CHAPTER #04 DIFFERENTIATION

1. $\frac{d}{dx} x^n = nx^{n-1}$

2. $\frac{d}{dx} ax^n = a\frac{d}{dx} x^n$

3. $\frac{d}{dx} x = 1$

4. $\frac{d}{dx} x^2 = 2x$

5. $\frac{d}{dx} \sqrt{x} = \frac{1}{2\sqrt{x}}$

6. $\frac{d}{dx} k = 0$

PRODUCT FORMULA

$\frac{d}{dx}(U \cdot V) = U\frac{d}{dx}V + V\frac{d}{dx}U$

QOUTIENT FORMULA

$\frac{d}{dx}\left(\frac{U}{V}\right) = \frac{V\frac{d}{dx}U - U\frac{d}{dx}V}{V^2}$

$\frac{d}{dx}(B \cdot F)^n = n(B \cdot F)^{n-1}\frac{d}{dx}(B \cdot F)$

$\frac{d}{dx}\sqrt{\square} = \frac{\frac{d}{dx}\square}{2\sqrt{\square}}$

$\frac{d}{dx}\sqrt{x^2+1} = \frac{2x}{2\sqrt{x^2+1}}$

$\frac{d}{dx}\sqrt{x^2+1} = \frac{x}{\sqrt{x^2+1}}$

"DERIVATIVE OF TRIGONOMETRIC FUNCTIONS"

$\frac{d}{dx}\sin x = \cos x$

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

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

$\frac{d}{dx}\sec x = \sec x \cdot \tan x$

$\frac{d}{dx}\operatorname{cosec} x = -\operatorname{cosec} x \cdot \cot x$

$\frac{d}{dx}\cot x = -\operatorname{cosec}^2 x$

KAAM KI BAAT :

Agr angle other x hoa to angle ka derivative phir se lena parega.

$$\frac{d}{dx}\sin 4x^2 = \cos 4x^2 \frac{d}{dx}(4x^2)$$

$$= 8x \cdot \cos 4x^2$$

"INVERSE TRIGONOMETRIC FUNCTION"

$$\frac{d}{dx}\sin^{-1}x = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\cos^{-1}x = -\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\tan^{-1}x = \frac{1}{x^2+1}$$

$$\frac{d}{dx}\cot^{-1}x = -\frac{1}{x^2+1}$$

$$\frac{d}{dx}\sec^{-1}x = \frac{1}{x\sqrt{x^2-1}}$$

$$\frac{d}{dx}\operatorname{cosec}^{-1}x = -\frac{1}{x\sqrt{x^2-1}}$$

$$\log x = 0.4343 \ln x$$

$$\frac{d}{dx}\sin^{-1}\square = \frac{1}{\sqrt{1-\square^2}}\frac{d}{dx}\square$$

$$\frac{d}{dx}\ln(x)$$

$$\frac{d}{dx}\ln x = \frac{1}{x}$$

$$\frac{d}{dx}\ln\square = \frac{1}{\square}\cdot\frac{d}{dx}\square$$

"EXPONENTIAL FUNCTION"

$$\frac{d}{dx}e^x = e^x$$

$$\frac{d}{dx}e^{\square} = e^{\square}\frac{d}{dx}\square$$

$$\frac{d}{dx}y = \frac{dy}{dx}$$

$$\frac{d}{dx}y^n = ny^{n-1}\frac{dy}{dx}$$

INTEGRATION

DERIVATIVE OF FIRST PRINCIPLE

(ab-initio method)

or (Definition of derivative

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

$$\lim_{x \to a} \frac{\sin x}{x} = 1$$

(1) $\sin U + \sin V = 2\sin\frac{(U+V)}{2}\cos\frac{(U-V)}{2}$

(2) $\sin U - \sin V = 2\cos\frac{(U+V)}{2}\sin\frac{(U-V)}{2}$

(3) $\cos U + \cos V = 2\cos\frac{(U+V)}{2}\cos\frac{(U-V)}{2}$

(4) $\cos U - \cos V = -2\sin\frac{(U+V)}{2}\sin\frac{(U-V)}{2}$

(1) $\int x^n dx = \frac{x^{n+1}}{n+1} + C$

(2) $\int f^n(x) \cdot d(f(x)) = \frac{f(x)^{n+1}}{n+1} + C$

- When internal power of x is '1' and constant 'b' is added or subtracted.

$$\int (ax+b)^n dx = \frac{1}{a} \cdot \frac{(ax+b)^{n+1}}{n+1} + C$$

$$\int \frac{dz}{z} = \ln z \text{ or } \int \frac{1}{z} dz = \ln z$$

$$\int \frac{dz}{z-a} = \ln(z-a)$$

Integration k liye laagnii hai k baakiir function ka derivative ho.

