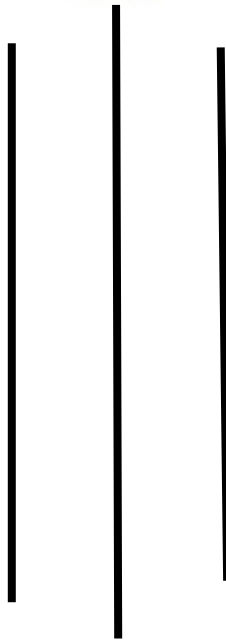


NEPAL ENGINEERING COLLEGE

(AFFILIATED TO POKHARA UNIVERSITY)

Changunarayan, Bhaktapur



REPORT ON:

Root of Nonlinear Equation Using Secant Method

SUBMITTED BY:

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CRN: 020-626

SUBMITTED TO:

Electrical and

Electronics

Experiment no:-4

TITLE:-

ROOT OF NONLINEAR EQUATION USING SECANT METHOD.

OBJECTIVE:-

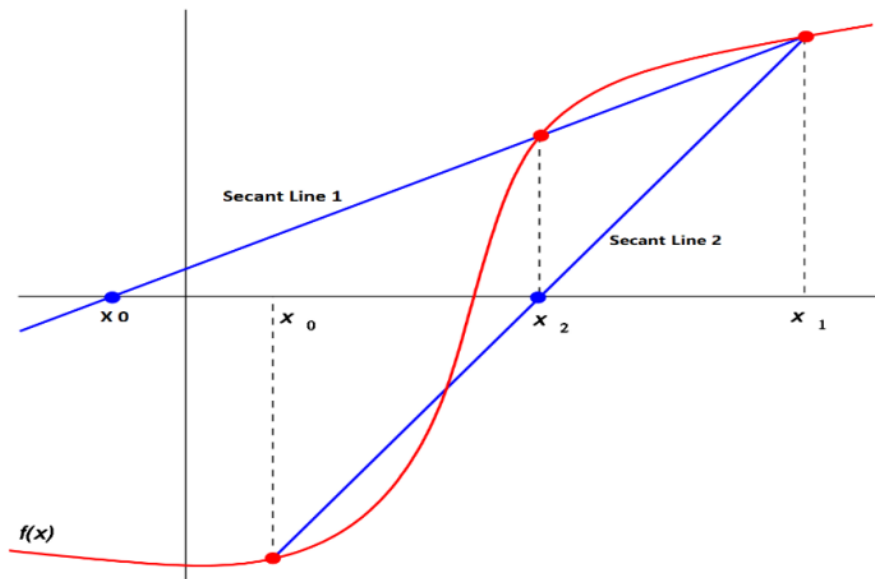
To implement and calculate the root using the Secant method on Matlab and C-programming.

THEORY:-

Introduction: A root finding algorithm which assumes a function to be approximately linear in the region of interest. Each improvement is taken as the point where the approximating line crosses the axis. The secant method retains only the most recent estimate, so the root does not necessarily remain bracketed.

Let x_1 and x_2 be the initial guesses. The point of intersection between x-axis and secant line (i.e. x_0) gives the next estimate of a root.

$$x_0 = \frac{x_1 f(x_2) - x_2 f(x_1)}{f(x_2) - f(x_1)}$$



Algorithm:

