

Task 2

Table of Contents

1 Bisection $f(x) = \sin(x)\sinh(x)$; Limits = [1 4] [3].....	1
1 Bisection $f(x) = (R^2-x^2)^{1/2} - \tan(x)$ [3].....	1
2 Newtons $f(x) = e^x - (1+x+(x^2/2))$ [3].....	2
2 Newtons $f(x) = 10\log(x)-x$ [3].....	3
3 Newtons Intersect [6].....	3
4 Bracketing Bisect [6].....	4
4 Bracketing Newton [6].....	4

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

```
clear;
clc;
close all;
imax = 50;
tol = 1e-6;
a1 = 1;
b1 = 4;
[root1,iterations1] = bisect1(@function1,a1,b1,imax,tol);
```

Converged to root after 22 iterations.

```
x1 = linspace(a1,b1,1000);
y1 = function1(x1);
y_root1 = function1(root1);
figure;
plot(x1,y1,'-b',root1,y_root1,'o');
yline(0,'-k');
xlabel('Iteration');
ylabel('Function');
title({'Root of Sin(x)'});
```

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

```
clear;
clc;
close all;
imax = 50;
tol = 1e-6;
a2 = 4;
b2 = 4.7;
[root2,iterations2] = bisect1(@function2,a2,b2,imax,tol);
```

Converged to root after 20 iterations.

```
x2 = linspace(a2,b2,1000);
y2 = function2(x2);
y_root2 = function2(root2);
figure;
```

```
plot(x2,y2,'-b',root2,y_root2,'o');
yline(0,'-k');
title({'Root of'});
```

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

```
clc;
clear;
close all;

tol = 1e-6;
imax = 20;
x1 = 5;
x2 = 1;
[root1] = newton1(x1,@function3,@function5,imax,tol);
```

```
Iteration - 2, Error - 46.1643
Iteration - 3, Error - 16.0667
Iteration - 4, Error - 5.44882
Iteration - 5, Error - 1.79689
Iteration - 6, Error - 0.577093
Iteration - 7, Error - 0.181242
Iteration - 8, Error - 0.0559416
Iteration - 9, Error - 0.0170484
Iteration - 10, Error - 0.00514904
Iteration - 11, Error - 0.0015455
Iteration - 12, Error - 0.000461924
Iteration - 13, Error - 0.000137666
Iteration - 14, Error - 4.09493e-05
Iteration - 15, Error - 1.21648e-05
Iteration - 16, Error - 3.61065e-06
Iteration - 17, Error - 1.07106e-06
Iteration - 18, Error - 3.17598e-07
Root found: 0.012385 after 18 iterations.
```

```
[root2] = newton1(x2,@function4,@function6,imax,tol);
```

```
Iteration - 2, Error - 0.057506
Iteration - 3, Error - 0.000208369
Iteration - 4, Error - 2.75192e-09
Root found: 1.11833 after 4 iterations.
```

```
x1 = linspace(-1,1,1000);
y1 = function3(x1);
y_root1 = function3(root1);
figure;
plot(x1,y1,'-b',root1,y_root1,'o');
yline(0,'-k');
xlabel('Iteration');
ylabel('Function');
title({'Newton'});

x2 = linspace(0,2,1000);
y2 = function4(x2);
y_root2 = function4(root2);
```

```
figure;
plot(x2,y2,'-b',root2,y_root2,'o');
yline(0,'-k');
title({'Newton'});
```

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

```
clc;
clear;
close all;

tol = 1e-6;
imax = 20;x3 = 4;
[root3] = newton1(x3,@function7,@function8,imax,tol);
```

```
Iteration - 2, Error - 0.0525228
Iteration - 3, Error - 8.7361e-05
Iteration - 4, Error - 2.46418e-10
Root found: 4.19493 after 4 iterations.
```

```
x3 = linspace(3,10,1000);
y3 = function7(x3);
y4 = function9(x3);
y5 = function10(x3);
y_root3 = function7(root3);
figure;
plot(x3,y3,'-b',root3,y_root3,'o');
hold on
plot(x3,y4,'-g');
plot(x3,y5,'-r');
yline(0,'-k');
title({'10log(x)'});
hold off
```

3 Newtons Intersect [6]

```
clc;
clear;
close all;

tol = 1e-6;
imax = 20;
x3 = 4;
[root4] = newton1(x3,@function7,@function8,imax,1e-10);
```

```
Iteration - 2, Error - 0.0525228
Iteration - 3, Error - 8.7361e-05
Iteration - 4, Error - 2.46418e-10
Iteration - 5, Error - 6.66134e-16
Root found: 4.19493 after 5 iterations.
```

```
x3 = linspace(3,10,1000);
y3 = function7(x3);
```

```

y_root4 = function7(root4);
figure;
plot(x3,y3,'-b',root4,y_root4,'o');
yline(0,'-k');
title({'Newton Intersect'});

```

4 Bracketing Bisect [6]

```

clc;
clear;
close all;

tol = 1e-6;
imax = 20;
a = 4;
b = 10;
[root,iterations] = bisectbracket(@function7,a,b,1000,imax,tol)

```

```

Root found: 4.19493
Root found: 5.96738
Root found: 8.00425
Root found: 9.99942
Roots found: [4.19493 5.96738 8.00425 9.99942]
Total iterations: 52
root = 1x4
    4.1949    5.9674    8.0043    9.9994
iterations =
    52

```

```

x1 = linspace(a,b,1000);
y1 = function7(x1);
y_root = function7(root);
figure;
plot(x1,y1,'-b',root,y_root,'o');
yline(0,'-k');
xlabel('Iteration');
ylabel('Function');
title({'Root of Sin(x)'});

```

4 Bracketing Newton [6]

```

clc;
clear;
close all;

% Define tolerance and maximum iterations
tol = 1e-6;
imax = 20;
x1 = 4;

% Call the Newton-Bracketing method
[root] = newtonbracket(x1, @function7, @function8, imax, tol);

```

Root found: 4.19493 after 3 iterations.
Root found: 5.96738 after 2 iterations.
Root found: 8.00425 after 1 iterations.
Root found: 9.99942 after 1 iterations.
All found roots: [4.19493157217558 5.96737875574713 8.00425307691197 9.99942161580608]

```
% Define the interval for plotting
x = linspace(-10, 10, 1000);
y1 = arrayfun(@function7, x);
y2 = arrayfun(@function8, x);

% Plot the functions
figure;
hold on;
grid on;
plot(x, y1, 'b', 'LineWidth', 2);

xlim([4 10])
yline(0, 'k--'); % Plot the x-axis
xlabel('x');
ylabel('f(x)');
title('Plot of Functions and Their Roots');
legend('Function 7');

% Plot the found roots
plot(root, zeros(size(root)), 'go', 'MarkerSize', 10, 'MarkerFaceColor', 'g');

grid on;
hold off;
```

