

UWTSD

Module

Task 2

ACHA7002

2504057

12/02/2025

Contents

1	Bisection	1
1.1	$fx = \sin x \sinh(x)$	1
1.2	$fx = R^2 - x^{21/2} - x \tan(x)$	2
2	Newton's method	2
2.1	Newton b $fx = ex - (1 + x + (x^2/2))$	3
2.2	Newton c $fx = 10 \log x - x$	4
3	Intersect plot $fx = 100e - x - 5 \sin(\pi x/2)$	5
4	Bracketing	6
4.1	Bisect $fx = 100e - x - 5 \sin(\pi x/2)$	6
4.2	Newton $fx = 100e - x - 5 \sin(\pi x/2)$	7
5	Appendices	7
5.1	Convergence table Bisection $fx = \sin x \sinh(x)$	7
5.2	Convergence table Bisection $fx = R^2 - x^{21/2} - x \tan(x)$	8
5.3	Convergence table Newton b $fx = ex - (1 + x + (x^2/2))$	8
5.4	Convergence table Newton c $fx = 10 \log x - x$	9
5.5	Convergence table Bisect $fx = 100e - x - 5 \sin(\pi x/2)$	9
5.6	Convergence table Newton $fx = 100e - x - 5 \sin(\pi x/2)$	10
5.7	Your code and functions	11

1 Bisection

A function was created based on equation 1.1 to solve roots using the bisection method

