$Discontinuity => Not\ differentiability$

DERIVATIVES

Definition:- Definition is the process of decreasing of a function.

Mathematically, $\frac{dy}{dx}[or, f'(x)] = \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x}$

Derivative from 1st principle

$$\frac{dy}{dx} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Derivative at a point x=a

$$\left(\frac{dy}{dx}\right)_{x=a} = f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$\lim_{h \to 0+} \frac{f(a+h)-f(a)}{h}$ is called the Right Hand Derivative of f(x) at x=a and expressed as Rf'(a) or, f'(a+).

$\lim_{h \to 0-} \frac{f(a-h)-f(a)}{-h}$ is called the Left Hand Derivative of f(x) at x=a and expressed as Lf'(a) or, f'(a-).

f'(a) exists if Rf'(a)=Lf'(a).

Formulae:-

(1) $\frac{d}{dx}(x^n) = nx^{n-1} \quad [n = ratonal\ no.]$

(2) $\frac{d}{dx}(e^x) = e^x$

(3) $\frac{d}{dx}(\log x) = \frac{1}{x}$

(4) $\frac{d}{dx}(a^x) = a^x \log_e a$

(5) $\frac{d}{dx}(\sin x) = \cos x$

(6) $\frac{d}{dx}(\cos x) = -\sin x$

(7) $\frac{d}{dx}(\tan x) = \sec^2 x$

(8) $\frac{d}{dx}(\cot x) = -cosec^2 x$

(9) $\frac{d}{dx}(\sec x) = \sec x \tan x$

(10) $\frac{d}{dx}(cosec\ x) = -cosec\ x \cot x$