Secant Method

Theory:

The Secant Method is an open method, meaning it does not require the root to be bracketed within an interval. Instead, it uses two initial approximations and constructs a secant line through the corresponding function values. The x-intercept of this secant line is taken as the next approximation.

The iterative formula of the Secant Method is,

$$x_{n+1} = x_n - \frac{f(x_n)(x_n - x_{n-1})}{f(x_n) - f(x_{n-1})}$$

This method can be viewed as a modification of the Newton-Raphson Method where the derivative is approximated numerically. As a result, it converges faster than Bisection and False Position but is generally less stable than bracketing methods.

Compared to Newton-Raphson, the Secant Method avoids the need for analytical derivatives, making it more convenient in problems where derivatives are difficult to compute. However, because it does not guarantee convergence, careful selection of initial guesses is required.