INTEGRAL EXPONENTIAL FUNCTION :

- $\int e^x dx = e^x + C$
- $\int e^{\square} d\square \Rightarrow$ eg: $\int e^{x^3} 3x^2 dx = e^{x^3}$

$$\int a^x\,dx = \frac{a^x}{\ln a} + C$$

- $\int a^{\square}\,d\square = \frac{a^{\square}}{\ln a} + C$

INTEGRAL OF TRIGNOMETRIC FUNCTION

- $\int \sin x\,dx = -\cos x + C$
- $\int \cos x\,dx = \sin x + C$
- $\int \tan x\,dx = \ln \sec x + C$
- $\int \cot x\,dx = \ln \sin x + C$
- $\int \sec x\,dx = \ln(\sec x + \tan x) + C$
- $\int \quad = \ln \tan\left(\frac{x}{2} + \frac{\pi}{4}\right) + C$
- $\int \operatorname{cosec} x\,dx = \ln(\operatorname{cosec} x - \cot x) + C$
  $= \ln\left(\tan \frac{x}{2}\right) + C$

- $\int \sec^2 x\,dx = \tan x + C$
- $\int \operatorname{cosec}^2 x\,dx = -\cot x + C$

- $\int \sec x \cdot \tan x\,dx = \sec x + C$
- $\int \operatorname{cosec} x \cdot \cot x\,dx = -\operatorname{cosec} x + C$

- $\sin^2\theta = \frac{1 - \cos 2\theta}{2}$
- $\cos^2\theta = \frac{1 + \cos 2\theta}{2}$
- $\cos^2 \square = \frac{1 + \cos 2\square}{2}$

- $1 - \cos\square = 2\sin^2\frac{\square}{2}$
- $1 + \cos\square = 2\cos^2\frac{\square}{2}$

CONVERSION FORMULA

- $A > B$ شرط
- $\sin A\cos B = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$
- $\cos A\sin B = \frac{1}{2}[\sin(A+B) - \sin(A-B)]$
- $\cos A\cos B = \frac{1}{2}[\cos(A+B) + \cos(A-B)]$
- $\sin A\sin B = -\frac{1}{2}[\cos(A+B) - \cos(A-B)]$

$$\int \sqrt{a^2 - x^2}\,dx = \frac{1}{2}x\sqrt{a^2 - x^2} + \frac{1}{2}a^2\sin^{-1}\frac{x}{a} + C$$

INTEG. BY PARTS

$$\int U \cdot V\,dx = U\int V\,dx - \int\left[\frac{dU}{dx}\int V\,dx\right]dx$$

Date _____

$$\int \frac{dx}{\sqrt{a^2-x^2}} = \sin^{-1}\frac{x}{a} + C$$

$$\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a}\sec^{-1}\frac{x}{a} + C$$

$$\int \frac{dx}{a^2+x^2} = \frac{1}{a}\tan^{-1}\frac{x}{a} + C$$

$$\int \frac{dx}{x^2-a^2} = \frac{1}{2a}\ln\left(\frac{x-a}{x+a}\right) + C$$

$$\int \frac{dx}{a^2-x^2} = \frac{1}{2a}\ln\left(\frac{a+x}{a-x}\right) + C$$

$$\int \frac{dx}{\sqrt{x^2+a^2}} = \ln\left(x+\sqrt{x^2+a^2}\right)$$

$$\int \frac{1}{\sqrt{x^2-a^2}} = \ln\left(x+\sqrt{x^2-a^2}\right)$$

Date

$$\int \frac{dx}{x\sqrt{a^2+x^2}} = \frac{-1}{a} \ln \left| \frac{a+\sqrt{a^2+x^2}}{x} \right| + C$$

$$\int \frac{dx}{x\sqrt{a^2-x^2}} = \frac{-1}{a} \ln \left| \frac{a+\sqrt{a^2-x^2}}{x} \right| + C$$

$$\int U\,dV = UV - \int V\,du$$

$$\int a^x dx = \frac{a^x}{\ln a} + C$$

hyperbolic mein sirf $\int \sinh = \cosh$ or
$\int \operatorname{sech} x \tanh x = -\operatorname{sech} x$
sirf inden k sign chng hote hai.

$$\int \tan^n x\,dx = \frac{\tan^{n-1} x}{n-1} - \int \tan^{n-2} x\,dx$$

$$\int \sec^n x\,dx = \frac{\sec^{n-2} x \tan x}{n-1} + \frac{n-2}{n-1} \int \sec^{n-2} x\,dx$$