

Task 2

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1 Bisection $f(x) = \sin(x)\sinh(x)$; Limits = [1 4] [3]

```
tic
clc;
clear;
tol = 1e-6;
imax = 50;

% For function (b):  $f(x) = \sin(x) * \sinh(x)$ 
a1 = 1;
b1 = 4;
[root1,iterations1] = bisect(@myfunction1, a1, b1, imax, tol);
```

```
ITERATION 1
Lower guess = 1.000000
Upper guess = 4.000000
Mid-point = 2.500000
```

```
ITERATION 2
Lower guess = 2.500000
Upper guess = 4.000000
Mid-point = 3.250000
```

```
ITERATION 3
Lower guess = 2.500000
Upper guess = 3.250000
Mid-point = 2.875000
```

```
ITERATION 4
Lower guess = 2.875000
Upper guess = 3.250000
Mid-point = 3.062500
```

```
ITERATION 5
Lower guess = 3.062500
Upper guess = 3.250000
Mid-point = 3.156250
```

```
ITERATION 6
Lower guess = 3.062500
Upper guess = 3.156250
Mid-point = 3.109375
```

```
ITERATION 7
Lower guess = 3.109375
Upper guess = 3.156250
```

Mid-point = 3.132812

ITERATION 8
Lower guess = 3.132812
Upper guess = 3.156250
Mid-point = 3.144531

ITERATION 9
Lower guess = 3.132812
Upper guess = 3.144531
Mid-point = 3.138672

ITERATION 10
Lower guess = 3.138672
Upper guess = 3.144531
Mid-point = 3.141602

ITERATION 11
Lower guess = 3.138672
Upper guess = 3.141602
Mid-point = 3.140137

ITERATION 12
Lower guess = 3.140137
Upper guess = 3.141602
Mid-point = 3.140869

ITERATION 13
Lower guess = 3.140869
Upper guess = 3.141602
Mid-point = 3.141235

ITERATION 14
Lower guess = 3.141235
Upper guess = 3.141602
Mid-point = 3.141418

ITERATION 15
Lower guess = 3.141418
Upper guess = 3.141602
Mid-point = 3.141510

ITERATION 16
Lower guess = 3.141510
Upper guess = 3.141602
Mid-point = 3.141556

ITERATION 17
Lower guess = 3.141556
Upper guess = 3.141602
Mid-point = 3.141579

ITERATION 18
Lower guess = 3.141579
Upper guess = 3.141602
Mid-point = 3.141590

ITERATION 19
Lower guess = 3.141590
Upper guess = 3.141602
Mid-point = 3.141596

ITERATION 20
Lower guess = 3.141590

```
Upper guess = 3.141596
Mid-point = 3.141593
```

```
ITERATION 21
```

```
Lower guess = 3.141590
Upper guess = 3.141593
Mid-point = 3.141592
```

```
ITERATION 22
```

```
Lower guess = 3.141592
Upper guess = 3.141593
Mid-point = 3.141592
```

```
Converged to root within tolerance
```

```
% Generate values for plotting
```

```
x1 = linspace(a1, b1, 1000);
```

```
y1 = myfunction1(x1);
```

```
y_root1 = myfunction1(root1);
```

```
% Plot
```

```
figure;
```

```
plot(x1, y1, '-b', root1, y_root1, 'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r');
```

```
ylines(0, '-k');
```

```
xlabel('x');
```

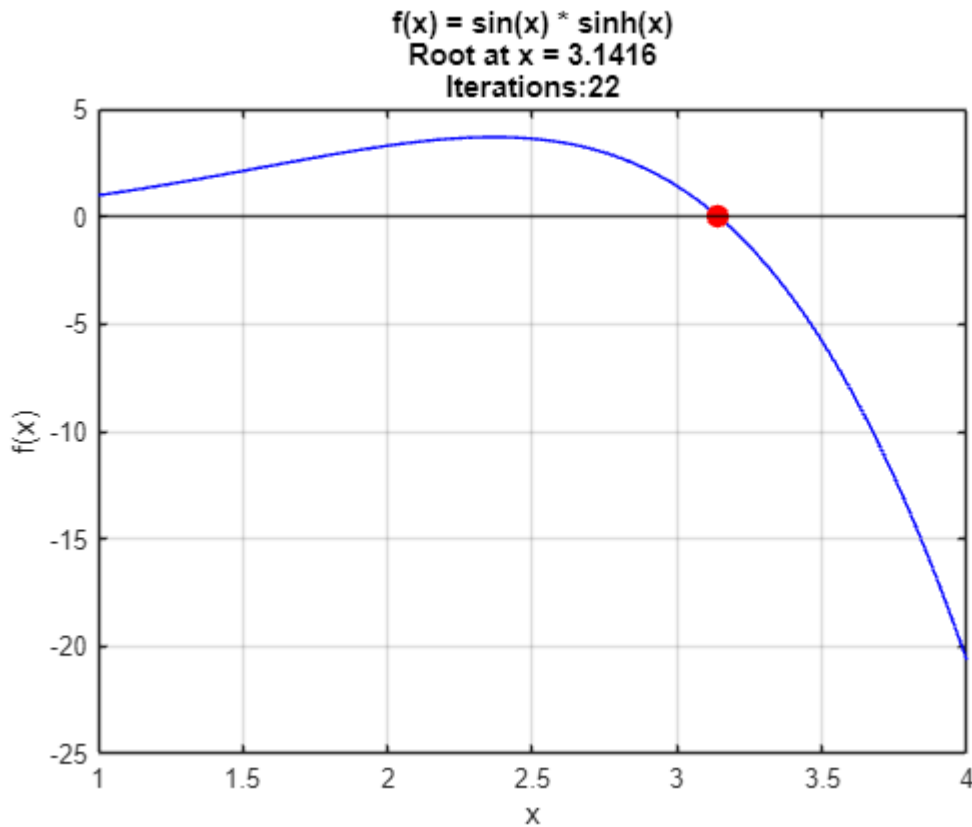
```
ylabel('f(x)');
```

```
title({'f(x) = sin(x) * sinh(x)', ...
```

```
    ['Root at x = ', num2str(root1)], ...
```

```
    ['Iterations:', num2str(iterations1)]});
```

```
grid on;
```



