Class 12 Maths Chapter 7: Integrals - Notes, Important Questions and MCQs (2026-27)

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These Class 12 Maths Chapter 7 notes cover “Integrals” from the NCERT Mathematics Part II textbook (2026-27): integration as the inverse of differentiation, standard integrals, integration by substitution, partial fractions and by parts, special integrals, definite integrals, the fundamental theorem of calculus and properties of definite integrals – with formula tables, solved examples, Q&A, 10 MCQs and a free PDF.

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Chapter Overview

Integration is the inverse process of differentiation. If $d/dx\ F(x) = f(x)$, then $\int f(x)\,dx = F(x) + C$, where C is the constant of integration. Such an F is called an antiderivative or primitive.

Indefinite integrals are found using standard results and methods – substitution, partial fractions and integration by parts. A definite integral $\int_a^b f(x)\,dx = F(b) - F(a)$ gives a number and, for $f \geq 0$, the area under the curve.

Important Topics and Concepts

Basics and Standard Integrals

- $\int x^n\,dx = x^{n+1}/(n+1) + C$, $n \neq -1$; $\int (1/x)\,dx = \log|x| + C$.
- $\int e^x\,dx = e^x + C$; $\int a^x\,dx = a^x/\log a + C$.
- $\int \sin x\,dx = -\cos x + C$; $\int \cos x\,dx = \sin x + C$; $\int \sec^2 x\,dx = \tan x + C$.

- $\int dx/\sqrt{(1 - x^2)} = \sin^{-1}x + C$; $\int dx/(1 + x^2) = \tan^{-1}x + C$.
- Properties: $\int [f \pm g]\, dx = \int f\, dx \pm \int g\, dx$; $\int k f\, dx = k \int f\, dx$.

Integration by Substitution

- Put $x = g(t)$ or $t = g(x)$ to convert to a standard form.
- $\int \tan x\, dx = \log |\sec x| + C$; $\int \cot x\, dx = \log |\sin x| + C$.
- $\int \sec x\, dx = \log |\sec x + \tan x| + C$; $\int \operatorname{cosec} x\, dx = \log |\operatorname{cosec} x - \cot x| + C$.
- Trigonometric identities help simplify (e.g. $\sin^2 x = (1 - \cos 2x)/2$).

Special Integrals

- $\int dx/(x^2 - a^2) = (1/2a) \log |(x - a)/(x + a)| + C$.
- $\int dx/(a^2 - x^2) = (1/2a) \log |(a + x)/(a - x)| + C$.
- $\int dx/(x^2 + a^2) = (1/a) \tan^{-1}(x/a) + C$.
- $\int dx/\sqrt{(x^2 \pm a^2)} = \log |x + \sqrt{(x^2 \pm a^2)}| + C$; $\int dx/\sqrt{(a^2 - x^2)} = \sin^{-1}(x/a) + C$.
- Quadratic denominators: complete the square, then use these forms.

Partial Fractions and By Parts

- Partial fractions: split a proper rational function into simpler fractions (linear, repeated, quadratic factors).
- By parts: $\int u\, v\, dx = u \int v\, dx - \int [u' \int v\, dx]\, dx$.
- Choose u by ILATE: Inverse trig, Logarithmic, Algebraic, Trigonometric, Exponential.
- $\int e^x [f(x) + f'(x)]\, dx = e^x f(x) + C$.
- $\int \sqrt{(a^2 - x^2)}\, dx = (x/2)\sqrt{(a^2 - x^2)} + (a^2/2) \sin^{-1}(x/a) + C$.

Definite Integrals and Properties

- Fundamental theorem: $\int_a^b f(x)\, dx = F(b) - F(a)$.
- P_1: $\int_a^b f = -\int$ from b to a of f; P_2: $\int_a^b f = \int$ from a to c of f + $\int$ from c to b of f.
- P_3: $\int_a^b f(x)\, dx = \int_a^b f(a + b - x)\, dx$; P_4: $\int_0^a f(x)\, dx = \int_0^a f(a - x)\, dx$.
- $\int_{-a}^{a} f(x)\, dx = 2\int_0^a f(x)\, dx$ if f is even; = 0 if f is odd.
- $\int_0^{2a} f(x)\, dx = 2\int_0^a f(x)\, dx$ if $f(2a - x) = f(x)$; = 0 if $f(2a - x) = -f(x)$.

Solved Examples

Board-pattern practice.

- $\int x e^x\, dx = x e^x - e^x + C$ (by parts, u = x).
- $\int dx/(x^2 - 4) = (1/4) \log |(x - 2)/(x + 2)| + C$.
- $\int 2x/(1 + x^2)\, dx = \log (1 + x^2) + C$ (substitute $t = 1 + x^2$).
- $\int_0$^(π/2) sin x/(sin x + cos x) dx: using P_4, $I = \int \cos x/(\cos x + \sin x)\, dx$; $2I = \pi/2 \Rightarrow I = \pi/4$.
- $\int_{-1}^{1} x^3\, dx = 0$, since x^3 is odd.

Partial Fraction Forms

Rational function	Partial fraction form
$(px + q)/((x - a)(x - b))$	$A/(x - a) + B/(x - b)$
$(px + q)/(x - a)^2$	$A/(x - a) + B/(x - a)^2$
$(px^2 + qx + r)/((x - a)(x - b)(x - c))$	$A/(x - a) + B/(x - b) + C/(x - c)$
$(px^2 + qx + r)/((x - a)^2(x - b))$	$A/(x - a) + B/(x - a)^2 + C/(x - b)$

Rational function	Partial fraction form
$(px^2 + qx + r)/((x - a)(x^2 + bx + c))$	$A/(x - a) + (Bx + C)/(x^2 + bx + c)$

Important Definitions and Terms

Term	Meaning
Antiderivative	Function whose derivative is the integrand
Indefinite integral	Family F(x) + C
Constant of integration	Arbitrary constant C
Integrand	Function being integrated
Substitution	Changing variable to simplify
Partial fractions	Splitting a rational function
Integration by parts	$\int uv = u\int v - \int(u'\int v)$
ILATE	Order for choosing first function
Definite integral	F(b) – F(a)
Odd function	f(–x) = –f(x)

Short Answer Questions

Q1. Find $\int x^5\,dx$.

