Comparison Between Secant & Regula falsi method.

Secant Method

1) The Secant method does not require that the root remain bracketed. and hence it does not always converge.

2) The Secant method may converge to root even if initial approximations $[x_0$ and x_1 does not include root. {i.e., root is outside $[x_0, x_1]$}

3) Formula for Secant method -

x_0 and x_1 are initial approximations close to the root.

$$x_2 = x_1 - \frac{f(x_1)}{f(x_1)-f(x_0)}(x_1-x_0)$$

$$x_3 = x_2 - \frac{f(x_2)}{f(x_2)-f(x_1)}(x_2-x_1)$$

$$\vdots$$

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

Regula Falsi Method

1) The Regula Falsi method requires that the root remain bracketed and hence it always converge.

2) This is not true for Regula Falsi method. In this method root must lie in the interval $[x_0, x_1]$

3) Formula for Regula Falsi method - Root lies in $[a, b]$

case (i) If $f(a) < 0$ then the end point b is fixed and the successive approximations

$$x_0 = a$$

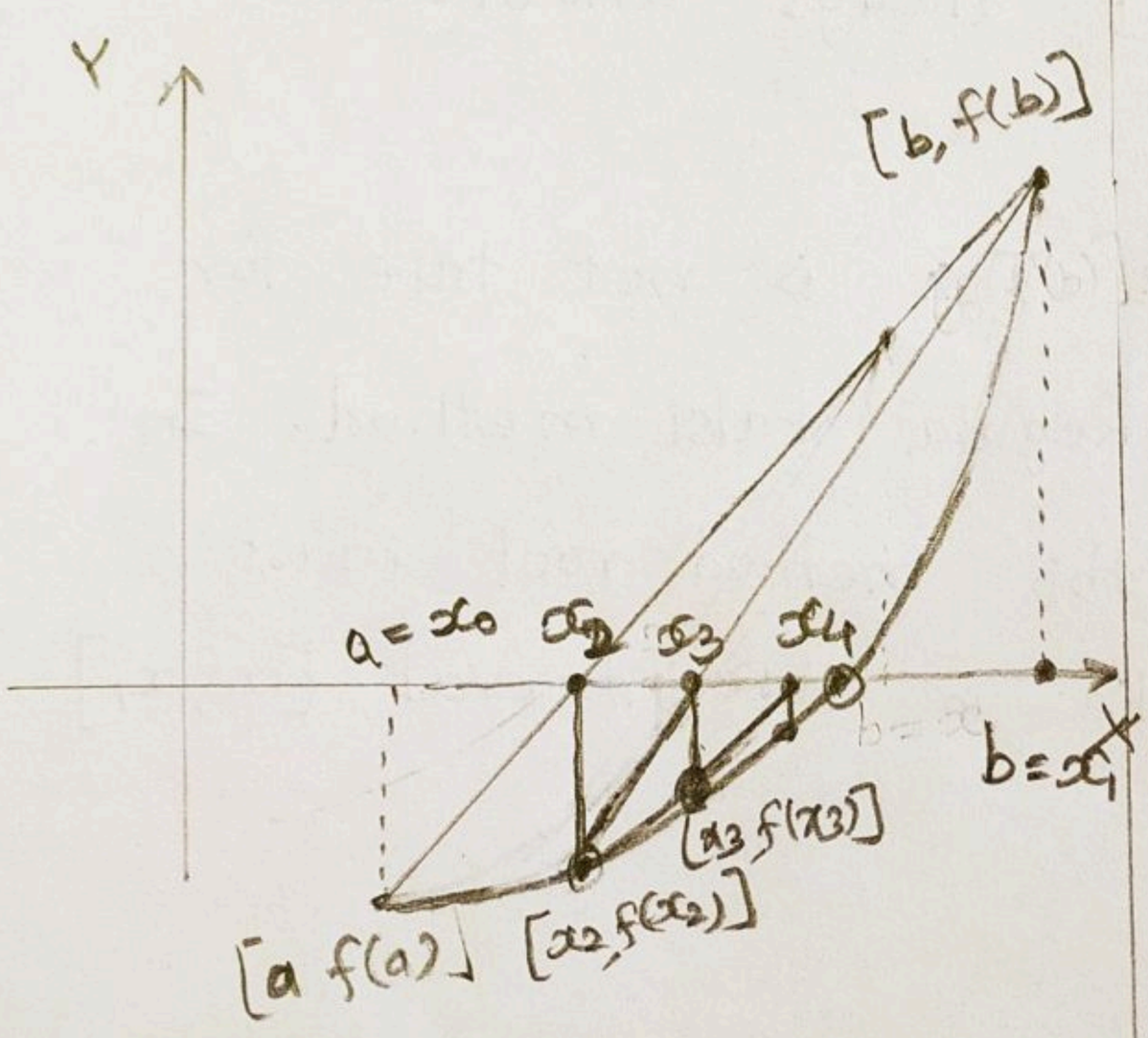
$$x_{n+1} = x_n - \frac{f(x_n)}{f(b)-f(x_n)}(b-x_n)$$

