

Review of last class:

Standard Integral (मानक समाकल)

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

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

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

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

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

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

$$\int \cos x \, dx = \sin x + C$$

$$\int \sin x \, dx = -\cos x + C$$

$$\int \sec^2 x \, dx = \tan x + C$$

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

$$\int \sec x \tan x \, dx = \sec x + C$$

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



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

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

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

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

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

$$\frac{d}{dx} \left\{ \frac{x^{n+1}}{(n+1)} + c \right\} = x^n$$

$$\frac{d}{dx} \log |x| = \frac{1}{x}$$

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

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

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

$$\int e^x dx = e^x + c$$

$$\int a^x dx = \frac{a^x}{\log_e a} + c$$

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

$$\int \frac{1}{x} dx = \log |x| + c$$

Integral of the product of a constant and a function (अचर एवं फलन के गुणनफल का समाकल)

λ : Constant (अचर)

$$\int \lambda f(x) dx = \lambda \int f(x) dx$$

$$\int 3 \cos x dx = 3 \int \cos x dx$$

Property of Integration

$$\int (f_1(x) + f_2(x) + f_3(x) + \dots) dx = \int f_1(x) dx + \int f_2(x) dx + \int f_3(x) dx + \dots$$



Q.1: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

$$\int (x+3)(x-4) dx$$

Solution:

$$\int (x+3)(x-4) dx$$

$$\int (x^2 - 4x + 3x - 12) dx$$

$$\int (x^2 - x - 12) dx$$

$$\int x^2 dx - \int x dx - 12 \int dx$$

$$\frac{x^{2+1}}{2+1} - \frac{x^{1+1}}{1+1} - 12x + c$$

$$\frac{x^3}{3} - \frac{x^2}{2} - 12x + c$$

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

Ans

Q.2: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

$$\int \left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)^2 dx$$

Solution:

$$\int \left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)^2 dx$$

$$= \int \left[(\sqrt{x})^2 + \left(\frac{1}{\sqrt{x}} \right)^2 + 2\sqrt{x} \cdot \frac{1}{\sqrt{x}} \right] dx$$

$$= \int \left(x + \frac{1}{x} + 2 \right) dx$$

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

$$= \frac{x^2}{2} + \log|x| + 2x + C \quad \text{Ans}$$

$$; (a+b)^2 = a^2 + b^2 + 2ab$$

$$; (\sqrt{x})^2 = (x^{1/2})^2 = x^{1/2 \cdot 2} = x^1 = x$$

$$; \int dx = x$$

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

Q.3: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

Solution:

$$\int \frac{1-x^4}{1-x} dx$$

$$\int \frac{1^2 - (x^2)^2}{1-x}$$

$$\int \frac{(1+x^2)(1-x^2)}{1-x} dx$$

$$\int \frac{(1+x^2)(1^2-x^2)}{1-x} dx$$

$$\int \frac{(1+x^2)(1+x)(1-x)}{1-x} dx$$

$$\int (1+x^2)(1+x) dx$$

$$\int (1+x+x^2+x^3) dx$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$\int (1 + x + x^2 + x^3) dx$$

$$\int (x^3 + x^2 + x + 1) dx$$

$$\int x^3 dx + \int x^2 dx + \int x dx + \int 1 dx$$

$$\frac{x^4}{4} + \frac{x^3}{3} + \frac{x^2}{2} + x + c$$

Ans

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



Q.4: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

$$\int \frac{x^4}{x^2+1} dx$$

Solution:

$$\int \frac{(x^2)^2}{x^2+1} dx$$

$$\int \frac{(x^2)^2 - 1^2 + 1^2}{x^2+1} dx \quad a^2 - b^2 = (a+b)(a-b)$$

$$\int \frac{(x^2+1)(x^2-1) + 1}{x^2+1} dx \quad ; \quad \frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$$

$$\int \left[\frac{(x^2+1)(x^2-1)}{x^2+1} + \frac{1}{x^2+1} \right] dx$$

$$\int \left[\frac{(x^2+1)(x^2-1)}{x^2+1} + \frac{1}{x^2+1} \right] dx$$

$$\int \left[x^2 - 1 + \frac{1}{x^2+1} \right] dx$$

$$\int x^2 dx - \int dx + \int \frac{1}{x^2+1} dx$$

$$\frac{x^3}{3} - x + \tan^{-1}x + C$$

Ans



Q.5: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

$$\int \tan^2 x \, dx$$

Solution:

