

Class 12 Mathematics: Previous Year Questions, Chapter-wise

1048 CBSE board exam questions, 2022–2026 · 13 chapters · sorted by question type

Each question shows its exam year and marks. A question repeated across paper sets appears once. Questions that need a figure from the original paper are left out. Questions only, no answers. Chapter headings link to free notes and MCQs for that chapter on studynos.co.in.

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1 Relations and Functions

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (18)

Q1. CBSE 2026 · 1 mark A relation R on set $A = \{1, 2, 3\}$ defined as $R = \{(1, 1), (2, 2), (1, 2)\}$ is

- (a) Reflexive only (b) Reflexive and Transitive
(c) Symmetric and Transitive (d) Transitive only

Q2. CBSE 2026 · 1 mark A relation R on set $A = \{1, 2, 3\}$ defined as $R = \{(1, 2), (2, 1), (2, 2)\}$ is

- (a) Reflexive only (b) Reflexive and Transitive
(c) Symmetric and Transitive (d) Symmetric only

Q3. CBSE 2026 · 1 mark Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be a function defined as $f(x) = x^3$, then f is:

- (a) one-one onto function (b) many-one function
(c) one-one but not onto function
(d) neither one-one nor onto function

Q4. CBSE 2026 · 1 mark A relation R on set $A = \{1, 2, 3\}$ is defined as $R = \{(1, 3), (3, 3), (1, 1), (2, 2), (3, 1)\}$ is

- (a) only reflexive and symmetric (b) reflexive only
(c) only reflexive and transitive
(d) reflexive, symmetric and transitive

Q5. CBSE 2026 · 1 mark Assertion (A): A function $f: \mathbb{N} \rightarrow \mathbb{N}$ given by $f(x) = x^3 + 2$, $x \in \mathbb{N}$ is one-one but not onto. Reason (R): Since $\forall y \in \mathbb{N}$ (Codomain), there does not exist $x = (y - 2)^{1/3}$ in $\mathbb{N}$ (Domain) such that $f(x) = x^3 + 2 = y$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q6. CBSE 2026 · 1 mark If points $(2, 3)$, $(0, 4)$ and $(p, 2)$ are collinear, then the value of p is:

- (a) $4/7$ (b) $-3/7$ (c) 4 (d) -4

Q7. CBSE 2026 · 1 mark If the area of triangle ABC with vertices $A(3, 1)$, $B(-2, 1)$ and $C(0, k)$ is 5 sq. units, then values of k are:

- (a) 3, 1 (b) -1, 3 (c) -1, 2 (d) 0, 2

Q8. CBSE 2025 · 1 mark Assertion (A): Let $\mathbb{Z}$ be the set of integers. A function $f: \mathbb{Z} \rightarrow \mathbb{Z}$ defined as $f(x) = 3x - 5$, $\forall x \in \mathbb{Z}$ is a bijective. Reason (R): A function is a bijective if it is both surjective and injective.

- (a) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q9. CBSE 2024 · 1 mark If the points $A(3, -2)$, $B(k, 2)$ and $C(8, 8)$ are collinear, then the value of k is

- (a) 2 (b) -3 (c) 5 (d) -4

Q10. CBSE 2024 · 1 mark A function $f: \mathbb{R}^+ \rightarrow \mathbb{R}$ (where $\mathbb{R}^+$ is the set of all non-negative real numbers) defined by $f(x) = 4x + 3$ is:

- (a) one-one but not onto (b) onto but not one-one
(c) both one-one and onto (d) neither one-one nor onto

Q11. CBSE 2024 · 1 mark A relation R defined on set $A = \{x: x \in \mathbb{Z} \text{ and } 0 \leq x \leq 10\}$ as $R = \{(x, y): x = y\}$ is given to be an equivalence relation. The number of equivalence classes is:

- (a) 1 (b) 2 (c) 10 (d) 11

Q12. CBSE 2024 · 1 mark A relation R defined on a set of human beings as $R = \{(x, y): x \text{ is 5 cm shorter than } y\}$ is:

- (a) reflexive only (b) reflexive and transitive
(c) symmetric and transitive
(d) neither transitive, nor symmetric, nor reflexive



Q13. CBSE 2024 · 1 mark Let $f: \mathbb{R}^+ \rightarrow [-5, \infty)$ be defined as $f(x) = 9x^2 + 6x - 5$, where $\mathbb{R}^+$ is the set of all non-negative real numbers. Then, f is:

- (a) one-one (b) onto (c) bijective
(d) neither one-one nor onto

Q14. CBSE 2024 · 1 mark Which of the following statements is not true about equivalence classes A_i ($i = 1, 2, \dots, n$) formed by an equivalence relation R defined on a set A ?

- (a) $\cup$ from $i=1$ to n of $A_i = A$ (b) $A_i \cap A_j \neq \emptyset, i \neq j$
(c) $x \in A_i$ and $x \in A_j \Rightarrow A_i = A_j$
(d) All elements of A_i are related to each other, for all i

Q15. CBSE 2024 · 1 mark Let $\mathbb{R}^+$ denote the set of all non-negative real numbers. Then the function $f: \mathbb{R}^+ \rightarrow \mathbb{R}^+$ defined as $f(x) = x^2 + 1$ is:

- (a) one-one but not onto (b) onto but not one-one
(c) both one-one and onto (d) neither one-one nor onto

Q16. CBSE 2024 · 1 mark A function $f: \mathbb{R} \rightarrow A$ defined as $f(x) = x^2 + 1$ is onto, if A is:

- (a) $(-\infty, \infty)$ (b) $(1, \infty)$ (c) $[1, \infty)$ (d) $[-1, \infty)$

Q17. CBSE 2024 · 1 mark Let $\mathbb{Z}$ denote the set of integers, then function $f: \mathbb{Z} \rightarrow \mathbb{Z}$ defined as $f(x) = x^3 - 1$ is:

- (a) both one-one and onto (b) one-one but not onto
(c) onto but not one-one (d) neither one-one nor onto

Q18. CBSE 2024 · 1 mark Assertion (A): The relation $R = \{(x, y): (x + y) \text{ is a prime number and } x, y \in \mathbb{N}\}$ is not a reflexive relation. Reason (R): The number ' $2n$ ' is composite for all natural numbers n .

- (a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true, but R is false (d) A is false, but R is true

VERY SHORT ANSWER (6)

Q19. CBSE 2026 · 2 marks Check whether $f: \mathbb{R} - \{3\} \rightarrow \mathbb{R}$ defined as $f(x) = (x^2 - 2)/(x - 3)$ is onto or not.

Q20. CBSE 2026 · 2 marks Check whether $f: \mathbb{R} - \{3\} \rightarrow \mathbb{R}$ defined as $f(x) = (x - 2)/(x - 3)$ is onto or not.

Q21. CBSE 2026 · 2 marks A relation R on $A = \{1, 2, 3\}$ is defined as $R = \{(1, 1) (3, 3), (1, 2)\}$. Is R a symmetric relation? Justify. Write the smallest relation set R_1 such that $R \subseteq R_1$ becomes an equivalence relation on the set $\{1, 2, 3\}$.

Q22. CBSE 2023 · 2 marks (a) A function $f: A \rightarrow B$ defined as $f(x) = 2x$ is both one-one and onto. If $A = \{1, 2, 3, 4\}$, then find the set B . OR (b) Evaluate: $\sin^{-1}(\sin 4\pi/3) + \cos^{-1}(\cos 4\pi/3) + \tan^{-1}(1)$

Q23. CBSE 2023 · 2 marks (a) A function $f: A \rightarrow B$ defined as $f(x) = 2x$ is both one-one and onto. If $A = \{1, 2, 3, 4\}$, then find the set B . OR (b) Evaluate: $\sin^{-1}(\sqrt{3}/2) + \cos^{-1}(\sqrt{3}/2) + \tan^{-1}(1)$

Q24. CBSE 2023 · 2 marks A function $f: A \rightarrow B$ defined as $f(x) = 2x$ is both one-one and onto. If $A = \{1, 2, 3, 4\}$, then find the set B .

SHORT ANSWER (2)

Q25. CBSE 2026 · 3 marks (a) Let $A = \mathbb{R} - \{3\}$ and $B = \mathbb{R} - \{1\}$. A function $f: A \rightarrow B$ is defined by $f(x) = (x - 2)/(x - 3)$. Find whether f is one-one and onto.

Q26. CBSE 2024 · 3 marks A relation R on set $A = \{1, 2, 3, 4, 5\}$ is defined as $R = \{(x, y) : |x^2 - y^2| < 8\}$. Check whether the relation R is reflexive, symmetric and transitive.

LONG ANSWER (16)

Q27. CBSE 2026 · 5 marks A relation R is defined on $\mathbb{Z}$, the set of integers, as $R = \{(x, y) : |x - y| \text{ is divisible by a prime number 'p', } x, y \in \mathbb{Z}\}$. Check whether R is an equivalence relation or not.

Q28. CBSE 2026 · 5 marks Show that $f: \mathbb{R}^+ \rightarrow [-5, \infty)$ given by $f(x) = 4x^2 + 4x - 5$ is both one-one and onto where $\mathbb{R}^+ = [0, \infty)$. Also, find $p \in \mathbb{R}^+$ such that $f(p) = 3$.

Q29. CBSE 2026 · 5 marks Show that a function $f: \mathbb{R}^+ \rightarrow A \subseteq \mathbb{N}$, defined as $f(x) = 4x^2 + 12x + 15$ is one-one. Find set A so that f is onto where $\mathbb{R}^+ = [0, \infty)$. Also, find if there exists $a \in \mathbb{R}^+$ such that $f(a) = 7$. Justify.

Q30. CBSE 2024 · 5 marks Let $A = \{x \mid x \in \mathbb{Z}, 0 \leq x \leq 12\}$. Show that the relation $R = \{(a, b) : a, b \in A, (a - b) \text{ is divisible by } 4\}$ is an equivalence relation. Find the set of elements related to 2.

Q31. CBSE 2024 · 5 marks (a) Show that a function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 2x/(1+x^2)$ is neither one-one nor onto. Further, find set A so that the given function $f: \mathbb{R} \rightarrow A$ becomes an onto function.

Q32. CBSE 2024 · 5 marks (a) Show that a function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 2x^2/(1+x^2)$ is neither one-one nor onto. Further, find set A so that the given function $f: \mathbb{R} \rightarrow A$ becomes an onto function.

Q33. CBSE 2024 · 5 marks Show that a function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = x^2 + x + 1$ is neither one-one nor onto. Also, find all the values of x for which $f(x) = 3$.

Q34. CBSE 2024 · 5 marks A relation R on set $A = \{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$ be defined as $R = \{(x, y) : x + y \text{ is an integer divisible by } 2\}$. Show that R is an equivalence relation. Also, write the equivalence class $[2]$.

Q35. CBSE 2024 · 5 marks A relation R on set $A = \{x : -10 \leq x \leq 10, x \in \mathbb{Z}\}$ is defined as $R = \{(x, y) : (x - y) \text{ is divisible by } 5\}$. Show that R is an equivalence relation. Also, write the equivalence class $[5]$.

Q36. CBSE 2024 · 5 marks Let $A = \mathbb{R} - \{5\}$ and $B = \mathbb{R} - \{1\}$. Consider the function $f: A \rightarrow B$, defined by $f(x) = (x - 3)/(x - 5)$. Show that f is one-one and onto.

Q37. CBSE 2023 · 5 marks A relation R is defined on a set of real numbers $\mathbb{R}$ as $R = \{(x, y) : x \cdot y \text{ is an irrational number}\}$. Check whether R is reflexive, symmetric and transitive or not.

Q38. CBSE 2023 · 5 marks A relation R is defined on a set of real numbers as $R = \{(x, y) : x \cdot y \text{ is an irrational number}\}$. Check whether R is reflexive, symmetric and transitive or not.

Q39. CBSE 2023 · 5 marks A function $f: [-4, 4] \rightarrow [0, 4]$ is given by $f(x) = \sqrt{16 - x^2}$. Show that f is an onto function but not a one-one function. Further, find all possible values of ' a ' for which $f(a) = 7$.



Q40. CBSE 2023 · 5 marks Prove that a function $f: [0, \infty) \rightarrow [-5, \infty)$ defined as $f(x) = 4x^2 + 4x - 5$ is both one-one and onto.

Q41. CBSE 2023 · 5 marks Check whether a function $f: [-1/2, 1/2]$ defined as $f(x) = x/(1 + 2x)$ is one-one and onto or not.

Q42. CBSE 2023 · 5 marks If N denotes the set of all natural numbers and R is the relation on $N \times N$ defined by $(a, b) R (c, d)$, if $ad(b + c) = bc(a + d)$. Show that R is an equivalence relation.

CASE-BASED (7)

CASE STUDY · CBSE 2026

Two friends Ramesh and Divya have started playing Ludo at their house. While rolling the die, they observed each time, that the possible outcomes are $\{1, 2, 3, 4, 5, 6\}$. Let A be the set of players and B be the set of all possible outcomes, so $A = \{\text{Ramesh, Divya}\}$ and $B = \{1, 2, 3, 4, 5, 6\}$. Let relation $R: B \rightarrow B$ be defined as $R = \{(x, y) : y \text{ is divisible by } x\}$.

Q43. CBSE 2026 · 1 mark Let relation $R: B \rightarrow B$ be defined as $R = \{(x, y) : y \text{ is divisible by } x\}$. Write all elements of R .

Q44. CBSE 2026 · 1 mark Assertion (A): A function $f: N \rightarrow N$ given by $f(x) = x^3 + 2$, $x \in N$ is one-one but not onto. Reason (R): Since $y \in N$ (Codomain), there does not exist $x = (y - 2)^{1/3}$ in N (Domain) such that $f(x) = x^3 + 2 = y$. Which of the following is correct?

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

Q45. CBSE 2026 · 1 mark Assertion (A) : A relation R on the set $\{1, 2, 3\}$ defined as $R = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3)\}$ is an equivalence relation. Reason (R) : A relation that is reflexive, symmetric and transitive is an equivalence relation.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

CASE STUDY · CBSE 2026

A school wants the students of class XII to do a project on 'Sustainability' keeping the world environment in mind. They select the student participants on the basis of an essay writing competition. 7 students out of 80 are selected for the project and are categorized into two sets such that : Girl students belong to Set $A = \{G_1, G_2, G_3, G_4\}$, Boy students belong to Set $B = \{B_1, B_2, B_3\}$.

Q46. CBSE 2026 · 1 mark How many relations are possible from Set $A \rightarrow$ Set B ?

Q47. CBSE 2026 · 1 mark A school wants the students of class XII to do a project on 'Sustainability' keeping the world environment in mind. They select the student participants on the basis of an essay writing competition. 7 students out of 80 are selected for the project and are categorized into two sets such that: Girl students belong to Set $A = \{G_1, G_2, G_3, G_4\}$, Boy students belong to Set $B = \{B_1, B_2, B_3\}$. How many relations are possible from Set $A \rightarrow$ Set B ?

CASE STUDY · CBSE 2025

A class-room teacher is keen to assess the learning of her students the concept of "relations" taught to them. She writes the following five relations each defined on the set $A = \{1, 2, 3\}$: $R_1 = \{(2, 3), (3, 2)\}$, $R_2 = \{(1, 2), (1, 3), (3, 2)\}$, $R_3 = \{(1, 2), (2, 1), (1, 1)\}$, $R_4 = \{(1, 1), (1, 2), (3, 3), (2, 2)\}$, $R_5 = \{(1, 1), (1, 2), (3, 3), (2, 2), (2, 1), (2, 3), (3, 2)\}$

Q48. CBSE 2025 · 4 marks (i) Identify the relation which is reflexive, transitive but not symmetric.

CASE STUDY · CBSE 2023

The equation of the path traced by a roller-coaster is given by the polynomial $f(x) = a(x + 9)(x + 1)(x - 3)$. If the roller-coaster crosses y-axis at a point $(0, 1)$.

Q49. CBSE 2023 · 2 marks (i) Find the value of a .

2 Inverse Trigonometric Functions

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (15)

Q1. CBSE 2026 · 1 mark If $2 \cos^{-1} x = y$, then

- (a) $0 \leq y \leq \pi$ (b) $-\pi \leq y \leq \pi$ (c) $0 \leq y \leq 2\pi$ (d) $-\pi \leq y \leq 0$

Q2. CBSE 2026 · 1 mark If $\tan^{-1} x = 3y$, then

- (a) $-\pi/2 < y < \pi/2$ (b) $-3\pi/2 < y < 3\pi/2$ (c) $-\pi/6 < y < \pi/6$ (d) $-\pi/6 \leq y \leq \pi/6$

Q3. CBSE 2026 · 1 mark If $\sin^{-1} x + \pi/2 = y$, then

- (a) $-\pi/2 \leq y \leq \pi/2$ (b) $-3\pi/2 \leq y \leq -\pi/2$ (c) $\pi/2 \leq y \leq 3\pi/2$ (d) $0 \leq y \leq \pi$

Q4. CBSE 2026 · 1 mark If $y = \tan^{-1}[(1 - \cos x)/\sin x]$, then dy/dx is equal to :

- (a) 1 (b) 2 (c) $1/2$ (d) $-1/2$

Q5. CBSE 2026 · 1 mark The domain of $f(x) = \cos^{-1}(2x - 5)$ is :

- (a) $[-1, 1]$ (b) $[4, 6]$ (c) $[-7, -3]$ (d) $[2, 3]$



Q6. CBSE 2026 · 1 mark The domain of $\sin^{-1}(1 - 2x)$ is:

- (a) $[-1, 1]$ (b) $[-1, 3]$ (c) $[-2, 2]$ (d) $[0, 1]$

Q7. CBSE 2026 · 1 mark The domain of $\cos^{-1}(4x + 1)$ is:

- (a) $[-1, 1]$ (b) $[-3, 5]$ (c) $[-4, 4]$ (d) $[-1/2, 0]$

Q8. CBSE 2026 · 1 mark The principal value of $\sec^{-1}(\sqrt{2}) + 2 \operatorname{cosec}^{-1}(-\sqrt{2})$ is:

- (a) $-\pi/2$ (b) $-\pi/4$ (c) $\pi/4$ (d) $\pi/2$

Q9. CBSE 2026 · 1 mark For the inverse trigonometric functions, which of the following Principal Value Branch is not correctly defined?