1 Bisection $f(x) = (R^2 - x^2)^{1/2} - x \tan(x)$ [3]

```
% For function (c):  $f(x) = \sqrt{R^2 - x^2} - x * \tan(x)$ 
a2 = 4;
b2 = 4.7;
[root2,iterations2] = bisection(@myfunction2, a2, b2, imax, tol);
```

```
ITERATION 1
Lower guess = 4.000000
Upper guess = 4.700000
Mid-point = 4.350000
```

```
ITERATION 2
Lower guess = 4.000000
Upper guess = 4.350000
Mid-point = 4.175000
```

```
ITERATION 3
Lower guess = 4.175000
Upper guess = 4.350000
Mid-point = 4.262500
```

```
ITERATION 4
Lower guess = 4.262500
Upper guess = 4.350000
Mid-point = 4.306250
```

```
ITERATION 5
Lower guess = 4.262500
Upper guess = 4.306250
Mid-point = 4.284375
```

ITERATION 6
Lower guess = 4.262500
Upper guess = 4.284375
Mid-point = 4.273437

ITERATION 7
Lower guess = 4.262500
Upper guess = 4.273437
Mid-point = 4.267969

ITERATION 8
Lower guess = 4.267969
Upper guess = 4.273437
Mid-point = 4.270703

ITERATION 9
Lower guess = 4.270703
Upper guess = 4.273437
Mid-point = 4.272070

ITERATION 10
Lower guess = 4.270703
Upper guess = 4.272070
Mid-point = 4.271387

ITERATION 11
Lower guess = 4.270703
Upper guess = 4.271387
Mid-point = 4.271045

ITERATION 12
Lower guess = 4.271045
Upper guess = 4.271387
Mid-point = 4.271216

ITERATION 13
Lower guess = 4.271045
Upper guess = 4.271216
Mid-point = 4.271130

ITERATION 14
Lower guess = 4.271045
Upper guess = 4.271130
Mid-point = 4.271088

ITERATION 15
Lower guess = 4.271088
Upper guess = 4.271130
Mid-point = 4.271109

ITERATION 16
Lower guess = 4.271088
Upper guess = 4.271109
Mid-point = 4.271098

ITERATION 17
Lower guess = 4.271088
Upper guess = 4.271098
Mid-point = 4.271093

ITERATION 18
Lower guess = 4.271093
Upper guess = 4.271098

Mid-point = 4.271096

ITERATION 19

Lower guess = 4.271093

Upper guess = 4.271096

Mid-point = 4.271094

ITERATION 20

Lower guess = 4.271094

Upper guess = 4.271096

Mid-point = 4.271095

Converged to root within tolerance

```
% Generate values for plotting
```

```
x2 = linspace(a2, b2, 1000);
```

```
y2 = myfunction2(x2);
```

```
y_root2 = myfunction2(root2);
```

```
% Plot
```

```
figure;
```

```
plot(x2, y2, '-b', root2, y_root2, 'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r');
```

```
ylines(0, '-k');
```

```
xlabel('x');
```

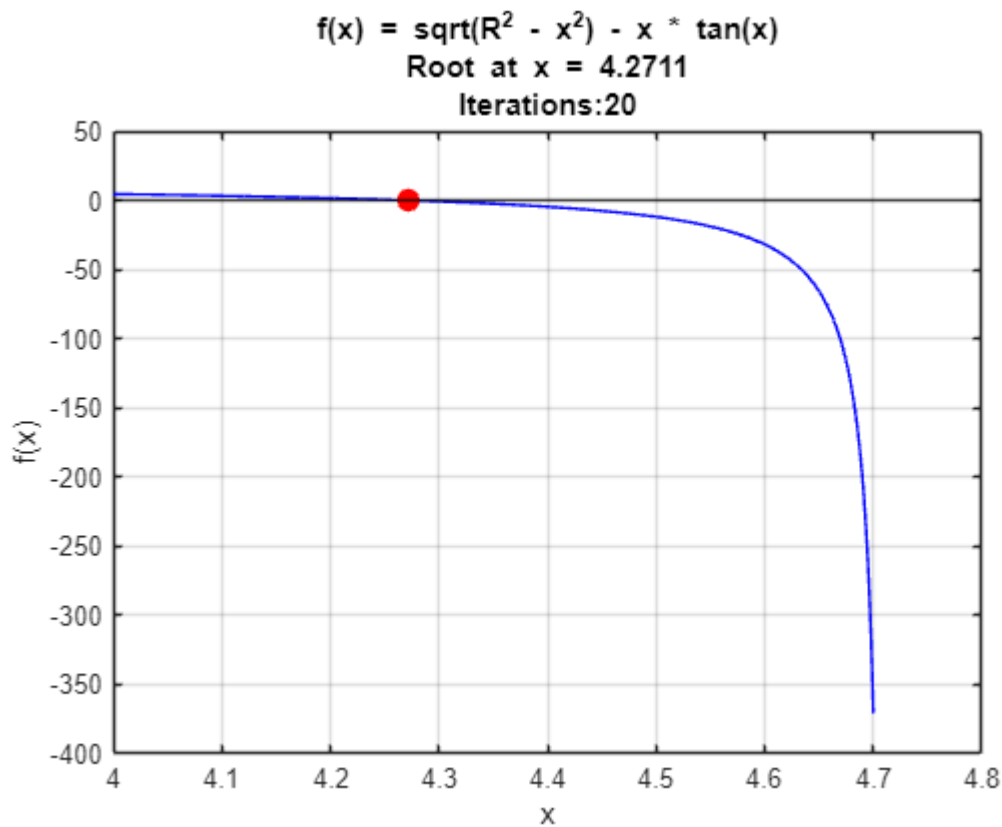
```
ylabel('f(x)');
```

```
title({'f(x) = sqrt(R^2 - x^2) - x * tan(x)', ...
```

```
    ['Root at x = ', num2str(root2)],...
```

```
    ['Iterations:', num2str(iterations2)]});
```

```
grid on;
```