case (ii) If $f(a)>0$ end point a is fixed and successive approximations are

$$x_0 = b$$

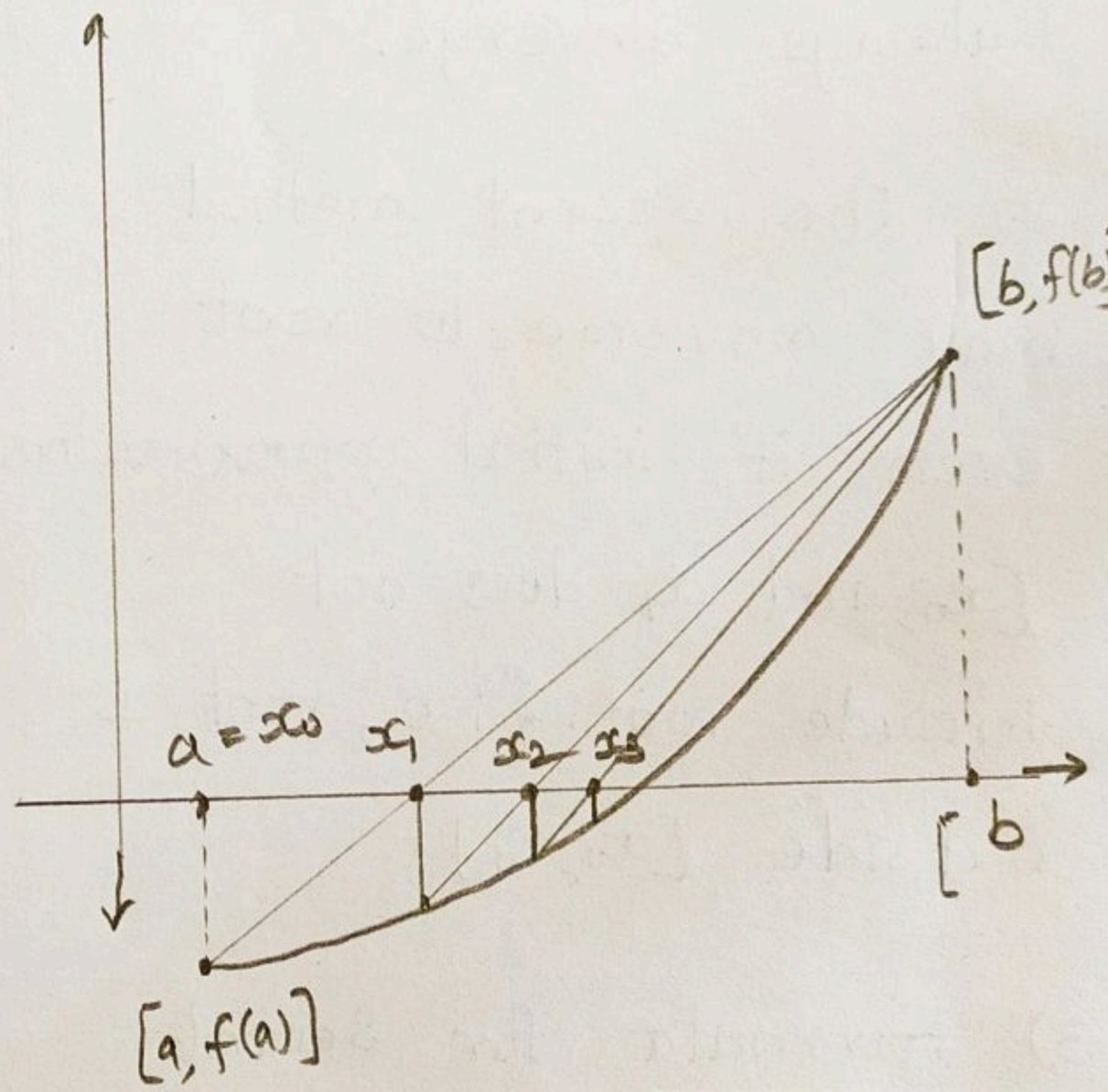
$$x_{n+1} = x_n - \frac{f(x_n)}{f(x_n)-f(a)}(x_n-a)$$

