Introduction to finding roots:

- $f(x) = 0$
- satisfy the eq^n.

Polynomial eq^n:

- its solution type.
- algebraic eq^n

Transcendental eq^n:

- non-algebraic eq^n.

root finding

- Iterative methods.
  - Bracketing $\longrightarrow |x^*| \leq \sqrt{\left(\frac{a_{n-1}}{2}\right)^2 -}$
  - Open and end. $\longrightarrow x^* = -\frac{a_{n-1}}{a_n}$.

stop → Error.

Bisection method:

- Algorithm
- procedure

0.10

Iteration method: (open method)

$f(x)=0$, $\rightarrow \phi(x)=0$.

$f(x)=x^2-2x-1=0$,

$$\boxed{\frac{-a^{n-1}}{a^n}} \rightarrow \text{value when } a^n x^n + a^{n-1} x^{n-1} + \cdots$$

$f(a)(b) < 0$.

$x^2-2x-1=0$.

$\Rightarrow x(x-2)-1=0$.

$$\Rightarrow x = \frac{1}{x-2}.$$

$$x_1 = \frac{1}{x_0-2}$$

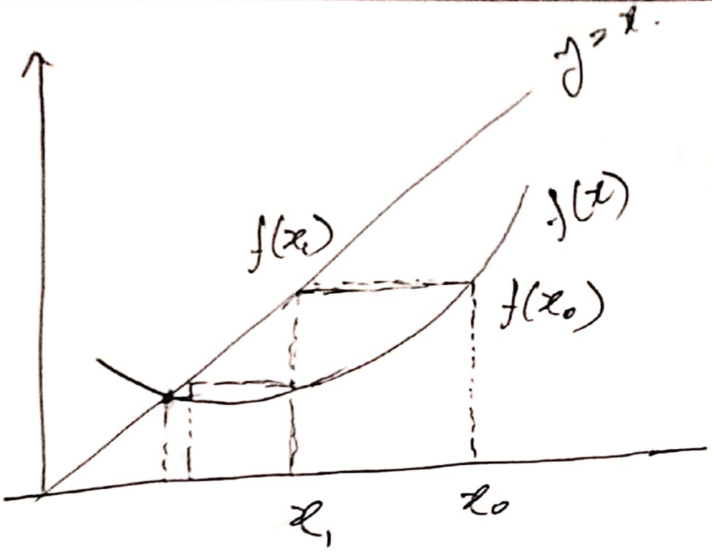
$$= \frac{1}{3-2}$$

$$= \frac{1}{1}$$

$$= 1$$

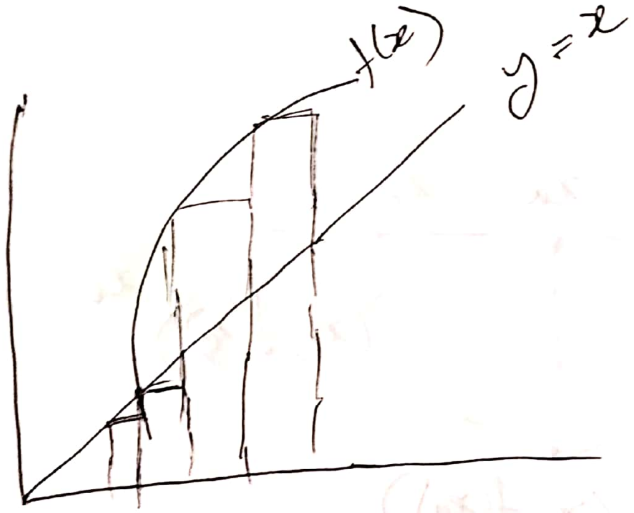
$$x_2 = \frac{1}{1-2} = \frac{1}{-1} = -1$$

$$x_3 = \frac{1}{-1-2} = \frac{1}{-3} = -\frac{1}{3}$$



$f'(x) < 1$

Converging into root.