2 Newtons $f(x) = e^x - (1 + x + (x^2/2))$ [3]

```
x_guess=5;
[newtonroot2b,iterations3]=newton(x_guess,@myfunction3,@myfunction4,imax,tol);
```

```
ITERATION 1
First Guess = 5.000000
Next guess = 4.087773
```

```
Difference = 0.912227
```

```
ITERATION 2
First Guess = 4.087773
Next guess = 3.241020
```

```
Difference = 0.846752
```

```
ITERATION 3
First Guess = 3.241020
Next guess = 2.487381
```

```
Difference = 0.753639
```

```
ITERATION 4
First Guess = 2.487381
Next guess = 1.849522
```

```
Difference = 0.637859
```

```
ITERATION 5
First Guess = 1.849522
```

Next guess = 1.337187
Difference = 0.512335

ITERATION 6
First Guess = 1.337187
Next guess = 0.944907
Difference = 0.392280

ITERATION 7
First Guess = 0.944907
Next guess = 0.656151
Difference = 0.288756

ITERATION 8
First Guess = 0.656151
Next guess = 0.449883
Difference = 0.206268

ITERATION 9
First Guess = 0.449883
Next guess = 0.305706
Difference = 0.144177

ITERATION 10
First Guess = 0.305706
Next guess = 0.206451
Difference = 0.099255

ITERATION 11
First Guess = 0.206451
Next guess = 0.138834
Difference = 0.067617

ITERATION 12
First Guess = 0.138834
Next guess = 0.093096
Difference = 0.045738

ITERATION 13
First Guess = 0.093096
Next guess = 0.062307
Difference = 0.030790

ITERATION 14
First Guess = 0.062307
Next guess = 0.041646
Difference = 0.020661

ITERATION 15
First Guess = 0.041646
Next guess = 0.027812
Difference = 0.013834

ITERATION 16
First Guess = 0.027812
Next guess = 0.018563

Difference = 0.009249

ITERATION 17
First Guess = 0.018563
Next guess = 0.012385

Difference = 0.006178

ITERATION 18
First Guess = 0.012385
Next guess = 0.008261

Difference = 0.004124

ITERATION 19
First Guess = 0.008261
Next guess = 0.005509

Difference = 0.002752

ITERATION 20
First Guess = 0.005509
Next guess = 0.003674

Difference = 0.001836

ITERATION 21
First Guess = 0.003674
Next guess = 0.002449

Difference = 0.001224

ITERATION 22
First Guess = 0.002449
Next guess = 0.001633

Difference = 0.000816

ITERATION 23
First Guess = 0.001633
Next guess = 0.001089

Difference = 0.000544

ITERATION 24
First Guess = 0.001089
Next guess = 0.000726

Difference = 0.000363

ITERATION 25
First Guess = 0.000726
Next guess = 0.000484

Difference = 0.000242

ITERATION 26
First Guess = 0.000484
Next guess = 0.000323

Difference = 0.000161

ITERATION 27
First Guess = 0.000323
Next guess = 0.000215

Difference = 0.000108

ITERATION 28
First Guess = 0.000215
Next guess = 0.000143

Difference = 0.000072

ITERATION 29
First Guess = 0.000143
Next guess = 0.000096

Difference = 0.000048

ITERATION 30
First Guess = 0.000096
Next guess = 0.000064

Difference = 0.000032

ITERATION 31
First Guess = 0.000064
Next guess = 0.000043

Difference = 0.000021

ITERATION 32
First Guess = 0.000043
Next guess = 0.000028

Difference = 0.000014

ITERATION 33
First Guess = 0.000028
Next guess = 0.000019

Difference = 0.000009

ITERATION 34
First Guess = 0.000019
Next guess = 0.000011

Difference = 0.000007

ITERATION 35
First Guess = 0.000011
Next guess = 0.000008

Difference = 0.000003

ITERATION 36
First Guess = 0.000008
Next guess = 0.000001

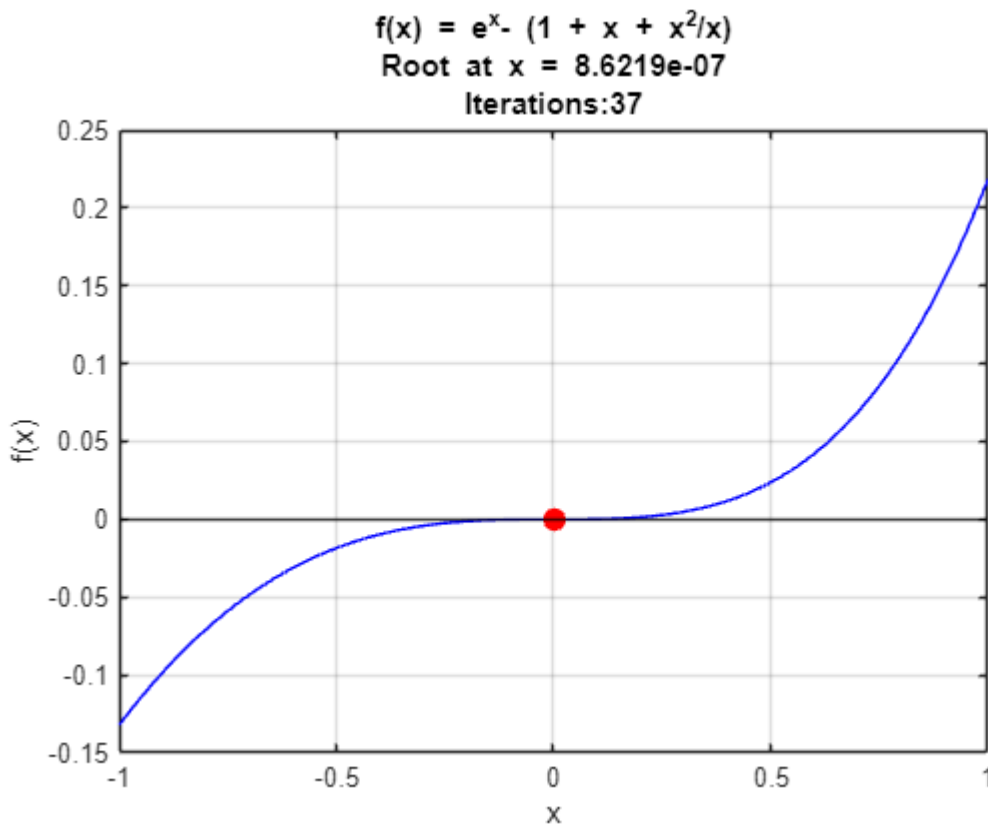
Difference = 0.000007

ITERATION 37
First Guess = 0.000001

Next guess = 0.000001

Difference = 0.000000

```
figure;  
x3=linspace(-1,1,1000);  
y3=myfunction3(x3);  
y_root3=myfunction3(newtonroot2b);  
plot(x3,y3,'-b',newtonroot2b,y_root3,'ro','MarkerSize',8,'MarkerFaceColor','r')  
yline(0,'-k');  
xlabel('x');  
ylabel('f(x)');  
grid on;  
title({'f(x) = e^x- (1 + x + x^2/x)'...  
      ['Root at x = ',num2str(newtonroot2b)]...  
      ['Iterations:',num2str(iterations3)]});
```