- (a) $\tan^{-1} : \mathbb{R} \rightarrow (-\pi/2, \pi/2)$
 (b) $\sec^{-1} : \mathbb{R} - (-1, 1) \rightarrow [0, \pi] - \{\pi/2\}$ (c) $\cot^{-1} : \mathbb{R} \rightarrow (0, \pi)$
 (d) $\operatorname{cosec}^{-1} : \mathbb{R} - (-1, 1) \rightarrow [-\pi/2, \pi/2]$

Q10. CBSE 2026 · 1 mark Derivative of $\cos^{-1}(\sin x + \cos x)/\sqrt{2}$, $-\pi/4 < x < \pi/4$ with respect to x is:

- (a) -1 (b) 1 (c) $\pi/4$ (d) $-\pi/4$

Q11. CBSE 2024 · 1 mark The derivative of $\tan^{-1}(x^2)$ w.r.t. x is:

- (a) $x/(1+x^4)$ (b) $2x/(1+x^4)$ (c) $-2x/(1+x^4)$ (d) $1/(1+x^4)$

Q12. CBSE 2024 · 1 mark If $y = \cos^{-1}(e^x)$, then dy/dx is:

- (a) $1/(e^x\sqrt{1-e^{2x}})$ (b) $-1/(e^x\sqrt{1-e^{2x}})$ (c) $1/\sqrt{1-e^{2x}}$
 (d) $-1/\sqrt{1-e^{2x}}$

Q13. CBSE 2023 · 1 mark Assertion (A): The range of the function $f(x) = 2 \sin^{-1}(x) + 2\pi/3$, where $x \in [-1, 1]$, is $[2\pi/5, 2\pi]$. Reason (R): The range of the principal value branch of $\sin^{-1}(x)$ is $[0, \pi]$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true and Reason (R) is false.
 (d) Assertion (A) is false and Reason (R) is true.

Q14. CBSE 2023 · 1 mark Assertion (A) : All trigonometric functions have their inverses over their respective domains. Reason (R) : The inverse of $\tan^{-1} x$ exists for some x .

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true and Reason (R) is false.
 (d) Assertion (A) is false and Reason (R) is true.

Q15. CBSE 2023 · 1 mark Assertion (A): All trigonometric functions have their inverses over their respective domains. Reason (R): The inverse of $\tan^{-1} x$ exists for some $x \in \mathbb{R}$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true and Reason (R) is false.
 (d) Assertion (A) is false and Reason (R) is true.

VERY SHORT ANSWER (24)

Q16. CBSE 2026 · 2 marks Simplify: $\tan^{-1}((\cos 2x + \sin 2x)/(\cos 2x - \sin 2x))$, $0 < x < \pi/4$.

Q17. CBSE 2026 · 2 marks Simplify: $\cot^{-1}((1 + \cos 2x)/(1 - \cos 2x))$, $x \in [0, \pi/2]$.

Q18. CBSE 2026 · 2 marks Simplify: $\sin^{-1}(\sqrt{(1 + \cos 2x)/2})$, $0 < x < \pi/2$

Q19. CBSE 2026 · 2 marks If $x = e^{\sin^{-1} t}$, $y = e^{\cos^{-1} t}$, find dy/dx at $t = 1/2$

Q20. CBSE 2026 · 2 marks Find the value of $\sin [\cot^{-1}(\sqrt{2}(\cos(\tan^{-1} 1)))]$.

Q21. CBSE 2026 · 2 marks Evaluate: $\tan^{-1}((\sqrt{3} - 1)/(\sqrt{3} + 1)) + \cot^{-1}(1/\sqrt{3}) + \tan^{-1}(\sin(-\pi/2)) + \tan^{-1}(2\tan(3\pi/8))$

Q22. CBSE 2026 · 2 marks Evaluate: $\tan^{-1}(1 - \sqrt{3})/\sqrt{3} + \cot^{-1}(1/\sqrt{3}) + \tan^{-1}(\sin(-\pi/2)) + \tan^{-1}(2\tan(3\pi/8))$

Q23. CBSE 2026 · 2 marks Evaluate: $\tan^{-1}(1 - \sqrt{3}/1 + \sqrt{3}) + \cot^{-1}(1/\sqrt{3}) + \tan^{-1}(\sin(-\pi/2)) + \tan^{-1}(2\tan(3\pi/8))$

Q24. CBSE 2026 · 2 marks Evaluate $\sin^{-1}(3\tan(\tan^{-1}(1/4)))$.

Q25. CBSE 2026 · 2 marks Evaluate $\sin[1 - 7\cos^2\theta \cos\theta - \sin\theta]/(\sin 6\theta)$

Q26. CBSE 2026 · 2 marks Evaluate $\tan(\tan^{-1}((1 - 3\cos\theta)/(\sin\theta + \sqrt{3}\cos\theta)))$.

Q27. CBSE 2025 · 2 marks Evaluate: $\tan^{-1}(2 \sin^{-1}(2/\sqrt{3}) - \cos^{-1}(2/\sqrt{3}))$

Q28. CBSE 2024 · 2 marks Find the value of $\tan^{-1}(1) + \cos^{-1}(-1/2) + \sin^{-1}(-1/2)$.

Q29. CBSE 2024 · 2 marks Differentiate $\cot^{-1}((1 + x + x^2)/x)$ w.r.t. x .

Q30. CBSE 2024 · 2 marks (a) Find the value of $\tan^{-1}(-1/\sqrt{3}) + \cot^{-1}(1/\sqrt{3}) + \tan^{-1}(\sin(-\pi/2))$.

Q31. CBSE 2024 · 2 marks Find the value of $\sin^{-1}(-1/2) + \cos^{-1}(-\sqrt{3}/2) + \cot^{-1}(\tan(4\pi/3))$.

Q32. CBSE 2024 · 2 marks Evaluate: $\sec^2(\tan^{-1}(1/2)) + \operatorname{cosec}^2(\cot^{-1}(1/3))$

Q33. CBSE 2024 · 2 marks Find the value of $\{\sin^{-1}(\cos(\tan^{-1}(\sec^{-1}(3)))) + \sin^{-1}(3/5)\}$.

Q34. CBSE 2024 · 2 marks Express $\tan^{-1}(\cos x - \sin x)/(\cos x)$, where $-\pi/2 < x < \pi/2$ in the simplest form.

Q35. CBSE 2023 · 2 marks Evaluate $\sin^{-1}(\sin 3\pi/4) + \cos^{-1}(\cos \pi) + \tan^{-1}(1)$.

Q36. CBSE 2023 · 2 marks Evaluate: $\sin^{-1}(1/2) + \cos^{-1}(\sqrt{3}/2) + \cos^{-1}(0)$.

Q37. CBSE 2023 · 2 marks Evaluate: $\sin^{-1}(\sin(3\pi/11)) + \cos^{-1}(\cos(2 \cdot 3\pi/11))$

Q38. CBSE 2023 · 2 marks Evaluate: $\sin^{-1}(\cos(\sin^{-1}(\sqrt{3}/2))) + \cos^{-1}(\cos(\sin^{-1}(\sqrt{3}/2)))$

Q39. CBSE 2023 · 2 marks Find the domain of $y = \sin^{-1}(x^2 - 4)$.

SHORT ANSWER (2)

Q40. CBSE 2026 · 3 marks Find the value of $\sin^{-1}(3/5) + \tan^{-1}(5/6) + \cos^{-1}(13/6)$.

Q41. CBSE 2022 · 3 marks Evaluate: $\int_0^1 \tan^{-1} x \, dx$



LONG ANSWER (3)

Q42. CBSE 2026 · 5 marks Find the domain of $g(x) = \cos^{-1}(x^2 - 1)$. Hence, find the value of x for which $g(x) = \pi/3$. Also, write the range of $\cos^{-1} x$ other than its principal branch.

Q43. CBSE 2026 · 5 marks Find the domain of $p(x) = \sin^{-1}(1 - 2x^2)$. Hence, find the value of x for which $p(x) = \pi/6$. Also, write the range of $2p(x) + \pi/2$.

Q44. CBSE 2026 · 5 marks Find the domain of $q(x) = \cos^{-1}(4x^2 - 3)$. Hence, find the value of x for which $q(x) = 0$. Also, write the range of $3q(x) - \pi$.

CASE-BASED (6)

Q45. CBSE 2024 · 1 mark Assertion (A): $\sec^{-1}(2/\sqrt{3}) = \pi/6$. Reason (R): $\cos(\pi/6) = \sqrt{3}/2$

Q46. CBSE 2023 · 1 mark Assertion (A): Range of $[\sin^{-1} x + 2 \cos^{-1} x]$ is $[0, \pi]$. Reason (R): Principal value branch of $\sin^{-1} x$ has range $[-\pi/2, \pi/2]$.

Q47. CBSE 2023 · 1 mark Assertion (A): Range of $[\sin^{-1} x + 2 \cos^{-1} x]$ is $[0, \pi]$. Reason (R): Principal value branch of $\sin^{-1} x$ has range $[-\pi/2, \pi/2]$. Select the correct answer

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A)
- (c) Assertion (A) is true and Reason (R) is false
- (d) Assertion (A) is false and Reason (R) is true

CASE STUDY · CBSE 2024

If a function $f : X \rightarrow Y$ defined as $f(x) = y$ is one-one and onto, then we can define a unique function $g : Y \rightarrow X$ such that $g(y) =$

x , where $x \in X$ and $y = f(x)$, $y \in Y$. Function g is called the inverse of function f . The domain of sine function is $\mathbb{R}$ and function $\sin : \mathbb{R} \rightarrow \mathbb{R}$ is neither one-one nor onto. Let sine function be defined from set A to $[-1, 1]$ such that inverse of sine function exists, i.e., $\sin^{-1} x$ is defined from $[-1, 1]$ to A .

Q48. CBSE 2024 · 1 mark If A is the interval other than principal value branch, give an example of one such interval.

CASE STUDY · CBSE 2023

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer: (A) Both (A) and (R) are true and (R) is the correct explanation of (A). (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). (C) (A) is true, but (R) is false. (D) (A) is false, but (R) is true.

Q49. CBSE 2023 · 1 mark Assertion (A): Maximum value of $(\cos^{-1} x)^2$ is π^2 . Reason (R): Range of the principal value branch of $\cos^{-1} x$ is $(-\pi/2, \pi/2)$.

CASE STUDY · CBSE 2023

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

Q50. CBSE 2023 · 1 mark Assertion (A): All trigonometric functions have their inverses over their respective domains. Reason (R): The inverse of $\tan^{-1} x$ exists for some $x \in \mathbb{R}$.

3 Matrices**Notes & MCQs →****MULTIPLE CHOICE AND ASSERTION-REASON** (73)

Q1. CBSE 2026 · 1 mark Which of the following cannot be the order of a row-matrix?

- (a) 2×1 (b) 1×2 (c) 1×1 (d) $1 \times n$

Q2. CBSE 2026 · 1 mark Which of the following properties is/are true for two matrices of suitable orders? (i) $(A + B)' = A' + B'$ (ii) $(A - B)' = B' - A'$ (iii) $(AB)' = AB$ (iv) $(kAB)' = kBA$ (k is a scalar)

- (a) (i) only (b) (i), (ii) and (iii) (c) (i) and (ii) (d) (i) and (iv)

Q3. CBSE 2026 · 1 mark If A and B are skew symmetric matrices of same order, then which of the following matrices is also skew symmetric?

- (a) AB (b) $AB + BA$ (c) $(A + B)^2$ (d) $A - B$

Q4. CBSE 2026 · 1 mark Which of the following cannot be an order of a column-matrix?

- (a) 1×2 (b) 2×1 (c) 1×1 (d) $m \times 1$, where $m \in \mathbb{N}$

Q5. CBSE 2026 · 1 mark If A and B are symmetric matrices of same order, then which of the following matrices is a skew-symmetric matrix?

- (a) $A^2 + B^2$ (b) $A^2 - B^2$ (c) $AB + BA$ (d) $AB - BA$

Q6. CBSE 2026 · 1 mark If $A = [a_{ij}]_{3 \times 3}$ is a scalar matrix then which of the following must be true?

- (a) A must be a symmetric matrix
(b) A must be a skew-symmetric matrix
(c) A must be an identity matrix (d) A must be a null matrix

Q7. CBSE 2026 · 1 mark Which of the following properties is/are true for two matrices of suitable orders? (i) $(A + B)^T = A^T + B^T$ (ii) $(A - B)^T = B^T - A^T$ (iii) $(AB)^T = AB^T$ (iv) $(kAB)^T = kBA^T$ (k is a scalar)

- (a) (i) only (b) (i), (ii) and (iii) (c) (i) and (ii) (d) (i) and (iv)

Q8. CBSE 2026 · 1 mark If A and B are symmetric matrices of same order, then $(AB - BA)$ is a

- (a) Zero matrix (b) Identity matrix (c) Symmetric matrix
(d) Skew symmetric matrix



Q9. CBSE 2026 · 1 mark If A and B are square matrices of same order, then which of the following statements is/are always true?

(i) $(A + B)(A - B) = A^2 - B^2$ (ii) $AB = BA$ (iii) $(A + B)^2 = A^2 + AB + BA + B^2$ (iv) $AB = 0 \Rightarrow A = 0$ or $B = 0$

- (a) Only (i) and (iii) (b) Only (ii) and (iii) (c) Only (iii)
(d) Only (iii) and (iv)

Q10. CBSE 2026 · 1 mark If $A = \begin{bmatrix} 1 & a & b \\ -1 & 2 & c \\ 0 & 3 & 5 \end{bmatrix}$ is a symmetric matrix, then the value of $3a + b + c$ is

- (a) 2 (b) 6 (c) 4 (d) 0

Q11. CBSE 2026 · 1 mark If $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ and $A + A' = I$, then the value of $x \in [0, 2\pi]$ is

- (a) 0 (b) $\pi/4$ (c) $\pi/3$ (d) $\pi/2$

Q12. CBSE 2026 · 1 mark For a square matrix A, $(3A)^{-1} =$

- (a) $3A^{-1}$ (b) $9A^{-1}$ (c) $(1/3)A^{-1}$ (d) $(1/9)A^{-1}$

Q13. CBSE 2026 · 1 mark If $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ and $A + A' = I$, then value of $x \in [-\pi/2, \pi/2]$ is

- (a) $\pi/2$ (b) $\pi/3$ (c) 0 (d) $-\pi/2$

Q14. CBSE 2026 · 1 mark The number of all possible matrices of order 2×3 with each entry 1 or 2 is :

- (a) 16 (b) 81 (c) 64 (d) 32

Q15. CBSE 2026 · 1 mark If $A = \begin{bmatrix} 1 & a & b \\ -1 & 2 & c \\ 0 & 5 & 3 \end{bmatrix}$ is a symmetric matrix, then the value of $3a + b + c$ is

- (a) 2 (b) 6 (c) 4 (d) 0

Q16. CBSE 2026 · 1 mark If $A = \begin{bmatrix} \tan x & -\cot x \\ \cot x & \tan x \end{bmatrix}$ and $A + A' = 2I$, then value of x in $(\pi/2, 0)$ is

- (a) 0 (b) $\pi/3$ (c) $\pi/4$ (d) $\pi/2$

Q17. CBSE 2026 · 1 mark If A and B are skew-symmetric matrices of same order, then $AB + BA$ is a/an :

- (a) symmetric matrix (b) skew-symmetric matrix
(c) null matrix (d) identity matrix

Q18. CBSE 2026 · 1 mark If $\begin{bmatrix} 4 & 1 & 3 \\ -4 & 8 & 4 \\ -1 & 2 & 1 \end{bmatrix} A = \begin{bmatrix} -4 & 8 & 4 \\ -1 & 2 & 1 \\ -3 & 6 & 3 \end{bmatrix}$, then order of A must be :

- (a) 3×1 (b) 1×3 (c) 1×1 (d) 3×3

Q19. CBSE 2026 · 1 mark If $A^2 = 4A + 3I$ and $A^{-1} = xA + yI$, then the value of $(x + y)$ is:

- (a) -1 (b) 1 (c) $5/3$ (d) 7

Q20. CBSE 2026 · 1 mark If a matrix B is such that $B \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 2 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 2 & 0 & 1 \end{bmatrix}$, then the order of matrix B is:

- (a) 1×3 (b) 3×1 (c) 3×3 (d) 1×1

Q21. CBSE 2026 · 1 mark If a square matrix A is such that $A^2 = A$ and $(I - A)^3 = xA + I$, then value of x must be:

- (a) 7 (b) 5 (c) -7 (d) -1

Q22. CBSE 2026 · 1 mark If $A = [a_{ij}]$ is a 2×2 matrix whose elements are given by $a_{ij} = (i - 3j)/2$, then A is:

- (a) $\begin{bmatrix} -5/2 & 1/2 \\ -1 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} -1/2 & 1/2 \\ 5/2 & 2 \end{bmatrix}$
(c) $\begin{bmatrix} -5/2 & -1/2 \\ 1 & 1/2 \end{bmatrix}$ (d) $\begin{bmatrix} -1/2 & -2/2 \\ 5/2 & 1/2 \end{bmatrix}$

Q23. CBSE 2026 · 1 mark Assertion (A): If A and B are two square matrices such that AB and BA are defined, then it is not necessary that $AB = BA$. Reason (R): Product of two diagonal matrices of same order is commutative.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q24. CBSE 2026 · 1 mark Let $A = [a_{ij}]$ be a 2×2 matrix whose elements are given by $a_{ij} = 2(2i - j)/3$. Then A is:

- (a) $\begin{bmatrix} 1/3 & -3/4 \\ 4/3 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 1/3 & 0 \\ 4/3 & -3 \end{bmatrix}$
(c) $\begin{bmatrix} 4/3 & -3/3 \\ 1/3 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 4/3 & 0 \\ 1/3 & -3 \end{bmatrix}$

