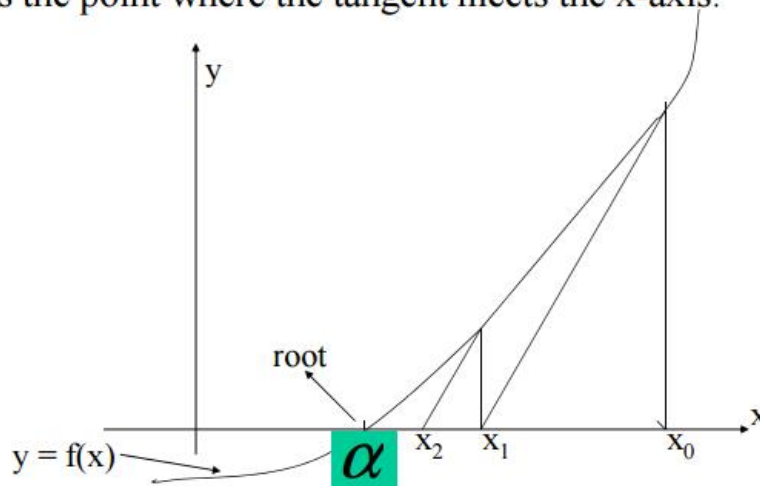المحاضرة الخامسة

Newton-Raphson Method /
Newton's Method

At an approximate x_k to the root ,the curve is approximated by the tangent to the curve at x_k and the next approximation x_{k+1} is the point where the tangent meets the x-axis.

Tangent at (x_k, f_k) :

$$y = f(x_k) + f'(x_k)(x-x_k)$$

This tangent cuts the x-axis at x_{k+1}

$$x_{k+1} = x_k - \frac{f(x_k)}{f'(x_k)}$$

<u>Warning</u> :   If $f'(x_k)$ is very small , method fails.

• Two function Evaluations per iteration

Newton's Method for finding the square root of a number $x = \sqrt{a}$

$f(x) = x^2 - a^2 = 0$

$$x_{k+1} = x_k - \frac{x_k^2 - a^2}{2 \, x_k}$$

Example : a = 5 , initial approximation $x_0 = 2$.

$x_1 = 2.25$

$x_2 = 2.236111111$

$x_3 = 2.236067978$

$x_4 = 2.236067978$