2 Newtons $f(x) = 10\log(x)-x$ [3]

```
x_guess2=1;  
[newtonroot2c,iterations4]=newton(x_guess2,@myfunction5,@myfunction6,imax,tol);
```

ITERATION 1
First Guess = 1.000000
Next guess = 1.111111

Difference = 0.111111

ITERATION 2
First Guess = 1.111111
Next guess = 1.118299

Difference = 0.007188

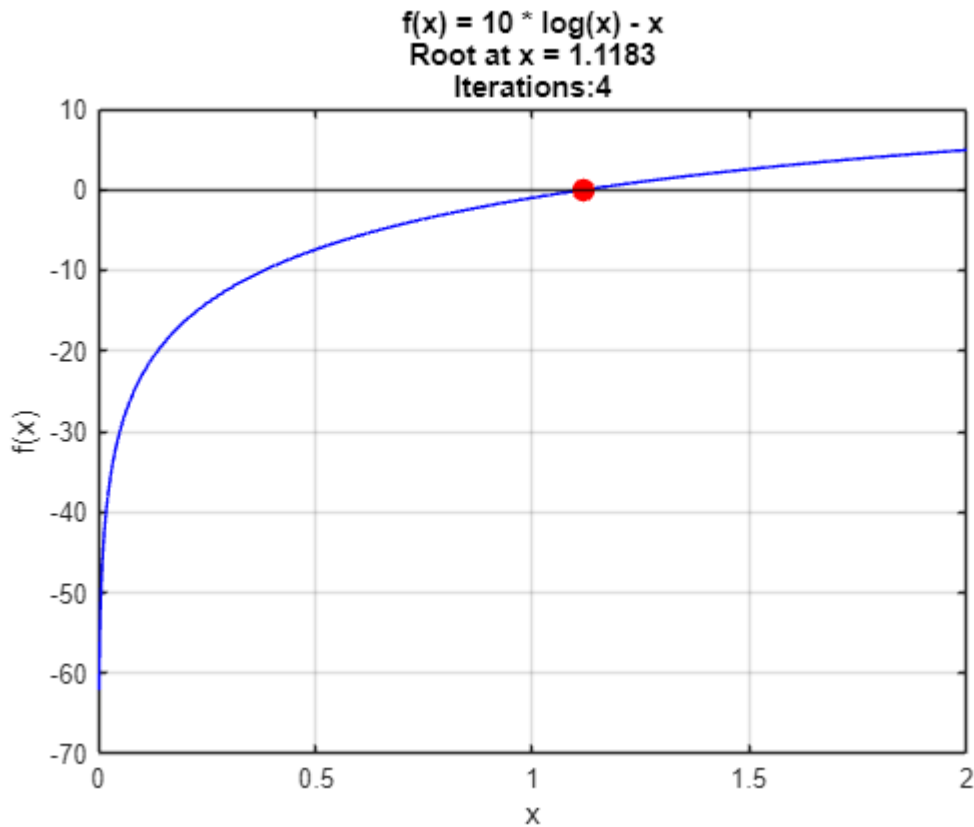
ITERATION 3
First Guess = 1.118299
Next guess = 1.118326

Difference = 0.000026

ITERATION 4
First Guess = 1.118326
Next guess = 1.118326

Difference = 0.000000

```
figure;  
x4=linspace(0,2,1000);  
y4=myfunction5(x4);  
y_root4=myfunction5(newtonroot2c);  
plot(x4,y4,'-b',newtonroot2c,y_root4,'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r')  
yline(0, '-k');  
xlabel('x');  
ylabel('f(x)');  
grid on;  
title({'f(x) = 10 * log(x) - x'...  
      ['Root at x = ',num2str(newtonroot2c)]...  
      ['Iterations:',num2str(iterations4)]});
```



3 Newtons Intersect [6]

```
x_guess3=4;
imax2=20;
[newtonroot3b,iterations5]=newton(x_guess3,@myfunction7,@myfunction8,imax2,tol);
```

```
ITERATION 1
First Guess = 4.000000
Next guess = 4.189103
```

```
Difference = 0.189103
```

```
ITERATION 2
First Guess = 4.189103
Next guess = 4.194922
```

```
Difference = 0.005819
```

```
ITERATION 3
First Guess = 4.194922
Next guess = 4.194932
```

```
Difference = 0.000010
```