Q25. CBSE 2026 · 1 mark Let $A = [a_{ij}]$ be a 2×2 matrix whose elements are given by $a_{ij} = (2(i + 2j))/3$. Then A is given by:

- (a) $\begin{bmatrix} 25/12 & 3 \\ 16/3 & 33 \end{bmatrix}$ (b) $\begin{bmatrix} 16/12 & 3 \\ 25/3 & 33 \end{bmatrix}$
(c) $\begin{bmatrix} 25/3 & 3 \\ 16/12 & 3 \end{bmatrix}$ (d) $\begin{bmatrix} 16/3 & 3 \\ 25/12 & 3 \end{bmatrix}$

Q26. CBSE 2026 · 1 mark If $\sin \cos A = \cos -\sin$ and $A + A = I$, then is equal to:

- (a) 0 (b) $\pi/6$ (c) $\pi/3$ (d) $\pi/2$

Q27. CBSE 2026 · 1 mark If A is a symmetric matrix, then for any matrix B of order same as A, BAB is a/an:

- (a) Skew symmetric matrix (b) Identity matrix
(c) Symmetric matrix (d) Null matrix

Q28. CBSE 2026 · 1 mark Let $A = \begin{bmatrix} 0 & 3 & 4 \\ -2 & 0 & 1 \\ -4 & -1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & -0 & 1 \\ 2 & 4 & -3 \end{bmatrix}$. If $A + B + C = O$, then matrix C is:

- (a) $\begin{bmatrix} -2 & -3 & 5 \\ 3 & 4 & -3 \end{bmatrix}$ (b) $\begin{bmatrix} -3 & -3 & -5 \\ 3 & 4 & 2 \end{bmatrix}$ (c) $\begin{bmatrix} 3 & 3 & -5 \\ -3 & -4 & 2 \end{bmatrix}$
(d) $\begin{bmatrix} -5 & -3 & -3 \\ 2 & 3 & 4 \end{bmatrix}$

Q29. CBSE 2026 · 1 mark For any square matrix A with real entries, if $A + A'$ is a symmetric matrix then:

- (a) $(A - A')$ cannot be a skew symmetric matrix
(b) $(A - A')$ is a skew symmetric matrix
(c) A is always a symmetric matrix
(d) A is always a skew symmetric matrix

Q30. CBSE 2026 · 1 mark A matrix $B = [b_{ij}]_{m \times m}$ is said to be a diagonal matrix, if:

- (a) $b_{ij} = 0$, when $i = j$ (b) $b_{ij} = 1$, when $i = j$
(c) $b_{ij} = 1$, when $i \neq j$ (d) $b_{ij} = 0$, when $i \neq j$

Q31. CBSE 2025 · 1 mark Let $A = \begin{bmatrix} 1 & 2 & -1 \\ 0 & 4 & -1 \\ 3 & 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 2 \\ 5 \\ 7 \end{bmatrix}$, $C = \begin{bmatrix} 9 & 8 & 7 \end{bmatrix}$ which of the following is defined?

- (a) Only AB (b) Only AC (c) Only BA (d) All AB, AC and BA

Q32. CBSE 2025 · 1 mark If A and B are invertible matrices, then which of the following is not correct?

- (a) $(A + B)^{-1} = B^{-1} + A^{-1}$ (b) $(AB)^{-1} = B^{-1}A^{-1}$
(c) $\text{adj}(A) = |A| A^{-1}$ (d) $|A|^{-1} = |A^{-1}|$

Q33. CBSE 2024 · 1 mark If $A = \begin{bmatrix} \sin x & -\cos x \\ \cos x & \sin x \end{bmatrix}$, then the value of x, for which A is an identity matrix, is

- (a) $\pi/2$ (b) π (c) 0 (d) $3\pi/2$



Q34. CBSE 2024 · 1 mark If the matrix $A = [0, a, -7; -3, 0, -5; b, 3, 0]$ is a skew-symmetric matrix, then the values of 'a' and 'b' are

- (a) $a = 5, b = 3$ (b) $a = 5, b = -7$ (c) $a = -5, b = -7$
(d) $a = -5, b = 7$

Q35. CBSE 2024 · 1 mark If $[8, 14; 9, 7] = [1, 2; 3, 1]X$, then matrix X is

- (a) $[3, 2; 0, 7]$ (b) $[2, 7; 0, 3]$ (c) $[2, 0; 3, 7]$ (d) $[2, -0; 3, 7]$

Q36. CBSE 2024 · 1 mark If a matrix has 36 elements, the number of possible orders it can have, is:

- (a) 13 (b) 3 (c) 5 (d) 9

Q37. CBSE 2024 · 1 mark If A and B are two non-zero square matrices of same order such that $(A + B)^2 = A^2 + B^2$, then:

- (a) $AB = O$ (b) $AB = -BA$ (c) $BA = O$ (d) $AB = BA$

Q38. CBSE 2024 · 1 mark If $[[x + y, 2], [5, xy]] = [[6, 2], [5, 8]]$, then the value of $(2x + 2y)/(24/x + 24/y)$ is:

- (a) 7 (b) 6 (c) 8 (d) 18

Q39. CBSE 2024 · 1 mark If matrices A and B are of order 1×3 and 3×1 respectively, then the order of $A'B'$ is:

- (a) 1×1 (b) 3×1 (c) 1×3 (d) 3×3

Q40. CBSE 2024 · 1 mark If $[x + 2y, 5; 2, x + y] = [6, 5; 2, 8]$, then the value of $(x/24 + y/24)$ is:

- (a) 7 (b) 6 (c) 8 (d) 18

Q41. CBSE 2024 · 1 mark If the sum of all the elements of a 3×3 scalar matrix is 9, then the product of all its elements is:

- (a) 0 (b) 9 (c) 27 (d) 729

Q42. CBSE 2024 · 1 mark If $A = [a_{ij}]$ be a 3×3 matrix, where $a_{ij} = i - 3j$, then which of the following is false?

- (a) $a_{11} < 0$ (b) $a_{12} + a_{21} = -6$ (c) $a_{13} > a_{31}$ (d) $a_{31} = 0$

Q43. CBSE 2024 · 1 mark If $F(x) = |\cos x, \sin x, 0; -\sin x, \cos x, 0; 0, 0, 1|$ and $[F(x)]^2 = F(kx)$, then the value of k is:

- (a) 1 (b) 2 (c) 0 (d) -2

Q44. CBSE 2024 · 1 mark Assertion (A): For any symmetric matrix A, $B'AB$ is a skew-symmetric matrix. Reason (R): A square matrix P is skew-symmetric if $P' = -P$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q45. CBSE 2024 · 1 mark The number of all scalar matrices of order 3, with each entry $-1, 0$ or 1 , is:

- (a) 1 (b) 3 (c) 2 (d) 39

Q46. CBSE 2024 · 1 mark If for the matrix $A = [1, -\tan(x); \tan(x), 1]$, $A + A' = (2/3)I$, then the value of $x \in [0, \pi/2]$ is:

- (a) 0 (b) $\pi/4$ (c) $\pi/3$ (d) $\pi/6$

Q47. CBSE 2024 · 1 mark If $A = [a_{ij}]$ is an identity matrix, then which of the following is true ?

- (a) $a_{ij} = 1$ if $i = j$, 0 if $i \neq j$ (b) $a_{ij} = 1$, for all i, j
(c) $a_{ij} = 0$, for all i, j (d) $a_{ij} = 0$ if $i = j$, 1 if $i \neq j$

Q48. CBSE 2024 · 1 mark If A and B are two skew symmetric matrices, then $(AB + BA)$ is :

- (a) a skew symmetric matrix (b) a symmetric matrix
(c) a null matrix (d) an identity matrix

Q49. CBSE 2024 · 1 mark If $A = [2 \ 0 \ 0; 0 \ 3 \ 0; 0 \ 0 \ 5]$, then A^{-1} is :

- (a) $[1/2 \ 0 \ 0; 0 \ 1/3 \ 0; 0 \ 0 \ 1/5]$ (b) $30[1/2 \ 0 \ 0; 0 \ 1/3 \ 0; 0 \ 0 \ 1/5]$
(c) $(1/30)[2 \ 0 \ 0; 0 \ 3 \ 0; 0 \ 0 \ 5]$
(d) $(1/30)[1/2 \ 0 \ 0; 0 \ 1/3 \ 0; 0 \ 0 \ 1/5]$

Q50. CBSE 2024 · 1 mark Assertion (A): Every scalar matrix is a diagonal matrix. Reason (R): In a diagonal matrix, all the diagonal elements are 0.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q51. CBSE 2024 · 1 mark For any square matrix A, $(A - A^T)$ is always:

- (a) an identity matrix (b) a null matrix
(c) a skew symmetric matrix (d) a symmetric matrix

Q52. CBSE 2024 · 1 mark If the matrix $[5, 0, 0; 0, d, b; 0, c, a]$ is a scalar matrix, then the value of $a + 2b + 3c + 4d$ is:

- (a) 0 (b) 5 (c) 10 (d) 25

Q53. CBSE 2024 · 1 mark Given that $A^{-1} = [2/7, -3/2; 1/7, 2]$, matrix A is:

- (a) $7[2, 3; 1, -2]$ (b) $[2, 3; 1, -2]$ (c) $[2, 3; 1, -2] \cdot 1/7$
(d) $[2, 3; 1, -2] \cdot 1/49$

Q54. CBSE 2024 · 1 mark If $A = [2, -4; -1, 2]$, then the value of $I - A + A^2 - A^3 + \dots$ is:

- (a) $[-3/4, -1; 1, -1]$ (b) $[3, -4; -1, 1]$ (c) $[0, 0; 0, 0]$
(d) $[1, 0; 0, 1]$

Q55. CBSE 2024 · 1 mark If $A = [[1, 3], [3, 4]]$ and $A^2 - kA - 5I = O$, then the value of k is:

- (a) 3 (b) 5 (c) 7 (d) 9

Q56. CBSE 2024 · 1 mark If $[[a, c, 0], [b, d, 0], [0, 0, 5]]$ is a scalar matrix, then the value of $a + 2b + 3c + 4d$ is:

- (a) 0 (b) 5 (c) 10 (d) 25

Q57. CBSE 2024 · 1 mark If $A = [[-1, -4], [2, 2]]$, then the value of $I - A + A^2 - A^3 + \dots$ is:

- (a) $[-1, -4], [1, 3]$ (b) $[3, -4], [-1, 1]$ (c) $[0, 0], [0, 0]$
(d) $[1, 0], [0, 1]$

Q58. CBSE 2024 · 1 mark Given that $A^{-1} = (1/7)[[2, -1], [-3, 2]]$, matrix A is:

- (a) $7[[2, 1], [3, -2]]$ (b) $[[2, 1], [3, -2]]$ (c) $(1/7)[[2, 1], [3, -2]]$
(d) $(1/49)[[2, 1], [3, -2]]$



Q59. CBSE 2023 · 1 mark If for a square matrix A , $A^2 - 3A + I = O$ and $A^{-1} = xA + yI$, then the value of $x + y$ is:

- (a) -2 (b) 2 (c) 3 (d) -3/2

Q60. CBSE 2023 · 1 mark If $|A| = 2$, where A is a 2×2 matrix, then $|4A^{-1}|$ equals:

- (a) 4 (b) 2 (c) 8 (d) 32

Q61. CBSE 2023 · 1 mark If $A = \begin{bmatrix} 2 & 5 \\ 4 & 3 \end{bmatrix}$ and $2A + B$ is a null matrix, then B is equal to:

- (a) $\begin{bmatrix} -4 & -10 \\ -8 & -6 \end{bmatrix}$ (b) $\begin{bmatrix} 4 & 10 \\ 8 & 6 \end{bmatrix}$ (c) $\begin{bmatrix} 3 & 10 \\ 8 & 5 \end{bmatrix}$
(d) $\begin{bmatrix} 3 & -10 \\ -8 & 5 \end{bmatrix}$

Q62. CBSE 2023 · 1 mark If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ and $(3I + 4A)(3I - 4A) = x^2I$, then the value(s) of x is/are:

- (a) -7 (b) 0 (c) -5 (d) ± 5

Q63. CBSE 2023 · 1 mark If A is a 2×3 matrix such that AB and AB' both are defined, then order of the matrix B is

- (a) 2×2 (b) 2×1 (c) 3×2 (d) 3×3

Q64. CBSE 2023 · 1 mark If $\begin{bmatrix} 2 & 0 \\ 5 & 4 \end{bmatrix} = P + Q$, where P is a symmetric and Q is a skew symmetric matrix, then Q is equal to

- (a) $\begin{bmatrix} 2 & 5/2 \\ 5/2 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & -5/2 \\ 5/2 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 0 & 5/2 \\ -5/2 & 0 \end{bmatrix}$
(d) $\begin{bmatrix} 2 & -5/2 \\ 5/2 & 4 \end{bmatrix}$

Q65. CBSE 2023 · 1 mark If matrix A is a symmetric matrix, then the value of $x + y + z$ is:

- (a) 10 (b) 6 (c) 8 (d) 0

Q66. CBSE 2023 · 1 mark For what value of x , where $0 < x < \pi/2$, is $A + A^T = I_3$, where $A = \begin{bmatrix} \cos x & \sin x & -\sin x \\ \sin x & \cos x & 0 \end{bmatrix}$?

- (a) $\pi/3$ (b) $\pi/6$ (c) 0 (d) $\pi/2$

Q67. CBSE 2023 · 1 mark If $A = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$, then BA is equal to:

- (a) $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

Q68. CBSE 2023 · 1 mark A and B are skew-symmetric matrices of same order. AB is symmetric, if:

- (a) $AB = O$ (b) $AB = -BA$ (c) $AB = BA$ (d) $BA = O$

Q69. CBSE 2023 · 1 mark A and B are square matrices of same order. If $(A + B)^2 = A^2 + B^2$, then

- (a) $AB = BA$ (b) $AB = -BA$ (c) $AB = O$ (d) $BA = O$

Q70. CBSE 2023 · 1 mark For what value of $x \in [0, 2\pi]$, is $A + A^T = I_3$, where $A = \begin{bmatrix} \cos x & \sin x & -\sin x \\ \sin x & \cos x & 0 \end{bmatrix}$?

- (a) $\pi/3$ (b) $\pi/6$ (c) 0 (d) $\pi/2$

Q71. CBSE 2023 · 1 mark If A is a square matrix and $A^2 = A$, then $(I + A)^2 - 3A$ is equal to:

- (a) I (b) A (c) $2A$ (d) $3I$

Q72. CBSE 2023 · 1 mark If A is a 3×4 matrix and B is a matrix such that AB and $A'B$ are both defined, then the order of the matrix B is:

- (a) 3×4 (b) 3×3 (c) 4×4 (d) 4×3

Q73. CBSE 2023 · 1 mark If $9/4 - 5/2 = (y - 2)/(1 - x)$, then:

- (a) $x = 1, y = 2$ (b) $x = 2, y = 1$ (c) $x = 1, y = -1$
(d) $x = 3, y = 2$

VERY SHORT ANSWER (1)

Q74. CBSE 2026 · 2 marks For the matrix $A = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$, find the numbers a and b so that $A^2 + aA + bI = O$.

SHORT ANSWER (3)

Q75. CBSE 2026 · 3 marks If $A = \begin{bmatrix} 3 & 2 & 0 \\ 1 & 4 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then compute $A^2 - 7A + 10I$.

Q76. CBSE 2026 · 3 marks If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, then compute $A^2 - 4A - 5I$.

Q77. CBSE 2026 · 3 marks If $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$, then compute $A^2 - 5A + 4I$.

LONG ANSWER (19)

Q78. CBSE 2026 · 5 marks If $A = \begin{bmatrix} 0 & 1 & 1 \\ 2 & 1 & 2 \\ 1 & 2 & 0 \end{bmatrix}$, find A^{-1} and use it to solve the following system of equations: $-2y + z = 7$, $2x - y - z = 8$, $x - 2y = 10$

Q79. CBSE 2026 · 5 marks If $P = \begin{bmatrix} -1 & 1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $Q = \begin{bmatrix} 2 & -2 & 4 \\ -4 & 2 & -4 \\ -2 & 1 & 5 \end{bmatrix}$, find $(QP)^{-1}$ and hence solve the following system of equations using matrices: $x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$

Q80. CBSE 2026 · 5 marks If $P = \begin{bmatrix} -1 & 1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $Q = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ -2 & -1 & 5 \end{bmatrix}$, find (QP) and hence solve the following system of equations using matrices: $x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$

Q81. CBSE 2026 · 5 marks If $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & -3 \\ 1 & -1 & 1 \end{bmatrix}$, find A^{-1} . Using A^{-1} solve the system of equations: $x - y + z = 4$, $2x + y - 3z = 0$, $x + y + z = 2$

Q82. CBSE 2026 · 5 marks On the inauguration day of a new showroom, a lucky draw was organized and some vouchers of ₹ 1,000 and ₹ 500 were given to the lucky draw winners. A total of 60 vouchers were given on the day. The number of ₹ 1,000 vouchers added to 3 times the number of ₹ 500 vouchers, gives 100. Express the given information as a system of linear equations in two variables. Hence, find the number of vouchers of each type by matrix method.

Q83. CBSE 2026 · 5 marks A man goes to buy fruits from the market. The shopkeeper informs him that 4 apples, 3 oranges and 2 bananas cost ₹ 60; 2 apples, 4 oranges and 6 bananas cost ₹ 90; whereas 6 apples, 2 oranges and 3 bananas cost ₹ 70. Using matrix method, find the cost of one fruit of each kind.

Q84. CBSE 2026 · 5 marks Three students A, B and C go to a bookstore to buy art books, story books and puzzle solving books. A buys one of each type of book for a total of ₹21. B buys 4 art books, 3 story books and 2 puzzle solving books for ₹60. C buys 6 art books, 2 story books and 3 puzzle solving books and pays ₹10 more than B. Use matrix method to find the cost of each type of book.



Q85. CBSE 2025 · 5 marks A school wants to allocate students into three clubs: Sports, Music and Drama, under following conditions: The number of students in Sports club should be equal to the sum of the number of students in Music and Drama club. The number of students in Music club should be 20 more than half the number of students in Sports club. The total number of students to be allocated in all three clubs are 180. Find the number of students allocated to different clubs, using matrix method.