$x^6/6 + C$.

Q2. Find $\int \sec^2 x\,dx$.

tan x + C.

Q3. Write $\int dx/(x^2 + a^2)$.

$(1/a)\tan^{-1}(x/a) + C$.

Q4. State the ILATE rule.

Choose the first function in the order Inverse, Logarithmic, Algebraic, Trigonometric, Exponential.

Q5. Find $\int e^x(\sin x + \cos x)\,dx$.

$e^x \sin x + C$.

Q6. Evaluate $\int_0^1 x\,dx$.

1/2.

Q7. What is $\int_{-a}^{a} f(x)\,dx$ for odd f?

0.

Q8. Find $\int \tan x\,dx$.

$\log|\sec x| + C$.

Long Answer Questions

Q1. Evaluate ∫ dx/((x + 1)(x + 2)).

1/((x + 1)(x + 2)) = A/(x + 1) + B/(x + 2).

A = 1, B = –1.

Integrate: log |x + 1| – log |x + 2|.

= log |(x + 1)/(x + 2)| + C.

Check by differentiation.

Q2. Evaluate ∫ x sin x dx.

u = x, v = sin x (ILATE).

∫ = x(–cos x) – ∫ 1·(–cos x) dx.

= –x cos x + ∫ cos x dx.

= –x cos x + sin x + C.

Verify by differentiating.

Q3. Evaluate ∫₀^(π/2) log sin x dx.

I = ∫ log sin x dx; by P₄ I = ∫ log cos x dx.

2I = ∫ log (sin 2x / 2) dx.

= ∫₀^(π/2) log sin 2x dx – (π/2) log 2.

First part equals I (substitution and P₆).

I = –(π/2) log 2.

MCQs with Answers

1. ∫ (1/x) dx =(a) x (b) log |x| + C (c) 1/x² + C (d) e^x + CAnswer: (b) log |x| + C

2. ∫ cos x dx =(a) sin x + C (b) –sin x + C (c) tan x + C (d) –cos x + CAnswer: (a) sin x + C

3. ∫ e^x dx =(a) e^x + C (b) x e^x + C (c) e^x/x + C (d) log x + CAnswer: (a) e^x + C

4. ∫ dx/√(1 – x²) =(a) $\cos^{-1}x$ + C (b) $\sin^{-1}x$ + C (c) $\tan^{-1}x$ + C (d) log x + CAnswer: (b) $\sin^{-1}x$ + C

5. $\int_{-1}^{1} x^5$ dx =(a) 1/3 (b) 0 (c) 2 (d) 1Answer: (b) 0

6. First function by ILATE in ∫ x log x dx(a) x (b) log x (c) either (d) neitherAnswer: (b) log x

7. ∫ sec x dx =(a) log |sec x + tan x| + C (b) tan x + C (c) sec x tan x + C (d) log |cos x| + CAnswer: (a) log |sec x + tan x| + C

8. $\int_0^2$ x dx =(a) 1 (b) 2 (c) 4 (d) 0Answer: (b) 2

9. ∫ x e^x dx =(a) x e^x + C (b) e^x(x – 1) + C (c) e^x(x + 1) + C (d) x² e^x + CAnswer: (b) e^x(x – 1) + C

10. $\int_a^b$ f(x) dx = $\int_a^b$ f(?) dx(a) b – x (b) a + b – x (c) a – x (d) x – aAnswer: (b) a + b – x

Quick Revision Points

- Integration = antidifferentiation.
- Standard integrals table.
- Substitution.
- Special integrals.
- Partial fractions; by parts with ILATE.
- Definite integrals; properties.

Chapter Summary

Integration reverses differentiation: $\int f(x)\,dx = F(x) + C$. Standard results, together with substitution, special integral forms, partial fractions and integration by parts (using ILATE), allow most functions in the syllabus to be integrated.

Definite integrals are evaluated using the fundamental theorem $F(b) – F(a)$, and properties such as $\int_0^a f(x)\,dx = \int_0^a f(a – x)\,dx$ and the even/odd rules make many problems quick.

Exam Tips and PYQ Pattern

- Memorise the standard and special integrals.
- Identify the method before starting.
- Always add + C for indefinite integrals.
- Use P_4 for symmetric definite integrals.
- Check answers by differentiating.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the NCERT Class 12 Mathematics Part II textbook, prescribed in the CBSE 2026-27 syllabus.

Can I download these notes as a PDF?

Yes. Use the free PDF link at the top of this page – no signup needed.

What is the ILATE rule?

A rule for choosing the first function in integration by parts: Inverse trigonometric, Logarithmic, Algebraic, Trigonometric, Exponential.

What is the fundamental theorem of calculus?

If F is an antiderivative of f, then $\int_a^b f(x)\,dx = F(b) – F(a)$.

Conclusion

Integrals is the highest-weightage calculus chapter. Practise every method here and save the free PDF.

More Notes: Class 12 Maths Chapter 6: notes | Class 12 Maths Chapter 8: Application of Integrals notes | All Class 12 Maths notes

Freshness Note: These notes follow the NCERT Class 12 Maths textbook, Mathematics Part II (NCERT reprint 2026-27, rationalised syllabus), and the CBSE syllabus for the 2026-27 session. Last checked on 26 November 2026.