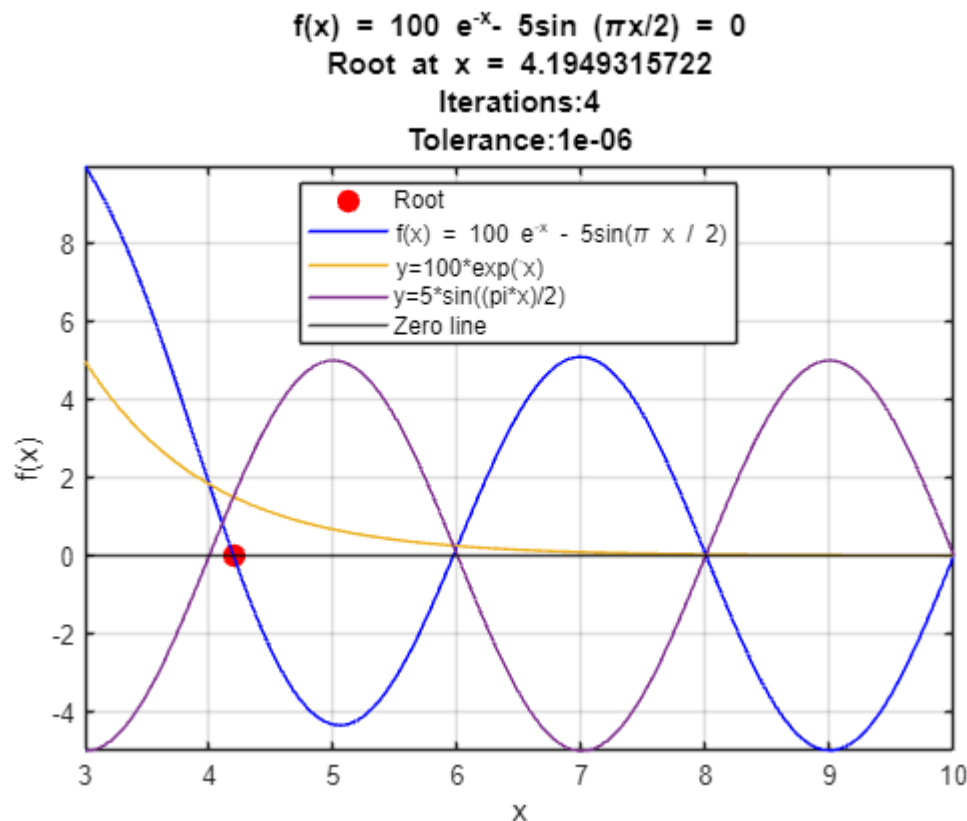
```
ITERATION 4
First Guess = 4.194932
Next guess = 4.194932
```

```
Difference = 0.000000
```

```

figure;
x5=linspace(3,10,1000);
yo1=myfunction9(x5);
yo2=myfunction10(x5);
y5=myfunction7(x5);
y_root5=myfunction7(newtonroot3b);
plot(newtonroot3b, y_root5, 'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r',
'DisplayName', 'Root');
hold on;
plot(x5, y5, '-b', 'DisplayName', 'f(x) = 100 e^{-x} - 5sin(\pi x / 2)');
hold on
plot(x5,yo1,'DisplayName','y=100*exp(-x)')
plot(x5,yo2,'DisplayName','y=5*sin((pi*x)/2)')
yline(0, '-k','DisplayName','Zero line');
xlabel('x');
ylabel('f(x)');
grid on;
title({'f(x) = 100 e^{-x} - 5sin (\pi x/2) = 0'...
    ['Root at x = ',num2str(newtonroot3b, '%.10f')]...
    ['Iterations:',num2str(iterations5)]...
    ['Tolerance:',num2str(tol)]});
axis tight
legend('Location','best')

```



```
imax3=1000;
```

```
tol2=1e-10;
[newtonroot3c,iterations6]=newton(x_guess3,@myfunction7,@myfunction8,imax3,tol2);
```

```
ITERATION 1
First Guess = 4.000000
Next guess = 4.189103
```

```
Difference = 0.189103
```

```
ITERATION 2
First Guess = 4.189103
Next guess = 4.194922
```

```
Difference = 0.005819
```

```
ITERATION 3
First Guess = 4.194922
Next guess = 4.194932
```

```
Difference = 0.000010
```

```
ITERATION 4
First Guess = 4.194932
Next guess = 4.194932
```

```
Difference = 0.000000
```

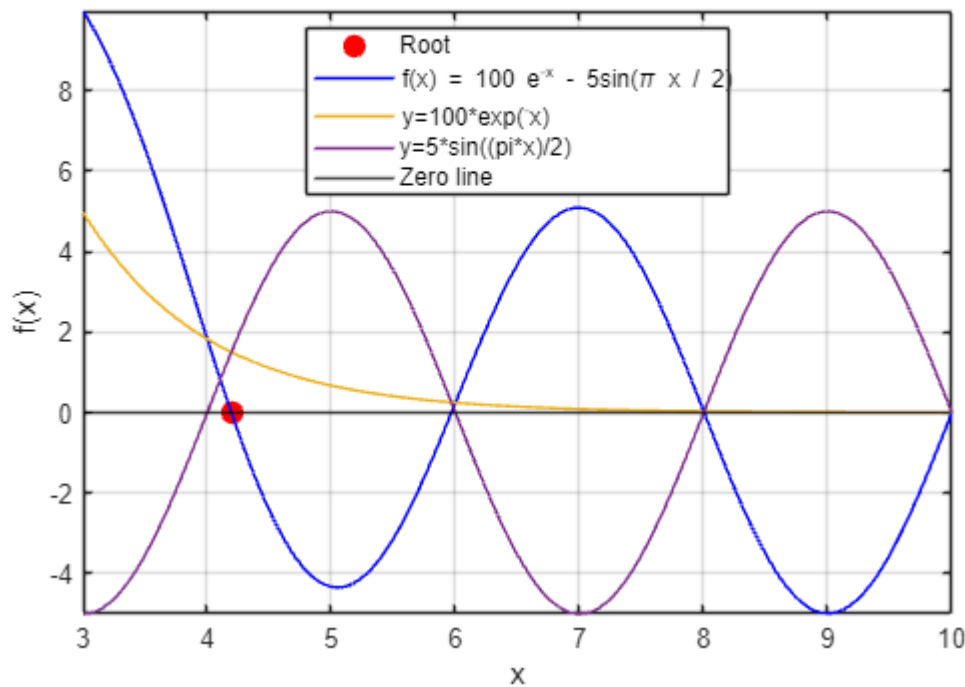
```
figure;
y_root6=myfunction7(newtonroot3c);
plot(newtonroot3c, y_root6, 'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r',
'DisplayName', 'Root');
hold on
plot(x5, y5, '-b', 'DisplayName', 'f(x) = 100 e^{-x} - 5sin(\pi x / 2)');
plot(x5,yo1,'DisplayName','y=100*exp(^-x)')
plot(x5,yo2,'DisplayName','y=5*sin((pi*x)/2)')
yline(0, '-k','DisplayName','Zero line');
xlabel('x');
ylabel('f(x)');
grid on;
title({'f(x) = 100 e^{-x} - 5sin (\pix/2) = 0'...
['Root at x = ',num2str(newtonroot3c, '%.10f')]}...
['Iterations:',num2str(iterations6)]...
['Tolerance:',num2str(tol2)]]);
axis tight
legend('Location','best')
```

$$f(x) = 100 e^{-x} - 5 \sin(\pi x / 2) = 0$$

Root at $x = 4.1949315722$

Iterations:4

Tolerance:1e-10



% Same iteration count as initial guess is close to root

4 Bracketing Bisect [6]

```
x6=linspace(4,10,1000);
y6=myfunction9(x6);
y7=myfunction10(x6);
```

```
[bisectbracket,brack2its]=bisect_bracket(@myfunction7,4,5,200,tol,1.75,4);
```