$$x_2 = (x_1 + x_3) / 2 \quad \text{Equation 1-1}$$

1.1 $f(x) = \sin(x) \sinh(x)$

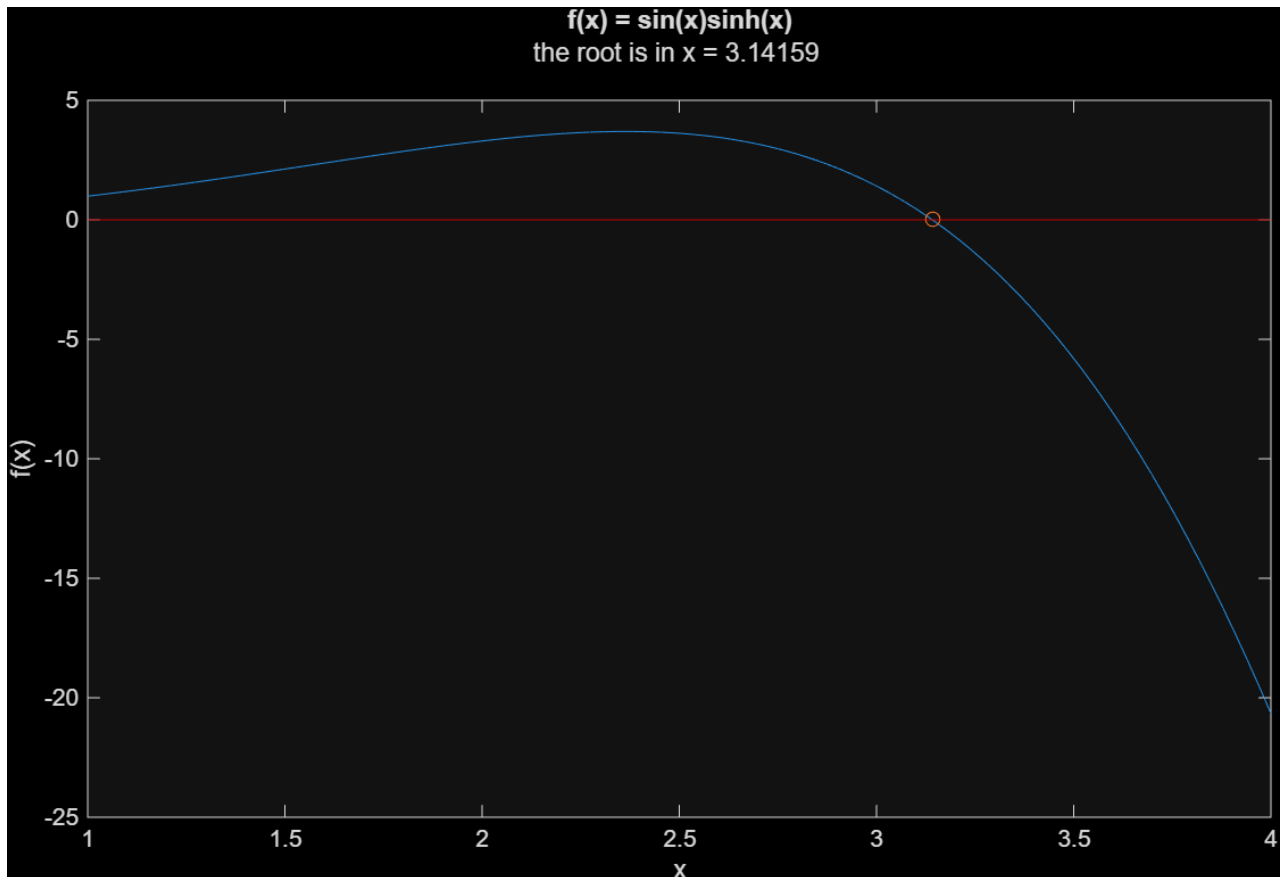


Figure 1-1

$$1.2 \quad f(x) = (R^2 - x^2)^{1/2} - x \tan(x)$$

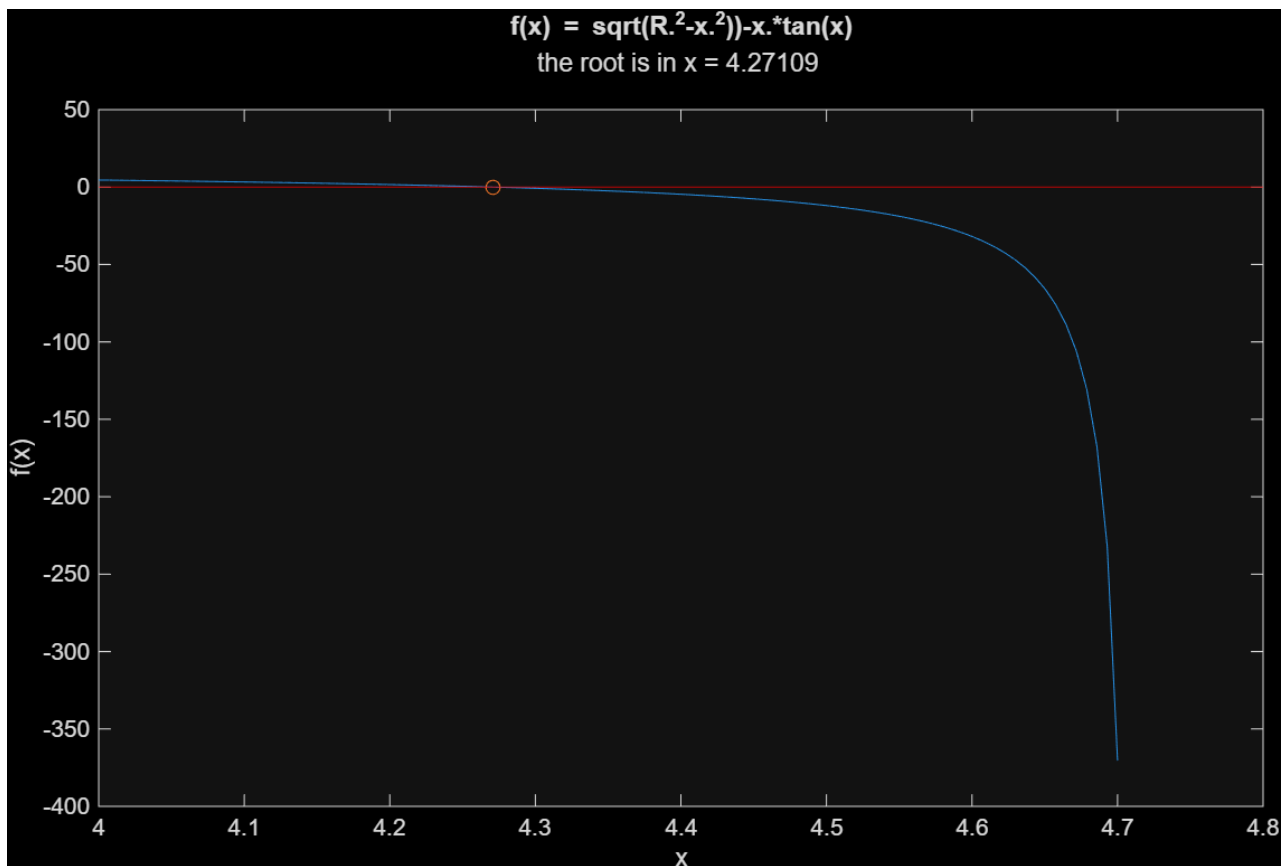


Figure 1-2

2 Newton's method

A function was made from equation 2.1 to evaluate roots with the newton method to use this method, functions and their derivative functions were created.

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad \text{Equation 2-1}$$

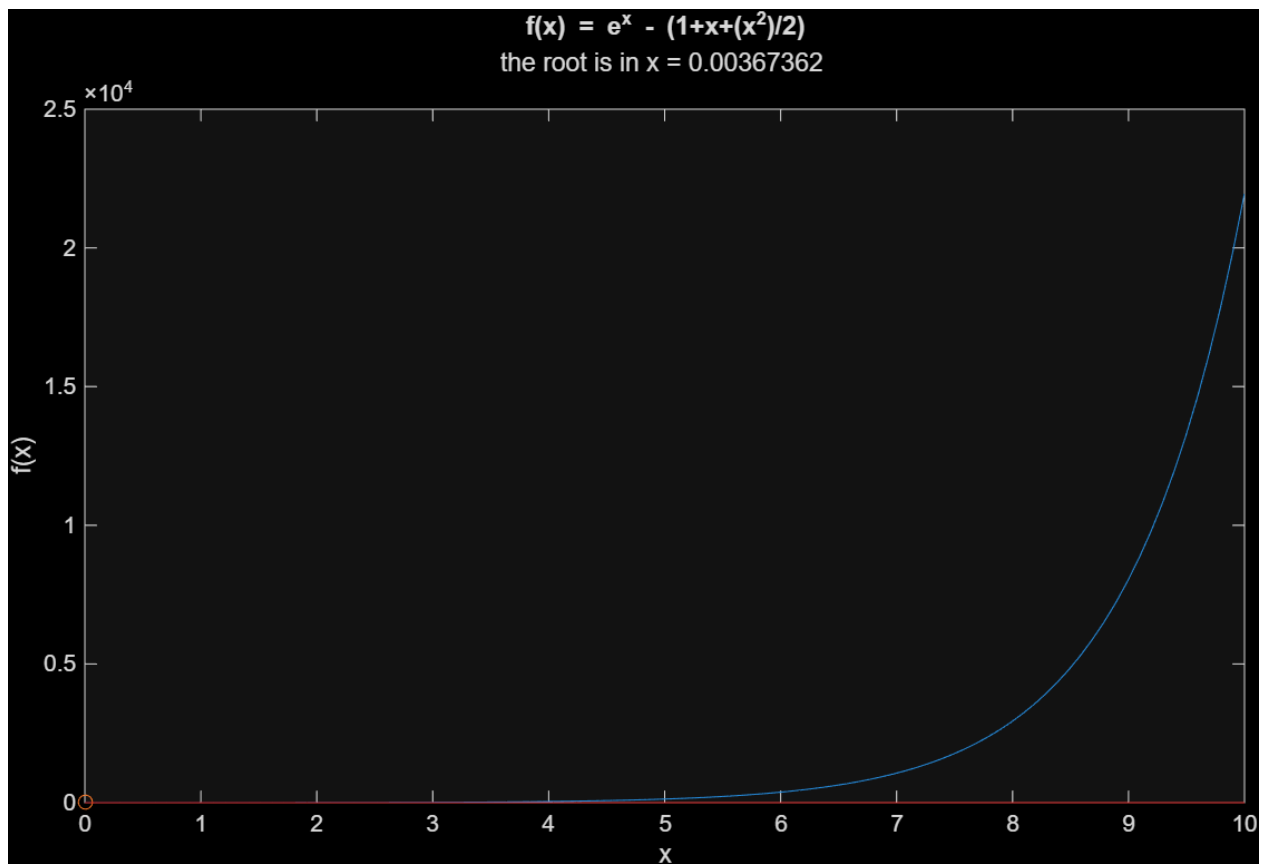
2.1 Newton b $f(x) = e^x - (1 + x + (x^2/2))$ 

