

Root Finding

Bisection Method:

☐ Find the root of the function $f(x) = x e^x - 1$ by bisection method.

Solⁿ :

The code for finding the root of the function is below:

```
% Functions
f = @(x) x*exp(x)-1;
a = input('Enter the first value: ');
b = input('Enter the second value: ');
n = input('Enter number of iteration: ');
e = input('Enter number of tolerance: ');

if f(a)*f(b) < 0
    for i=1:n
        c = (a+b)/2;
        fprintf('P%d = %.4f \n',i,c)
        if abs(c-b)<e || abs (c-a)<e
            break
        end
        if f(a)*f(c)<0
            b=c;
        elseif f(b)*f(c)<0
            a=c;
        end
    end
else
    disp('No Roots between given brackets')
end
```

```
P1 = 0.5000
P2 = 0.7500
P3 = 0.6250
P4 = 0.5625
P5 = 0.5938
P6 = 0.5781
P7 = 0.5703
P8 = 0.5664
```

☐ Find the root of the function $f(x) = x e^x - 1$ by iteration method.

Solⁿ :

The code for finding the root of the function is below:

```
% define functions
```

```

f = @(x) x*exp(x)-1;
g = @(x)exp(-x);
x0 = input('Enter the initial guess: ');
e = input('Enter tolerance: ');
flag = true;
i = 0;

% performing iteration method
while flag == true && i<100
    x = g(x0);
    if abs(x-x0)<e
        flag = false;
    end
    x0 = x;
    i = i+1;
    disp([x, x-exp(-x), i])
end

```

0.6065	0.0613	1.0000
0.5452	-0.0345	2.0000
0.5797	0.0196	3.0000
0.5601	-0.0111	4.0000
0.5712	0.0063	5.0000
0.5649	-0.0036	6.0000
0.5684	0.0020	7.0000

○ Find the root of the function $f(x) = x e^x - 1$ by Newton-Raphson method.

Solⁿ :

The code for finding the root of the function is below:

```

% define function
f = @(x) x*exp(x)-1;
g = @(x) exp(x)+x*exp(x);
n = 20;
x0 = input('Enter the initial guess: ');
e = input('Enter number of tolerance: ');
flag = true;
i = 0;

% performing Newton-Raphson method
if g(x0)~= 0
    for i =1:n
        x1 = x0 - f(x0)/g(x0);
        fprintf("x%d = %.20f\n",i,x1)
        if abs(x1-x0)<e

```

```

        break
    end
    x0 =x1;
end
else
    disp("newton rhapson failed")
end

```

```

x1 = 0.68393972058572116701
x2 = 0.57745447715444975234
x3 = 0.56722973773011708953
x4 = 0.56714329653029593725

```

○ Find the root of the function $f(x) = x e^x - 1$ by Regula-Falsi method.

Solⁿ :

The code for finding the root of the function is below:

```

% inputs and function
f = @(x) x*exp(x)-1;
a = input('Enter the first value: ');
b = input('Enter the second value: ');
n = input('Enter number of iteration: ');
e = input('Enter number of tolerance: ');

% performing Regula-Falsi
if f(a)*f(b) < 0
    for i=1:n
        c = ((b*f(a)-a*f(b))/(f(b)-f(a)))
        fprintf('P%d = %.4f \n',i,c)
        if abs(c-b)<e || abs (c-a)<e
            break
        end
        if f(a)*f(c)<0
            b=c;
        elseif f(b)*f(c)<0
            a=c;
        end
    end
else
    disp('No Roots between given brackets')
end

```

```

c = -0.3679
P1 = -0.3679
c = -0.2094
P2 = -0.2094
c = -0.2805
P3 = -0.2805
c = -0.2491
P4 = -0.2491
c = -0.2631
P5 = -0.2631
c = -0.2569
P6 = -0.2569

```

c = -0.2596
P7 = -0.2596