ITERATION 1

```
Lower guess = 4.000000
Upper guess = 5.000000
Mid-point = 4.500000
```

ITERATION 2

```
Lower guess = 4.000000
Upper guess = 4.500000
Mid-point = 4.250000
```

ITERATION 3

```
Lower guess = 4.000000
Upper guess = 4.250000
Mid-point = 4.125000
```

ITERATION 4

```
Lower guess = 4.125000
Upper guess = 4.250000
Mid-point = 4.187500
```

ITERATION 5
Lower guess = 4.187500
Upper guess = 4.250000
Mid-point = 4.218750

ITERATION 6
Lower guess = 4.187500
Upper guess = 4.218750
Mid-point = 4.203125

ITERATION 7
Lower guess = 4.187500
Upper guess = 4.203125
Mid-point = 4.195312

ITERATION 8
Lower guess = 4.187500
Upper guess = 4.195312
Mid-point = 4.191406

ITERATION 9
Lower guess = 4.191406
Upper guess = 4.195312
Mid-point = 4.193359

ITERATION 10
Lower guess = 4.193359
Upper guess = 4.195312
Mid-point = 4.194336

ITERATION 11
Lower guess = 4.194336
Upper guess = 4.195312
Mid-point = 4.194824

ITERATION 12
Lower guess = 4.194824
Upper guess = 4.195312
Mid-point = 4.195068

ITERATION 13
Lower guess = 4.194824
Upper guess = 4.195068
Mid-point = 4.194946

ITERATION 14
Lower guess = 4.194824
Upper guess = 4.194946
Mid-point = 4.194885

ITERATION 15
Lower guess = 4.194885
Upper guess = 4.194946
Mid-point = 4.194916

ITERATION 16
Lower guess = 4.194916
Upper guess = 4.194946
Mid-point = 4.194931

ITERATION 17
Lower guess = 4.194931
Upper guess = 4.194946
Mid-point = 4.194939

ITERATION 18
Lower guess = 4.194931
Upper guess = 4.194939
Mid-point = 4.194935

ITERATION 19
Lower guess = 4.194931
Upper guess = 4.194935
Mid-point = 4.194933

ITERATION 20
Lower guess = 4.194931
Upper guess = 4.194933
Mid-point = 4.194932

ITERATION 1
Lower guess = 5.750000
Upper guess = 6.750000
Mid-point = 6.250000

ITERATION 2
Lower guess = 5.750000
Upper guess = 6.250000
Mid-point = 6.000000

ITERATION 3
Lower guess = 5.750000
Upper guess = 6.000000
Mid-point = 5.875000

ITERATION 4
Lower guess = 5.875000
Upper guess = 6.000000
Mid-point = 5.937500

ITERATION 5
Lower guess = 5.937500
Upper guess = 6.000000
Mid-point = 5.968750

ITERATION 6
Lower guess = 5.937500
Upper guess = 5.968750
Mid-point = 5.953125

ITERATION 7
Lower guess = 5.953125
Upper guess = 5.968750
Mid-point = 5.960938

ITERATION 8
Lower guess = 5.960938
Upper guess = 5.968750
Mid-point = 5.964844

ITERATION 9
Lower guess = 5.964844
Upper guess = 5.968750
Mid-point = 5.966797

ITERATION 10
Lower guess = 5.966797
Upper guess = 5.968750

Mid-point = 5.967773

ITERATION 11

Lower guess = 5.966797

Upper guess = 5.967773

Mid-point = 5.967285

ITERATION 12

Lower guess = 5.967285

Upper guess = 5.967773

Mid-point = 5.967529

ITERATION 13

Lower guess = 5.967285

Upper guess = 5.967529

Mid-point = 5.967407

ITERATION 14

Lower guess = 5.967285

Upper guess = 5.967407

Mid-point = 5.967346

ITERATION 15

Lower guess = 5.967346

Upper guess = 5.967407

Mid-point = 5.967377

ITERATION 16

Lower guess = 5.967377

Upper guess = 5.967407

Mid-point = 5.967392

ITERATION 17

Lower guess = 5.967377

Upper guess = 5.967392

Mid-point = 5.967384

ITERATION 18

Lower guess = 5.967377

Upper guess = 5.967384

Mid-point = 5.967381

ITERATION 19

Lower guess = 5.967377

Upper guess = 5.967381

Mid-point = 5.967379

ITERATION 20

Lower guess = 5.967379

Upper guess = 5.967381

Mid-point = 5.967380

ITERATION 1

Lower guess = 7.500000

Upper guess = 8.500000

Mid-point = 8.000000

ITERATION 2

Lower guess = 8.000000

Upper guess = 8.500000

Mid-point = 8.250000

ITERATION 3

Lower guess = 8.000000

Upper guess = 8.250000
Mid-point = 8.125000

ITERATION 4
Lower guess = 8.000000
Upper guess = 8.125000
Mid-point = 8.062500

ITERATION 5
Lower guess = 8.000000
Upper guess = 8.062500
Mid-point = 8.031250

