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CHAPTER NOTES

Integrals Class 12 Notes — CBSE Maths Chapter 7

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Integrals Class 12 Notes — CBSE Maths Chapter 7

Chapter 7 — **Integrals** — is the biggest and most important chapter, carrying **10-12 marks**. Covers indefinite integrals (methods: substitution, partial fractions, by parts) and definite integrals (fundamental theorem, properties).

Key Concepts

Standard Integrals

$$\int x^n dx = x^{n+1}/(n+1) + C \quad (n \neq -1) \quad | \int (1/x) dx = \ln|x| + C$$

$$\int e^x dx = e^x + C \quad | \int a^x dx = a^x/\ln a + C$$

$$\int \sin x dx = -\cos x + C \quad | \int \cos x dx = \sin x + C$$

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

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

$$\int 1/\sqrt{1-x^2} dx = \sin^{-1}x + C \quad | \int 1/(1+x^2) dx = \tan^{-1}x + C$$

Methods of Integration

1. Substitution

If integrand = $f(g(x)) \cdot g'(x)$, substitute $t = g(x)$

Example: $\int 2x \cdot \cos(x^2) dx \rightarrow \text{let } t = x^2 \rightarrow \int \cos t dt = \sin t + C = \sin(x^2) + C$

2. Integration by Parts

$$\int u \cdot v dx = u \int v dx - \int [u' \cdot \int v dx] dx$$

ILATE rule for choosing u : Inverse trig > Logarithmic > Algebraic > Trig > Exponential

(Choose u as the function that comes first in ILATE)

3. Partial Fractions

For $P(x)/Q(x)$ where $\deg P < \deg Q$:

$$(x+1)/[(x-1)(x+2)] = A/(x-1) + B/(x+2)$$

Repeated: $1/(x-1)^2 = A/(x-1) + B/(x-1)^2$

Quadratic: $(x+1)/(x^2+1)(x-1) = A/(x-1) + (Bx+C)/(x^2+1)$

Special Integrals

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

$$\int 1/(x^2-a^2) dx = (1/2a)\ln|(x-a)/(x+a)| + C$$

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

$$\int 1/\sqrt{x^2+a^2} dx = \ln|x + \sqrt{x^2+a^2}| + C$$

$$\int e^{x[f(x) + f'(x)]} dx = e^{xf(x)} + C \leftarrow \text{very useful!}$$

Definite Integrals

Fundamental Theorem: $\int_a^b f(x)dx = F(b) - F(a)$ where $F'(x) = f(x)$

Key Properties:

$$\int_a^b f(x)dx = -\int_b^a f(x)dx$$

$$\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$$

$$\int_a^b f(x)dx = \int_a^b f(a+b-x)dx$$

$$\int_0^a f(x)dx = \int_0^a f(a-x)dx \leftarrow \text{most useful property!}$$

$$\int_{-a}^a f(x)dx = 2\int_0^a f(x)dx \text{ if } f \text{ is even; } = 0 \text{ if } f \text{ is odd}$$

$$\int_0^{2a} f(x)dx = 2\int_0^a f(x)dx \text{ if } f(2a-x) = f(x); = 0 \text{ if } f(2a-x) = -f(x)$$

Quick Revision Points

- ILATE for by-parts: Inverse trig > Log > Algebraic > Trig > Exp
- $\int e^{x[f(x)+f'(x)]}dx = e^{xf(x)} + C$
- Partial fractions: degree of numerator must be less than denominator
- $\int_0^a f(x)dx = \int_0^a f(a-x)dx$ — the most powerful property
- Even function: $\int_{-a}^a = 2\int_0^a$; Odd function: $\int_{-a}^a = 0$

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Next: Applications of Integrals →



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