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Application of Integrals — CBSE Class 12 Mathematics Chapter Test

FREE CHAPTER TEST · CLASS XII · MATHEMATICS (041) · PATTERN OF THE CBSE SAMPLE QUESTION PAPER 2026-27

TIME ALLOWED	MAXIMUM MARKS	QUESTIONS	NAME / ROLL NO.
1½ hours	40	19 (A 10 · B 3 · C 2 · D 2 · E 2)	

GENERAL INSTRUCTIONS

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 19 questions. All questions are compulsory.
2. This question paper is divided into five sections: A, B, C, D and E.
3. In Section A, Questions 1 to 8 are multiple choice questions (MCQs) and Questions 9 and 10 are assertion-reason based questions of 1 mark each.
4. In Section B, Q11–13 are very short answer (VSA) type questions, carrying 2 marks each.
5. In Section C, Q14–15 are short answer (SA) type questions, carrying 3 marks each.
6. In Section D, Q16–17 are long answer (LA) type questions, carrying 5 marks each.
7. In Section E, Q18–19 are case study based questions, carrying 4 marks each, with sub-parts of the values of 1, 1 and 2 marks.
8. There is no overall choice. However, an internal choice has been provided in 1 question of Section B, 1 question of Section C, 1 question of Section D and in the 2-mark sub-part of each question of Section E.
9. Use of calculators is not allowed. log x denotes the natural logarithm of x.
10. This chapter test follows the section structure, question types and marks per question of the CBSE Class XII Mathematics (041) Sample Question Paper 2026-27, released on 21 September 2026 at cbseacademic.nic.in, at half the length of the 80-mark board paper: 40 marks in 1½ hours.
11. The answer key and the marking scheme are at the end of this booklet. Attempt the paper in 1½ hours before you look at them.

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Chapter: Application of Integrals · **Topics:** Area under a line · Area under a parabola · Area of a circle and its parts · Area of an ellipse and its parts · Area with respect to the y-axis · Curves crossing the x-axis

SECTION A

This section comprises 10 questions of 1 mark each: 8 multiple choice questions (MCQs) and 2 assertion-reason based questions.

1. The area of the region bounded by the curve $y = x^2$, the x-axis and the lines $x = 0$ and $x = 3$ is 1

(A) 9 sq units (B) 27 sq units

(C) 3 sq units (D) 18 sq units

2. The area enclosed by the circle $x^2 + y^2 = 16$ is 1

(A) 4π sq units (B) 8π sq units

(C) 16π sq units (D) 32π sq units

3. The area of the region bounded by the line $y = 2x + 1$, the x-axis and the lines $x = 0$ and $x = 2$ is 1

(A) 4 sq units (B) 6 sq units

(C) 5 sq units (D) 8 sq units

4. The area enclosed by the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is 1

(A) 36π sq units (B) 13π sq units

(C) 3π sq units (D) 6π sq units

5. The area of the region in the first quadrant bounded by the parabola $y^2 = 4x$, the x-axis and the line $x = 1$ is 1

(A) $\frac{2}{3}$ sq units (B) $\frac{4}{3}$ sq units

(C) $\frac{8}{3}$ sq units (D) 2 sq units

6. The area of the region bounded by $y = |x|$, the x-axis and the lines $x = -1$ and $x = 1$ is 1

(A) 2 sq units (B) $\frac{1}{2}$ sq unit

(C) 1 sq unit (D) 0

7. The area of the region bounded by the curve $x = y^2$, the y-axis and the lines $y = 0$ and $y = 2$ is 1

(A) $\frac{8}{3}$ sq units (B) $\frac{4}{3}$ sq units

(C) 2 sq units (D) 4 sq units

8. The area of the region bounded by the curve $y = \sin x$ and the x-axis between $x = 0$ and $x = 2\pi$ is 1

(A) 0 (B) 2 sq units

(C) 1 sq unit (D) 4 sq units

9. **Assertion (A):** The area of the region bounded by $y = x^3$, the x-axis and the lines $x = -1$ and $x = 1$ is $\frac{1}{2}$ sq unit. 1

Reason (R): $\int_{-1}^{1} x^3\,dx = 0$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

10. **Assertion (A):** The area of the region bounded by $y = \cos x$, the x-axis and the lines $x = 0$ and $x = \pi$ is 0. 1

Reason (R): $\int_{0}^{\pi} \cos x\,dx = 0$.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

SECTION B

This section comprises 3 very short answer (VSA) type questions of 2 marks each.

11. Find the area of the region bounded by the curve $y = x^2 + 1$, the x-axis and the lines $x = 1$ and $x = 2$. 2

12. (a) Find the area of the region in the first quadrant bounded by the parabola $y^2 = 16x$, the x-axis and the lines $x = 1$ and $x = 4$. 2

OR

(b) Find the area of the region in the first quadrant bounded by the parabola $x^2 = 4y$, the y-axis and the lines $y = 1$ and $y = 4$.