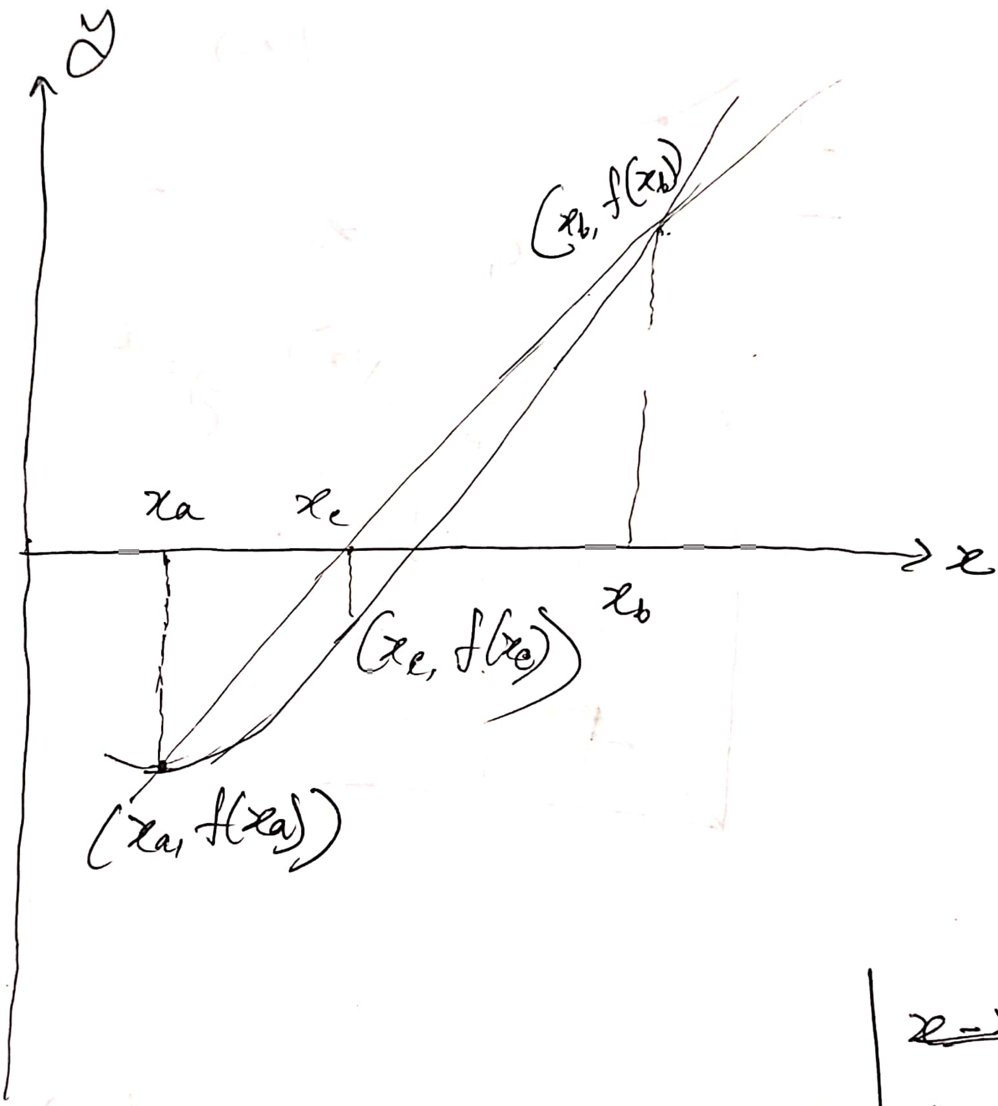
$f'(x) > 1$

Diverge into root.

$$f(x) \rightarrow \frac{\phi(x)}{\phi'(x) < 1}$$

False Position or

Regular position:



$$\frac{y - f(x_a)}{x - x_a} = \frac{f(x_b) - f(x_a)}{x_b - x_a}.$$

$$\therefore x = x_a - \frac{f(x_a)}{f(x_b) - f(x_a)} (x_b - x_a)$$

$\cancel{x - x_1}$

$(y - y_1)$

$+ \frac{y_2 - y_1}{x_2 - x_1}$

$(x - x_1) = 0$

15.10.19

Newton- Raphson Method (NR Method)

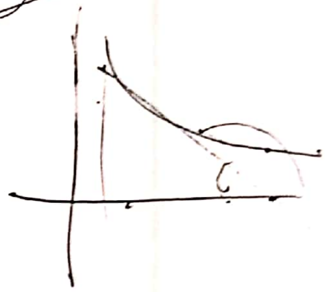
→ open method

→ Let, $f(x)=0$.

$f(x_0+h) = 0$.

$f(x_0+h) = f(x_0) + h$

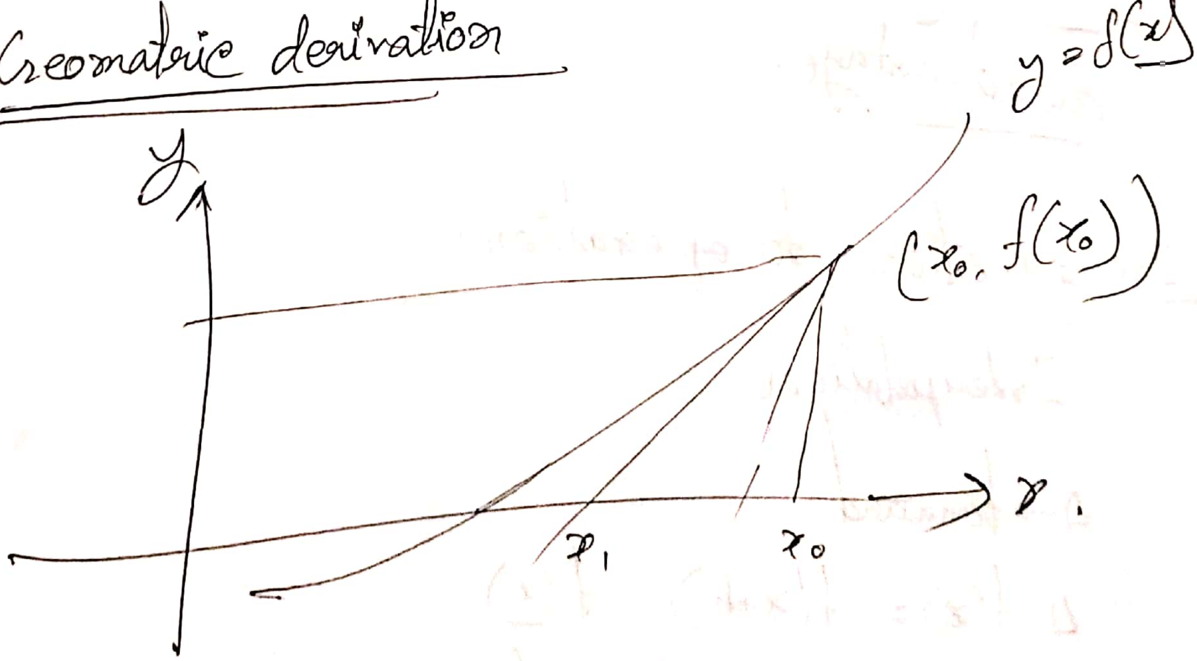
analytic derivation



$f(x_{i+1}) =$

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

Geometric derivation



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Rate of convergence of ~~Net~~ Newton. Raphson method:

α - be the exact soln of $y = f(x)$

i.e. $f(\alpha) = 0$.

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

Ques: NR as a quardratic convergence.

Secant Method

advantages:

disadvantage.