Chap 3 Differentiation

$$* \quad f'(x_0) = \lim_{h \to 0} \frac{f(x_0+h) - f(x_0)}{h}$$

* If f is diff at $x=C$ Then f is cont at $X=C$

- Diff Rules:-

1- $(f(x) \pm g(x))' = f'(x) \pm g'(x)$

2- $(f(x) \cdot g(x))' = f(x)\, g'(x) + g(x) f'(x)$

3- $\left(\frac{f(x)}{g(x)}\right)' = \frac{g(x)f'(x) - g'(x) f(x)}{[g(x)]^2} \quad g(x) \neq 0$

4- $(f \circ g)'(x) = f'(g(x)) \times g'(x)$

- Derivative & Trigonometric

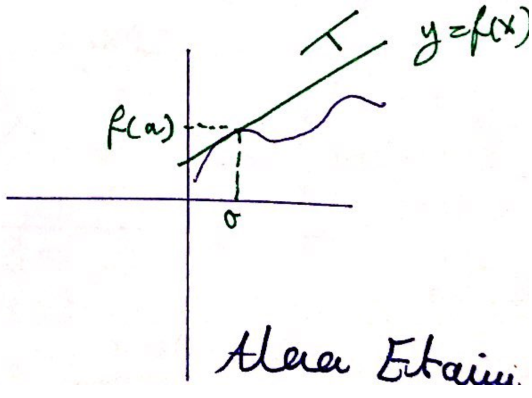
- $(\sin x)' = \cos X$
- $(\cos x)' = -\sin X$
- $(\tan X)' = \sec^2 X$
- $(\cot x)' = -\csc^2 X$
- $(\sec x)' = \sec x \tan x$
- $(\csc x)' = -\csc x \cot x$

Tangent & Normal

- Tangent

$y - y_0 = m(x - x_0)$

$(x_0, y_0) = (a, f(a)) / m = f'(a)$



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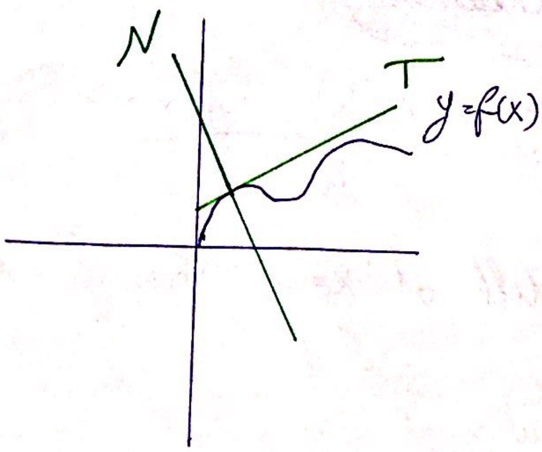
Normal

$y - y_0 = n(x - x_0)$

$(x_0, y_0) = (a, f(a))$

$n = \frac{-1}{m}$

$mn = -1$



Implicit diffrentiation

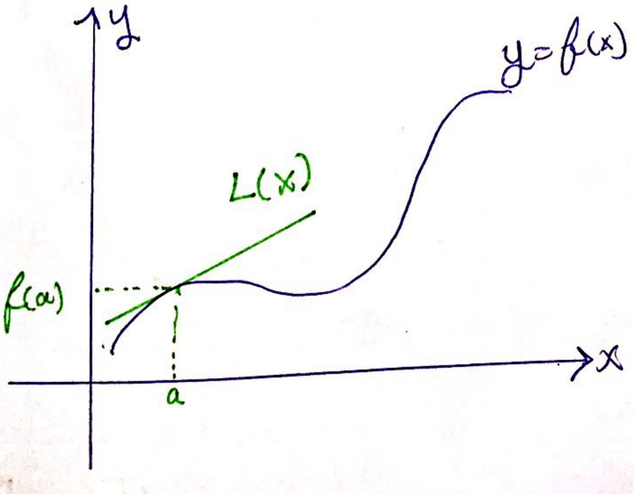
$\frac{dy}{dx}$ → dy → dependent on x so we diff → respect to X
dx → Independent

linearization

If f is diff function at $x=a$
Then The linearization of f at $x=a$ is
defined by :-

$$\boxed{L(x) = f(a) + f'(a)(x-a)}$$

حيث L هي تقريب
لـ (النقاط القريبة من a)
$L(x)$ approximate $f(a)$ near
by $x=a$
$L(x) \approx f(x)$



Prove :-

$y - y_0 = m(x - x_0)$
$(x_0, y_0) = (a, f(a))$
$f'(a) = m$
$y - f(a) = f'(a)(x-a)$
$y = f'(a)(x-a) + f(a)$
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* $L(x)$ is the standard linear approximation of $f(x)$ near $x=a$

* if $y=f(x)$ is diff at $x=a$ Then $\frac{dy}{dx}=f'(x)\Big|_{x=a}=f'(a)$

$\rightarrow dy=f'(a)\,dx$

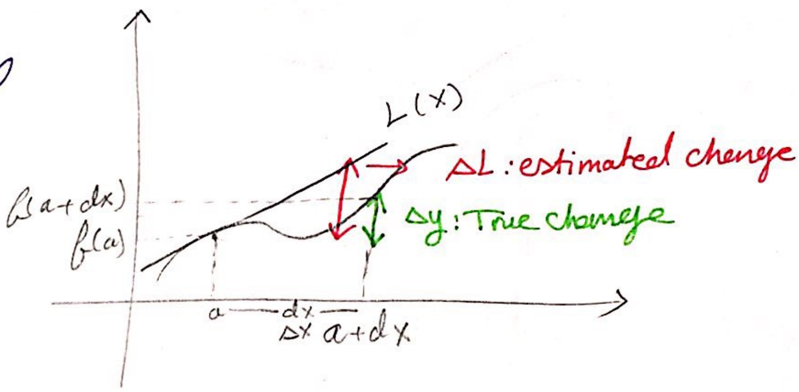
- dependant variable
- Independant Variable $dx=\Delta x$

$\underbrace{dy}_{\text{estimated value}} \approx \underbrace{\Delta y}_{\text{True value}} = \Delta f$

$\boxed{\Delta L \approx \Delta y}$

- result: we use the differential dy to estimate The True change Δy

Error = $|T-E|$



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