13. Find the area of the region bounded by $y = |x - 2|$, the x-axis and the lines $x = 0$ and $x = 4$. 2

SECTION C

This section comprises 2 short answer (SA) type questions of 3 marks each.

14. (a) Find the area of the region bounded by the curve $y = \sqrt{(4 - x^2)}$, the x-axis and the lines $x = 0$ and $x = 1$. 3

OR

(b) Using integration, find the area of the region in the first quadrant enclosed by the ellipse $\frac{x^2}{9} + \frac{y^2}{25} = 1$ and the coordinate axes.

15. Find the area of the region bounded by the curve $y = x^2$, the x-axis and the lines $x = -1$ and $x = 2$. 3

SECTION D

This section comprises 2 long answer (LA) type questions of 5 marks each.

16. (a) Using integration, find the area enclosed by the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$. 5

OR

(b) Find the area of the region in the first quadrant bounded by the circle $x^2 + y^2 = 16$, the x-axis and the lines $x = 0$ and $x = 2$.

17. Find the area of the region bounded by the parabola $y^2 = 12x$ and its latus rectum. 5

SECTION E

This section comprises 2 case study based questions of 4 marks each, with sub-parts of 1, 1 and 2 marks.

18. A garden is in the shape of the region enclosed by the ellipse $\frac{x^2}{36} + \frac{y^2}{16} = 1$, with lengths in metres.

(i) Express y in terms of x for the upper half of the ellipse. [1]

(ii) Write the integral that gives the area of the part of the garden in the first quadrant. [1]

(iii) Find the total area of the garden. [2]

OR

(iii) Find the area of the part of the garden in the first quadrant between $x = 0$ and $x = 3$. [2]

19. A logo is made from the region bounded by the parabola $x^2 = 4y$ and the line $y = 4$.

(i) Find the points where the line $y = 4$ meets the parabola. [1]

(ii) Express x in terms of y for the right half ($x \geq 0$) of the parabola. [1]

(iii) Find the area of the logo. [2]

OR

(iii) Find the area of the region bounded by the parabola, the x-axis and the line $x = 4$. [2]

END OF THE QUESTION PAPER

ANSWER KEY — SECTION A

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
(A)	(C)	(B)	(D)	(B)	(C)	(A)	(D)	(B)	(D)

MARKING SCHEME AND WORKED SOLUTIONS

Marks for each step are shown in brackets, as in the CBSE marking scheme. Any correct alternative method earns full marks.

Q1. Answer (A). $\int_0^3 x^2\,dx = [x^3/3]_0^3 = 9$.

Q2. Answer (C). $4\int_0^4 \sqrt{(16 - x^2)}\,dx = 4\,[x\sqrt{(16 - x^2)}/2 + 8\sin^{-1}(x/4)]_0^4 = 4 \times 4\pi = 16\pi$.

Q3. Answer (B). $\int_0^2 (2x + 1)\,dx = [x^2 + x]_0^2 = 6$.

Q4. Answer (D). Area of an ellipse = $\pi ab = \pi \times 3 \times 2 = 6\pi$.

Q5. Answer (B). $\int_0^1 2\sqrt{x}\,dx = [(4/3)\,x^{3/2}]_0^1 = 4/3$.

Q6. Answer (C). By symmetry, $2\int_0^1 x\,dx = 2 \times 1/2 = 1$.

Q7. Answer (A). $\int_0^2 y^2\,dy = [y^3/3]_0^2 = 8/3$.

Q8. Answer (D). $\int_0^{\pi} \sin x\,dx = 2$, and the part from π to 2π lies below the x-axis with area $|-2| = 2$; total 4.

Q9. Answer (B). Area = $2\int_0^1 x^3\,dx = 1/2$, so A is true; R is also true (x^3 is odd), but the area is not that integral (the part below the axis must be taken with a positive sign). Answer (B).

Q10. Answer (D). R is true, but the area is $\int_0^{\pi/2} \cos x\,dx + |\int_{\pi/2}^{\pi} \cos x\,dx| = 1 + 1 = 2$, so A is false. Answer (D).