Q86. CBSE 2024 · 5 marks If $A = \begin{bmatrix} -1 & 2 & 0 \\ -1 & 1 & -2 \\ 0 & -2 & 1 \end{bmatrix}$, find A^{-1} and use it to solve the following system of equations: $x - 2y = 10$, $2x - y - z = 8$, $-2y + z = 7$

Q87. CBSE 2024 · 5 marks (a) If $A = \begin{bmatrix} 5 & 0 & 4 \\ 2 & 3 & 2 \\ 1 & 2 & 1 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 1 & 3 & 1 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$, find $(AB)^{-1}$. Also, find $|(AB)^{-1}|$.

Q88. CBSE 2024 · 5 marks Solve the following system of equations, using matrices: $2x + 3y + 10z = 4$, $4x - 6y + 5z = 1$, $6x + 9y - 20z = 2$, where $x, y, z \neq 0$

Q89. CBSE 2024 · 5 marks Use the product of matrices $\begin{bmatrix} 1 & -2 & 3 \\ 3 & 2 \\ 0 & 1 & -1 \end{bmatrix}$ and $\begin{bmatrix} 4 & -7 & 7 \\ -7 & -7 & 0 \\ 5 & -4 & 4 \end{bmatrix}$ to solve the following system of equations: $x + 2y - 3z = 6$, $3x + 2y - 2z = 3$, $2x - y + z = 2$

Q90. CBSE 2023 · 5 marks (a) If $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 2 & 2 & 5 \\ 6 & 1 & 5 \\ 1 & 1 & 3 \end{bmatrix}$, find $(AB)^{-1}$. OR (b) Solve the following system of equations by matrix method: $x + 2y + 3z = 6$, $2x - y + z = 2$, $3x + 2y - 2z = 3$.

Q91. CBSE 2023 · 5 marks (a) If $A = \begin{bmatrix} 1 & 2 & 2 \\ 1 & 3 & 0 \\ 0 & 1 & 2 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 1 & 3 & 1 \\ 1 & 5 & 5 \\ -1 & -2 & -2 \end{bmatrix}$, find $(AB)^{-1}$. OR (b) Solve the following system of equations by matrix method: $x + 2y + 3z = 6$, $2x - y + z = 2$, $3x + 2y - 2z = 3$

Q92. CBSE 2023 · 5 marks If $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 3 & 1 \\ 2 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 6 & 1 & 5 \end{bmatrix}$, find $(AB)^{-1}$.

Q93. CBSE 2023 · 5 marks If $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 0 \\ 0 & 2 & 3 \end{bmatrix}$, then show that $A^3 - 6A^2 + 7A + 2I = O$.

Q94. CBSE 2023 · 5 marks If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix}$, then show that $A^3 - 6A^2 + 7A + 2I = O$.

Q95. CBSE 2023 · 5 marks If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, then show that $A^3 - 6A^2 + 7A + 2I = O$.

Q96. CBSE 2023 · 5 marks Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$. Using the inverse A^{-1} , solve the system of linear equations $x - y + 2z = 1$; $2y - 3z = 1$; $3x - 2y + 4z = 3$.

CASE-BASED (4)

CASE STUDY · CBSE 2026

A carpenter needs to design a wooden box in the shape of a cuboid such that the sum of its length and breadth is 3 cm more than its height. Twice of its length, thrice of its breadth and its height add up to 10 cm. Its breadth added to 7 times its height is 1 cm less than 3 times its length.

Q97. CBSE 2026 · 4 marks (i) Write the equations representing the various dimensions and express them as the matrix equation $AX = B$.

Q98. CBSE 2026 · 1 mark A carpenter needs to design a wooden box in the shape of a cuboid such that the sum of its length and breadth is 3 cm more than its height. Twice of its length, thrice of its breadth and its height add up to 10 cm. Its breadth added to 7 times its height is 1 cm less than 3 times its length. Write the equations representing the various dimensions and express them as the matrix equation $AX = B$.

Q99. CBSE 2026 · 1 mark Assertion (A): If A and B are two square matrices such that AB and BA are defined, then it is not necessary that $AB = BA$. Reason (R): Product of two diagonal matrices of same order is commutative. Which of the following is correct?

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

CASE STUDY · CBSE 2024

A scholarship is a sum of money provided to a student to help him or her pay for education. Some students are granted scholarships based on their academic achievements, while others are rewarded based on their financial needs. Every year a school offers scholarships to girl children and meritorious achievers based on certain criteria. In the session 2022–23, the school offered monthly scholarship of ₹3,000 each to some girl students and ₹4,000 each to meritorious achievers in academics as well as sports. In all, 50 students were given the scholarships and monthly expenditure incurred by the school on scholarships was ₹1,80,000.

Q100. CBSE 2024 · 4 marks (i) Express the given information algebraically using matrices.

4 Determinants

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (45)

Q1. CBSE 2026 · 1 mark If $A_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and $A_2 = \begin{bmatrix} 0 & 0 & 6 \\ 0 & 1 & 0 \\ 0 & 2 & 0 \end{bmatrix}$, then

- (a) $|A_1| = 2|A_2|$ (b) $|A_2| = -2|A_1|$ (c) $|A_1| = |A_2|$
- (d) $|A_2| = -|A_1|$

Q2. CBSE 2026 · 1 mark One of the values of x for which $|\cos x \sin x; \sin x \cos x| = 1$ is

- (a) 0 (b) $\pi/4$ (c) $\pi/3$ (d) $\pi/2$



Q3. CBSE 2026 · 1 mark If $A_1 = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and $A_2 = \begin{bmatrix} 6 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 2 & 0 \end{bmatrix}$, then

- (a) $|A_1| = 2|A_2|$ (b) $|A_2| = -2|A_1|$ (c) $|A_1| = |A_2|$
(d) $|A_2| = -|A_1|$

Q4. CBSE 2026 · 1 mark One of the values of x for which $|\sin x \cos x; \sin x \cos x| = 1$ is

- (a) 0 (b) $\pi/4$ (c) $\pi/3$ (d) $\pi/2$

Q5. CBSE 2026 · 1 mark If $D_1 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ and $D_2 = \begin{bmatrix} 6 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 2 & 0 \end{bmatrix}$, then

- (a) $D_1 = 2D_2$ (b) $D_2 = -2D_1$ (c) $D_1 = D_2$ (d) $D_2 = -D_1$

Q6. CBSE 2026 · 1 mark If $[-1, -2, -2], [-a, 2, 1], [0, 4, 2a]] = -86$, then the sum of all possible values of a is

- (a) 4 (b) 5 (c) -4 (d) 9

Q7. CBSE 2026 · 1 mark For a square matrix A , $(3A)^{-1} =$

- (a) $3A^{-1}$ (b) $9A^{-1}$ (c) $(1/3)A^{-1}$ (d) $(1/9)A^{-1}$

Q8. CBSE 2026 · 1 mark If $[-1 -2 5; -2 a -1; 0 4 a 2] = -86$, then the sum of all possible values of a is

- (a) 4 (b) 5 (c) -4 (d) 9

Q9. CBSE 2026 · 1 mark If the area of a triangle is 15 sq. units with vertices $(3, -7)$, $(6, 3)$ and $(k, 3)$, then the value(s) of k is/are :

- (a) 3 (b) 9 (c) -9, -3 (d) 9, 3

Q10. CBSE 2026 · 1 mark If $[-1 -2 5; -2 a 1; 0 4 2a] = -86$, then the sum of all possible values of a is

- (a) 4 (b) 5 (c) -4 (d) 9

Q11. CBSE 2026 · 1 mark If $B(\text{adj } B) = [1003 \ 1003 \ 1003]$, then the value of $\det(B-1) =$

- (a) $1/3$ (b) $1/9$ (c) 3 (d) 9

Q12. CBSE 2026 · 1 mark If $A(\text{adj } A) = [2026 \ 0 \ 0; 0 \ 2026 \ 0; 0 \ 0 \ 2026]$, then the value of $|\text{adj } A|$ is equal to:

- (a) 2026 (b) $(2026)^{-1}$ (c) $(2026)^{-2}$ (d) $(2026)^2$

Q13. CBSE 2026 · 1 mark If $A(\text{adj } A) = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then the value of $|2A|$ is:

- (a) 6 (b) 54 (c) 12 (d) 24

Q14. CBSE 2026 · 1 mark If points $(2, 3)$, $(0, 4)$ and $(p, 2)$ are collinear, then the value of p is:

- (a) $4/7$ (b) $-3/7$ (c) 4 (d) -4

Q15. CBSE 2026 · 1 mark If A is a non-singular matrix, then which of the following is not true ?

- (a) $\text{adj } A$ is singular (b) $(\text{adj } A)^{-1} = (\text{adj } A^{-1})$ (c) $|A| \neq 0$
(d) A^{-1} exists

Q16. CBSE 2026 · 1 mark If the area of $\triangle ABC$ with vertices $A(3, 1)$, $B(-2, 1)$ and $C(0, k)$ is 5 sq. units, then values of k are :

- (a) 3, 1 (b) -1, 3 (c) -1, 2 (d) 0, 2

Q17. CBSE 2026 · 1 mark If the area of triangle ABC with vertices $A(3, 1)$, $B(-2, 1)$ and $C(0, k)$ is 5 sq. units, then values of k are:

- (a) 3, 1 (b) -1, 3 (c) -1, 2 (d) 0, 2

Q18. CBSE 2025 · 1 mark If A is a square matrix of order 2 such that $\det(A) = 4$, then $\det(4 \text{ adj } A)$ is equal to:

- (a) 16 (b) 64 (c) 256 (d) 512

Q19. CBSE 2024 · 1 mark If $|x+2, 2x+4; -x, 3x| = |6, -1; 2, 3|$, then the value of x is

- (a) 1 (b) 2 (c) -2 (d) -1

Q20. CBSE 2024 · 1 mark Assertion (A): For matrix $A = \begin{bmatrix} 1 & -\cos \theta & -1 \\ -\cos \theta & 1 & \cos \theta \\ -1 & \cos \theta & 1 \end{bmatrix}$, where $\theta \in [0, 2\pi]$, $|A| \in [2, 4]$. Reason (R): $\cos \theta \in [-1, 1]$, $\forall \theta \in [0, 2\pi]$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q21. CBSE 2024 · 1 mark If a_{ij} and A_{ij} represent the $(ij)^{\text{th}}$ element and its cofactor of the matrix $\begin{bmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 1 & 5 & -7 \end{bmatrix}$ respectively, then the value of $a_{11}A_{21} + a_{12}A_{22} + a_{13}A_{23}$ is:

- (a) 0 (b) -28 (c) 114 (d) -114

Q22. CBSE 2024 · 1 mark $|(x+1, x-1); (x, x+1)|$ is equal to:

- (a) $2x^3$ (b) 2 (c) 0 (d) $2x^3 - 2$

Q23. CBSE 2024 · 1 mark Assertion (A): For matrix $A = \begin{bmatrix} 1 & -\cos \theta & 1 \\ 1 & \cos \theta & -\cos \theta \\ 1 & -\cos \theta & 1 \end{bmatrix}$, where $\theta \in [0, 2\pi]$, $|A| \in [2, 4]$. Reason (R): $\cos \theta \in [-1, 1]$, $\forall \theta \in [0, 2\pi]$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q24. CBSE 2024 · 1 mark If $|c-b \ a \ c; b-a \ c \ b; a \ c-| = kabc$, then the value of k is:

- (a) 0 (b) 1 (c) 2 (d) 4

Q25. CBSE 2024 · 1 mark If $|a-b \ a \ c; b-a \ c \ b; a \ b, -c| = kabc$, then the value of k is:

- (a) 0 (b) 1 (c) 2 (d) 4

Q26. CBSE 2024 · 1 mark If $|a-b \ a \ c; b-a \ c \ b; a \ b, a-c| = kabc$, then the value of k is:

- (a) 0 (b) 1 (c) 2 (d) 4

Q27. CBSE 2024 · 1 mark Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a square matrix such that $\text{adj } A = A$. Then, $(a + b + c + d)$ is equal to :

- (a) $2a$ (b) $2b$ (c) $2c$ (d) 0

Q28. CBSE 2024 · 1 mark If $|\begin{bmatrix} 1 & 3 & 1 \\ 0 & k & 0 \\ 0 & 1 & 0 \end{bmatrix}| = \pm 6$, then the value of k is :

- (a) 2 (b) -2 (c) ± 2 (d) $\neq 2$

Q29. CBSE 2024 · 1 mark If $|\begin{bmatrix} 100 & 10k & 131 \end{bmatrix}| = \pm 6$, then the value of k is:

- (a) 2 (b) -2 (c) ± 2 (d) $\neq 2$

Q30. CBSE 2024 · 1 mark If $A = \begin{bmatrix} 2 & 0 & 0 \\ 1 & 3 & 1 \\ 5 & -1 & -1 \end{bmatrix}$, then the value of $|A(\text{adj } A)|$ is:

- (a) 100 I (b) 10 I (c) 10 (d) 1000



Q31. CBSE 2024 · 1 mark Given that $[1, x] [4, -2; 0, 0] = 0$, the value of x is:

- (a) -4 (b) -2 (c) 2 (d) 4

Q32. CBSE 2024 · 1 mark If $A = [a_{ij}] = [[-2, 1, 5], [1, 3, 2], [5, 0, 4]]$ and c_{ij} is the cofactor of element a_{ij} , then the value of $a_{21} \times c_{11} + a_{22} \times c_{12} + a_{23} \times c_{13}$ is:

- (a) -57 (b) 0 (c) 9 (d) 57

Q33. CBSE 2023 · 1 mark Let A be a 3×3 matrix such that $|\text{adj } A| = 64$. Then $|A|$ is equal to:

- (a) 8 only (b) -8 only (c) 64 (d) 8 or -8

Q34. CBSE 2023 · 1 mark If $2A^{-1} = |A|A^{(k-1)}$, where A is a 3×3 matrix, then the value of k is:

- (a) 81 (b) 8 (c) 2 (d) $1/2$

Q35. CBSE 2023 · 1 mark If $[1, x; 3, 2x]$ is a singular matrix, then the product of all possible values of x is:

- (a) 6 (b) -6 (c) 0 (d) -7

Q36. CBSE 2023 · 1 mark If (a, b) , (c, d) and (e, f) are the vertices of triangle ABC and Δ denotes the area of triangle ABC , then $|a \ c \ e; b \ d \ f; 1 \ 1 \ 1|/2$ is equal to

- (a) $2\Delta^2$ (b) $4\Delta^2$ (c) 2Δ (d) 4Δ

Q37. CBSE 2023 · 1 mark If $|1 \ 2 \ 1; 2 \ 3 \ 1; 3 \ a \ 1|$ is non-singular matrix and $a \in A$, then the set A is

- (a) $\mathbb{R}$ (b) $\{0\}$ (c) $\{4\}$ (d) $\mathbb{R} - \{4\}$

Q38. CBSE 2023 · 1 mark If $|A| = |kA|$, where A is a square matrix of order 2, then sum of all possible values of k is

- (a) 1 (b) -1 (c) 2 (d) 0

Q39. CBSE 2023 · 1 mark If $A \cdot (\text{adj } A) = 3I$, then the value of $A + \text{adj } A$ is equal to:

- (a) 12 (b) 9 (c) 3 (d) 27

Q40. CBSE 2023 · 1 mark Let A be the area of a triangle having vertices (x_1, y_1) , (x_2, y_2) and (x_3, y_3) . Which of the following is correct?

- (a) $A = |1/2 \text{ determinant with rows } [1, x_1, y_1], [1, x_2, y_2], [1, x_3, y_3]|$
 (b) $2A = |\text{determinant with rows } [1, x_1, y_1], [1, x_2, y_2], [1, x_3, y_3]|$
 (c) $2A = \text{determinant with rows } [1, x_1, y_1], [1, x_2, y_2], [1, x_3, y_3]$
 (d) $A = \text{determinant with rows } [x_1, y_1], [x_2, y_2], [x_3, y_3]$

Q41. CBSE 2023 · 1 mark Let A be a skew-symmetric matrix of order 3. If $A = x$, then $(2023)^x$ is equal to:

- (a) 2023 (b) $2023^{(-1)}$ (c) $(2023)^{+2}$ (d) 1

Q42. CBSE 2023 · 1 mark If $A \cdot (\text{adj } A) = [3 \ 0 \ 0; 0 \ 3 \ 0; 0 \ 0 \ 3]$, then the value of $|A| + \text{adj } A$ is equal to:

- (a) 12 (b) 9 (c) 3 (d) 27

Q43. CBSE 2023 · 1 mark The value of the determinant 1810111172 is:

- (a) 47 (b) -79 (c) 49 (d) -51

Q44. CBSE 2023 · 1 mark If the area of a triangle with vertices $(2, -6)$, $(5, 4)$ and $(k, 4)$ is 35 sq units, then k is

- (a) 12 (b) -2 (c) -12, 2 (d) 12, -2

Q45. CBSE 2023 · 1 mark The product $[a \ b; -b \ a] [a \ b; -b \ a]$ is equal to:

- (a) $[(a^2 - b^2) \ 0; 0 \ (a^2 - b^2)]$ (b) $[0 \ (b^2 - a^2); 0 \ (b^2 - a^2)]$
 (c) $[0 \ (a^2 - b^2); 0 \ (a^2 - b^2)]$ (d) $[b \ 0; 0 \ a]$

LONG ANSWER (9)

Q46. CBSE 2026 · 5 marks If $A = [[0, 1, 1], [2, 1, 2], [1, 2, 0]]$, find A^{-1} and use it to solve the following system of equations: $-2y + z = 7$, $2x - y - z = 8$, $x - 2y = 10$.

Q47. CBSE 2026 · 5 marks Obtain the value of $\Delta = |[1, x, 1, 1], [1, y, 1, 1], [1, 1, z, 1], [1, 1, 1, -3]|$ in terms of x, y and z . Further, if $\Delta = 0$ and x, y, z are non-zero real numbers, prove that $x^{-1} + y^{-1} + z^{-1} = -1$.

