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CHAPTER NOTES

Applications of Integrals Class 12 Notes — CBSE Maths Chapter 8

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Applications of Integrals Class 12 Notes — CBSE Maths Chapter 8

Chapter 8 — **Applications of Integrals** — covers finding areas under curves and between curves using definite integrals. Carries **6 marks** (typically one 6-mark question).

Key Concepts

Area Under a Curve

Area between curve $y = f(x)$, x-axis, and $x = a$ to $x = b$:

$$A = \int_a^b f(x) \, dx \text{ (when curve is above x-axis)}$$

$$A = -\int_a^b f(x) \, dx = \left| \int_a^b f(x) \, dx \right| \text{ (when curve is below x-axis)}$$

Area between curve $x = f(y)$, y-axis, and $y = c$ to $y = d$:

$$A = \int_c^d f(y) \, dy$$

Area Between Two Curves

If $f(x) \geq g(x)$ on $[a, b]$:

$$A = \int_a^b [f(x) - g(x)] \, dx$$

(Upper curve minus lower curve)

Standard Areas (Frequently Asked)

Circle $x^2 + y^2 = r^2$: Area = πr^2

Ellipse $x^2/a^2 + y^2/b^2 = 1$: Area = πab

Parabola $y^2 = 4ax$: Area between vertex and latus rectum = $(8a^2)/3$

Area between line and parabola: find intersection points, integrate the difference

Solved Examples

Example 1

Q: Find the area enclosed by the circle $x^2 + y^2 = 4$.

Solution: $y = \sqrt{4-x^2}$ (upper semicircle)

Area = $4 \int_0^2 \sqrt{4-x^2} dx$ (by symmetry, 4 × first quadrant)

$= 4 \times [x\sqrt{4-x^2}/2 + 2\sin^{-1}(x/2)]_0^2 = 4 \times [0 + 2(\pi/2)] = 4\pi$ sq units

Example 2

Q: Find the area between $y = x^2$ and $y = x$.

Solution: Intersection: $x^2 = x \rightarrow x = 0, 1$. For $0 \leq x \leq 1$: $x \geq x^2$

Area = $\int_0^1 (x - x^2) dx = [x^2/2 - x^3/3]_0^1 = 1/2 - 1/3 = 1/6$ sq units

Quick Revision Points

- Area = $\int(\text{upper} - \text{lower})dx$ or $\int(\text{right} - \text{left})dy$
- Use symmetry to simplify: circle has 4-fold, ellipse has 4-fold symmetry
- Find intersection points first!
- Area is always positive — use absolute value if needed
- Common areas: circle (πr^2), ellipse (πab), parabola problems

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Next: Differential Equations →



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