Numerical Analysis
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SECANT METHOD (derivation)

The secant method can also be derived from geometry, as shown in Figure 1. Taking two initial guesses, x_{i-1} and x_i, one draws a straight line between $f(x_i)$ and $f(x_{i-1})$ passing through the x-axis at x_{i+1}. *ABE* and *DCE* are similar triangles.

Hence

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

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

On rearranging, the secant method is given as

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

Xr = xu –f(xu) (xu-xl)/ f(xu)-f(xl)

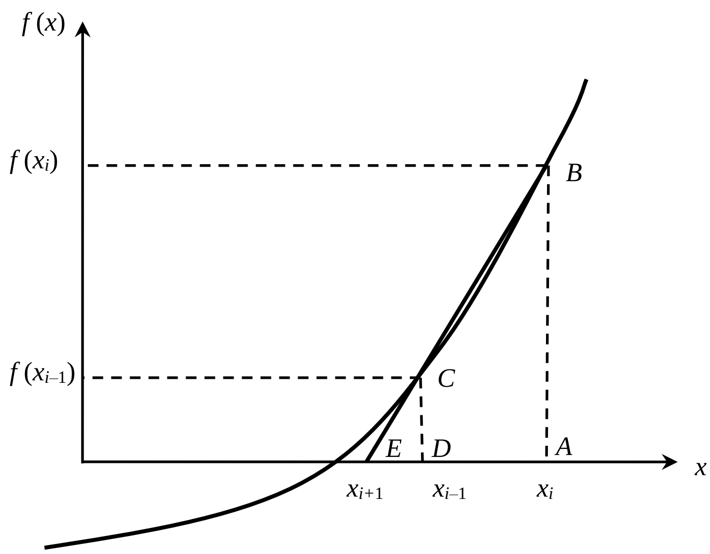

Figure 1 Geometrical representation of the secant method.

Qa).Find out the root of the function $f(x) = x^4 - x - 10$ using Secant method with [1,2] initial bounds.

b) stop the iterative procedure when the following conditions get satisfied:

i. |f(xr)| < Es
ii. Eabs < Es

iii. Er < Es , where Es = 0.001

c) comment on the efficiency of the following conditions to approximate the root of the given function.

			x^4-x-10		secant method				
s.no	x0	f(x0)	x1	f(x1)	x2	f(x2)	erorr < 0.001	Eabs<0.001	Er < 0.001
1	1	-10	2	4	1.71428571	-3.07788	FALSE		
2	1.714286	-3.07788	2	4	1.83853125	-0.4128	FALSE	FALSE	FALSE
3	1.838531	-0.4128	2	4	1.85363596	-0.04777	FALSE	FALSE	FALSE
4	1.853636	-0.04777	2	4	1.85536335	-0.00543	FALSE	FALSE	TRUE
5	1.855363	-0.00543	2	4	1.85555944	-0.00062	TRUE	TRUE	TRUE

Open methods

Characteristics:

1) Its works with at least one initial bounds
2) The root will always be located beyond the bound(s) or in other words the root will not be bracketed between the bounds.

Secant method:

1. **belongs to open method category**
2. **it takes two initial bounds to start with**