Application of Integrals Class 12 Important Questions

10 questions · 27 marks · no calculator · step-marked answers

Name _____ Date _____ Score / 27

- Original questions in the board paper's question types, from 1-mark MCQs to a case study. Try every question before you look at the answers.
- No calculator: as in the CBSE board exam, everything works by hand.
- Worked answers with step marks for 5 questions start after the questions. The other 5 open free on the chapter page with a free account (no card): the link is next to each one.
- Online, with more practice: cbsemathrevision.com/class-12/application-of-integrals

Section A · Multiple choice and assertion–reason (1 mark each)

1. **1 mark · Area under lines and parabolas**

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

(a) 9 (b) 27

(c) 3 (d) 6

2. **1 mark · Area of circles and ellipses**

What is the area of the region inside the ellipse $\frac{x^2}{25} + \frac{y^2}{4} = 1$?

(a) 7π (b) 29π

(c) 10π (d) 100π

3. **1 mark · Area under lines and parabolas**

In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.

Assertion (A): The area of the region bounded by $y = \sin x$, the x-axis and the lines $x = 0$ and $x = 2\pi$ is 4 square units.

Reason (R): $\int_0^{2\pi} \sin x \, dx = 0$.

(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 · Short answer (2 marks each)

4. **2 marks · Area under lines and parabolas**

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

5. **2 marks · Area under lines and parabolas**

How much area lies under the curve $y = \sqrt{x}$ and above the x-axis between $x = 0$ and $x = 9$?

Section C · Short answer (3 marks each)

6. **3 marks · Area of circles and ellipses**

Use integration to find the area of the quarter of the circle $x^2 + y^2 = 36$ that lies in the first quadrant.

7. **3 marks · Area under lines and parabolas**

The part of the parabola $y^2 = 9x$ in the first quadrant, the x-axis and the line $x = 4$ enclose a region. Find its area.

Section D · Long answer (5 marks each)

8. **5 marks · Area of circles and ellipses**

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

9. **5 marks · Area with the y-axis**

Find the area enclosed between the curve $x^2 = 9y$ (with $x \geq 0$), the y-axis and the horizontal lines $y = 1$ and $y = 4$.

Section E · Case study (4 marks)

10. **4 marks · Area under lines and parabolas**

Arched gateway. The opening of a garden gateway is bounded by the ground ($y = 0$) and an arch with equation $y = 4 - \dfrac{x^2}{4}$, with x and y in metres.

i. How wide is the opening at ground level? *[1 mark]*

ii. How high is the top of the arch? *[1 mark]*

iii. Find the area of the opening. *[2 marks]*

Answers and worked solutions

Question 1 — 1 mark

$$\int_0^3 x^2\,dx = \left[\frac{x^3}{3}\right]_0^3 = 9 \text{ square units } \textbf{A1}$$

Correct option: (a) 9

Question 2 — 1 mark

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/application-of-integrals#iq-2

Question 3 — 1 mark

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/application-of-integrals#iq-3

Question 4 — 2 marks

Answer: 10 square units

Area $= \int_1^3 (2x+1)\,dx = [x^2+x]_1^3$ **M1**

$= 12 - 2 = 10$ square units **A1**

Question 5 — 2 marks

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/application-of-integrals#iq-5

Question 6 — 3 marks

Answer: 9π square units

Area $= \int_0^6 \sqrt{36-x^2}\,dx$ **M1**

$= \left[\frac{x}{2}\sqrt{36-x^2} + \frac{36}{2}\sin^{-1}\frac{x}{6}\right]_0^6$ **A1**

$= 18 \times \frac{\pi}{2} = 9\pi$ square units **A1**

Question 7 — 3 marks

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/application-of-integrals#iq-7

Question 8 — 5 marks

Answer: 20π square units

Upper half: $y = \frac{4}{5}\sqrt{25-x^2}$ **M1**

By symmetry, area $= 4\int_0^5 \frac{4}{5}\sqrt{25-x^2}\,dx$ **M1**

$\int_0^5 \sqrt{25-x^2}\,dx = \left[\frac{x}{2}\sqrt{25-x^2} + \frac{25}{2}\sin^{-1}\frac{x}{5}\right]_0^5 = \frac{25\pi}{4}$ **A1**

Area $= 4 \times \frac{4}{5} \times \frac{25\pi}{4}$ **A1**

$= 20\pi$ square units **A1**

Question 9 — 5 marks

Worked answer: free with a free account (no card) on the chapter page: cbsemathrevision.com/class-12/application-of-integrals#iq-9

Question 10 — 4 marks

i. $4 - \frac{x^2}{4} = 0 \Rightarrow x = \pm 4$: width $8\,m$ **A1**

ii. Greatest y is at $x = 0$: $4\,m$ **A1**

iii. Area

$= \int_{-4}^{4}\left(4 - \frac{x^2}{4}\right)dx = 2\left[4x - \frac{x^3}{12}\right]_0^4$ **M1**

$= 2\left(16 - \frac{16}{3}\right) = \frac{64}{3}\ \text{m}^2$ **A1**

More on this chapter, free: revision notes, a Route to 95 and practice with instant feedback at cbsemathrevision.com/class-12/application-of-integrals

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