

*Heaven's Light is Our Guide*  
**Rajshahi University of Engineering and Technology**



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ECE 2214

**Course Title**  
Numerical Methods and Discrete Mathematics Sessional

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**Lab Report 10:** Implementing Secant method of root finding in MATLAB.

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# Finding root of nonlinear equation using Secant Method.

## Introduction

### Secant Method

Secant Method is open method and starts with two initial guesses for finding real root of non-linear equations. In Secant method if  $x_0$  and  $x_1$  are initial guesses then next approximated root  $x_2$  is obtained by following formula:[1]

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

This method is similar to the false position method, except in false position method we bracket the root with initial guesses. But in secant method its not necessary. Also in false position method, we need to change the  $x$  intersect after checking its value for the function but in secant method we just need to change only one of the guesses until we reach our requirement for the result.

## Tools Used

- MATLAB R2021a - for writing and running code.
- MacTeX - $\text{\LaTeX}$ compiler.
- VS Code with  $\text{\LaTeX}$ workshop extension as a text editor.

# Process

## Code for Secant Method:

- File 1 – Function file

```
1 function secant_func(eqn, a, b, error)
2     syms x;
3
4     fa = eval(subs(eqn, x, a));
5     fb = eval(subs(eqn, x, b));
6
7     c = b- fb*(b-a)/(fb-fa);
8     fc = eval(subs(eqn, x, c));
9
10    while abs(fc) > error
11        arr = [a b c fc];
12        disp(arr);
13        a = b;
14        fa = fb;
15        b = c;
16        fb = fc;
17        c = b- fb*(b-a)/(fb-fa);
18        fc = eval(subs(eqn, x, c));
19    end
20
21    arr = [a b c fc];
22    disp(arr);
23
24    disp("The root(approx..) is: ");
25    disp(c);
26 end
```

- File 2 – Main file

```
1 clc, clear all, close all;
2 syms x;
3
4 eqn = input("Enter equation: ");
5 a = input("First guess: ");
6 b = input("Second guess: ");
7 error = input("Error: ");
8
9 secant_func(eqn, a, b, error);
```

## Output

```
Command Window

Enter equation: 5*x^3 + 6*x^2 +2*x +54
First guess: -2
Second guess: -3
Error: 0.01

-2.0000    -3.0000    -2.5075     7.8826

-3.0000    -2.5075    -2.6024     1.3044

-2.5075    -2.6024    -2.6213    -0.0700

-2.6024    -2.6213    -2.6203     0.0006

The root(approx..) is:
-2.6203

fx >> |
```

Figure 1: Secant method.

## Functions

All of the functions used in this experiment was used in the previous experiments. Only addition is how the user defined function is declared:

```
function secant_func(eqn, a, b, error)
```

Here *function* is a keyword to define a function. In this case the function is named *secant\_func* and it takes 4 inputs; the equation *eqn*, the first guess *a*, the second guess *b* & the error margin *error*.

When this function is called in the main file, it's given the four parameters and then it executes.

## References

- [1] “Secant Method Algorithm (Step Wise),” Nov. 2023, [Online; accessed 23. Nov. 2023]. [Online]. Available: <https://www.codesansar.com/numerical-methods/secant-method-algorithm.htm>