Figure 2-1

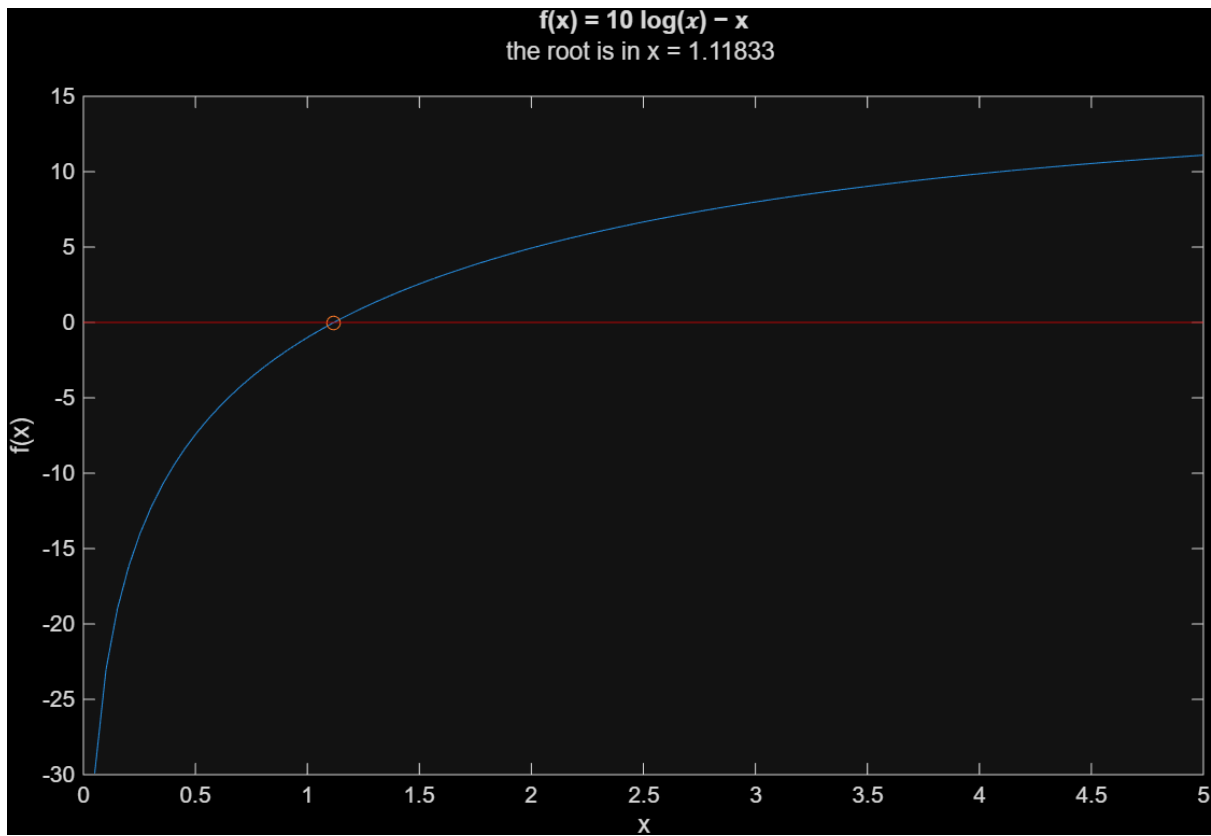
2.2 Newton c $f(x) = 10 \log(x) - x$ 

Figure 2-2

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

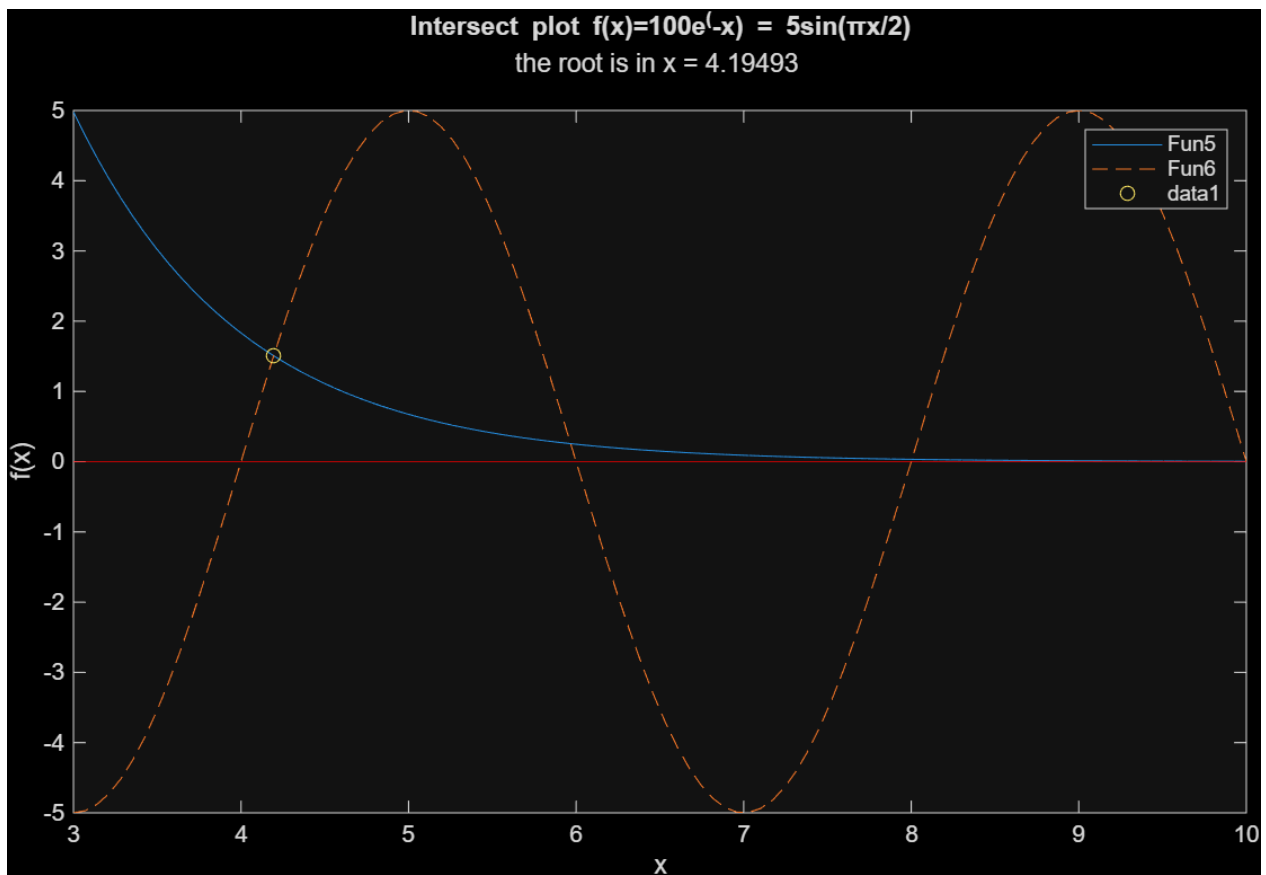


Figure 3-1

4 Bracketing

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

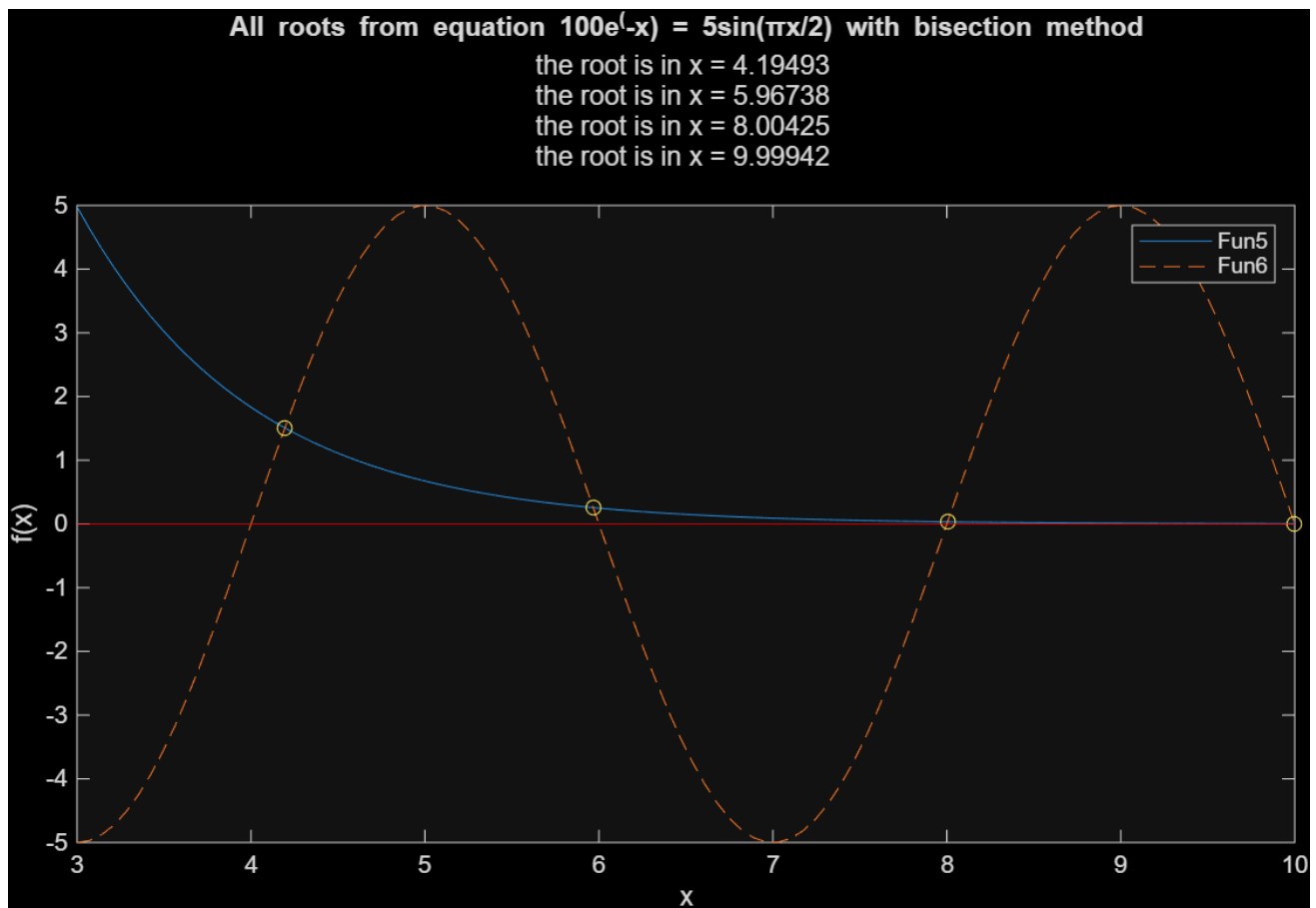


Figure 4-1 multiple roots Bisect for functions shown in legend

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

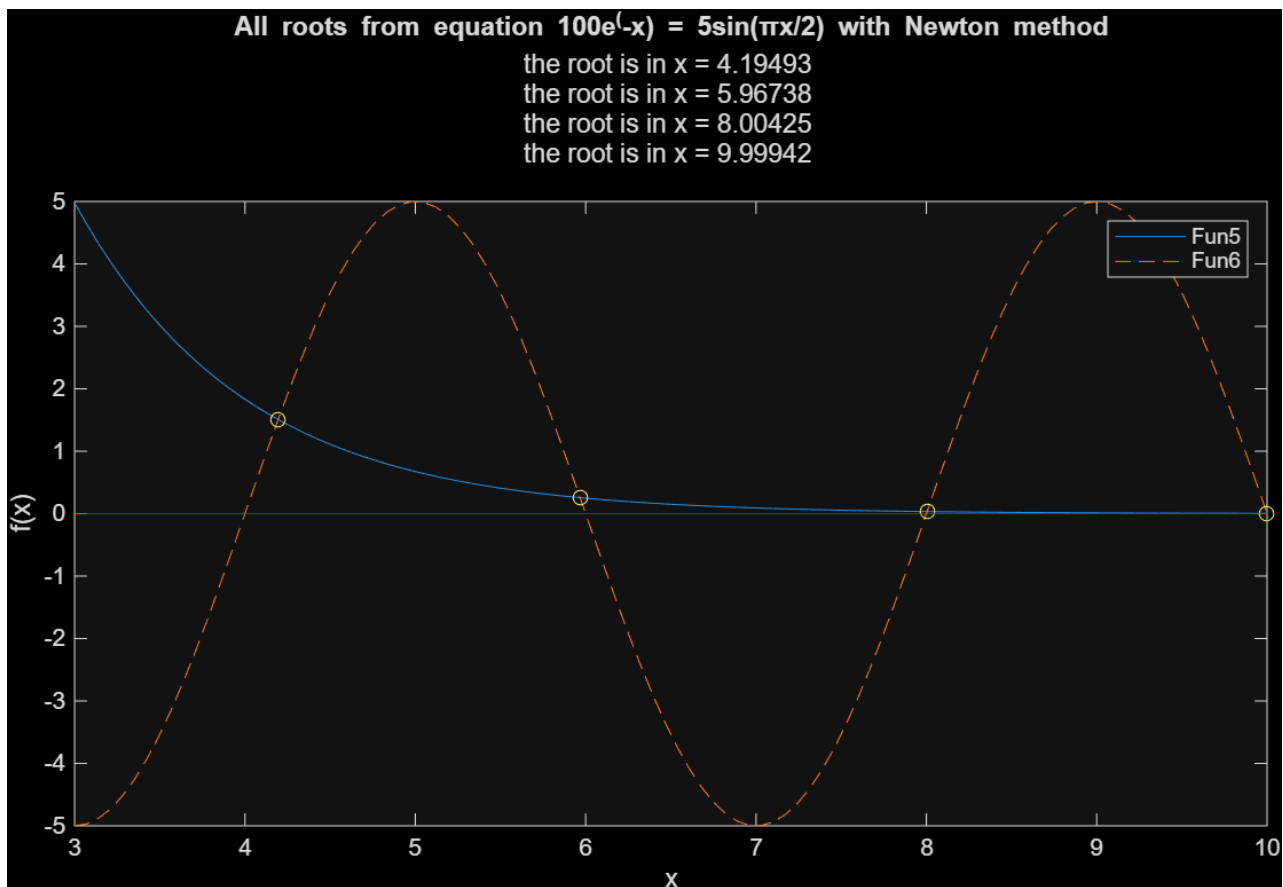


Figure 4-2 multiple roots Newton for functions shown in legend

5 Appendices

5.1 Convergence table Bisection $f(x) = \sin(x) \sinh(x)$

Root guess at x =	2.500000	after 1 iterations and an error of	1.500000e+00.
Root guess at x =	3.250000	after 2 iterations and an error of	7.500000e-01.
Root guess at x =	2.875000	after 3 iterations and an error of	3.750000e-01.
Root guess at x =	3.062500	after 4 iterations and an error of	1.875000e-01.
Root guess at x =	3.156250	after 5 iterations and an error of	9.375000e-02.
Root guess at x =	3.109375	after 6 iterations and an error of	4.687500e-02.
Root guess at x =	3.132812	after 7 iterations and an error of	2.343750e-02.
Root guess at x =	3.144531	after 8 iterations and an error of	1.171875e-02.
Root guess at x =	3.138672	after 9 iterations and an error of	5.859375e-03.
Root guess at x =	3.141602	after 10 iterations and an error of	2.929688e-03.
Root guess at x =	3.140137	after 11 iterations and an error of	1.464844e-03.
Root guess at x =	3.140869	after 12 iterations and an error of	7.324219e-04.
Root guess at x =	3.141235	after 13 iterations and an error of	3.662109e-04.
Root guess at x =	3.141418	after 14 iterations and an error of	1.831055e-04.
Root guess at x =	3.141510	after 15 iterations and an error of	9.155273e-05.
Root guess at x =	3.141556	after 16 iterations and an error of	4.577637e-05.