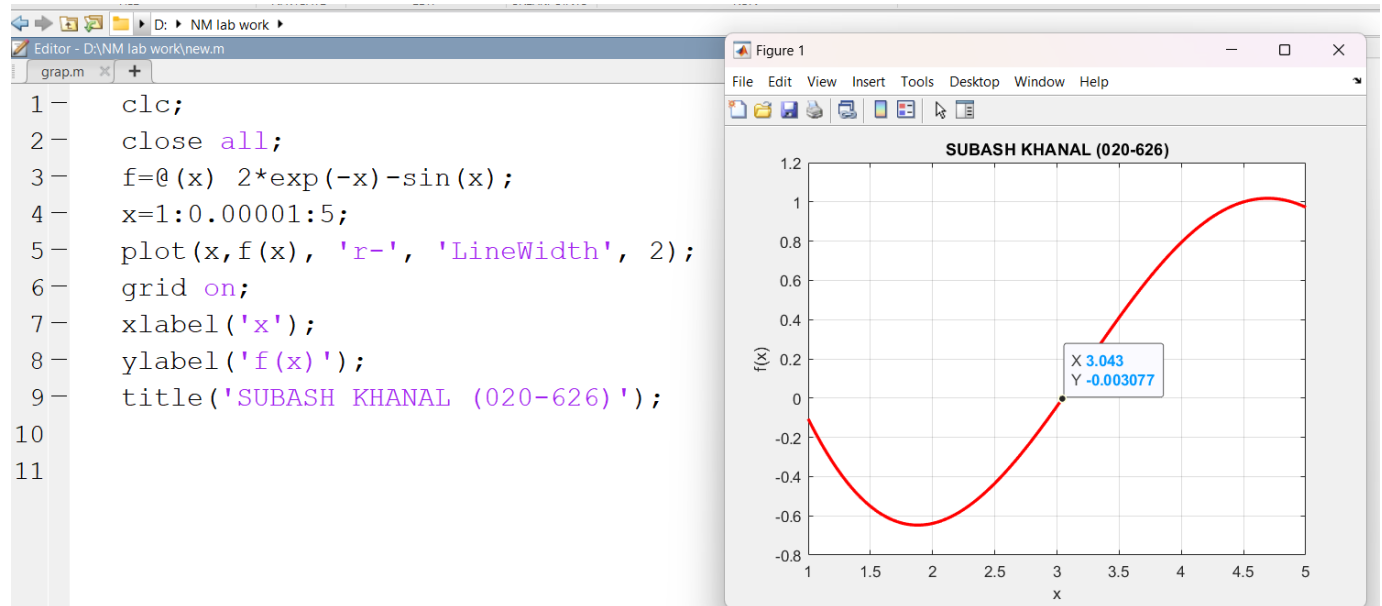
1. Decide initial value x_1 and x_2 .
2. Compute $x_0 = \frac{x_1 f(x_2) - x_2 f(x_1)}{f(x_2) - f(x_1)}$
3. Set $x_1 = x_2$ and $x_2 = x_0$
4. If absolute value of $f(x_0)$ is less than or equal to given limit, then $root = x_0$
5. Display the value of root.
6. Stop

Question: Implement above algorithm in MATLAB to calculate a root of the following equations

a) $2e^{-x} - \sin x$

Solution:-

Graph of the given Function:-



So from the above the root is nearly equal to -3.043.

Using C-programming

Syntax:-

```
/* finding the root of non-linear question
prepared by:-
Subash khalal
crn: 020-626 */

#include<stdio.h>
#include<conio.h>
#include<math.h>
float f(float x)
{
    return(2*exp(-x)-sin(x)); // defining the function
}
int main()
{
    float x0,x1,x2,d,e;
    int count=1,n;
    // programmer details
    printf("Secant Method prepared by:-\n Subash khalal\n\n");
    // guessing initial values taking from user
    printf("Enter the values of a and b:\n");
    scanf("%f%f",&x0,&x1);
    // for error taking from user
    printf("Enter the values of allowed error \n");
    scanf("%f",&e);
    // for the maximum number of iteration taking from user
    printf("Enter the maximum number of iterations:\n");
    scanf("%d",&n);
    // for the tabular form.
    printf("Iteration\t x0\t\t\t x1\t\t\t x2\n");
    do
    {
        if(f(x0)==f(x1))
```

```

    {
        printf("\nSolution cannot be found as the values
of a and b are same.\n");
        return 0;
    }
    // formula for secant method
    x2=(x0*f(x1)-x1*f(x0))/(f(x1)-f(x0));
    x0=x1;
    x1=x2;
    printf("%d\t\t\t\t\t%f\t\t\t\t\t%f\t\t\t\t\t%f\n",count,x0,x
1,x2);
    count++;
    if(count==n)
    {
        break;
    }
} while(fabs(f(x2))>e);
// printing the required solution
printf("\n The required solution is %f\n",x2);
}

```

Output:-

```
D:\NM lab work\secant.exe  X  +  v
Secant Method prepared by:-
Subash khandel
Enter the values of a and b:
3
5
Enter the values of allowed error
0.001
Enter the maximum number of iterations:
10
Iteration      x0              x1              x2
1              5.000000      3.081949      3.081949
2              3.081949      3.016405      3.016405
3              3.016405      3.046277      3.046277

The required solution is 3.046277

-----
Process exited after 16.6 seconds with return value 0
Press any key to continue . . . |
```

The root of the given function is highlighted in the output of c-programming output which was 3.046277 which is nearly equal to 3.043 which was interception/root from Matlab graph.

Using Matlab.

