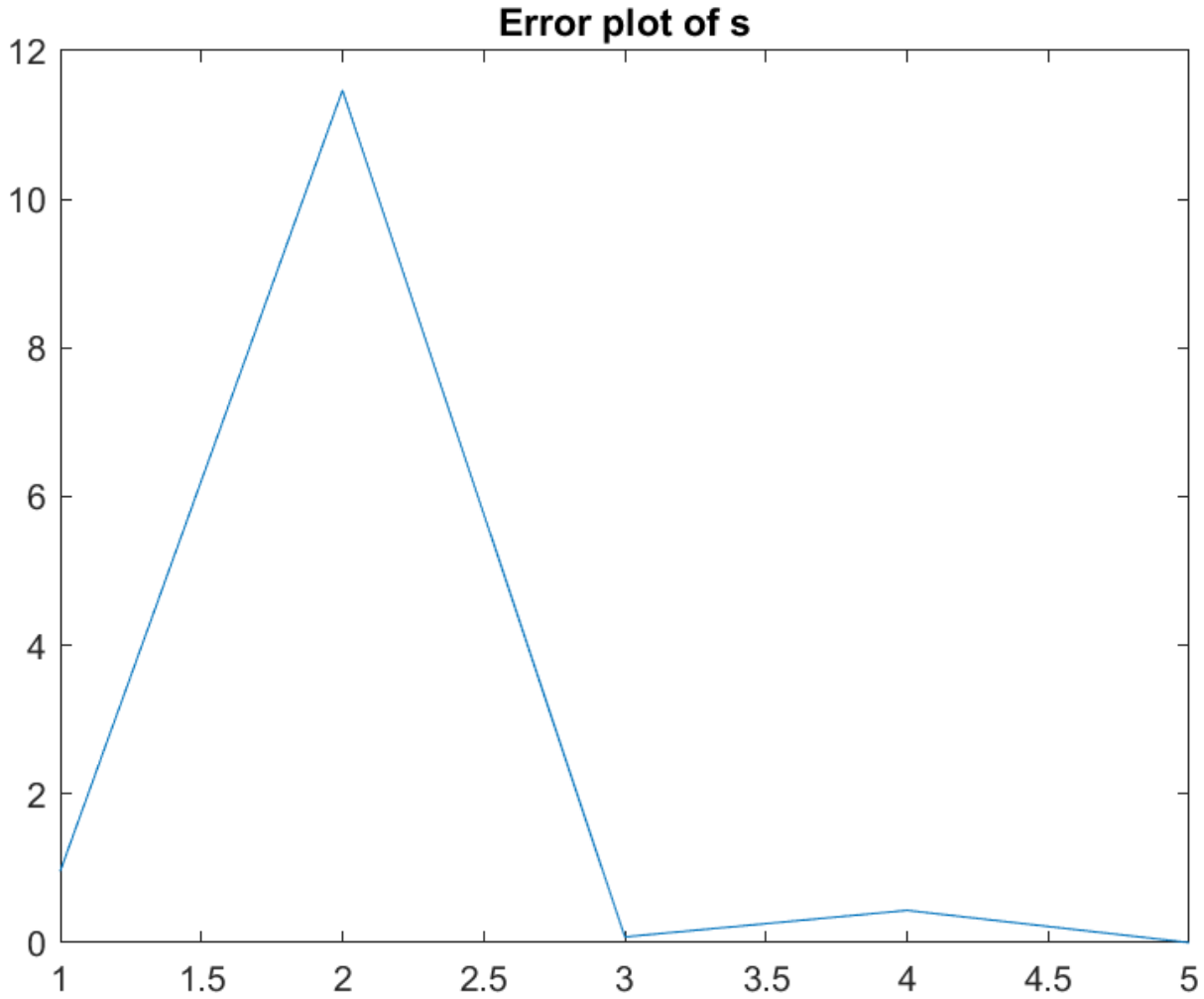
What is the allowed number of maximum iteration: 50

Roots of the functions are: 2.201689 + 1.276944i, 2.201689 - 1.276944i

Roots of the functions are: 2.195423, 0.801172




Error plot of r
6
5
4
3
2
1
0
1
1.5
2
2.5
3
3.5
4
4.5
5



2.(r=2,s=-2)