Root guess at x =	3.141579	after 17 iterations and an error of	2.288818e-05.
Root guess at x =	3.141590	after 18 iterations and an error of	1.144409e-05.

Root guess at x = 3.141596 after 19 iterations and an error of 5.722046e-06.
 Root guess at x = 3.141593 after 20 iterations and an error of 2.861023e-06.
 Root guess at x = 3.141592 after 21 iterations and an error of 1.430511e-06.
 Root guess at x = 3.141592 after 22 iterations and an error of 7.152557e-07.
Root found at x = 3.141592 after 23 iterations and an error of 7.152557e-07.

5.2 Convergence table Bisection $f(x) = (R^2 - x^2)^{1/2} - x \tan(x)$

Root guess at x = 4.350000 after 1 iterations and an error of 3.500000e-01.
 Root guess at x = 4.175000 after 2 iterations and an error of 1.750000e-01.
 Root guess at x = 4.262500 after 3 iterations and an error of 8.750000e-02.
 Root guess at x = 4.306250 after 4 iterations and an error of 4.375000e-02.
 Root guess at x = 4.284375 after 5 iterations and an error of 2.187500e-02.
 Root guess at x = 4.273437 after 6 iterations and an error of 1.093750e-02.
 Root guess at x = 4.267969 after 7 iterations and an error of 5.468750e-03.
 Root guess at x = 4.270703 after 8 iterations and an error of 2.734375e-03.
 Root guess at x = 4.272070 after 9 iterations and an error of 1.367187e-03.
 Root guess at x = 4.271387 after 10 iterations and an error of 6.835937e-04.
 Root guess at x = 4.271045 after 11 iterations and an error of 3.417969e-04.
 Root guess at x = 4.271216 after 12 iterations and an error of 1.708984e-04.
 Root guess at x = 4.271130 after 13 iterations and an error of 8.544922e-05.
 Root guess at x = 4.271088 after 14 iterations and an error of 4.272461e-05.
 Root guess at x = 4.271109 after 15 iterations and an error of 2.136230e-05.
 Root guess at x = 4.271098 after 16 iterations and an error of 1.068115e-05.
