



Secant Method

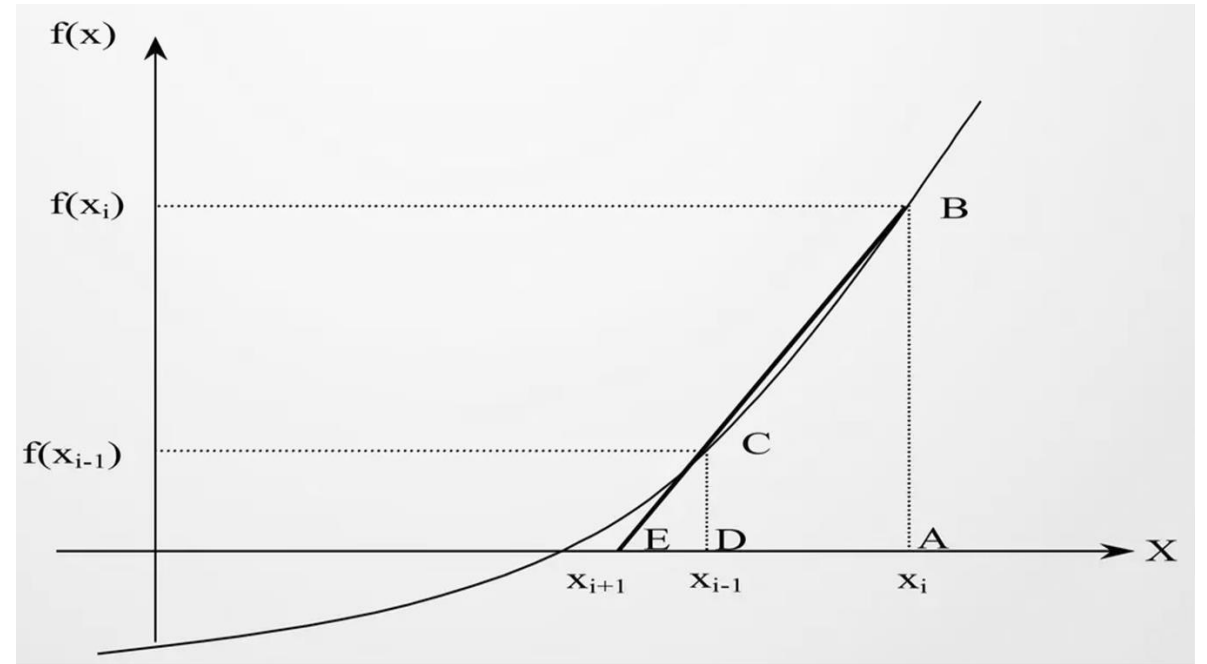


Secant Method

- The secant method is a root-finding numerical algorithm used for approximating the roots of a real-valued function.
- It iteratively refines **two initial guesses** to converge towards a more accurate estimate of the root.
- Secant method is similar to the Newton-Raphson method, but **does not require calculating derivatives**. Instead, it uses a linear approximation based on two previous iterates to estimate the next root.

How does it works:

A secant line is defined by using two points on graph of a function $f(x)$. It is necessary to choose these two initial points as x_i and x_{i-1} . Then next point x_{i+1} is obtained by computing x -value at which the secant line passing through the points $(x_i, f(x_i))$ and $(x_{i-1}, f(x_{i-1}))$ has a y -coordinate of zero.



The Geometric Similar Triangles

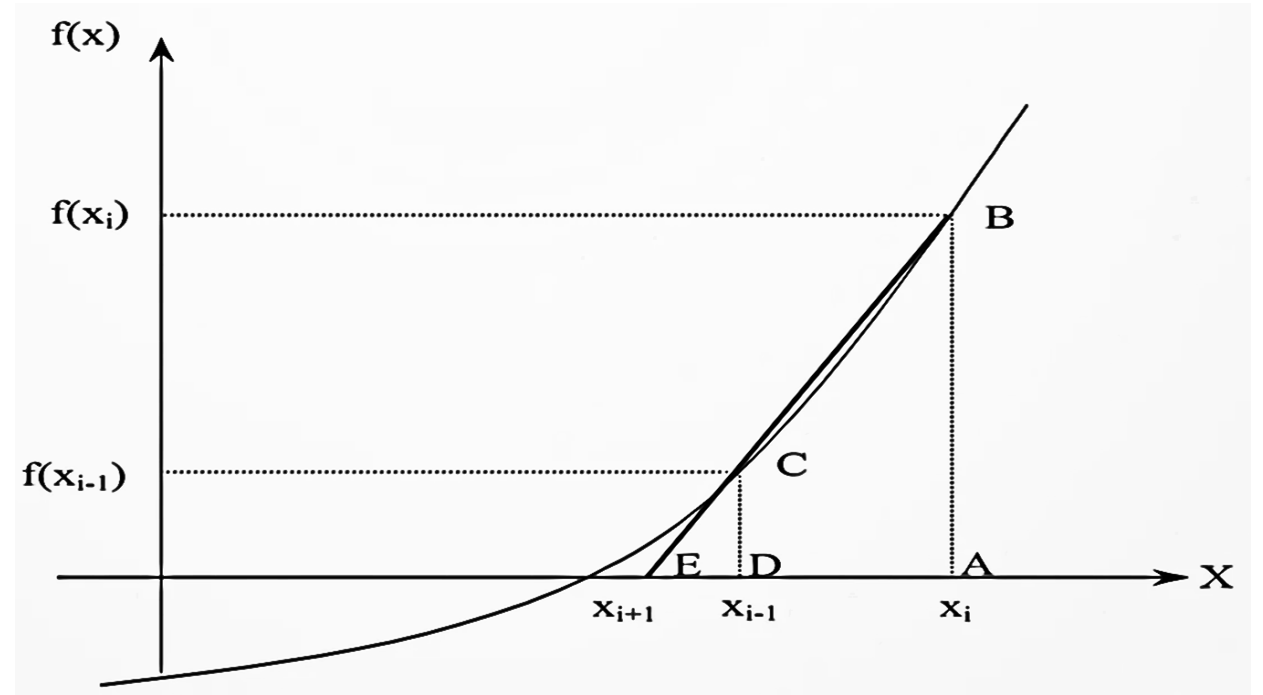
$$\frac{AB}{AE} = \frac{DC}{DE}$$

can be written as

$$\frac{f(x_i)}{x_i - x_{i+1}} = \frac{f(x_{i-1})}{x_{i-1} - x_{i+1}}$$


On rearranging, the secant method is given as

$$x_{i+1} = x_i - \frac{f(x_i)(x_i - x_{i-1})}{f(x_i) - f(x_{i-1})}$$





Advantages

- Versatility: The secant method is versatile and applicable to a wide range of functions.
 - Generally converges faster than the bisection method
 - Requires two guesses that don't need to bracket the root.
 - No Derivative Required: Unlike some other numerical methods, the secant method does not require the computation of derivatives which makes it better as in some cases derivative become very hard to find.
- 

Disadvantages

- Convergence: Convergence may not be guaranteed for all functions or initial guesses.
- Sensitivity to Initial Guesses: The choice of initial guesses can affect convergence speed and the possibility of convergence.
- Division by zero