Choose the method of solution by selecting number shown with method:

Muller Method-1,

Bairstow Method-2

2

What is the polynomial for which we have to find: x^4-7.4*x^3+20.44*x^2-24.184*x+9.6448

What is the starting value of r: 2

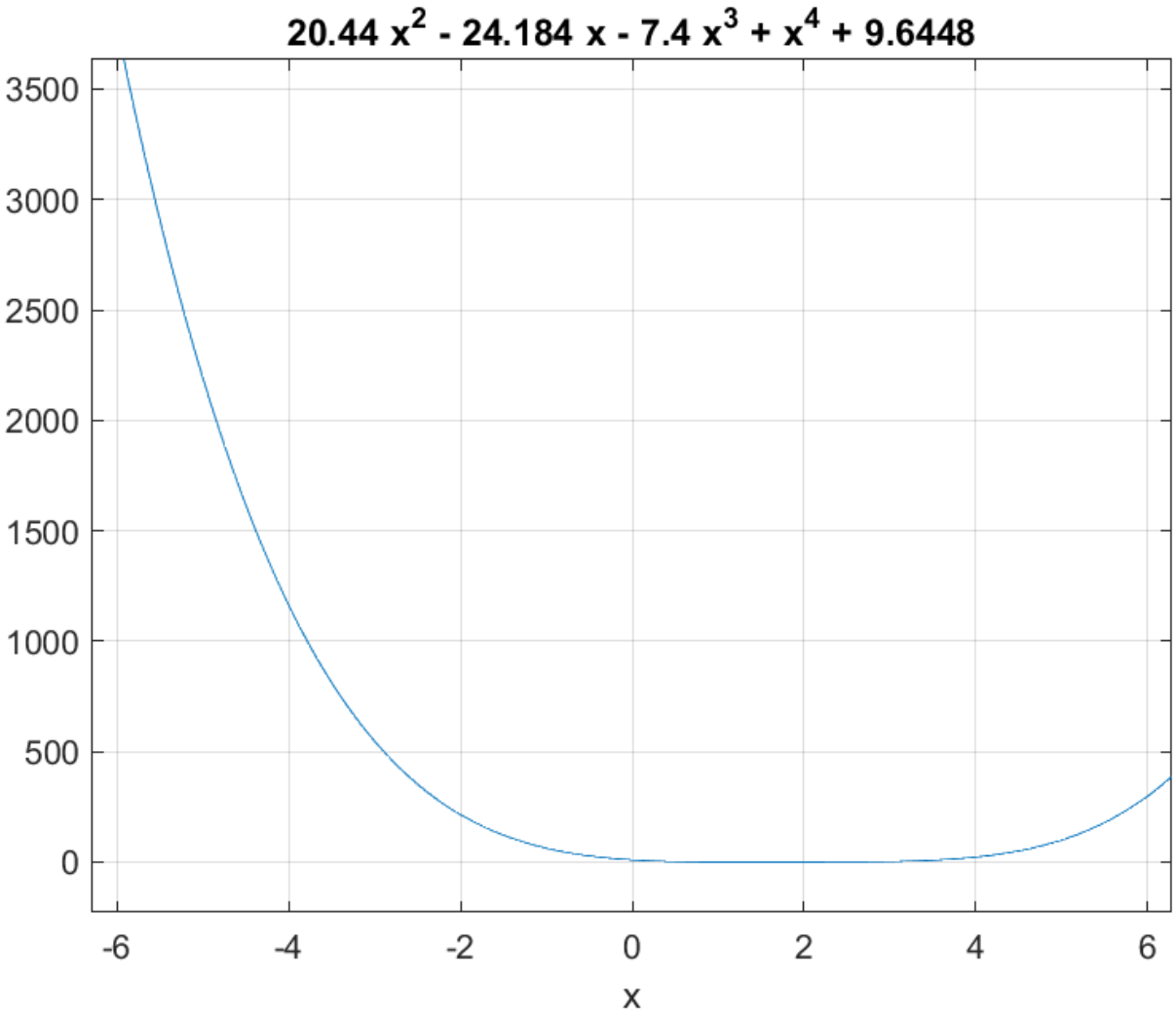
What is the starting value of s: -2

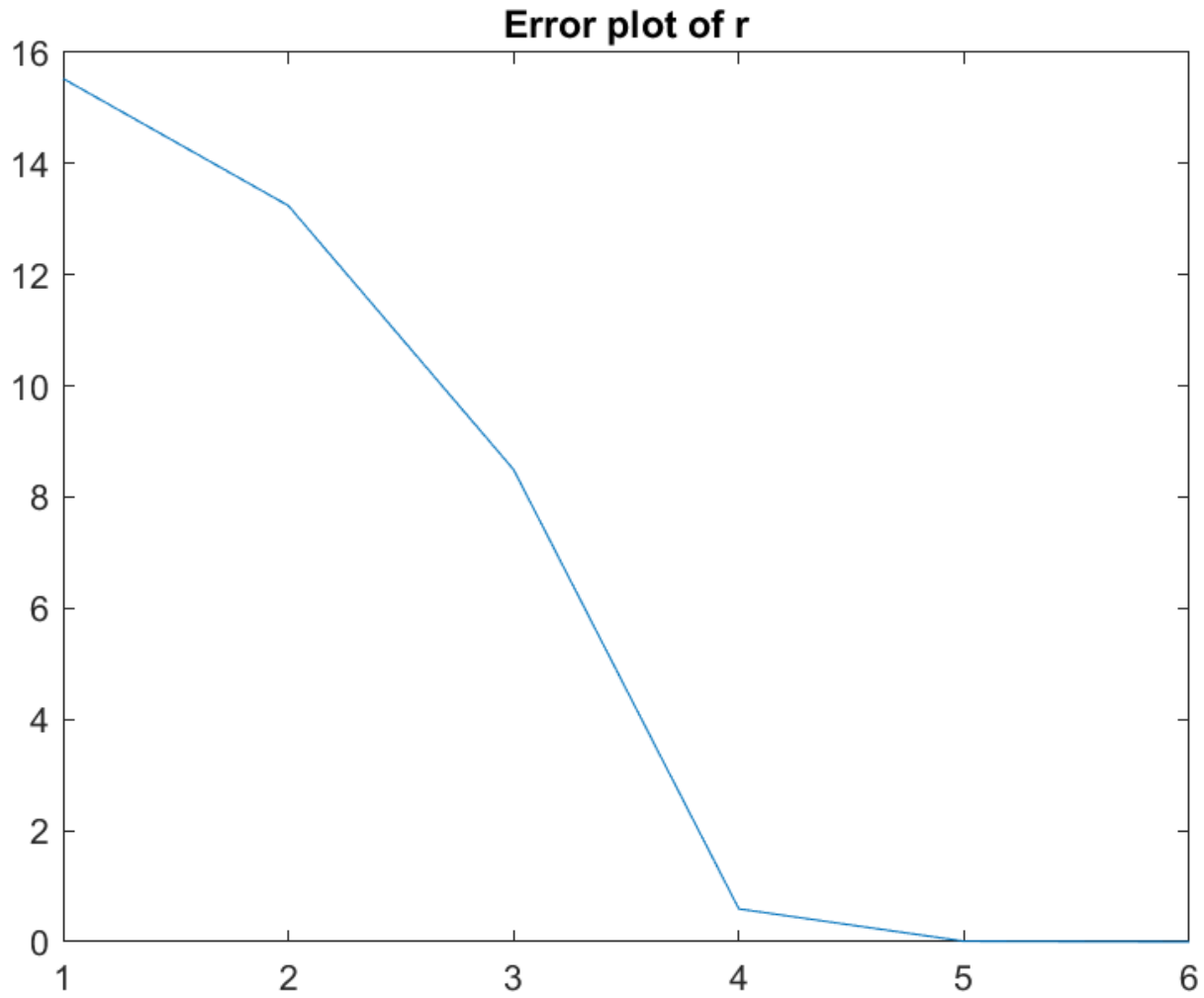
What is the allowed Value of relative error: 0.01