 Root guess at x = 4.271093 after 17 iterations and an error of 5.340576e-06.
 Root guess at x = 4.271096 after 18 iterations and an error of 2.670288e-06.
 Root guess at x = 4.271094 after 19 iterations and an error of 1.335144e-06.
 Root guess at x = 4.271095 after 20 iterations and an error of 6.675720e-07.
Root found at x = 4.271095 after 21 iterations and an error of 6.675720e-07.

5.3 Convergence table Newton b $f(x) = e^x - (1 + x + (x^2/2))$

Root guess at x = 4.087773 after 1 iterations and an error of 9.122272e-01.
 Root guess at x = 3.241020 after 2 iterations and an error of 8.467523e-01.
 Root guess at x = 2.487381 after 3 iterations and an error of 7.536393e-01.
 Root guess at x = 1.849522 after 4 iterations and an error of 6.378593e-01.
 Root guess at x = 1.337187 after 5 iterations and an error of 5.123353e-01.
 Root guess at x = 0.944907 after 6 iterations and an error of 3.922797e-01.
 Root guess at x = 0.656151 after 7 iterations and an error of 2.887557e-01.
 Root guess at x = 0.449883 after 8 iterations and an error of 2.062677e-01.
 Root guess at x = 0.305706 after 9 iterations and an error of 1.441774e-01.
 Root guess at x = 0.206451 after 10 iterations and an error of 9.925453e-02.
 Root guess at x = 0.138834 after 11 iterations and an error of 6.761720e-02.
 Root guess at x = 0.093096 after 12 iterations and an error of 4.573777e-02.
 Root guess at x = 0.062307 after 13 iterations and an error of 3.078993e-02.
 Root guess at x = 0.041646 after 14 iterations and an error of 2.066057e-02.
 Root guess at x = 0.027812 after 15 iterations and an error of 1.383368e-02.
 Root guess at x = 0.018563 after 16 iterations and an error of 9.249240e-03.
 Root guess at x = 0.012385 after 17 iterations and an error of 6.178103e-03.
 Root guess at x = 0.008261 after 18 iterations and an error of 4.124055e-03.