Q48. CBSE 2026 · 5 marks Find cost (per kg) of each fertilizer A, B and C that the farmer needs to buy, such that 1 kg each of fertilizer A and C added to 2 kg of B costs him ₹ 400. Also, cost of each kg of fertilizer B and C added together is equal to cost of 1 kg of fertilizer A. However, cost of 3 kg of fertilizer B added to ₹ 200 is the same as cost of 1 kg of fertilizer A and C together. Use matrix method to find the solution.

Q49. CBSE 2024 · 5 marks Using matrices, solve the following system of linear equations: $3x + 4y + 2z = 8$; $2y - 3z = 3$; $x - 2y + 6z = -2$

Q50. CBSE 2024 · 5 marks If $A = [-1 \ 2 \ 0; -1 \ 1 \ 0; -2 \ 2 \ 1]$, find A^{-1} and use it to solve the following system of equations: $x - 2y = 10$, $2x - y - z = 8$, $-2y + z = 7$

Q51. CBSE 2024 · 5 marks If $A = [[-1, -2, 0], [-1, 1, -2], [0, -2, 1]]$, find A^{-1} and use it to solve the following system of equations: $x - 2y = 10$, $2x - y - z = 8$, $-2y + z = 7$

Q52. CBSE 2024 · 5 marks (a) Solve the following system of equations, using matrices: $2x + 3y + 10z = 4$, $4x - 6y + 5z = 1$, $6x + 9y - 20z = 2$, where $x, y, z \neq 0$

Q53. CBSE 2024 · 5 marks If $A = [2, -1, 3; 1, 2, 3; 5, -1, -1]$, find A^{-1} and hence solve the following system of equations: $2x + y - 3z = 13$, $3x + 2y + z = 4$, $x + 2y - z = 8$.

Q54. CBSE 2023 · 5 marks If $A = [(-3 \ -2 \ -4); (2 \ 1 \ 2); (2 \ 1 \ 3)]$ and $B = [(1 \ 2 \ 0); (-2 \ -1 \ -2); (0 \ -1 \ 1)]$, then find AB and use it to solve the following system of equations: $x - 2y = 3$, $2x - y - z = 2$, $-2y + z = 3$

CASE-BASED (2)

CASE STUDY · CBSE 2026

A carpenter needs to design a wooden box in the shape of a cuboid such that the sum of its length and breadth is 3 cm more than its height. Twice of its length, thrice of its breadth and its height add up to 10 cm. Its breadth added to 7 times its height is 1 cm less than 3 times its length.

Q55. CBSE 2026 · 1 mark Find if A^{-1} exists. Justify your answer.



Q56. CBSE 2024 · 1 mark Assertion (A): For matrix $A = \begin{bmatrix} 1, \cos \theta, \cos \theta \\ -\cos \theta, 1, \cos \theta \\ -\cos \theta, -\cos \theta, 1 \end{bmatrix}$, where $\theta \in [0, 2\pi]$, $|A| \in [2, 4]$. Reason (R): $\cos \theta \in [-1, 1]$, $\forall \theta \in [0, 2\pi]$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true, but Reason (R) is false.
 (d) Assertion (A) is false, but Reason (R) is true.

5 Continuity and Differentiability

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (43)

Q1. CBSE 2026 · 1 mark If $e^{-x} + e^{-y} = 2$, then dy/dx is

- (a) e^{x-y} (b) e^{y-x} (c) $-e^{x-y}$ (d) $-e^{y-x}$

Q2. CBSE 2026 · 1 mark If $e^x(x+y) = 3x$, then dy/dx is

- (a) $y - 3e^x(-x)$ (b) $y - e^x(-x)$ (c) $(e^y - 1)/(e^x)$
 (d) $(e^y - 3)/(e^x)$

Q3. CBSE 2026 · 1 mark The value of k for which $f(x) = \{\sin 7x/5x, x \neq 0; k, x = 0\}$ is continuous at $x = 0$ is :

- (a) $5/7$ (b) $7/5$ (c) 0 (d) $1/5$

Q4. CBSE 2026 · 1 mark If $x + y = xy$, then dy/dx is

- (a) $1 - x/y$ (b) $1 - 1/x$ (c) $1 - (1-y)/x$ (d) $1 - (y-1)/x$

Q5. CBSE 2026 · 1 mark The value of k for which the function $f(x) = \{x^2 \sin(1/x), x \neq 0; k(x+1), x = 0\}$ is a continuous function, is:

- (a) $1/4$ (b) 2 (c) $1/2$ (d) 0

Q6. CBSE 2026 · 1 mark If $2 \cos^{-1} x = y$, then dy/dx is:

- (a) $-2 \sin^{-1} x$ (b) $1/\sin(y/2) - \sin(2y/2)$ (c) $-2/(\sqrt{1-2x^2})$
 (d) $-2 \operatorname{cosec}(y/2)$

Q7. CBSE 2026 · 1 mark Differential of $e^x(e^x)$ with respect to x is:

- (a) $\log x$ (b) $e^x(e^x)$ (c) $e^x x e^x(e^x)$ (d) $(e^x)^2$

Q8. CBSE 2026 · 1 mark If $f(x) = \{(\sin x + \cos x)/x, x \neq 0; k, x = 0\}$ is continuous at $x = 0$, then the value of k is:

- (a) 0 (b) $-\sqrt{2}$ (c) -1 (d) $\sqrt{2}$

Q9. CBSE 2026 · 1 mark The greatest integer function, $f(x) = [x]$, $0 < x < 3$ is not differentiable at how many points?

- (a) At only one point (b) At only two points (c) At no point
 (d) At three points

Q10. CBSE 2026 · 1 mark If $f(x) = (\sin x + \cos x)/x$, $x \neq 0$ and $k, x = 0$ is continuous at $x = 0$, then the value of k is:

- (a) 0 (b) $-\sqrt{2}$ (c) -1 (d) $\sqrt{2}$

Q11. CBSE 2026 · 1 mark If $f(x) = \{x^2/(x+1) - 4x/(x-5), x \neq -1; k, x = -1\}$ is continuous at $x = -1$, then the value of k is:

- (a) Any real value (b) 6 (c) -1 (d) -6

Q12. CBSE 2026 · 1 mark Derivative of $\cos^{-1}[(\sin x + \cos x)/\sqrt{2}]$, $-\pi/4 < x < \pi/4$ with respect to x is:

- (a) -1 (b) 1 (c) $\pi/4$ (d) $-\pi/4$

Q13. CBSE 2026 · 1 mark If $f(x) = \{(k - 4x^2)/(x - 5), x \neq -1; (1)/(x + 1), x = -1\}$ is continuous at $x = -1$, then the value of k is:

- (a) Any real value (b) 6 (c) -1 (d) -6

Q14. CBSE 2025 · 1 mark Which of the following is not a homogeneous function of x and y ?

- (a) $y^2 - xy$ (b) $x - 3y$ (c) $\sin(y/x) + y/x$ (d) $\tan x - \sec y$

Q15. CBSE 2025 · 1 mark If $f(x) = |x| + |x - 1|$, then which of the following is correct?

- (a) $f(x)$ is both continuous and differentiable, at $x = 0$ and $x = 1$.
 (b) $f(x)$ is differentiable but not continuous, at $x = 0$ and $x = 1$.
 (c) $f(x)$ is continuous but not differentiable, at $x = 0$ and $x = 1$.
 (d) $f(x)$ is neither continuous nor differentiable, at $x = 0$ and $x = 1$.

Q16. CBSE 2025 · 1 mark Assertion (A): $f(x) = \{3x - 8, x \leq 5; 2k, x > 5\}$ is continuous at $x = 5$ for $k = 5/2$. Reason (R): For a function f to be continuous at $x = n$, $\lim_{(x \rightarrow n^-)} f(x) = \lim_{(x \rightarrow n^+)} f(x) = f(n)$.

- (a) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true, but Reason (R) is false.
 (d) Assertion (A) is false, but Reason (R) is true.

Q17. CBSE 2024 · 1 mark The value of k , for which $f(x) = \{(\cos x + \sin x)/(x + 3\pi), \text{ if } x \neq -\pi/3; k, \text{ if } x = -\pi/3\}$ is continuous at $x = -\pi/3$, is

- (a) $2/3$ (b) $-2/3$ (c) $3/2$ (d) 6

Q18. CBSE 2024 · 1 mark Which of the following statements is true for the function $f(x) = 2x + 3$, $x \neq 0; 1, x = 0$?

- (a) $f(x)$ is continuous and differentiable $\forall x \in \mathbb{R}$
 (b) $f(x)$ is continuous $\forall x \in \mathbb{R}$
 (c) $f(x)$ is continuous and differentiable $\forall x \in \mathbb{R} - \{0\}$
 (d) $f(x)$ is discontinuous at infinitely many points

Q19. CBSE 2024 · 1 mark The derivative of $\sin(x^2)$ w.r.t. x , at $x = \pi$ is:

- (a) 1 (b) -1 (c) -2π (d) 2π

Q20. CBSE 2024 · 1 mark The derivative of $\sin(x^2)$ with respect to x , at $x = \sqrt{\pi}$ is:

- (a) 1 (b) -1 (c) $-2\sqrt{\pi}$ (d) $2\sqrt{\pi}$



Q21. CBSE 2024 · 1 mark The number of points, where $f(x) = [x]$, $0 < x < 3$ ($[\cdot]$ denotes greatest integer function) is not differentiable is:

- (a) 1 (b) 2 (c) 3 (d) 4

Q22. CBSE 2024 · 1 mark If $x = at$, $y = t/a$, then dy/dx is:

- (a) t^2 (b) $-t^2$ (c) $1/t^2$ (d) $-1/t^2$

Q23. CBSE 2024 · 1 mark Which of the following statements is true for the function $f(x) = \{x^2 + 3, x \neq 0; 1, x = 0\}$?

- (a) $f(x)$ is continuous and differentiable $\forall x \in \mathbb{R}$
 (b) $f(x)$ is continuous $\forall x \in \mathbb{R}$
 (c) $f(x)$ is continuous and differentiable $\forall x \in \mathbb{R} - \{0\}$
 (d) $f(x)$ is discontinuous at infinitely many points

Q24. CBSE 2024 · 1 mark The number of points of discontinuity of $f(x) = \{x+3, \text{ if } x \leq -3; -2x, \text{ if } -3 < x < 3; 6x+2, \text{ if } x \geq 3\}$ is:

- (a) 0 (b) 1 (c) 2 (d) infinite

Q25. CBSE 2024 · 1 mark $d/dx[\cos(\log x + e^x)]$ at $x = 1$ is:

- (a) $-\sin e$ (b) $\sin e$ (c) $-(1+e)\sin e$ (d) $(1+e)\sin e$

Q26. CBSE 2024 · 1 mark A function $f(x) = |1 - x + |x||$ is:

- (a) discontinuous at $x = 1$ only
 (b) discontinuous at $x = 0$ only (c) discontinuous at $x = 0, 1$
 (d) continuous everywhere

Q27. CBSE 2024 · 1 mark The derivative of 2^x w.r.t. 3^x is:

- (a) $(2^x / 3^x) \times (\log 2 / \log 3)$
 (b) $(3^x / 2^x) \times (\log 3 / \log 2)$
 (c) $(2^x / 3^x) \times (\log 3 / \log 2)$
 (d) $(3^x / 2^x) \times (\log 2 / \log 3)$

Q28. CBSE 2024 · 1 mark The derivative of 5^x w.r.t. e^x is:

- (a) $(5^x/e^x) \cdot (1/\log 5)$ (b) $(e^x/5^x) \cdot (1/\log 5)$
 (c) $(5^x/e^x) \cdot \log 5$ (d) $(e^x/5^x) \cdot \log 5$

Q29. CBSE 2024 · 1 mark Derivative of e^{2x} with respect to e^x is:

- (a) e^x (b) $2e^x$ (c) $2e^{2x}$ (d) $2e^{3x}$

Q30. CBSE 2024 · 1 mark For what value of k , the function $f(x) = \{(x^2 + x - 4)/x, x \neq 0; k, x = 0\}$ is continuous at $x = 0$?

- (a) 0 (b) $1/4$ (c) 1 (d) 4

Q31. CBSE 2024 · 1 mark The value of constant c that makes the function f defined by $f(x) = \{x^2 - c^2, \text{ if } x < 4; cx + 20, \text{ if } x \geq 4\}$ continuous for all real numbers is:

- (a) -2 (b) -1 (c) 0 (d) 2

Q32. CBSE 2023 · 1 mark For what value of k may the function $f(x) = \{k(3x^2 - 5x) \text{ for } 0 \leq x, \cos x \text{ for } x > 0\}$ become continuous?

- (a) 0 (b) 1 (c) $-1/2$ (d) No value

Q33. CBSE 2023 · 1 mark The function $f(x) = |x| - x$ is:

- (a) continuous but not differentiable at $x = 0$
 (b) continuous and differentiable at $x = 0$
 (c) neither continuous nor differentiable at $x = 0$
 (d) differentiable but not continuous at $x = 0$

Q34. CBSE 2023 · 1 mark If $\tan((x+y)/(x-y)) = k$, then dy/dx is equal to

- (a) $-y/x$ (b) y/x (c) $\sec^2(y/x)$ (d) $-\sec^2(y/x)$

Q35. CBSE 2023 · 1 mark The value of k for which function $f(x) = x^2$ for $0 \leq x$, kx for $x > 0$ is differentiable at $x = 0$ is:

- (a) 1 (b) 2 (c) any real number (d) 0

Q36. CBSE 2023 · 1 mark The value of k for which function $f(x) = \{x^2$ for $x \leq 0$; kx for $x > 0\}$ is differentiable at $x = 0$ is:

- (a) 1 (b) 2 (c) any real number (d) 0

Q37. CBSE 2023 · 1 mark For what value of $x \in [0, 2\pi]$, is $A + A^T = I_3$, where $A = [\cos x \sin x; -\sin x \cos x]$?

- (a) $\pi/3$ (b) $\pi/6$ (c) 0 (d) $\pi/2$

Q38. CBSE 2023 · 1 mark The value of k for which function $f(x) = \{x, 0 \leq x, kx^2, x < 0\}$ is differentiable at $x = 0$ is

- (a) 1 (b) 2 (c) any real number (d) 0

Q39. CBSE 2023 · 1 mark If $y = (\cos x - \sin x)/(\cos x + \sin x)$, then dy/dx is

- (a) $-2 \sec^2 x$ (b) $2 \sec^2 x$ (c) $-2 \sec x \log x$ (d) $2 \sec x \log x$

Q40. CBSE 2023 · 1 mark The function $f(x) = x$ is

- (a) continuous and differentiable everywhere.
 (b) continuous and differentiable nowhere.
 (c) continuous everywhere, but differentiable everywhere except at $x = 0$.
 (d) continuous everywhere, but differentiable nowhere.

Q41. CBSE 2023 · 1 mark If $y = \log(\sin ex)$, then dy/dx is:

- (a) $\cot ex$ (b) $\operatorname{cosec} ex$ (c) $ex \cot ex$ (d) $ex \operatorname{cosec} ex$

Q42. CBSE 2023 · 1 mark If $f(x) = 2x + 3\sin x + 6$, then the right hand derivative of $f(x)$ at $x = 0$ is:

- (a) 6 (b) 5 (c) 3 (d) 2

Q43. CBSE 2023 · 1 mark If $y = \sin^2(x^3)$, then dy/dx is equal to:

- (a) $2 \sin x^3 \cos x^3$ (b) $3x^3 \sin x^3 \cos x^3$ (c) $6x^2 \sin x^3 \cos x^3$
 (d) $2x^2 \sin^2(x^3)$

VERY SHORT ANSWER (29)

Q44. CBSE 2026 · 2 marks Check whether function $f(x)$ defined as $f(x) = \{(x^3 + 2(x-3)), 3 \leq x; 6, x = 3; (6x - x^3)/3, x < 3\}$ is continuous at $x = 3$ or not?

Q45. CBSE 2026 · 2 marks Check whether function $f(x)$ defined as $f(x) = \{x/(3-x), x < 3; (x-6)/(x-3), x \geq 3\}$ is continuous at $x = 3$ or not?

Q46. CBSE 2026 · 2 marks Check whether function $f(x)$ defined as $f(x) = \{x^2(3 - 2x) \text{ for } 0 \leq x \leq 3; 6x - x \text{ for } x > 3\}$ is continuous at $x = 3$ or not?

Q47. CBSE 2026 · 2 marks If $x = a \sin^3 t$, $y = b \cos^3 t$, then find dy/dx at $t = \pi/4$.

Q48. CBSE 2026 · 2 marks If $x = \sin t - \cos t$, $y = \sin t \cos t$, find dy/dx at $t = \pi/4$.

Q49. CBSE 2026 · 2 marks If $x = t + 1/t$ and $y = t - 1/t$, find dy/dx at $t = 2$.

Q50. CBSE 2026 · 2 marks If $x = e^t(t + 1/t)$ and $y = e^t(-t - 1/t)$, then find dy/dx at $t = -2$.

Q51. CBSE 2026 · 2 marks If $x = e^{\sin^{-1} t}$ and $y = e^{\cos^{-1} t}$, then find dy/dx at $t = 1/2$.



Q52. CBSE 2026 · 2 marks (a) Show that the function $f(x) = \{(\cos x - x/2), x \neq \pi/2; 1, x = \pi/2\}$ is continuous at $x = \pi/2$.

Q53. CBSE 2026 · 2 marks (a) Show that the function $f(x) = \{\cos x - 2x^2, x \leq \pi/2; -1, x > \pi/2\}$ is continuous at $x = \pi/2$.

Q54. CBSE 2026 · 2 marks Show that the function $f(x) = \cos x - x/2$, $x \neq \pi/2$ and $1, x = \pi/2$ is continuous at $x = \pi/2$.

Q55. CBSE 2026 · 2 marks (a) Differentiate x^x with respect to $x \log x$.

Q56. CBSE 2025 · 2 marks (a) Differentiate $2^{\cos 2x}$ w.r.t. $\cos 2x$.

Q57. CBSE 2024 · 2 marks If $(\cos x)^y = (\cos y)^x$, find dy/dx .

