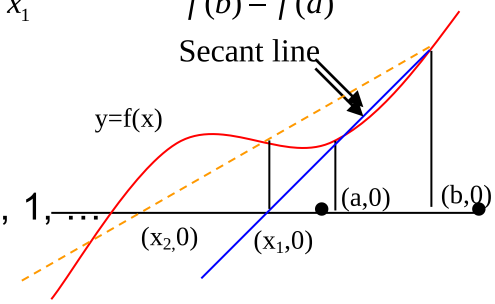
Secant Method:

Suppose a continuous function f defined on the interval [a,b] is given, but now we do not force the iterates to bracket a root. The graph of the function f is approximated by a secant line, we get

$$\frac{f(b)-f(a)}{b-a}=\frac{f(b)-y}{b-x}\Rightarrow\frac{f(b)-f(a)}{b-a}=\frac{f(b)-0}{b-x_1}\Rightarrow x_1=\frac{af(b)-bf(a)}{f(b)-f(a)}$$

Similarly $x_2=\dfrac{bf(x_1)-x_1f(b)}{f(x_1)-f(b)}$

In general $x_{i+2}=\dfrac{x_i f(x_{i+1})-x_{i+1}f(x_i)}{f(x_{i+1})-f(x_i)}$; i=0, 1,……



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x_{i+2} is an approximate root if $|x_{i+2}-x_{i+1}|<\varepsilon$ for any i.

Ex:

Find the root of the function x^3+4x^2-10 by using Secant method with $\varepsilon=1.3*10^{-8}$

Solution :

Let $x_0=1$ $x_1=2$

$f(x_0=1)=-5$ $f(x_1=2)=14$

$$x_2=x_1-\frac{f(x_1)*(x_1-x_0)}{f(x_1)-f(x_0)}=2-\frac{14*(2-1)}{14-(-5)}=\frac{24}{19}=1.2631$$

$\Longrightarrow f(x_2)=-1.602274379$

Continue to compute $x_3=1.338827839$ where $x_3=x_2-\frac{f(x_2)\,(x_2-x_1)}{f(x_2)-f(x_1)}$

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$|x_7-x_6|=|1.3652300134-1.3652300011|<1.3*10^{-8}$

n	x_n	$f(x_n)$
0	1	-5
1	2	14
2	1.2631578947	-1.6022743840
3	1.3388278388	-0.4303647480
4	1.3666163947	0.0229094308
5	1.3652119026	-0.002990679
6	1.3652300011	-0.0000002032

Note:

In method of false Position on the interval $[a_n , b_n]$

$x_{n+1} = a_n - \frac{f(a_n)(b_n - a_n)}{f(b_n) - f(a_n)}$ while in Secant method

$x_{n+1} = b_n - \frac{f(b_n)(b_n - a_n)}{f(b_n) - f(a_n)}$ in the same interval .