Q11. (2 marks) Answer: 10/3 sq units.
Area = $\int_1^2 (x^2 + 1)\,dx = [x^3/3 + x]_1^2$ [1] = $(8/3 + 2) - (1/3 + 1) = 10/3$ sq units. [1]

Q12. (2 marks) Answer: (a) 56/3 sq units; (b) 28/3 sq units.
(a) In the first quadrant $y = 4\sqrt{x}$, so area = $\int_1^4 4\sqrt{x}\,dx = [(8/3)x^{3/2}]_1^4$ [1] = $(8/3)(8 - 1) = 56/3$ sq units. [1]
OR (b) In the first quadrant $x = 2\sqrt{y}$, so area = $\int_1^4 2\sqrt{y}\,dy = [(4/3)\,y^{3/2}]_1^4$ [1] = $(4/3)(8 - 1) = 28/3$ sq units. [1]

Q13. (2 marks) Answer: 4 sq units.
Area = $\int_0^2 (2 - x)\,dx + \int_2^4 (x - 2)\,dx$ [1] = 2 + 2 = 4 sq units. [1]

Q14. (3 marks) Answer: (a) $\sqrt{3}/2 + \pi/3$ sq units; (b) $15\pi/4$ sq units.
(a) Area = $\int_0^1 \sqrt{(4 - x^2)}\,dx = [x\sqrt{(4 - x^2)}/2 + 2\sin^{-1}(x/2)]_0^1$ [1½] = $\sqrt{3}/2 + 2 \times \pi/6$ [1] = $\sqrt{3}/2 + \pi/3$ sq units. [½]
OR (b) In the first quadrant $y = (5/3)\sqrt{(9 - x^2)}$. [1] Area = $(5/3)\int_0^3 \sqrt{(9 - x^2)}\,dx = (5/3)[x\sqrt{(9 - x^2)}/2 + (9/2)\sin^{-1}(x/3)]_0^3$ [1] = $(5/3)(9/2 \times \pi/2) = 15\pi/4$ sq units. [1]

Q15. (3 marks) Answer: 3 sq units.
Area = $\int_{-1}^2 x^2\,dx$ (the curve lies above the x-axis). [1]
= $[x^3/3]_{-1}^2 = 8/3 - (-1/3)$ [1] = 3 sq units. [1]

Q16. (5 marks) Answer: (a) 20π sq units; (b) $2\sqrt{3} + 4\pi/3$ sq units.
(a) By symmetry, area = 4 × (area in the first quadrant), where $y = (4/5)\sqrt{(25 - x^2)}$. [1] Area = $4 \times (4/5)\int_0^5 \sqrt{(25 - x^2)}\,dx$ [1] = $(16/5)[x\sqrt{(25 - x^2)}/2 + (25/2)\sin^{-1}(x/5)]_0^5$ [1] = $(16/5)(25/2 \times \pi/2)$ [1] = 20π sq units. [1]
OR (b) In the first quadrant $y = \sqrt{(16 - x^2)}$. [1] Area = $\int_0^2 \sqrt{(16 - x^2)}\,dx = [x\sqrt{(16 - x^2)}/2 + 8\sin^{-1}(x/4)]_0^2$ [2] = $\sqrt{12} + 8 \times \pi/6$ [1] = $2\sqrt{3} + 4\pi/3$ sq units. [1]

Q17. (5 marks) Answer: 24 sq units.

For $y^2 = 4ax$, $4a = 12$, so $a = 3$; the latus rectum is the line $x = 3$. [1]

The region is symmetric about the x-axis: area $= 2\int_0^3 \sqrt{(12x)}\,dx$ [1] $= 2 \times 2\sqrt{3}\int_0^3 \sqrt{x}\,dx$ [1] $= 4\sqrt{3} \times (2/3) \times 3^{3/2}$ [1] $= 4\sqrt{3} \times 2\sqrt{3} = 24$ sq units. [1]

Q18. (4 marks) Answer: (i) $y = (2/3)\sqrt{(36 - x^2)}$; (ii) as shown; (iii) 24π m², or $3\sqrt{3} + 2\pi$ m².

(i) $y = (2/3)\sqrt{(36 - x^2)}$. [1]

(ii) $\int_0^6 (2/3)\sqrt{(36 - x^2)}\,dx$. [1]

(iii)(a) Area $= 4 \times (2/3)[x\sqrt{(36 - x^2)}/2 + 18\sin^{-1}(x/6)]_0^6$ [1] $= (8/3)(9\pi) = 24\pi$ m². [1]

OR (iii)(b) $(2/3)[x\sqrt{(36 - x^2)}/2 + 18\sin^{-1}(x/6)]_0^3 = (2/3)(9\sqrt{3}/2 + 3\pi)$ [1] $= 3\sqrt{3} + 2\pi$ m². [1]

Q19. (4 marks) Answer: (i) $(\pm 4, 4)$; (ii) $x = 2\sqrt{y}$; (iii) 64/3 sq units, or 16/3 sq units.

(i) $x^2 = 16$, so the points are $(-4, 4)$ and $(4, 4)$. [1]

(ii) $x = 2\sqrt{y}$. [1]

(iii)(a) By symmetry about the y-axis, area $= 2\int_0^4 2\sqrt{y}\,dy$ [1] $= 4 \times (2/3) \times 4^{3/2} = 64/3$ sq units. [1]

OR (iii)(b) Area $= \int_0^4 (x^2/4)\,dx$ [1] $= [x^3/12]_0^4 = 16/3$ sq units. [1]

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