4) Geometrical Interpretation. -

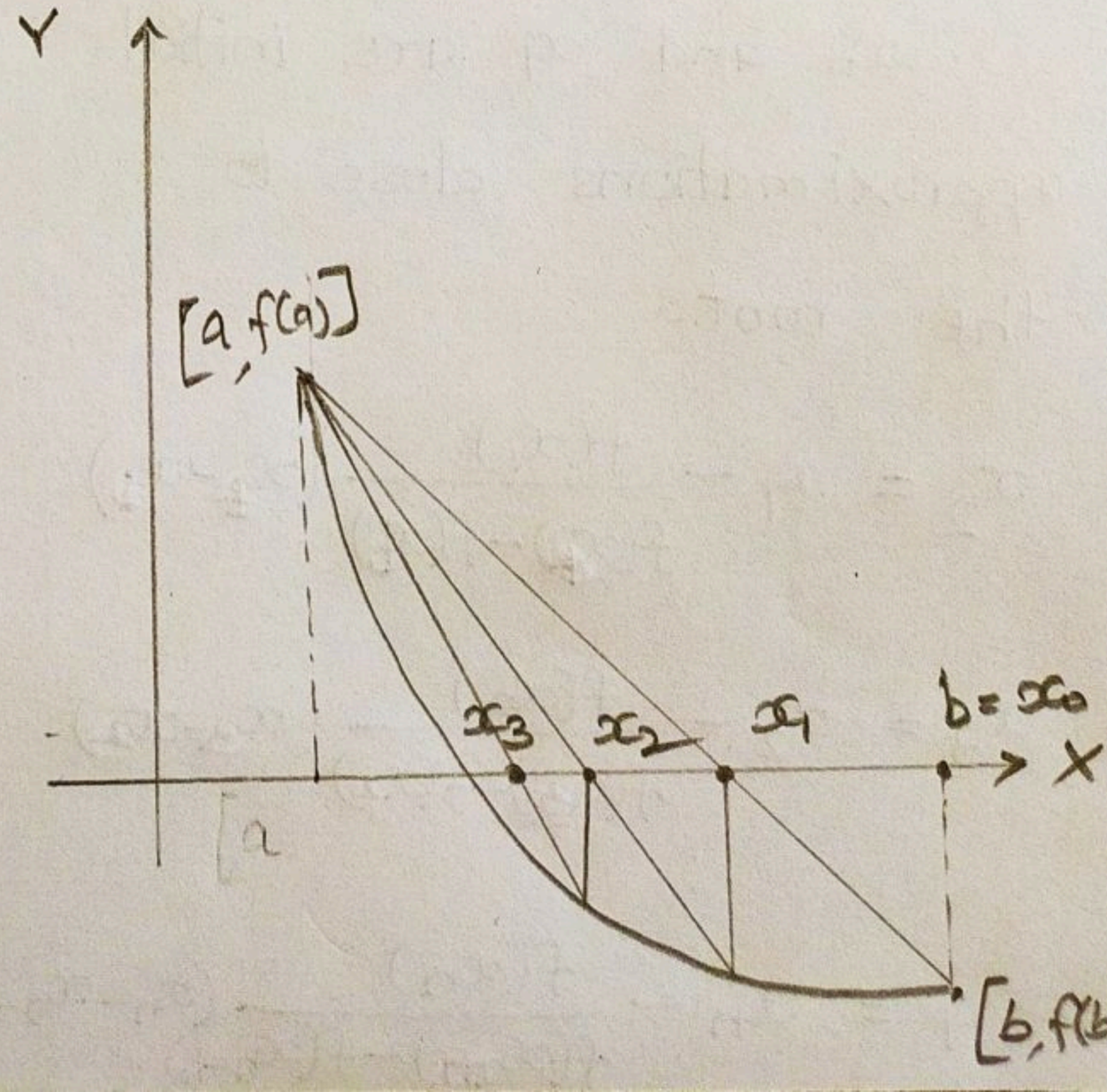


4) Geometrical Interpretation -

case (i) - $f(a)<0$, b is fixed



case (ii) $f(a)>0$, a is fixed.



5) The order of convergence of Secant method is $\frac{1+\sqrt{5}}{2}$.

6) The value of x_{n+1} is depends on the points $[x_n, f(x_n)]$ and $[x_{n-1}, f(x_{n-1})]$

5) Regula Falsi method has linear rate of convergence.

6) The value of x_{n+1} is depends on $[x_n, f(x_n)]$ and fixed point either a or b as the case may be.