Root guess at $x = 0.005509$ after 19 iterations and an error of $2.751737e-03$.
Root guess at $x = 0.003674$ after 20 iterations and an error of $1.835545e-03$.
 Maximum iterations reached without convergence in $x = 0.003674$

5.4 Convergence table Newton c $f(x) = 10 \log(x) - x$

Root guess at $x = 1.111111$ after 1 iterations and an error of $1.111111e-01$.
 Root guess at $x = 1.118299$ after 2 iterations and an error of $7.188244e-03$.
 Root guess at $x = 1.118326$ after 3 iterations and an error of $2.623582e-05$.
 Root guess at $x = 1.118326$ after 4 iterations and an error of $3.465053e-10$.
Root found at $x = 1.118326$ after 4 iterations and an error of $3.465053e-10$.

5.5 Convergence table Bisect $f(x) = 100e^{-x} - 5\sin(\pi x/2)$

Root guess at $x = 4.212121$ after 1 iterations and an error of $3.030303e-02$.
 Root guess at $x = 4.196970$ after 2 iterations and an error of $1.515152e-02$.
 Root guess at $x = 4.189394$ after 3 iterations and an error of $7.575758e-03$.
 Root guess at $x = 4.193182$ after 4 iterations and an error of $3.787879e-03$.
 Root guess at $x = 4.195076$ after 5 iterations and an error of $1.893939e-03$.
 Root guess at $x = 4.194129$ after 6 iterations and an error of $9.469697e-04$.
 Root guess at $x = 4.194602$ after 7 iterations and an error of $4.734848e-04$.
 Root guess at $x = 4.194839$ after 8 iterations and an error of $2.367424e-04$.
 Root guess at $x = 4.194957$ after 9 iterations and an error of $1.183712e-04$.
 Root guess at $x = 4.194898$ after 10 iterations and an error of $5.918561e-05$.
 Root guess at $x = 4.194928$ after 11 iterations and an error of $2.959280e-05$.
 Root guess at $x = 4.194943$ after 12 iterations and an error of $1.479640e-05$.
 Root guess at $x = 4.194935$ after 13 iterations and an error of $7.398201e-06$.
 Root guess at $x = 4.194931$ after 14 iterations and an error of $3.699100e-06$.
 Root guess at $x = 4.194933$ after 15 iterations and an error of $1.849550e-06$.
 Root guess at $x = 4.194932$ after 16 iterations and an error of $9.247751e-07$.
Root found at $x = 4.194932$ after 17 iterations and an error of $9.247751e-07$.
 Root guess at $x = 5.969697$ after 1 iterations and an error of $3.030303e-02$.
 Root guess at $x = 5.954545$ after 2 iterations and an error of $1.515152e-02$.
 Root guess at $x = 5.962121$ after 3 iterations and an error of $7.575758e-03$.
 Root guess at $x = 5.965909$ after 4 iterations and an error of $3.787879e-03$.
 Root guess at $x = 5.967803$ after 5 iterations and an error of $1.893939e-03$.
 Root guess at $x = 5.966856$ after 6 iterations and an error of $9.469697e-04$.
 Root guess at $x = 5.967330$ after 7 iterations and an error of $4.734848e-04$.
 Root guess at $x = 5.967566$ after 8 iterations and an error of $2.367424e-04$.
 Root guess at $x = 5.967448$ after 9 iterations and an error of $1.183712e-04$.
 Root guess at $x = 5.967389$ after 10 iterations and an error of $5.918561e-05$.
 Root guess at $x = 5.967359$ after 11 iterations and an error of $2.959280e-05$.
 Root guess at $x = 5.967374$ after 12 iterations and an error of $1.479640e-05$.
 Root guess at $x = 5.967381$ after 13 iterations and an error of $7.398201e-06$.
 Root guess at $x = 5.967378$ after 14 iterations and an error of $3.699100e-06$.
 Root guess at $x = 5.967379$ after 15 iterations and an error of $1.849550e-06$.
 Root guess at $x = 5.967379$ after 16 iterations and an error of $9.247751e-07$.
Root found at $x = 5.967379$ after 17 iterations and an error of $9.247751e-07$.
 Root guess at $x = 8.030303$ after 1 iterations and an error of $3.030303e-02$.
 Root guess at $x = 8.015152$ after 2 iterations and an error of $1.515152e-02$.
 Root guess at $x = 8.007576$ after 3 iterations and an error of $7.575758e-03$.
 Root guess at $x = 8.003788$ after 4 iterations and an error of $3.787879e-03$.

```

Root guess at x = 8.005682 after 5 iterations and an error of 1.893939e-03.
Root guess at x = 8.004735 after 6 iterations and an error of 9.469697e-04.
Root guess at x = 8.004261 after 7 iterations and an error of 4.734848e-04.
Root guess at x = 8.004025 after 8 iterations and an error of 2.367424e-04.
Root guess at x = 8.004143 after 9 iterations and an error of 1.183712e-04.
Root guess at x = 8.004202 after 10 iterations and an error of 5.918561e-05.
Root guess at x = 8.004232 after 11 iterations and an error of 2.959280e-05.
Root guess at x = 8.004247 after 12 iterations and an error of 1.479640e-05.
Root guess at x = 8.004254 after 13 iterations and an error of 7.398201e-06.
Root guess at x = 8.004250 after 14 iterations and an error of 3.699100e-06.
Root guess at x = 8.004252 after 15 iterations and an error of 1.849550e-06.
Root guess at x = 8.004253 after 16 iterations and an error of 9.247751e-07.
Root found at x = 8.004253 after 17 iterations and an error of 9.247751e-07.
Root guess at x = 9.969697 after 1 iterations and an error of 3.030303e-02.
Root guess at x = 9.984848 after 2 iterations and an error of 1.515152e-02.
Root guess at x = 9.992424 after 3 iterations and an error of 7.575758e-03.
Root guess at x = 9.996212 after 4 iterations and an error of 3.787879e-03.
Root guess at x = 9.998106 after 5 iterations and an error of 1.893939e-03.
Root guess at x = 9.999053 after 6 iterations and an error of 9.469697e-04.
Root guess at x = 9.999527 after 7 iterations and an error of 4.734848e-04.
Root guess at x = 9.999290 after 8 iterations and an error of 2.367424e-04.
Root guess at x = 9.999408 after 9 iterations and an error of 1.183712e-04.
Root guess at x = 9.999467 after 10 iterations and an error of 5.918561e-05.
Root guess at x = 9.999438 after 11 iterations and an error of 2.959280e-05.
Root guess at x = 9.999423 after 12 iterations and an error of 1.479640e-05.
Root guess at x = 9.999416 after 13 iterations and an error of 7.398201e-06.
Root guess at x = 9.999419 after 14 iterations and an error of 3.699100e-06.
Root guess at x = 9.999421 after 15 iterations and an error of 1.849550e-06.
Root guess at x = 9.999422 after 16 iterations and an error of 9.247751e-07.
Root found at x = 9.999422 after 17 iterations and an error of 9.247751e-07.