Q58. CBSE 2024 · 2 marks Check whether the function $f(x) = x^2 |x|$ is differentiable at $x = 0$ or not.

Q59. CBSE 2024 · 2 marks If $y = \cos(x) + \cos(y)$, prove that $dy/dx = -\sin(x)/(1 - \sin(y))$.

Q60. CBSE 2024 · 2 marks Check the differentiability of function $f(x) = [x]$ at $x = -3$, where $[.]$ denotes greatest integer function.

Q61. CBSE 2024 · 2 marks (a) If $f(x) = |\tan 2x|$, then find the value of $f'(x)$ at $x = \pi/3$.

Q62. CBSE 2024 · 2 marks Show that $f(x) = e^x - e^{-x} + x - \tan^{-1}x$ is strictly increasing in its domain.

Q63. CBSE 2024 · 2 marks (a) Check the differentiability of $f(x) = |\cos x|$ at $x = \pi/2$.

Q64. CBSE 2024 · 2 marks If $x = e^{(x/y)}$, prove that $(dy/dx) = (x \log x) / (\log x - 1)^2$

Q65. CBSE 2024 · 2 marks If $x = e^{(x/y)}$, prove that $dy/dx = (\log x)/(1 + (\log x)^2)$.

Q66. CBSE 2024 · 2 marks If $y = \cos^3(\sec^2 2t)$, find dy/dt .

Q67. CBSE 2023 · 2 marks If $y = (x + \sqrt{1-x^2})^2$, then show that $(x^2 - 1) dy/dx = 4y^2$.

Q68. CBSE 2023 · 2 marks If $y = (x + \sqrt{1-x^2})^2$, then show that $(x^2 - 1)(d^2y/dx^2) = 4y^2$.

Q69. CBSE 2023 · 2 marks If $y = a^x + b$, prove that $y(d^2y/dx^2) + (dy/dx)^2 = 0$.

Q70. CBSE 2023 · 2 marks If $y = (\sqrt{x})/(1+\sqrt{x})$, then find dy/dx at $x = 1$.

Q71. CBSE 2023 · 2 marks If $(x^2 + y^2)^2 = xy$, then find dy/dx .

Q72. CBSE 2023 · 2 marks If $x^y = e^{x^y}$, then show that $dy/dx = (y(1-x))/(1-yx)$.

SHORT ANSWER (13)

Q73. CBSE 2026 · 3 marks If $(\sin x)^y = y^{\cos x}$, then find dy/dx .

Q74. CBSE 2026 · 3 marks (a) If $xy = e^{(x-y)}$, then find dy/dx .

Q75. CBSE 2024 · 3 marks If $x = a \cos \theta$ and $y = b \sin \theta$, then prove that $d^2y/dx^2 = -(b^4)/(a^2y^3)$.

Q76. CBSE 2024 · 3 marks If $2^{\wedge}(x-1) + 2^{\wedge}(y-1) = a(x-y)$, prove that $dy/dx = 2^{\wedge}(y-1) / 2^{\wedge}(x-1)$.

Q77. CBSE 2024 · 3 marks If $2^{\wedge}(x-1) + 2^{\wedge}(y-1) = a(x-y)$, prove that $dy/dx = (1 - 2^{\wedge}(x-1))/(1 - 2^{\wedge}(y-1))$.

Q78. CBSE 2024 · 3 marks If $2^{\wedge}(x-1) + 2^{\wedge}(y-1) = a(x-y)$, prove that $dy/dx = 2^{\wedge}(x-1)/2^{\wedge}(y-1)$.

Q79. CBSE 2024 · 3 marks (a) If $x = e^{(\cos 3t)}$ and $y = e^{(\sin 3t)}$, prove that $dy/dx = (y \log x)/(x \log y)$.

Q80. CBSE 2024 · 3 marks (a) If $x^{30}y^{20} = (x+y)^{50}$, prove that $dy/dx = y/x$.

Q81. CBSE 2024 · 3 marks If $y = (\log x)^2$, prove that $x^2y'' + xy' = 2$.

Q82. CBSE 2024 · 3 marks If $x \cos(p+y) + \cos p \sin(p+y) = 0$, prove that $\cos p (dy/dx) = -\cos^2(p+y)$, where p is a constant.

Q83. CBSE 2024 · 3 marks Find the value of a and b so that function f defined as: $f(x) = \{(a + (x-2)/|x-2|), \text{ if } x < 2; (a+b), \text{ if } x = 2; (b + (x-2)/|x-2|), \text{ if } x > 2\}$ is a continuous function.

Q84. CBSE 2024 · 3 marks Given that $y = (\sin x)^x \cdot x^{(\sin x)} + a^x$, find dy/dx .

Q85. CBSE 2024 · 3 marks Given that $x^y + y^x = a^b$, where a and b are positive constants, find dy/dx .

LONG ANSWER (5)

Q86. CBSE 2026 · 5 marks If $x = \cos t$, $y = \cos mt$, prove that $(1-x^2)d^2y/dx^2 - x dy/dx + m^2y = 0$.

Q87. CBSE 2026 · 5 marks If $x = 3 \sin t - \sin 3t$, $y = 3 \cos t - \cos 3t$, find dy/dx and prove that $d^2y/dx^2 = -\operatorname{cosec}^3(2t) \cdot \operatorname{cosec} t/3$

Q88. CBSE 2026 · 5 marks If $x = a(\sin t - t \cos t)$ and $y = b(\cos t + t \sin t)$, then find dy/dx and d^2y/dx^2 .

Q89. CBSE 2026 · 5 marks (a) If $y^{\wedge}(\sqrt{2x+1}) = \log(\sqrt{2x+1} - \sqrt{x})$, show that $(x^2 + 1)(dy/dx) + xy + 1 = 0$.

Q90. CBSE 2025 · 5 marks (a) If $\sin^{-1}(\sqrt{1-x^2}) + \sin^{-1}(\sqrt{1-y^2}) = a^2$, then prove that $dy/dx = -y/\sqrt{1-x^2}/\sqrt{1-y^2}$.

CASE-BASED (9)

CASE STUDY · CBSE 2026

Sports car racing is a form of motorsport which uses sports car prototypes. The competition is held on special tracks designed in various shapes. The equation of one such track is given as follows: $f(x) = \{(x^4 - 4x^2)/24, 0 \leq x \leq 4; x - 3, x > 4\}$

Q91. CBSE 2026 · 1 mark Find $f'(x)$ for $0 < x < 3$.

CASE STUDY · CBSE 2026

Sports car racing is a form of motorsport which uses sports car prototypes. The competition is held on special tracks designed in various shapes. The equation of one such track is given as follows: $f(x) = \{x^2/2 - 4x, 0 \leq x \leq 4; x - 3, x > 4\}$

Q92. CBSE 2026 · 1 mark Find $f'(x)$ for $0 < x < 3$.

CASE STUDY · CBSE 2026



A Math teacher of a school is teaching the derivative of function in parametric form, to her students. She explains that sometimes the relation between two variables, (say x and y), is neither explicit nor implicit, but the two variables are expressed in a third variable, (say t). So we have $x = f(t)$ and $y = g(t)$. Such form is called parametric form. For finding the derivative in such case we use the chain rule as $dy/dx = (dy/dt)/(dx/dt)$.

Q93. CBSE 2026 · 1 mark If $x = at^3$, $y = at^5$, then find dy/dx .

CASE STUDY · CBSE 2026

Sports car racing is a form of motorsport which uses sports car prototypes. The competition is held on special tracks designed in various shapes. The equation of one such track is given as follows: $f(x) = \{(x^2 - 4x + 3)/(x - 4), \text{ for } 0 \leq x \leq 4; x - 3, \text{ for } x > 4\}$

Q94. CBSE 2026 · 1 mark Find $f'(x)$ for $0 < x < 3$.

CASE STUDY · CBSE 2023

A volleyball player serves the ball which takes a parabolic path given by the equation $h(t) = 7t - (3t^2)/2 - 1/2$, where $h(t)$ is the height of ball at any time t (in seconds), ($t \geq 0$).

Q95. CBSE 2023 · 2 marks Is $h(t)$ a continuous function? Justify.

CASE STUDY · CBSE 2023

A volleyball player serves the ball which takes a parabolic path given by the equation $h(t) = 7t - (3/2)t^2 - (1/3)t$, where $h(t)$ is the height of ball at any time t (in seconds), ($t \geq 0$).

Q96. CBSE 2023 · 2 marks Is $h(t)$ a continuous function? Justify.

CASE STUDY · CBSE 2023

A volleyball player serves the ball which takes a parabolic path given by the equation $h(t) = 7t - (27/12)t^2 + (13/12)t^3 - 1$, where $h(t)$ is the height of ball at any time t (in seconds), ($t \geq 0$).

Q97. CBSE 2023 · 4 marks A volleyball player serves the ball which takes a parabolic path given by the equation $h(t) = 7t - (27/12)t^2 + (13/12)t^3 - 1$, where $h(t)$ is the height of ball at any time t (in seconds), ($t \geq 0$). (i) Is $h(t)$ a continuous function? Justify. (ii) Find the time at which the height of the ball is maximum.

CASE STUDY · CBSE 2023

Let $f(x)$ be a real valued function. Then its Left Hand Derivative (L.H.D.): $f'_-(a) = \lim_{h \rightarrow 0^-} [f(a+h) - f(a)]/h$, Right Hand Derivative (R.H.D.): $f'_+(a) = \lim_{h \rightarrow 0^+} [f(a+h) - f(a)]/h$. Also, a function $f(x)$ is said to be differentiable at $x = a$ if its L.H.D. and R.H.D. at $x = a$ exist and both are equal. For the function $f(x) = \{3 - x, x \leq -1; (4x - 1)/2, -1 < x < 3/4; 4x - 3/4, x \geq 1\}$.

Q98. CBSE 2023 · 4 marks (i) What is R.H.D. of $f(x)$ at $x = 1$? (ii) What is L.H.D. of $f(x)$ at $x = 1$? (iii) Check if the function $f(x)$ is differentiable at $x = 1$.

CASE STUDY · CBSE 2023

Let $f(x)$ be a real valued function. Then its Left Hand Derivative (L.H.D.): $L f'(a) = \lim_{h \rightarrow 0^-} [f(a-h) - f(a)]/h$ Right Hand Derivative (R.H.D.): $R f'(a) = \lim_{h \rightarrow 0^+} [f(a+h) - f(a)]/h$ Also, a function $f(x)$ is said to be differentiable at $x = a$ if its L.H.D. and R.H.D. at $x = a$ exist and both are equal. For the function $f(x) = \{3 - x \text{ for } x \leq 1; x^2 - 4x + 3 \text{ for } 1 < x \leq 4; 3 - 2x \text{ for } x > 1\}$

Q99. CBSE 2023 · 1 mark What is R.H.D. of $f(x)$ at $x = 1$?

6 Application of Derivatives

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (23)

Q1. CBSE 2026 · 1 mark The least value of $f(x) = x^3 - 12x$, $x \in [0, 3]$ is

- (a) -16 (b) -9 (c) 0 (d) 16

Q2. CBSE 2026 · 1 mark The absolute maximum value of $f(x) = x^2 + 1$ in $[-5, 2]$ is

- (a) 26 (b) 1 (c) 5 (d) 2

Q3. CBSE 2026 · 1 mark The least value of $f(x) = e^{-x}$ in $[0, 3]$ is

- (a) e^{-3} (b) -1 (c) 1 (d) $-e^3$

Q4. CBSE 2026 · 1 mark For $f(x) = x + 1/x$ ($x \neq 0$)

- (a) local maximum value is 2 (b) local minimum value is -2
(c) local maximum value is -2
(d) local minimum value < local maximum value

Q5. CBSE 2026 · 1 mark The interval in which $y = x^3 \cdot e^{(-3x)}$ is an increasing function is :

- (a) $(-1, 2)$ (b) $(-\infty, 2)$ (c) $(1, \infty)$ (d) $(0, 1)$

Q6. CBSE 2026 · 1 mark Assertion (A): $f(x) = e^{(-x)}$ is a decreasing function, where $x \in \mathbb{R}$. Reason (R): If $f'(x) < 0$, then $f(x)$ is a decreasing function.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q7. CBSE 2026 · 1 mark The rate of change of volume of a sphere with respect to its diameter, when its radius is 5 cm, is :

- (a) 400 cm³/cm (b) 100 cm³/cm (c) 50 cm³/cm
(d) 25 cm³/cm

Q8. CBSE 2026 · 1 mark The surface area of a sphere when its volume changes at the same rate as its radius is:

- (a) 4π sq. units (b) 1 sq. unit (c) 4 sq. units (d) π sq. units



Q9. CBSE 2026 · 1 mark If the distance travelled by a particle in t seconds is given by $S = 72t + 3t^2 - t^3$, then time taken by the particle to come to rest is:

- (a) 4 seconds (b) 6 seconds (c) 3 seconds (d) 0 seconds

Q10. CBSE 2026 · 1 mark A cylindrical tank is being filled with sand at a rate of $314 \text{ m}^3/\text{h}$. If the radius of the tank is 10 m, then the height of sand in the tank increases at the rate of:

- (a) 1.1 m/h (b) 1 m/h (c) $\pi \text{ m/h}$ (d) $2/\pi \text{ m/h}$

Q11. CBSE 2026 · 1 mark Absolute minimum value of $f(x) = (x - 2)^2 + 5$ in the interval $[-3, 2]$ is:

- (a) -3 (b) 2 (c) 5 (d) 30

Q12. CBSE 2025 · 1 mark The absolute maximum value of function $f(x) = x^3 - 3x + 2$ in $[0, 2]$ is:

- (a) 0 (b) 2 (c) 4 (d) 5

Q13. CBSE 2024 · 1 mark Let $f(x)$ be a continuous function on $[a, b]$ and differentiable on (a, b) . Then, this function $f(x)$ is strictly increasing in (a, b) if:

- (a) $f'(x) < 0, \forall x \in (a, b)$ (b) $f'(x) > 0, \forall x \in (a, b)$
(c) $f'(x) = 0, \forall x \in (a, b)$ (d) $f(x) > 0, \forall x \in (a, b)$

Q14. CBSE 2024 · 1 mark The function $f(x) = x^3 - 3x^2 + 12x - 18$ is:

- (a) strictly decreasing on $\mathbb{R}$ (b) strictly increasing on $\mathbb{R}$
(c) neither strictly increasing nor strictly decreasing on $\mathbb{R}$
(d) strictly decreasing on $(-\infty, 0)$

Q15. CBSE 2024 · 1 mark If the sides of a square are decreasing at the rate of 1.5 cm/s , the rate of decrease of its perimeter is:

- (a) 1.5 cm/s (b) 6 cm/s (c) 3 cm/s (d) 2.25 cm/s

Q16. CBSE 2024 · 1 mark The point of inflexion of a function $f(x)$ is the point where:

- (a) $f'(x) = 0$ and $f'(x)$ changes its sign from positive to negative from left to right of that point.
(b) $f'(x) = 0$ and $f'(x)$ changes its sign from negative to positive from left to right of that point.
(c) $f'(x) = 0$ and $f'(x)$ does not change its sign from left to right of that point.
(d) $f'(x) \neq 0$.

Q17. CBSE 2024 · 1 mark The rate of change of surface area of a sphere with respect to its radius ' r ', when $r = 4 \text{ cm}$, is:

- (a) $64\pi \text{ cm}^2/\text{cm}$ (b) $48\pi \text{ cm}^2/\text{cm}$ (c) $32\pi \text{ cm}^2/\text{cm}$
(d) $16\pi \text{ cm}^2/\text{cm}$

Q18. CBSE 2024 · 1 mark The function $f(x) = kx - \sin x$ is strictly increasing for

- (a) $k > 1$ (b) $k < 1$ (c) $k > -1$ (d) $k < -1$

Q19. CBSE 2023 · 1 mark If $f(x) = a(x - \cos x)$, where $a \in \mathbb{R}$ is strictly decreasing in which of the following?

- (a) $\{0\}$ (b) $(0, \pi)$ (c) $(-\pi, 0)$ (d) $(-\pi, \pi)$

Q20. CBSE 2023 · 1 mark If $f(x) = a(x - \cos x)$ is strictly decreasing in $\mathbb{R}$, then a lies in which of the following?

- (a) $\{0\}$ (b) $(0, \infty)$ (c) $(-\infty, 0)$ (d) $(-\infty, \infty)$

Q21. CBSE 2023 · 1 mark If $f(x) = a(x - \cos x)$ is strictly decreasing in:

- (a) $\{0\}$ (b) $(0, \pi)$ (c) $(-\pi, 0)$ (d) $(-\pi, \pi)$

Q22. CBSE 2023 · 1 mark If $y = (\cos x + \sin x)/(\cos x - \sin x)$, then dy/dx is:

- (a) $2\sec^2 x/4$ (b) $-2\sec^2 x/4$ (c) $\sec x \log 4$ (d) $-\sec x \log 4$

Q23. CBSE 2023 · 1 mark If $y = (\cos x + \sin x)/(\sin x - \cos x)$, then dy/dx is:

- (a) $\sec^2(x/4)$ (b) $-\sec^2(x/4)$ (c) $\log|\sec(x/4)|$
(d) $-\log|\sec(x/4)|$

VERY SHORT ANSWER (34)

Q24. CBSE 2026 · 2 marks A room freshner bottle in the shape of an inverted cone sprays the perfume at regular intervals such that volume of the perfume in the bottle decreases at the steady rate of $1 \text{ mm}^3/\text{min}$. Find the rate at which level of perfume is dropping at an instant when level of perfume in the bottle is 10 mm, if the semi-vertical angle of conical bottle is $\pi/6$.

Q25. CBSE 2026 · 2 marks Find the absolute maximum value of $f(x) = \cos x + \sin^2 x$, $x \in [0, \pi]$.

Q26. CBSE 2026 · 2 marks The volume of a spherical balloon is increasing at the rate of $20 \text{ cm}^3/\text{s}$. Find the rate of change of its surface area when its radius is 4 cm.

Q27. CBSE 2026 · 2 marks Find the sub-interval(s) of $[0, \pi/2]$ in which $f(x) = \tan x - 4x$ is increasing.