ITERATION 6
Lower guess = 8.000000
Upper guess = 8.031250
Mid-point = 8.015625

ITERATION 7
Lower guess = 8.000000
Upper guess = 8.015625
Mid-point = 8.007812

ITERATION 8
Lower guess = 8.000000
Upper guess = 8.007812
Mid-point = 8.003906

ITERATION 9
Lower guess = 8.003906
Upper guess = 8.007812
Mid-point = 8.005859

ITERATION 10
Lower guess = 8.003906
Upper guess = 8.005859
Mid-point = 8.004883

ITERATION 11
Lower guess = 8.003906
Upper guess = 8.004883
Mid-point = 8.004395

ITERATION 12
Lower guess = 8.003906
Upper guess = 8.004395
Mid-point = 8.004150

ITERATION 13
Lower guess = 8.004150
Upper guess = 8.004395
Mid-point = 8.004272

ITERATION 14
Lower guess = 8.004150
Upper guess = 8.004272
Mid-point = 8.004211

ITERATION 15
Lower guess = 8.004211
Upper guess = 8.004272
Mid-point = 8.004242

ITERATION 16

Lower guess = 8.004242
Upper guess = 8.004272
Mid-point = 8.004257

ITERATION 17

Lower guess = 8.004242
Upper guess = 8.004257
Mid-point = 8.004250

ITERATION 18

Lower guess = 8.004250
Upper guess = 8.004257
Mid-point = 8.004253

ITERATION 19

Lower guess = 8.004250
Upper guess = 8.004253
Mid-point = 8.004251

ITERATION 20

Lower guess = 8.004251
Upper guess = 8.004253
Mid-point = 8.004252

ITERATION 1

Lower guess = 9.250000
Upper guess = 10.250000
Mid-point = 9.750000

ITERATION 2

Lower guess = 9.750000
Upper guess = 10.250000
Mid-point = 10.000000

ITERATION 3

Lower guess = 9.750000
Upper guess = 10.000000
Mid-point = 9.875000

ITERATION 4

Lower guess = 9.875000
Upper guess = 10.000000
Mid-point = 9.937500

ITERATION 5

Lower guess = 9.937500
Upper guess = 10.000000
Mid-point = 9.968750

ITERATION 6

Lower guess = 9.968750
Upper guess = 10.000000
Mid-point = 9.984375

ITERATION 7

Lower guess = 9.984375
Upper guess = 10.000000
Mid-point = 9.992188

ITERATION 8

Lower guess = 9.992188
Upper guess = 10.000000
Mid-point = 9.996094

ITERATION 9
Lower guess = 9.996094
Upper guess = 10.000000
Mid-point = 9.998047

ITERATION 10
Lower guess = 9.998047
Upper guess = 10.000000
Mid-point = 9.999023

ITERATION 11
Lower guess = 9.999023
Upper guess = 10.000000
Mid-point = 9.999512

ITERATION 12
Lower guess = 9.999023
Upper guess = 9.999512
Mid-point = 9.999268

ITERATION 13
Lower guess = 9.999268
Upper guess = 9.999512
Mid-point = 9.999390

ITERATION 14
Lower guess = 9.999390
Upper guess = 9.999512
Mid-point = 9.999451

ITERATION 15
Lower guess = 9.999390
Upper guess = 9.999451
Mid-point = 9.999420

ITERATION 16
Lower guess = 9.999420
Upper guess = 9.999451
Mid-point = 9.999435

ITERATION 17
Lower guess = 9.999420
Upper guess = 9.999435
Mid-point = 9.999428

ITERATION 18
Lower guess = 9.999420
Upper guess = 9.999428
Mid-point = 9.999424

ITERATION 19
Lower guess = 9.999420
Upper guess = 9.999424
Mid-point = 9.999422

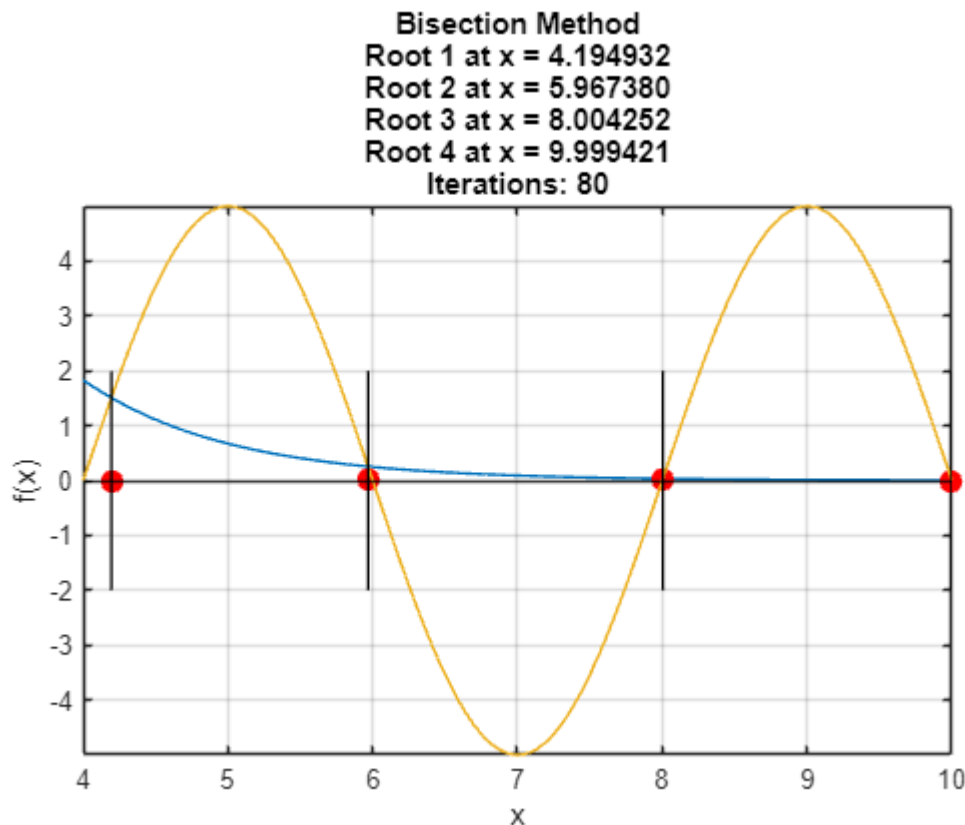
ITERATION 20
Lower guess = 9.999420
Upper guess = 9.999422
Mid-point = 9.999421

```
figure;  
y_root8=myfunction7(bisectbracket);  
plot(x6,y6,bisectbracket,y_root8,'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r')
```

```

hold on
plot(x6,y7)
yline(0, '-k');
for ii = 1:length(bisectbracket)
    x1 = bisectbracket(ii);
    y_start1 = y_root8(ii) - 2; % Lower bound of the line
    y_end1 = y_root8(ii) + 2;   % Upper bound of the line
    line([x1, x1], [y_start1, y_end1], 'Color', 'black','linewidth',1);
end
xlabel('x');
ylabel('f(x)');
grid on;
title({'Bisection Method', ...
    ['Root 1 at x = ', num2str(bisectbracket(1), '%.6f')], ...
    ['Root 2 at x = ', num2str(bisectbracket(2), '%.6f')], ...
    ['Root 3 at x = ', num2str(bisectbracket(3), '%.6f')], ...
    ['Root 4 at x = ', num2str(bisectbracket(4), '%.6f')], ...
    ['Iterations: ', num2str(brack2its)]]);
axis tight