```

5.6 Convergence table Newton $f(x) = 100e^{-x} - 5\sin(\pi x/2)$

```

Root guess at x = 4.194883 after 1 iterations and an error of 1.306522e-02.
Root guess at x = 4.194932 after 2 iterations and an error of 4.816810e-05.
Root guess at x = 4.194932 after 3 iterations and an error of 6.738610e-10.
Root found at x = 4.194932 after 3 iterations and an error of 6.738610e-10.
Root guess at x = 5.967444 after 1 iterations and an error of 2.804978e-02.
Root guess at x = 5.967379 after 2 iterations and an error of 6.496833e-05.
Root guess at x = 5.967379 after 3 iterations and an error of 2.467511e-10.
Root found at x = 5.967379 after 3 iterations and an error of 2.467511e-10.
Root guess at x = 8.004253 after 1 iterations and an error of 4.253077e-03.
Root guess at x = 8.004253 after 2 iterations and an error of 6.991717e-08.
Root found at x = 8.004253 after 2 iterations and an error of 6.991717e-08.
Root guess at x = 9.999604 after 1 iterations and an error of 6.021000e-02.
Root guess at x = 9.999422 after 2 iterations and an error of 1.823283e-04.
Root guess at x = 9.999422 after 3 iterations and an error of 2.836487e-11.
Root found at x = 9.999422 after 3 iterations and an error of 2.836487e-11.

```

5.7 Your code and functions

```
% Clear the space
clc, clear, close all

%% Root Solving
% 1. Bisection Method
% Exercise a) in script function call "bisect"
% Exercise b) in script function call "Fun1"
% Exercise c) in script function call "Fun2"
x1 = linspace(1, 4,100); % Interval for the function created in Fun1
x2 = linspace(4, 4.7,100); % Interval for the function created in Fun2
y1 = Fun1(x1);
y2 = Fun2(x2);

%% d) evaluate first function

x_root_Fun1 = bisect('Fun1',1,4,50,1e-6);

%% d) evaluate second function
x_root_Fun2 = bisect('Fun2',4,4.7,50,1e-6);

%% e) plotting the function and marking the root wit "o"
% For Fun1 from the exercise b)
y_root_Fun1 = Fun1(x_root_Fun1);

figure(1);
plot(x1,y1,'-',x_root_Fun1,y_root_Fun1,'o')
yline(0,'r') % line in y=0
xlabel('x');
ylabel('f(x)');
title('f(x) = sin(x)sinh(x)')
subtitle(sprintf('the root is in x = %g \n', x_root_Fun1))

% For Fun2 from the exercise c)
y_root_Fun2 = Fun2(x_root_Fun2);

figure(2);
plot(x2,y2,'-',x_root_Fun2,y_root_Fun2,'o')
yline(0,'r') % line in y=0
xlabel('x');
ylabel('f(x)');
title('f(x) = sqrt(R.^2-x.^2)-x.*tan(x)')
subtitle(sprintf('the root is in x = %g \n', x_root_Fun2))

%%
% 2. Newton's Method
% Exercise a) in script function call "newton"
% Exercise b) in script function call "Fun3"
% Exercise c) in script function call "Fun4"

% d) evaluate function from b)
x_root_Fun3_newton = newton(5,'Fun3', 'Deriv_Fun3',20, 1e-6); % Maximun number of
iteration achive

%% d) evaluate function from c)
x_root_Fun4_newton = newton(1,'Fun4', 'Deriv_Fun4',20, 1e-6);
```

```

%% e) plotting the function and marking the root wit "o"
x3 = linspace(0,10,100); % Interval for the function created in Fun3
x4 = linspace(0, 5,100); % Interval for the function created in Fun4
y3 = Fun3(x3);
y4 = Fun4(x4);
y_root_Fun3 = Fun3(x_root_Fun3_newton);

figure(3);
plot(x3,y3,'-',x_root_Fun3_newton,y_root_Fun3,'o')
yline(0,'r') % line in y=0
xlabel('x');
ylabel('f(x)');
title('f(x) = e^x - (1+x+(x^2)/2)')
subtitle(sprintf('the root is in x = %g \n', x_root_Fun3_newton))

% For Fun4 from the section c)
y_root_Fun4 = Fun4(x_root_Fun4_newton);

figure(4);
plot(x4,y4,'-',x_root_Fun4_newton,y_root_Fun4,'o')
yline(0,'r') % line in y=0
xlabel('x');
ylabel('f(x)');
title('f(x) = 10 log(x) - x')
subtitle(sprintf('the root is in x = %g \n', x_root_Fun4_newton))

%% 3. Newton's Method - Intersection of two functions
% b) plot both functions Fun5 and Fun6 in the desire interval
x5 = linspace(3, 10, 100);
y5 = Fun5(x5);
y6 = Fun6(x5);

figure(5)
plot(x5, y5, '-', x5, y6, '--');
yline(0,'r') % line in y=0
xlabel('x');
ylabel('f(x)');
title('Intersect plot f(x)=100e^(-x) = 5sin(400*(pi*x/2))');
legend('Fun5', 'Fun6');
hold on

% c) With Newton function get the root from Fun7 around x = 4. Fun7 correspond to
equation (*).

x_root_Fun7_newton = newton(4,'Fun7', 'Deriv_Fun7',20, 1e-10);
y_root_Fun7 = Fun6(x_root_Fun7_newton);
plot(x_root_Fun7_newton,y_root_Fun7, 'o')
subtitle(sprintf('the root is in x = %g \n', x_root_Fun7_newton))
hold off

%% 4. Bracketing (Multiple Roots)
% a) Bracketing routine
x6 = linspace(4,10,100); % Define interval
y7 = Fun7(x6); % Evaluate Fun7 over the interval x6
figure(6)
plot(x6,y7)
brackets = [];
for k = 1:length(x6)-1