$$\int \tan^2 x \, dx$$

$$= \int (\sec^2 x - 1) \, dx$$

$$= \int \sec^2 x \, dx - \int 1 \, dx$$

$$= \tan x - x + C \quad \text{Ans}$$

$$1 + \tan^2 x = \sec^2 x$$

$$\tan^2 x = \sec^2 x - 1$$



Q.6: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

$$\int \frac{1}{\sin^2 x \cos^2 x} dx$$

Solution:

$$\int \frac{\sin^2 x + \cos^2 x}{\sin^2 x \cos^2 x} dx \quad ; \quad 1 = \sin^2 x + \cos^2 x$$

$$\int \left[\frac{\sin^2 x}{\sin^2 x \cos^2 x} + \frac{\cos^2 x}{\sin^2 x \cos^2 x} \right] dx \quad \frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$$

$$\int (\sec^2 x + \operatorname{cosec}^2 x) dx$$

$$\int \sec^2 x dx + \int \operatorname{cosec}^2 x dx$$

$$\tan x - \cot x + c$$

Q.7: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

$$\int \frac{1}{1 - \sin x} dx$$

Solution:

$$\int \frac{1}{1 - \sin x} \cdot \frac{1 + \sin x}{1 + \sin x} dx$$

$$\int \frac{1 + \sin x}{1 - \sin^2 x} dx$$

$$\int \frac{1 + \sin x}{\cos^2 x} dx$$

$$\int \left[\frac{1}{\cos^2 x} + \frac{\sin x}{\cos^2 x} \right] dx$$

$$\int \sec^2 x dx + \int \frac{\sin x}{\cos x \cos x} dx$$

$$= \tan x + \int \sec x \tan x dx$$

$$= \tan x + \sec x + C$$

Ans

Q.8: x के सापेक्ष समाकलन ज्ञात करें (Integrate with respect to x)

$$\int \sqrt{1 + \sin 2x} \, dx$$

Solution:

$$\begin{aligned} \int \sqrt{1 + \sin 2x} \, dx &= \int \sqrt{1 + 2 \sin x \cos x} \, dx \\ &= \int \sqrt{\sin^2 x + \cos^2 x + 2 \sin x \cos x} \, dx \\ &= \int \sqrt{(\sin x + \cos x)^2} \, dx \\ &= \int (\sin x + \cos x) \, dx \\ &= \int \sin x \, dx + \int \cos x \, dx \\ &= -\cos x + \sin x + C \end{aligned}$$

Ans

HW Question:

$$\int \cot^2 x \, dx =$$

COMMENT



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Solution to previous HW Question:

$$\int \frac{1}{\sqrt{x}} dx = ?$$

$$\int \frac{1}{\sqrt{x}} dx = \int \frac{1}{x^{1/2}} dx$$

$$= \int x^{-1/2} dx$$

$$= \frac{x^{-1/2+1}}{-\frac{1}{2}+1} + c$$

$$= \frac{x^{1/2}}{\frac{1}{2}} + c$$

$$= 2\sqrt{x} + c \quad \text{Ans}$$



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Previous Years Questions (PYQ) & Practice Problems

UP BTE 2023,....

Q.1: $\int \left(x - \frac{1}{x}\right)^2 dx$

UP BTE 2017,....

Q.2: $\int \left(1 + \frac{1}{x}\right)^2 dx$

Q.3: $\int \frac{x^2}{x^2+1} dx$

UP BTE 2016,....

Q.4: $\int \frac{1 - \cos 2x}{1 + \cos 2x} dx$

Q.5: $\int \frac{dx}{1 + \sin x}$

UP BTE 1993,....

Q.6 $\int \frac{4 - 5 \sin x}{\cos^2 x} dx$

UP BTE 1998,....

Q.7: $\int \frac{1 + \sin x}{\cos^2 x} dx$

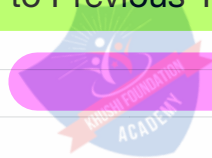
Q.8: $\int \frac{\cos 2x}{\sin^2 x \cos^2 x} dx$

UP BTE 1999,....

Q.9: $\int \frac{\sec x + \tan x}{\sec x - \tan x} dx$

Q.10: $\int \frac{1}{1 + \cos x} dx$

Next video: Solutions to Previous Years Questions (PYQ) & Practice Problems



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