Syntax:-

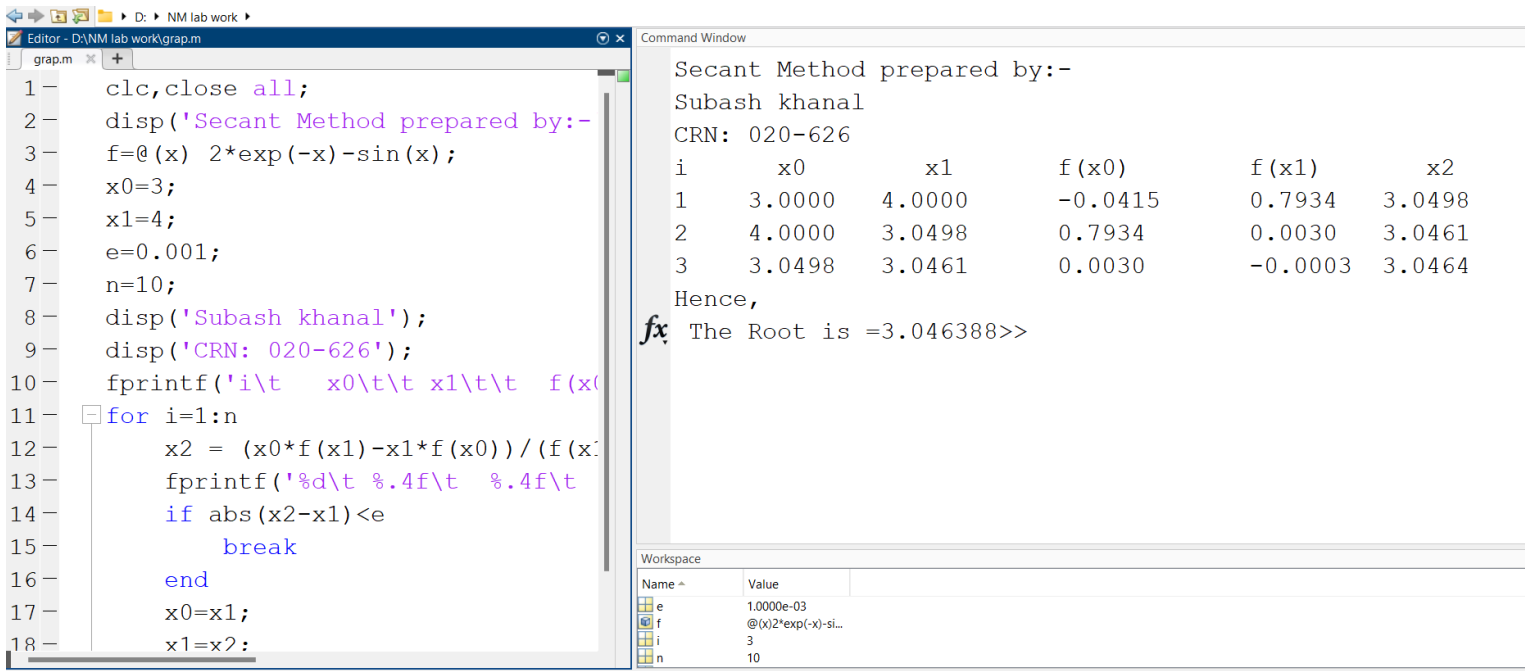
```
clc,close all;
disp('Secant Method prepared by:-');
f=@(x) 2*exp(-x)-sin(x);
x0=3;
x1=4;
e=0.001;
n=10;
disp('Subash khanal');
disp('CRN: 020-626');

fprintf('i\t    x0\t\t x1\t\t f(x0)\t\t f(x1)\t    x2\t\t\n');
for i=1:n
    x2 = (x0*f(x1)-x1*f(x0))/(f(x1)-f(x0));
    fprintf('%d\t %.4f\t %.4f\t %.4f\t %.4f\t\n',i,x0,x1,f(x0),f(x1),x2)

    if abs(x2-x1)<e
        break
    end
    x0=x1;
    x1=x2;
end

fprintf('Hence,\n The Root is =%f',x2);
```


Output:-



The screenshot displays the MATLAB environment with the Editor window showing a script named 'grap.m' and the Command Window showing the execution output.

Editor - D:\NM lab work\grap.m

```
1 clc,close all;
2 disp('Secant Method prepared by:-
3 f=@(x) 2*exp(-x)-sin(x);
4 x0=3;
5 x1=4;
6 e=0.001;
7 n=10;
8 disp('Subash khanal');
9 disp('CRN: 020-626');
10 fprintf('i\t x0\t\t x1\t\t f(x0)
11 for i=1:n
12     x2 = (x0*f(x1)-x1*f(x0))/(f(x1)-f(x0));
13     fprintf('%d\t %.4f\t %.4f\t
14     if abs(x2-x1)<e
15         break
16     end
17     x0=x1;
18     x1=x2;
```

Command Window

```
Secant Method prepared by:-
Subash khanal
CRN: 020-626
i      x0      x1      f(x0)      f(x1)      x2
1      3.0000   4.0000   -0.0415    0.7934    3.0498
2      4.0000   3.0498    0.7934    0.0030    3.0461
3      3.0498   3.0461    0.0030   -0.0003    3.0464
Hence,
fx The Root is =3.046388>>
```

Workspace

Name ^	Value
e	1.0000e-03
f	@(x)2*exp(-x)-si...
i	3
n	10

Description:-

From above program from c-programming and matlab it was clear that root are same using any and also from the graph. So, using above program we can find the root i.e, 3.04.

Conclusion:-

Hence, from above we can implement and calculate the root using the secant method on Matlab and C-programming.