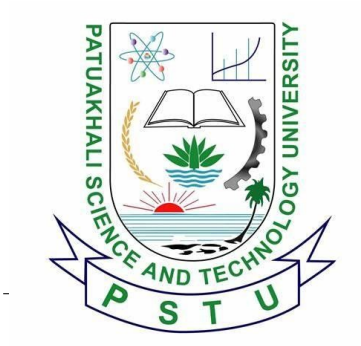

PATUAKHALI SCIENCE AND TECHNOLOGY UNIVERSITY

COURSE CODE CCE 312
Numerical Methods Sessional

SUBMITTED TO:

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Assignment 18
Assignment title: Secant Method
Date of submission: 08 Wed, Oct 2025

Problem Statement

Background:

A pharmacodynamics research team is modeling the concentration of a new heart medication in the bloodstream over time. The drug's effectiveness is directly related to its steady-state concentration, where the rate of administration equals the rate of elimination. The model for the steady-state concentration C (in mg/L) is derived from a nonlinear pharmacokinetic equation.

The Challenge:

After simplifying the complex biological model, the team arrives at the following equation that must be solved for the steady-state concentration C:

$$C^2 - 2 = 0$$

Code

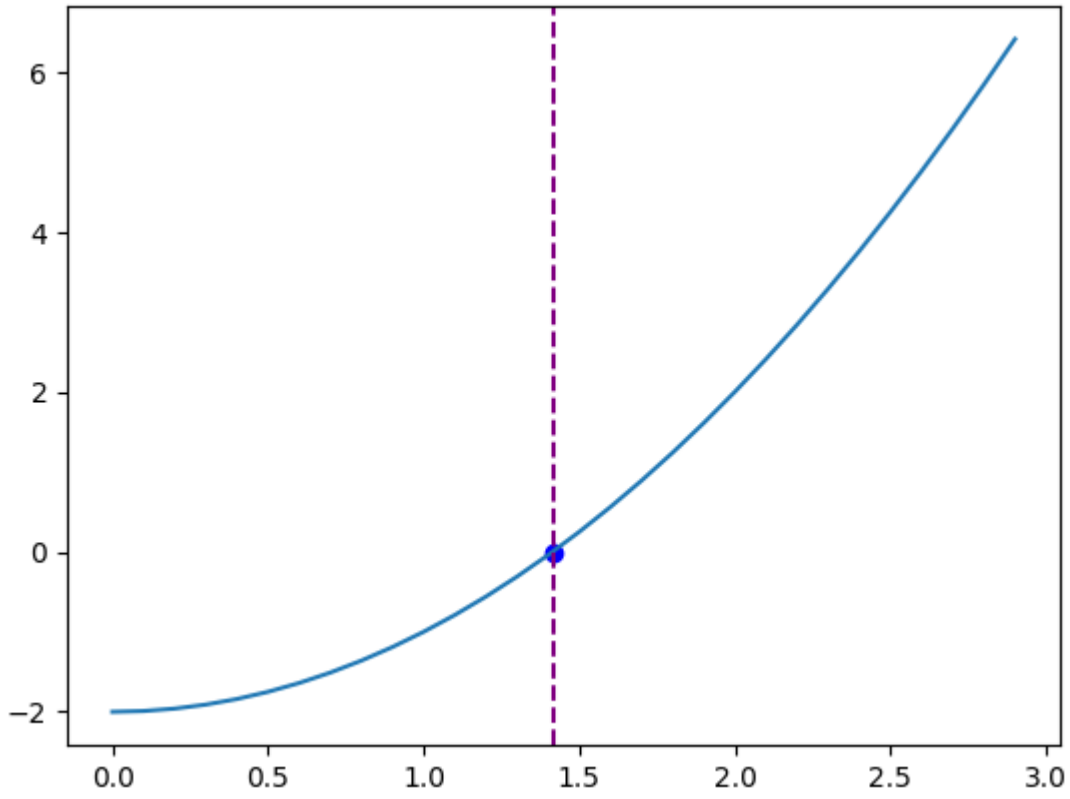
```
# Our function
def f(x):
return x**2 - 2

def secant_method(f, x0, x1, tol=1e-7, max_iter=100):
    for i in range(max_iter):
        if abs(f(x1)) < tol:
            return x1
        if f(x1) == f(x0):  # Prevent division by zero
            print("Division by zero encountered in secant method.")
            return None
        # Secant method formula
        x2 = x1 - f(x1) * (x1 - x0) / (f(x1) - f(x0))
        x0, x1 = x1, x2
    print("Maximum iterations reached without convergence.")
    return None

print(secant_method(f, 1, 2))
root = secant_method(f, 1, 2)

# Let's plot the result
x = np.arange(0, 3, 0.1)
plt.plot(x, f(x), label='f(x) = x^2 - 2')
plt.scatter(root, f(root), color='blue')  # Mark the root on the plot
plt.axvline(root, color='purple', linestyle='--', label=f'x = root
({root:.5f})')
```

Visualization



Result

```
X = 1.4142135620573204
```