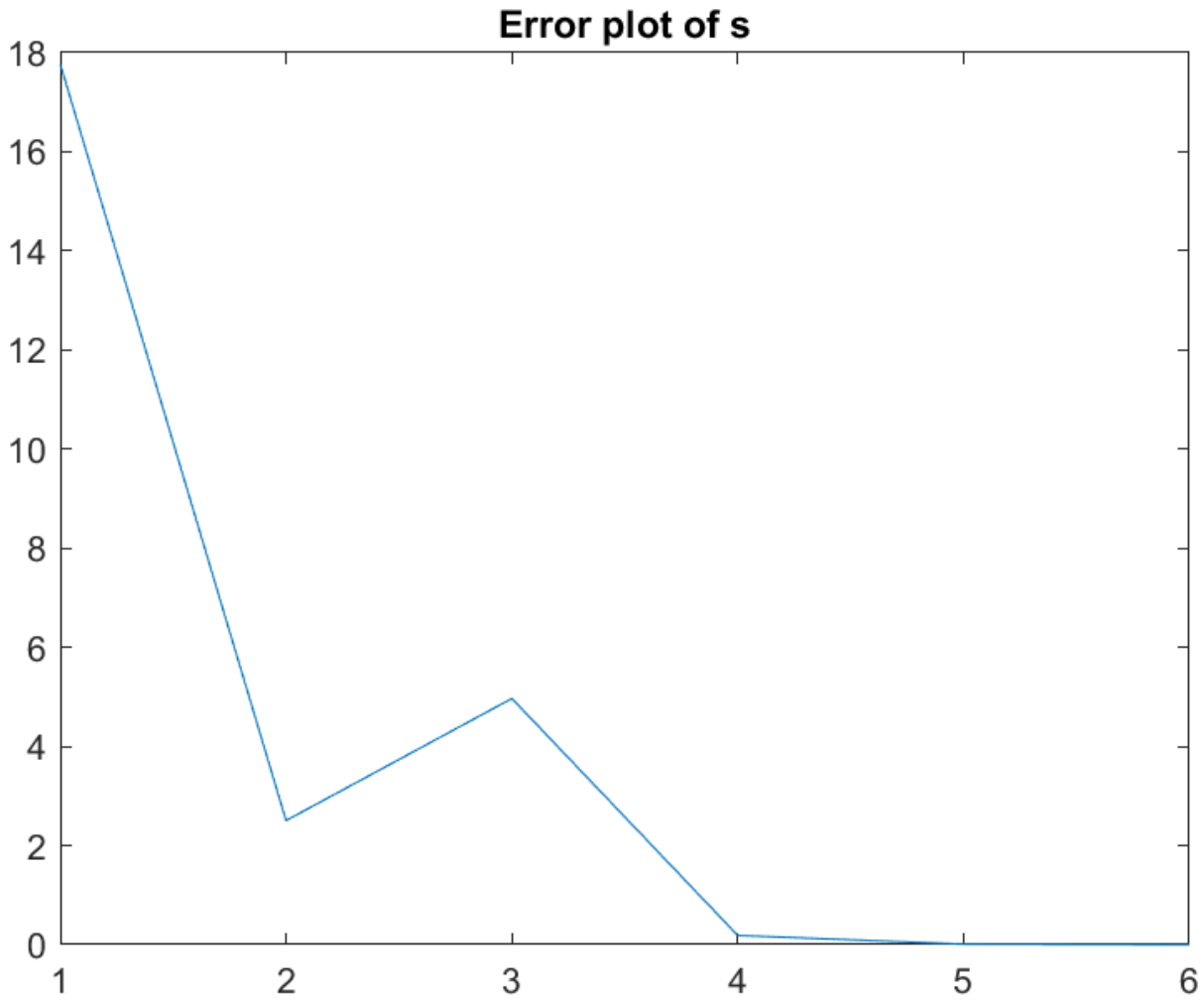
What is the allowed number of maximum iteration: 50

Roots of the functions are: 2.200000, 0.800000

Roots of the functions are: 2.200000 + 0.800000i, 2.200000 - 0.800000i




Error plot of r
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6



The order of convergence of muller's method is approximately 1.84 which is significantly larger than the order of convergence of the secant method but lower than the Newton Raphson method. It is shown that if Bairstow's method is applied to a polynomial with exactly one real root r and the initial trial factor vanishes at r, then all succeeding iterates will vanish at r and hence the method cannot converge . The cubic case is investigated in more detail and examples are given to show that this fact can cause difficulties in practice if the initial trial factor has a root close to r and if the roots of P have a certain configuration.