Q28. CBSE 2026 · 2 marks Find the sub-interval of $(0, \infty)$ in which $f(x) = x^2 e^{(-x)}$ is increasing.

Q29. CBSE 2026 · 2 marks Find the sub-interval of $(0, \infty)$ in which $f(x) = x \log x$ is increasing.

Q30. CBSE 2026 · 2 marks Find the values of x for which $f(x) = x^x$, $x > 0$ is increasing.

Q31. CBSE 2026 · 2 marks Find the interval(s) in which the function $f(x) = x/\log x$, where $x \in (0, 1) \cup (1, \infty)$, is increasing.

Q32. CBSE 2026 · 2 marks Find the interval(s) for which the function $f(x) = x/3 + 3/x$, $x > 0$ is increasing.

Q33. CBSE 2026 · 2 marks Determine the values of x for which $f(x) = (x - 3)/(x + 1)$, $x \neq -1$ is an increasing function.

Q34. CBSE 2026 · 2 marks Determine the interval(s) in which $f(x) = 5x^{(3/2)} - 3x^{(5/2)}$, $x > 0$ is increasing.

Q35. CBSE 2025 · 2 marks Find the intervals in which function $f(x) = x^{(5/3)} - (5/2)x^{(2/3)}$ is (i) increasing (ii) decreasing.

Q36. CBSE 2024 · 2 marks Find the intervals on which the function $f(x) = 10 - 6x - 2x^2$ is (a) strictly increasing (b) strictly decreasing.

Q37. CBSE 2024 · 2 marks Show that of all rectangles inscribed in a given circle, the square has the maximum area.

Q38. CBSE 2024 · 2 marks Show that the function $f(x) = 4x^3 - 18x^2 + 27x - 7$ has neither maxima nor minima.

Q39. CBSE 2024 · 2 marks Find the absolute maximum and minimum values of the function $f(x) = 12x^{(4/3)} - 6x^{(1/3)}$, $x \in [0, 1]$.

Q40. CBSE 2024 · 2 marks Find local maximum value and local minimum value (whichever exists) for the function $f(x) = 4x^2 + 1/x$ ($x \neq 0$).



Q41. CBSE 2024 · 2 marks If M and m denote the local maximum and local minimum values of the function $f(x) = x + 1/x$ ($x \neq 0$) respectively, find the value of $(M - m)$.

Q42. CBSE 2024 · 2 marks Show that $f(x) = e^x - e^{-x} + x - \tan^{-1} x$ is strictly increasing in its domain.

Q43. CBSE 2024 · 2 marks Determine whether the function $f(x) = x^2 - 6x + 3$ is increasing or decreasing in $[4, 6]$.

Q44. CBSE 2024 · 2 marks Find the interval in which the function $f(x) = x^4 - 4x^3 + 10$ is strictly decreasing.

Q45. CBSE 2024 · 2 marks The volume of a cube is increasing at the rate of $6 \text{ cm}^3/\text{s}$. How fast is the surface area of cube increasing, when the length of an edge is 8 cm ?

Q46. CBSE 2024 · 2 marks Show that $f(x) = 4 \sin x + \cos x - x$ is an increasing function of x in $[0, \pi/2]$.

Q47. CBSE 2023 · 2 marks Show that the function $f(x) = \sin^4(x) \cos^{-4}(x)$, $x \in [\pi/4, 3\pi/2]$, is strictly decreasing.

Q48. CBSE 2023 · 2 marks Find the sub-intervals in which $f(x) = \log(2 + x) - (2x)/(2 + x)$, $x > -2$ is increasing or decreasing.

Q49. CBSE 2023 · 2 marks If the product of two positive numbers is 9, find the numbers so that the sum of their squares is minimum.

Q50. CBSE 2023 · 2 marks If $t_1 = \tan^{-1}(a/x)$, $t_2 = \tan^{-1}(1/\cot a/y)$, then show that $dy/dx + ydx/dy = 0$.

Q51. CBSE 2023 · 2 marks If the circumference of circle is increasing at the constant rate, prove that rate of change of area of circle is directly proportional to its radius.

Q52. CBSE 2023 · 2 marks If $f(x) = a(\tan x - \cot x)$, where $a \neq 0$, then find whether $f(x)$ is increasing or decreasing function in its domain.

Q53. CBSE 2023 · 2 marks If $y = x^{1/x}$, then find dy/dx at $x = 1$.

Q54. CBSE 2023 · 2 marks There exists at least one value of b for which $f(x) = b^x$, $b \neq 0$ is strictly increasing in $\mathbb{R} \setminus \{0\}$. State True or False. Justify.

Q55. CBSE 2023 · 2 marks Find the points on the curve $6y = x^3 + 2$ at which ordinate is changing 8 times as fast as abscissa.

Q56. CBSE 2023 · 2 marks Find the interval in which the function $f(x) = 2x^3 - 3x$ is strictly increasing.

Q57. CBSE 2023 · 2 marks Find the point on the curve $y^2 = 8x$ for which the abscissa and ordinate change at the same rate.

SHORT ANSWER (5)

Q58. CBSE 2026 · 3 marks A spherical balloon loses its volume due to escape of air from it in such a way that decrease of volume at any instant is proportional to its surface area. Show that the radius is decreasing at a constant rate.

Q59. CBSE 2026 · 3 marks A thin metallic wire in the shape of a circular ring has its enclosed area increasing at a uniform rate when heated. Show that the rate of change of circumference varies inversely as the radius.

Q60. CBSE 2026 · 3 marks The volume of a wooden block in the shape of a cube increases at a constant rate as the air becomes moist during the rainy season. Show that the rate of change of its surface area varies inversely as the length of edge of the cube.

Q61. CBSE 2025 · 3 marks The side of an equilateral triangle is increasing at the rate of 3 cm/s . At what rate its area increasing when the side of the triangle is 15 cm ?

Q62. CBSE 2024 · 3 marks Find the intervals in which the function $f(x) = (\log x) / x$ is strictly increasing or strictly decreasing.

LONG ANSWER (7)

Q63. CBSE 2026 · 5 marks Find the sub intervals in which $f(x) = \cot^{-1}(\sin x + \cos x)$, $x \in (0, \pi)$ is increasing and decreasing.

Q64. CBSE 2026 · 5 marks Find the sub-interval of $(0, \pi)$ in which $f(x) = \tan^{-1}(\sin x - \cos x)$ is increasing and decreasing.

Q65. CBSE 2026 · 5 marks Of all the closed right circular cylindrical cans of given volume 200 cm^3 , find the dimensions of the can which has the minimum surface area.

Q66. CBSE 2026 · 5 marks Find the sub-interval of $[0, \pi/2]$ in which $f(x) = \log(\sin x + \cos x)$ is increasing and decreasing.

Q67. CBSE 2025 · 5 marks Find the absolute maximum and absolute minimum of function $f(x) = 2x^3 - 15x^2 + 36x + 1$ on $[1, 5]$.

Q68. CBSE 2024 · 5 marks It is given that function $f(x) = x^4 - 62x^2 + ax + 9$ attains local maximum value at $x = 1$. Find the value of 'a', hence obtain all other points where the given function $f(x)$ attains local maximum or local minimum values.

Q69. CBSE 2024 · 5 marks (a) It is given that function $f(x) = x^4 - 62x^2 + ax + 9$ attains local maximum value at $x = 1$. Find the value of 'a', hence obtain all other points where the given function $f(x)$ attains local maximum or local minimum values. OR (b) The perimeter of a rectangular metallic sheet is 300 cm . It is rolled along one of its sides to form a cylinder. Find the dimensions of the rectangular sheet so that volume of cylinder so formed is maximum.

CASE-BASED (25)

CASE STUDY · CBSE 2026

An online delivery company in a city has 5000 subscribers and collects annual subscription fees of ₹ 300 per subscriber for unlimited free deliveries. The company wishes to increase the annual subscription fee. It is predicted that, for every increase of ₹ 1, ten subscribers will discontinue. Assume that the company increased the annual fee by ₹ x .

Q70. CBSE 2026 · 1 mark An online delivery company in a city has 5000 subscribers and collects annual subscription fees of ₹ 300 per subscriber for unlimited free deliveries. The company wishes to increase the annual subscription fee. It is predicted that, for every increase of ₹ 1, ten subscribers will discontinue. Assume that the company increased the annual fee by ₹ x . How many subscribers will discontinue after an increase of ₹ x in annual fee?



Q71. CBSE 2026 · 1 mark How many subscribers will discontinue after an increase of ₹ x in annual fee?

CASE STUDY · CBSE 2026

Two vertical light poles of height 22 m and 16 m stand on the opposite sides of a 20 m wide road. Two ladders of length l_1 and l_2 are placed from a common point R on the road at a distance of x m from the smaller pole.

Q72. CBSE 2026 · 4 marks Two vertical light poles of height 22 m and 16 m stand on the opposite sides of a 20 m wide road. Two ladders of length l_1 and l_2 are placed from a common point R on the road at a distance of x m from the smaller pole. (i) Express $p(x) = l_1 + l_2$ in terms of x . (ii) Find $p'(x)$. (iii) (a) Find the value of x for which $(1/l_1) + (1/l_2)$ is minimum.

Q73. CBSE 2026 · 1 mark Express $p(x) = l_1 + l_2$ in terms of x .

CASE STUDY · CBSE 2026

At a birthday party, children are being served orange juice in conical cups. Each cup is 15 cm deep and has a radius 5 cm. The juice is being poured into this cup at a rate of $0.1 \text{ cm}^3/\text{s}$.

Q74. CBSE 2026 · 4 marks (i) Establish a relation between the height h of the juice in the cup and radius r of the surface of the juice in the cup, if the semi-vertical angle of the cone is α .

Q75. CBSE 2026 · 1 mark At a birthday party, children are being served orange juice in conical cups. Each cup is 15 cm deep and has a radius 5 cm. The juice is being poured into this cup at a rate of $0.1 \text{ cm}^3/\text{s}$. Establish a relation between the height h of the juice in the cup and radius r of the surface of the juice in the cup, if the semi-vertical angle of the cone is θ .

CASE STUDY · CBSE 2026

A company produces cylindrical tumblers, open from the top. Since they want uniformity in the product, they fix the surface area of the tumblers produced.

Q76. CBSE 2026 · 2 marks If for a tumbler, V is its volume, h the height and r the radius of the circular base, differentiate its volume with respect to radius of the base, where the surface area is constant.

Q77. CBSE 2026 · 2 marks A company produces cylindrical tumblers, open from the top. Since they want uniformity in the product, they fix the surface area of the tumblers produced. If for a tumbler, V is its volume, h the height and r the radius of the circular base, then differentiate its volume with respect to radius of the base, where the surface area is constant.

CASE STUDY · CBSE 2026

A company produces cylindrical tumblers, open from the top. Since they want uniformity in the product, they fix the surface

area of the tumblers produced. If for a tumbler, V is its volume, h the height and r the radius of the circular base, then:

Q78. CBSE 2026 · 4 marks A company produces cylindrical tumblers, open from the top. Since they want uniformity in the product, they fix the surface area of the tumblers produced. If for a tumbler, V is its volume, h the height and r the radius of the circular base, then: Differentiate its volume with respect to radius of the base, where the surface area is constant.

CASE STUDY · CBSE 2025

A technical company is designing a rectangular solar panel installation on a roof using 300 metres of boundary material. The design includes a partition running parallel to one of the sides dividing the area (roof) into two sections. Let the length of the side perpendicular to the partition be x metres and with parallel to the partition be y metres.

Q79. CBSE 2025 · 4 marks (i) Write the equation for the total boundary material used in the boundary and parallel to the partition in terms of x and y .

Q80. CBSE 2024 · 1 mark Assertion (A): If the side of a square is increasing at the rate of 0.2 cm/s , then the rate of increase of its perimeter is 0.8 cm/s . Reason (R): Perimeter of a square = 4 (side).

CASE STUDY · CBSE 2024

The relation between the height of the plant (y in cm) with respect to exposure to sunlight is governed by the relation $y = 4x - (1/2)x^2$, where x is the number of days it is exposed to sunlight.

Q81. CBSE 2024 · 1 mark Find the rate of growth of the plant with respect to sunlight.

CASE STUDY · CBSE 2024

The traffic police has installed Over Speed Violation Detection (OSVD) system at various locations in a city. These cameras can capture a speeding vehicle from a distance of 300 m and even function in the dark. A camera is installed on a pole at the height of 5 m. It detects a car travelling away from the pole at the speed of 20 m/s . At any point, x m away from the base of the pole, the angle of elevation of the speed camera from the car C is θ .

Q82. CBSE 2024 · 1 mark Express θ in terms of height of the camera installed on the pole and x .

CASE STUDY · CBSE 2024

Overspeeding increases fuel consumption and decreases fuel economy as a result of tyre rolling friction and air resistance. While vehicles reach optimal fuel economy at different speeds,



fuel mileage usually decreases rapidly at speeds above 80 km/h. The relation between fuel consumption F (l/100 km) and speed V (km/h) under some constraints is given as $F = (V^2/500) - (4V) + 14$.

Q83. CBSE 2024 · 1 mark Find F , when $V = 40$ km/h.

CASE STUDY · CBSE 2024

A store has been selling calculators at ₹350 each. A market survey indicates that a reduction in price (p) of calculator increases the number of units (x) sold. The relation between the price and quantity sold is given by the demand function $p = 450 - (1/2)x$.

Q84. CBSE 2024 · 1 mark Determine the number of units (x) that should be sold to maximise the revenue $R(x) = xp(x)$. Also, verify the result.

Q85. CBSE 2024 · 4 marks A store has been selling calculators at ₹350 each. A market survey indicates that a reduction in price (p) of calculator increases the number of units (x) sold. The relation between the price and quantity sold is given by the demand function $p = 450 - (1/2)x$. Determine the number of units (x) that should be sold to maximise the revenue $R(x) = xp(x)$. Also, verify the result.

CASE STUDY · CBSE 2023

A tank, formed using a combination of a cylinder and a cone, offers better drainage as compared to a flat bottomed tank. A tap is connected to such a tank whose conical part is full of water. Water is dripping out from a tap at the bottom at the uniform rate of $2 \text{ cm}^3/\text{s}$. The semi-vertical angle of the conical tank is 45° .

Q86. CBSE 2023 · 1 mark (i) Find the volume of water in the tank in terms of its radius r .

CASE STUDY · CBSE 2023

The equation of the path traced by a roller-coaster is given by the polynomial $f(x) = a(x + 9)(x + 1)(x - 3)$. If the roller-coaster crosses y -axis at a point $(0, -1)$.

Q87. CBSE 2023 · 4 marks (i) Find the value of a .

CASE STUDY · CBSE 2023

Engine displacement is the measure of the cylinder volume swept by all the pistons of a piston engine. The piston moves inside the cylinder bore. The cylinder bore in the form of circular cylinder open at the top is to be made from a metal sheet of area $75\pi \text{ cm}^2$.

Q88. CBSE 2023 · 1 mark If the radius of cylinder is r cm and height is h cm, then write the volume V of cylinder in terms of radius r .

CASE STUDY · CBSE 2023

In order to set up a rain water harvesting system, a tank to collect rain water is to be dug. The tank should have a square base and a capacity of 250 m^3 . The cost of land is ₹ 5,000 per square metre and cost of digging increases with depth and for the whole tank, it is ₹ $40,000 h^2$, where h is the depth of the tank in metres. x is the side of the square base of the tank in metres.

Q89. CBSE 2023 · 1 mark Find the total cost C of digging the tank in terms of x .

Q90. CBSE 2023 · 4 marks In order to set up a rain water harvesting system, a tank to collect rain water is to be dug. The tank should have a square base and a capacity of 250 m^3 . The cost of land is ₹5,000 per square metre and cost of digging increases with depth and for the whole tank, it is ₹ $40,000h^2$, where h is the depth of the tank in metres. x is the side of the square base of the tank in metres. (i) Find the total cost C of digging the tank in terms of x . (ii) Find dC/dx . (iii) Find the value of x for which cost C is minimum.

CASE STUDY · CBSE 2023

A volleyball player serves the ball which takes a parabolic path given by the equation $h(t) = 7t - (3t^2)/2 - 1/2$, where $h(t)$ is the height of ball at any time t (in seconds), ($t \geq 0$).

Q91. CBSE 2023 · 2 marks Find the time at which the height of the ball is maximum.

CASE STUDY · CBSE 2023

A volleyball player serves the ball which takes a parabolic path given by the equation $h(t) = 7t - (3/2)t^2 - (1/3)t$, where $h(t)$ is the height of ball at any time t (in seconds), ($t \geq 0$).

Q92. CBSE 2023 · 2 marks Find the time at which the height of the ball is maximum.

CASE STUDY · CBSE 2023

A contractor has 200 metres of fencing wire and wants to construct a rectangular garden using a brick wall on one side of the garden and wire fencing for the other three sides.

Q93. CBSE 2023 · 2 marks Assuming that the length of the side of the garden perpendicular to the brick wall is x metres and the side parallel to the brick wall is y metres, determine the relation representing the total length of fencing wire and also write $A(x)$, the area of the garden.

CASE STUDY · CBSE 2023

A father of Suraj wants to construct a rectangular garden using a brick wall on one side and wire fencing for the other three sides. He has 200 metres of fencing wire.



Q94. CBSE 2023 · 2 marks Determine the maximum value of $A(x)$.

