

Unit 1: Methods of Indefinite Integration (अनिश्चित समाकलन की विधि)

Chapter 1: Standard Integral (मानक समाकल)

Topic(s):

(1): Introduction to Integration (समाकलन का परिचय)

(2): Standard Integral (मानक समाकल)

(3): Few Previous Years Questions (PYQ)

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Sign of Integration: (समाकलन चिह्न)

∫

∫ S का विकृत रूप है, जो "Sum" का पहला अक्षर है।  
(Elongated form)

$f(x)$  :  $x$  का फलन (Function of  $x$ )

e.g. :  $f(x) = \cos x$

Integration of the function: (फलन का समाकलन)

$$\int f(x) dx = F(x) + C$$

Integrand

(समाकल्य)

Integral

(समाकल)

Constant of Integration

(समाकलन अक्षर)

Integration is the INVERSE process of Differentiation.

समाकलन अवकलन की विपरीत प्रक्रिया है।

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$$\frac{d}{dx} \sin x = \cos x \quad \int \cos x \, dx = \sin x + C$$

$$\frac{d}{dx} e^x = e^x \quad \int e^x \, dx = e^x + C$$

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



## Constant of Integration ( समाकलन अचर )

$$(1) \frac{d}{dx} \sin x = \cos x$$

$$(2) \frac{d}{dx} (\sin x + 6) = \frac{d}{dx} \sin x + \frac{d}{dx} 6$$
$$= \cos x + 0$$
$$= \cos x$$

$$(3) \frac{d}{dx} (\sin x - 3) = \frac{d}{dx} \sin x - \frac{d}{dx} 3$$
$$= \cos x - 0$$
$$= \cos x$$

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

Indefinite Integration

General Integration

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

$\lambda$ : Constant (अचर)

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

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



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## Standard Integral ( मानक समाकल )

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

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

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

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

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

$$\int \sin x \, dx = -\cos x + C_1 \quad ; \quad C_1 = -C$$

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

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

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

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

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

$$\int \operatorname{cosec}^2 x \, dx = -\cot x + C_1 \quad ; \quad C_1 = -C$$

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

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

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

$$\int \operatorname{cosec} x \cot x \, dx = -\operatorname{cosec} x + C_1$$

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

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

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

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

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

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

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

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

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

$$\int a^x \log a dx = a^x$$

$$\log a \int a^x dx = a^x$$

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



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

Example 1:  $\int 3^x dx = \frac{3^x}{\log 3}$

$$(a^m)^n = a^{mn}$$

Example 2:  $\int 10^x dx = \frac{10^x}{\log_e 10}$

Example 3:  $\int 10^{2x} dx = \int (10^2)^x dx = \int 100^x dx = \frac{100^x}{\log_e 100}$

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

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

$$= \frac{d}{dx} \frac{x^{n+1}}{(n+1)} + \frac{dc}{dx}$$

$$= \frac{1}{(n+1)} \frac{dx^{n+1}}{dx} + 0$$

$$= \frac{1}{(n+1)} (n+1) x^{n+1-1}$$

$$= x^n$$

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

$$\int x^n dx = \frac{x^{n+1}}{(n+1)} + c \quad ; \quad \begin{array}{l} n+1 \neq 0 \\ n \neq -1 \end{array}$$

Example 1:  $\int x^4 dx = \frac{x^{4+1}}{4+1} + c = \frac{x^5}{5} + c$

Example 2:  $\int dx = \int 1 dx = \int x^0 dx = \frac{x^{0+1}}{0+1} + c = x + c$

Example 3:  $\int \frac{1}{x^2} dx = \int x^{-2} dx = \frac{x^{-2+1}}{-2+1} + c = \frac{x^{-1}}{-1} + c = -\frac{1}{x} + c$

Example 4:  $\int \sqrt{x} dx = \int x^{1/2} dx$

Example 5:  $\int x^{2/3} dx = \frac{x^{2/3+1}}{2/3+1} + c = \frac{x^{5/3}}{5/3} + c = \frac{3}{5} x^{5/3} + c$

UP BTE 2010

Q.1:  $\int (x^3 + 3x^2 + 3x + 1) dx = \int x^3 dx + \int 3x^2 dx + \int 3x dx + \int 1 dx$

$$= \int x^3 dx + 3 \int x^2 dx + 3 \int x dx + 1 \int dx$$
$$= \frac{x^{3+1}}{3+1} + 3 \frac{x^{2+1}}{2+1} + 3 \frac{x^{1+1}}{1+1} + 1(x) + C$$
$$= \frac{x^4}{4} + x^3 + \frac{3}{2}x^2 + x + C$$

Property of Integration

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

UP BTE 2015

Q.2:  $\int (\sin x + \cos x) dx = \int \sin x dx + \int \cos x dx$

$$= -\cos x + \sin x + C$$

$$\int x^n dx = \frac{x^{n+1}}{(n+1)} + c \quad ; \quad \begin{matrix} n+1 \neq 0 \\ n \neq -1 \end{matrix}$$

What happens when  $n = -1$

$$\int x^{-1} dx = \int \frac{1}{x} dx = ?$$

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

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



HW Question:

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

COMMENT



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## Summary:

Integration is the INVERSE process of Differentiation.

समाकलन अवकलन की विपरीत प्रक्रिया है ।

Standard Integral ( मानक समाकल )

Trigonometric function

Inverse Trigonometric function

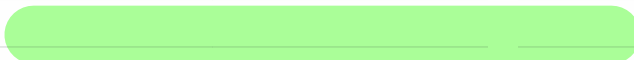
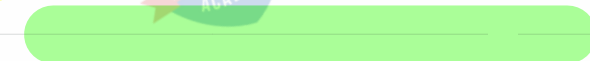
Exponential function

Algebraic function

$$\int dx = x + c$$

Next video:

Previous Years Questions (PYQ)



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