```

```

        % Check if function changes sign
        if y7(k) * y7(k+1) < 0
            % sign change → root bracket
            brackets = [brackets; x6(k), x6(k+1)];
        end
    end

%% b) Bisection routines to determine the position for all roots in this interval
to a tolerance of 1e-6.
all_roots_Fun7_bisect = zeros(1,length(brackets));
for i = 1:length(brackets)

    all_roots_Fun7_bisect(i) = bisect('Fun7',brackets(i,1),brackets(i,2),50,1e-6);

end

%% b) Newton routines to determine the position for all roots in this interval to
a tolerance of 1e-6.
all_roots_Fun7_newton = zeros(1,length(brackets));
for j = 1:length(brackets)

    all_roots_Fun7_newton(j) = newton(brackets(j,1), 'Fun7', 'Deriv_Fun7', 50, 1e-
6);

end

%% c) Plotting equation (**) for the range  $4 \leq x \leq 10$ , Indicating the position of
all roots with bisection method
f_all_roots_Fun7_bisect = Fun6(all_roots_Fun7_bisect);
figure(7)
plot(x5, y5, '-', x5, y6, '--', all_roots_Fun7_bisect, f_all_roots_Fun7_bisect, 'o');
yline(0, 'r') % line in y=0
xlabel('x');
ylabel('f(x)');
title('All roots from equation  $100e^{-x} = 5\sin(\pi x/2)$  with bisection method');
subtitle(sprintf('the root is in x = %g \n', all_roots_Fun7_bisect))
legend('Fun5', 'Fun6');

%% c) Plotting equation (**) for the range  $4 \leq x \leq 10$ , Indicating the position of
all roots with Newton's method
f_all_roots_Fun7_newton = Fun6(all_roots_Fun7_newton);
figure(8)
plot(x5, y5, '-', x5, y6, '--', all_roots_Fun7_newton, f_all_roots_Fun7_newton, 'o');
yline(0, 'r') % line in y=0
xlabel('x');
ylabel('f(x)');
title('All roots from equation  $100e^{-x} = 5\sin(\pi x/2)$  with Newton method');
subtitle(sprintf('the root is in x = %g \n', all_roots_Fun7_newton))
legend('Fun5', 'Fun6');

-----

% a) bisection function in MATLAB
function root = bisect(f,a,b,imax,tol)
% Input:
% f --> function to be evaluated
% a,b --> interval limits
% imax --> maximum number of iterations
% tol --> convergence criterion

```

```

% Output:
% root --> x position of the root
% initialise parameters
x1=a;
f1=feval(f,x1);
x3=b;
f3=feval(f,x3);
i=1;
% CHECK: verify that there is indeed a root in the interval [a b].
if f1*f3>0
    fprintf('No root in the specified interval')
end

% Begin iteration loop
while abs(x3 - x1) > tol && i< imax % Limit of interaction

    x2 = (x3+x1)/2;
    f2 = feval(f, x2);
    root = x2;
    % Find which half interval contains root
    if f2 == 0
        root = x2;

    elseif f1 * f2 < 0
        x3 = x2;
        f3 = f2;
    else
        x1 = x2;
        f1 = f2;
    end
    fprintf('Root guess at x = %10.6f after %d iterations and an error of %d.\n',
    root, i, abs(x3 - x1)); % Convergence table

    i = i + 1;

end
fprintf('Root found at x = %10.6f after %d iterations and an error of %d.\n',
root, i, abs(x3 - x1)) %final guess

-----

% b) Create function f(x) = sin(x)*sinh(x)
function y = Fun1(x)

y = sin(x).*sinh(x);

end

-----

% c) Create function f(x) = sqrt(R.^2-x.^2))-x.*tan(x).
function y = Fun2(x)

R =10;
y = (sqrt(R.^2-x.^2))-x.*tan(x);

end

```

```
-----

% a) Creation of Newton function
function root = newton(x,f,df,imax,tol)
% Inputs:
% x --> initial guess for the root
% f --> function to be evaluated
% df --> derivative of f respect to x
% imax --> maximum number of iterations
% tol --> convergence criterion
% Output:
% root --> x position of the root
% NB: both f and df are user coded functions

% initialise parameters.
xold=x;
dist = feval(f,xold)./feval(df,xold); %difference between our initial point and
root guess

count=1;
while abs(dist)>tol && count <= imax
    if df == 0 % CHECK: verify that the derivative is not zero.
        error('Problem')
    end
    % calculate equation 4
    root = xold - feval(f,xold) / feval(df, xold); % Update the root guess
    dist = abs(xold - root); % Update the distance for convergence check
    xold = root; % Prepare for the next iteration
    fprintf('Root guess at x = %10.6f after %d iterations and an error of %d.\n',
    root, count, dist); % Convergence table

    if count > imax % CHECK: Excessive iterations
        fprintf('Maximum iterations reached without convergence in x = %10.6f
\n',root);
    elseif abs(dist)<tol && count< imax
        fprintf('Root found at x = %10.6f after %d iterations and an error of %d.\n',
    root, count, dist); % final guess
    end
    count=count+1;
end

-----

% b) Create function  $f(x) = e^x - (1+x+(x^2)/2)$ 
function y = Fun3(x)

y = exp(x) - (1+x+(x.^2)./2);

end

-----
```

```
% b) Create derivate of function  $f(x) = e^x - (1+x+(x^2)/2)$   
function y = Deriv_Fun3(x)
```

```
y = exp(x) - (1+x);
```

```
end
```

```
% c) Create function  $f(x) = 10 \log(x) - x$   
function y = Fun4(x)
```

```
y = 10.*log(x)-x;
```

```
end
```

```
% c) Create derivate of function  $f(x) = 10 \log(x) - x$   
function y = Deriv_Fun4(x)
```

```
y = (10/x)-1;
```

```
end
```

```
% b) Create function  $100 e^{-x}$   
function y = Fun5(x)
```

```
y = 100.*exp(-x);
```

```
end
```

```
% b) Create function  $5\sin((\pi*x)/2)$   
function y = Fun6(x)
```

```
y = 5.*sin((pi.*x)/2);
```

```
end
```

```
% c) Create derivate of function  $f(x) = 5\sin(\pi x/2)$   
function y = Deriv_Fun6(x)
```

```
y = (5.*pi.*cos((pi.*x)/2))/2;
```

```
end
```

```
% b) Create function  $100.\exp(-x) - 5\sin(\pi x/2)$   
function y = Fun7(x)
```

```
y = 100.*exp(-x) - 5.*sin((pi.*x)/2);
```

```
end
```

```
% c) Create derivate of function  $f(x) = 100.\exp(-x) - 5\sin(\pi x/2)$   
function y = Deriv_Fun7(x)
```

```
y = -100.*exp(-x) - (5.*pi.*cos((pi.*x)/2))/2;
```

```
end
```