```



4 Bracketing Newton [6]

```

[newtonbracket,brack1its]=newton_bracket(x_guess3,@myfunction7,@myfunction8,imax3,to
12);

```

```
ITERATION 1
Current Guess = 4.000000
Next Guess = 4.189103
Difference = 0.189103

ITERATION 2
Current Guess = 4.189103
Next Guess = 4.194922
Difference = 0.005819

ITERATION 3
Current Guess = 4.194922
Next Guess = 4.194932
Difference = 0.000010

ITERATION 4
Current Guess = 4.194932
Next Guess = 4.194932
Difference = 0.000000

ITERATION 1
Current Guess = 5.694932
Next Guess = 5.991787
Difference = 0.296855

ITERATION 2
Current Guess = 5.991787
Next Guess = 5.967401
Difference = 0.024386

ITERATION 3
Current Guess = 5.967401
Next Guess = 5.967379
Difference = 0.000022

ITERATION 4
Current Guess = 5.967379
Next Guess = 5.967379
Difference = 0.000000

ITERATION 1
Current Guess = 7.467379
Next Guess = 8.175993
Difference = 0.708614

ITERATION 2
Current Guess = 8.175993
Next Guess = 7.999755
Difference = 0.176238

ITERATION 3
Current Guess = 7.999755
Next Guess = 8.004253
Difference = 0.004498

ITERATION 4
Current Guess = 8.004253
Next Guess = 8.004253
Difference = 0.000000

ITERATION 5
Current Guess = 8.004253
Next Guess = 8.004253
Difference = 0.000000
```

```
ITERATION 1
Current Guess = 9.504253
Next Guess = 10.131927
Difference = 0.627673
```

```
ITERATION 2
Current Guess = 10.131927
Next Guess = 9.997491
Difference = 0.134435
```

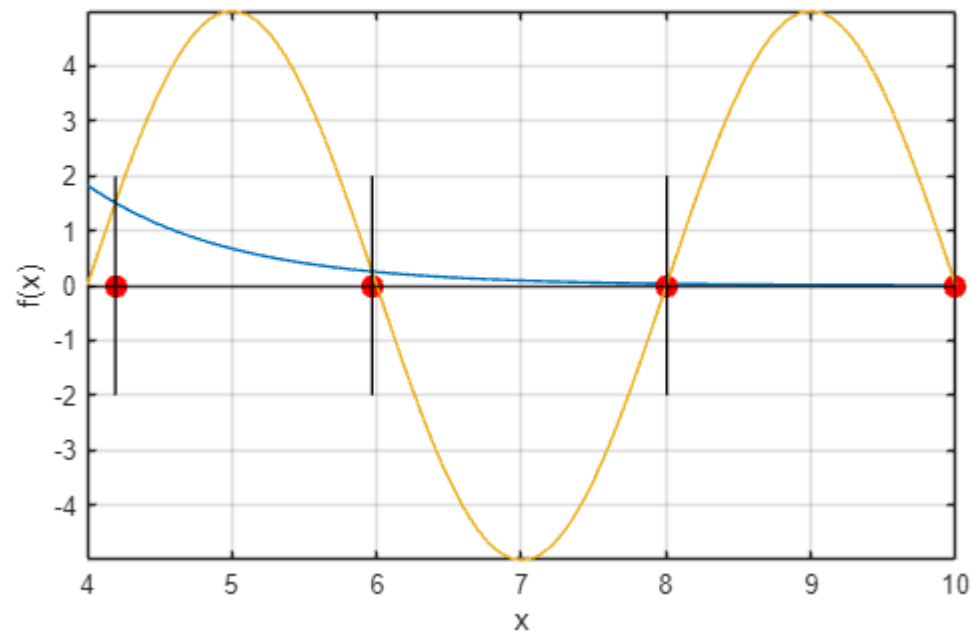
```
ITERATION 3
Current Guess = 9.997491
Next Guess = 9.999422
Difference = 0.001930
```

```
ITERATION 4
Current Guess = 9.999422
Next Guess = 9.999422
Difference = 0.000000
```

```
ITERATION 5
Current Guess = 9.999422
Next Guess = 9.999422
Difference = 0.000000
```

```
figure;
y_root7=myfunction7(newtonbracket);
plot(x6,y6,newtonbracket,y_root7,'ro', 'MarkerSize', 8, 'MarkerFaceColor', 'r')
hold on
plot(x6,y7)
yline(0, '-k');
for i = 1:length(newtonbracket)
    x = newtonbracket(i);
    y_start = y_root7(i) - 2; % Lower bound of the line
    y_end = y_root7(i) + 2; % Upper bound of the line
    line([x, x], [y_start, y_end], 'Color', 'black','linewidth',1);
end
xlabel('x');
ylabel('f(x)');
grid on;
title({'Newtons Method', ...
    ['Root 1 at x = ', num2str(newtonbracket(1), '%.6f')], ...
    ['Root 2 at x = ', num2str(newtonbracket(2), '%.6f')], ...
    ['Root 3 at x = ', num2str(newtonbracket(3), '%.6f')], ...
    ['Root 4 at x = ', num2str(newtonbracket(4), '%.6f')], ...
    ['Iterations: ', num2str(brack1its)]]});
axis tight
```

Newton's Method
Root 1 at $x = 4.194932$
Root 2 at $x = 5.967379$
Root 3 at $x = 8.004253$
Root 4 at $x = 9.999422$
Iterations: 18



toc

Elapsed time is 0.596131 seconds.