7 Integrals

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (47)

Q1. CBSE 2026 · 1 mark If $\int (3ax)/(b^2 + c^2x^2) dx = A \log |b^2 + c^2x^2| + K$, then the value of A is

- (a) $3a$ (b) $3a/(2b^2)$ (c) $3a/(b^2c^2)$ (d) $3a/(2c^2)$

Q2. CBSE 2026 · 1 mark The value of $\int_{-1}^1 x^3/(x^2 + 2|x| + 1) dx$ is

- (a) 0 (b) $\log 2$ (c) $2 \log 2$ (d) $(1/2) \log 2$

Q3. CBSE 2026 · 1 mark If $\int_0^1 (2a + 1 - x^2) dx = 4$, then the value of a is

- (a) $3/4$ (b) $3/2$ (c) 3 (d) $2\sqrt{3}$

Q4. CBSE 2026 · 1 mark $\int (1/(\cos x)) dx$ is equal to

- (a) $\tan^2(x/2) + C$ (b) $1 - \cot^2(x/2) + C$ (c) $-\cot(2x) + C$
(d) $\tan(2x) + C$

Q5. CBSE 2026 · 1 mark $\int \cos 2x/(\sin^2 x \cos^2 x) dx$ is equal to :

- (a) $\cot x + \tan x + C$ (b) $-\cot x + \sec x + C$
(c) $-\cot x + \tan x + C$ (d) $-(\tan x + \cot x) + C$

Q6. CBSE 2026 · 1 mark $\int dx/(x^2 + 6x + 10)$ is equal to :

- (a) $x \tan^{-1}(x + 3) + C$ (b) $\tan^{-1}(x + 3) + C$
(c) $(1/3) \tan^{-1}(x + 3) + C$ (d) $\tan^{-1} x + C$

Q7. CBSE 2026 · 1 mark $\int \sec x \tan x / (\sec x - \tan x) dx$ is equal to

- (a) $\log |\sec x + \tan x| + C$ (b) $\log |\sec x - \tan x| + C$
(c) $\log |1 + \cos x| + C$ (d) $\log |1 + \sin x| + C$

Q8. CBSE 2026 · 1 mark $\int_{-1}^1 \{x\} (1 - |x|) dx$ is equal to :

- (a) $2 \int_0^1 (1 + x) dx$ (b) $2 \int_{-1}^0 (1 + x) dx$ (c) 0
(d) $2 \int_0^1 \{x\} (1 - x) dx$

Q9. CBSE 2026 · 1 mark $\int e^{(-2x)}/(e^{(-x)} - 1) dx$ is equal to:

- (a) $\sin^{-1} e^{-x} + C$ (b) $\log|e^{-x} + \sqrt{(e^{(-2x)} - 1)}| + C$
(c) $\sin^{-1} ex + C$ (d) $\log|e^{-x} - \sqrt{(e^{(-2x)} - 1)}| + C$

Q10. CBSE 2026 · 1 mark $\int \cos x / \sqrt{(\sin^2 x + 1)} dx$ is equal to:

- (a) $\tan^{-1}(\sin x) + C$ (b) $\sin^{-1}(\sin x) + C$
(c) $\log|\sin x + \sqrt{(1 + \sin^2 x)}| + C$
(d) $\log|\sin x - \sqrt{(\sin^2 x + 1)}| + C$

Q11. CBSE 2026 · 1 mark $\int dx/(25 - 16x^2)$ is equal to:

- (a) $(1/5) \sin^{-1} 4x + C$ (b) $(1/25) \sin^{-1} 16x + C$
(c) $(1/4) \sin^{-1}(4x/5) + C$ (d) $(1/16) \sin^{-1}(4x/5) + C$

Q12. CBSE 2026 · 1 mark If $\int_0^1 dx/(e^x + e^{(-x)}) = \tan^{-1} e + k$, then the value of k is:

- (a) e (b) $\pi/4$ (c) 0 (d) $-\pi/4$

Q13. CBSE 2026 · 1 mark $\int 2dx/(25 - 16x^2)$ is equal to:

- (a) $(1/5) \sin^{-1} 4x + C$ (b) $(1/25) \sin^{-1} 16x + C$
(c) $(1/4) \sin^{-1}(4x/5) + C$ (d) $(1/16) \sin^{-1}(4x/5) + C$

Q14. CBSE 2026 · 1 mark The value of $\int_{-1}^{-5} x-1 dx$ is equal to :

- (a) $-\log 5$ (b) $x6$ (c) $\log(-5)$ (d) $x-6$

Q15. CBSE 2026 · 1 mark $\int (1 - \cos 2x)/(1 + \cos 2x) dx$ is equal to:

- (a) $\log |\sec^2 x| + C$ (b) $\log |\cos x| + C$
(c) $\log |1 + \cos 2x| + C$ (d) $\log |\sec x| + C$

Q16. CBSE 2026 · 1 mark The value of $\int_0^1 1/(3x - 4) dx$ is:

- (a) $1/3 \log 4$ (b) $-1/3 \log 4$ (c) $\log(-4)$ (d) $\log 4$

Q17. CBSE 2026 · 1 mark $\int (1 + \cos x)/(1 - \cos x) dx$ is equal to:

- (a) $2 \log |\sin(x/2)| + C$ (b) $(1/2) \log |\sin 2x| + C$
(c) $\log |1 - \cos 2x| + C$ (d) $\log |1 + \cos 2x| + C$

Q18. CBSE 2026 · 1 mark If $\int_0^1 (6x^2 - 4x + k) dx = 0$, then the value of k is:

- (a) 1 (b) 0 (c) 2 (d) -1

Q19. CBSE 2025 · 1 mark $\int_0^1 |x|/x dx$ is equal to:

- (a) -1 (b) 0 (c) 1 (d) 2

Q20. CBSE 2025 · 1 mark If $\int (1 - x^2)/x^2 dx = k \log x + C$, then k is equal to:

- (a) $-1/2 \log$ (b) $-\log 2$ (c) -1 (d) $1/2$

Q21. CBSE 2024 · 1 mark $\int (\cos^2 2x)/(\sin x \cos x) dx$ is equal to

- (a) $\cot x + \tan x + c$ (b) $-\cot x + \tan x + c$
(c) $\cot x - \tan x + c$ (d) $-\cot x - \tan x + c$

Q22. CBSE 2024 · 1 mark $\int [a \text{ to } b] f(x) dx$ is equal to:

- (a) $\int [a \text{ to } b] f(a - x) dx$ (b) $\int [a \text{ to } b] f(a + b - x) dx$
(c) $\int [a \text{ to } b] f(x - (a + b)) dx$
(d) $\int [a \text{ to } b] f((a - x) + (b - x)) dx$

Q23. CBSE 2024 · 1 mark If $\int_0^a dx/(4 + x^2) = \pi/6$, then the value of 'a' is:

- (a) $2\sqrt{3}$ (b) $\sqrt{3}/2$ (c) $\sqrt{3}$ (d) $1/\sqrt{3}$

Q24. CBSE 2024 · 1 mark If $f(x)$ is an odd function, then $\int_{-\pi/2}^{\pi/2} f(x) \cos x dx$ equals:

- (a) $2 \int_0^{\pi/2} f(x) \cos x dx$ (b) 0 (c) $2 \int_0^{\pi/2} f(x) dx$
(d) $2 \int_0^{\pi/2} \cos x dx$

Q25. CBSE 2024 · 1 mark $\int_0^{\pi/2} (\sin x - \cos x)/(1 + \sin x \cos x) dx$ is equal to:

- (a) π (b) Zero (0) (c) $\int_0^{\pi/2} \sin^2 x/(1 + \sin x \cos x) dx$
(d) $\pi^2/4$

Q26. CBSE 2024 · 1 mark If $\int_0^2 2e^{(2x)} dx = \int_0^a e^x dx$, then the value of 'a' is:

- (a) 1 (b) 2 (c) 4 (d) $1/2$

Q27. CBSE 2024 · 1 mark Anti-derivative of $\sqrt{(1 + \sin^2 x)}$, $x \in [0, \pi/4]$ is:

- (a) $\cos x + \sin x$ (b) $-\cos x + \sin x$ (c) $\cos x - \sin x$
(d) $-\cos x - \sin x$

Q28. CBSE 2024 · 1 mark $\int_{-a}^a f(x) dx = 0$, if :

- (a) $f(-x) = f(x)$ (b) $f(-x) = -f(x)$ (c) $f(a - x) = f(x)$
(d) $f(a - x) = -f(x)$



Q29. CBSE 2024 · 1 mark If $g(x)$ is a continuous function satisfying $g(-x) = -g(x)$, then $\int_0^{2a} g(x) dx$ is equal to:

- (a) 0 (b) $2\int_0^a g(x) dx$ (c) $\int_{-a}^a g(x) dx$
(d) $-\int_{-2a}^0 g(x) dx$

Q30. CBSE 2024 · 1 mark The value of $\int_0^3 \sqrt{9-x^2} dx$ is:

- (a) 6π (b) 4π (c) 2π (d) 18π

Q31. CBSE 2024 · 1 mark The value of $\int_{-1}^1 (1-|x|) dx$ is:

- (a) -2 (b) -1 (c) 1 (d) 2

Q32. CBSE 2023 · 1 mark $\int_0^{\pi/6} \sec^2(6x) dx$ is equal to:

- (a) $1/3$ (b) $-1/3$ (c) 3 (d) -3

Q33. CBSE 2023 · 1 mark $\int dx/(x \tan^{-1}x \tan^{-1}(1/x))$ is equal to:

- (a) $\sec^2(x/4) + C$ (b) $-\sec^2(x/4) + C$ (c) $\log \sec(x/4) + C$
(d) $-\log \sec(x/4) + C$

Q34. CBSE 2023 · 1 mark The primitive of $x^2 \cos^{-1}(1/2)$ is:

- (a) $\sec^2 x$ (b) $2 \sec^2 x \tan x$ (c) $\tan x$ (d) $-\cot x$

Q35. CBSE 2023 · 1 mark $\int_0^{\pi/6} (\sec^2 x - 6x) dx$ is equal to:

- (a) $1/3$ (b) $-1/3$ (c) $\sqrt{3}$ (d) $-\sqrt{3}$

Q36. CBSE 2023 · 1 mark If $d/dx f(x) = 2x + 3/x$ and $f(1) = 1$, then $f(x)$ is

- (a) $x^2 + 3 \log |x| + 1$ (b) $x^2 + 3 \log |x|$ (c) $2 - 3/x^2$
(d) $x^2 + 3 \log |x| - 4$

Q37. CBSE 2023 · 1 mark Anti-derivative of $(\tan x - 1)/(\tan x + 1)$ with respect to x is

- (a) $\sec^2(\pi/4 - x) + c$ (b) $-\sec^2(\pi/4 - x) + c$
(c) $\log|\sec(\pi/4 - x)| + c$ (d) $-\log|\sec(\pi/4 - x)| + c$

Q38. CBSE 2023 · 1 mark $\int (1 - 2\cos^2 x)/(\sin^2 x) dx$ is equal to:

- (a) $x - 2\cos x + C$ (b) $x + 2\cos x + C$ (c) $-x - 2\cos x + C$
(d) $-x + 2\cos x + C$

Q39. CBSE 2023 · 1 mark $\int dx/(2^{x+2})$ is equal to:

- (a) $2^{x+2} + C$ (b) $2^{x+2} \log 2 + C$ (c) $2^x/(2 \log 2) + C$
(d) $-2^x/(2 \log 2) + C$

Q40. CBSE 2023 · 1 mark $\int_0^2 dx/(x^2-4)$ equals:

- (a) $2 \log 2$ (b) $-2 \log 2$ (c) 2 (d) -2

Q41. CBSE 2023 · 1 mark $\int 2^{2x} dx$ is equal to

- (a) $2^{x+2} + C$ (b) $2^{x+2}/(\log 2) + C$
(c) $2^{2x}/(\log 2) + C$ (d) $2^{2x} \log 2 + C$

Q42. CBSE 2023 · 1 mark $\int x e^x/(1+x)^2 dx$ is equal to

- (a) $x e^x + C$ (b) $-x e^x + C$ (c) $x e^{2x} + C$
(d) $e^x/(1+x) + C$

Q43. CBSE 2023 · 1 mark The value of $\int_0^{\pi/2} \log(\tan x) dx$ is

- (a) $\pi/2$ (b) 0 (c) π (d) 1

Q44. CBSE 2023 · 1 mark $\int dx \log 5$ is equal to :

- (a) $5x + C$ (b) $6x + C$ (c) $5x + C$ (d) $6x + C$

Q45. CBSE 2023 · 1 mark $\int x \log 5 dx$ is equal to:

- (a) $5x^5 + C$ (b) $6x^6 + C$ (c) $5x^4 + C$ (d) $6x^5 + C$

Q46. CBSE 2023 · 1 mark $\int_0^4 (e^x)^2 dx$ is equal to:

- (a) $2e - 15/8$ (b) $2e - 16/8$ (c) $2/15 - e/8$ (d) $2/15 - e^8$

Q47. CBSE 2023 · 1 mark If $\int_0^a x^3 dx = 8$, then a is:

- (a) 2 (b) 4 (c) 8 (d) 10

VERY SHORT ANSWER (12)

Q48. CBSE 2026 · 2 marks Find: $\int (x^3 - 4)e^x/(x-2) dx$

Q49. CBSE 2024 · 2 marks Find: $\int \operatorname{cosec}(3x+1) \cot(3x+1) dx$

Q50. CBSE 2024 · 2 marks Find: $\int x/\sqrt{1+x^2} dx$

Q51. CBSE 2024 · 2 marks Evaluate: $\int_0^a x^2/(6+x) dx$

Q52. CBSE 2024 · 2 marks Find: $\int (e^x x^4 + 1)/(e^x x^4(1 + e^x(-x^4))) dx$

Q53. CBSE 2024 · 2 marks Evaluate: $\int_0^{\pi/2} \sin 2x \cos 3x dx$

Q54. CBSE 2024 · 2 marks Find: $\int x/(\sqrt{x^2-1}) dx$.

Q55. CBSE 2024 · 2 marks Evaluate: $\int_1^2 (1 - \cos x)/(1-x)^2 \times \log((1+x)/(1-x)) dx$

Q56. CBSE 2022 · 2 marks Find: $\int_{-2}^2 \sin(3x) \sin(x) dx$

Q57. CBSE 2022 · 2 marks Find: $\int \sin 3x \sin x dx$

Q58. CBSE 2022 · 2 marks Evaluate: $\int_0^1 x e^x dx / (1+x)^2$

Q59. CBSE 2022 · 2 marks Evaluate: $\int_0^1 e^x \sqrt{x^2+1} dx$

SHORT ANSWER (67)

Q60. CBSE 2026 · 3 marks Evaluate: $\int_0^1 x \tan^{-1}x dx$.

Q61. CBSE 2026 · 3 marks Find $\int (x+2)/(x-2) dx$.

Q62. CBSE 2026 · 3 marks If $I_1 = \int_{(-\pi/4)}^{(\pi/4)} 1/(1 + \cos 2x) dx$ and $I_2 = \int_{(-1/2)}^{(1/2)} |x| dx$, then show that $I_1 - 4I_2 = 0$.

Q63. CBSE 2026 · 3 marks If $I_1 = \int_{-\pi/4}^{(\pi/4)} dx/(1 + \cos 2x)$ and $I_2 = \int_{-1/2}^{(1/2)} |x| dx$, then show that $I_1 - 4I_2 = 0$.

Q64. CBSE 2026 · 3 marks Evaluate: $\int_0^1 x \sin^{-1}x dx$

Q65. CBSE 2026 · 3 marks Evaluate: $\int_0^1 \log(1+x^2) dx$

Q66. CBSE 2026 · 3 marks Find: $\int x^2/(x^2-9) dx$

Q67. CBSE 2026 · 3 marks Evaluate: $\int_5^{\pi/12} \pi/12 \cot^{-1} x dx$

Q68. CBSE 2026 · 3 marks If $d/dx(F(x)) = (1 + e^{1/x})/(x^2)$, then find $F(x)$ given that $F(0) = \log(1/2)$.

Q69. CBSE 2026 · 3 marks Find: $\int (x+1)/(x^2-6x+2) dx$

Q70. CBSE 2026 · 3 marks Evaluate: $\int (5\pi/12 \text{ to } \pi/12) \cot^{-1}(x) dx$

Q71. CBSE 2026 · 3 marks Find: $\int x/(x^2-6x+7) dx$

Q72. CBSE 2026 · 3 marks Find: $\int (3x^2-1)/(x^4-4x) dx$

Q73. CBSE 2026 · 3 marks Find : $\int dx/(x^{1/2} + x^{1/3})$

Q74. CBSE 2026 · 3 marks Evaluate : $\int_0^{\pi} (\sin^{2026} x)/(\sin^{2026} x + \cos^{2026} x) dx$

Q75. CBSE 2026 · 3 marks Find : $\int \cos x/((2 + \sin x)(4 + \sin x)) dx$

Q76. CBSE 2026 · 3 marks Evaluate: $\int_{-\pi/2}^{\pi/2} x^2 \cos x / (2^x + x + 1) dx$

Q77. CBSE 2026 · 3 marks Evaluate: $\int_0^{\pi/2} \sin^2 x / (1 + \sin 2x) dx$



- Q78.** CBSE 2026 · 3 marks Find : $\int (x \sin x)/(1 - \cos x) dx$
- Q79.** CBSE 2025 · 3 marks (a) Find: $\int (\sin x + 1 + \cos x)/(x + \cos x) dx$
- Q80.** CBSE 2024 · 3 marks Find: $\int x^2/((x+1)^2(x+3)) dx$
- Q81.** CBSE 2024 · 3 marks Evaluate: $\int_{-6}^6 |x-2| dx$
- Q82.** CBSE 2024 · 3 marks Find: $\int x / ((x^2 + 4)(x^2 + 9)) dx$
- Q83.** CBSE 2024 · 3 marks Find: $\int x^2/((x^2 + 4)(x^2 + 9)) dx$
- Q84.** CBSE 2024 · 3 marks (a) Evaluate: $\int 2x/(x^2 - 2x + 2) dx$
- Q85.** CBSE 2024 · 3 marks Find: $\int x^2 \cdot \sin^{-1}(x^{3/2}) dx$
- Q86.** CBSE 2024 · 3 marks (a) Evaluate: $\int (x^2 - 2x + 2)/x^2 dx$
- Q87.** CBSE 2024 · 3 marks Find: $\int x^2 \log(x^2 - 1) dx$
- Q88.** CBSE 2024 · 3 marks Find: $\int (x^2 + 1) / ((x^2 + 2)(x^2 + 4)) dx$
- Q89.** CBSE 2024 · 3 marks Find: $\int e^x (2 \sin^2 x + 1) / (1 + \cos 2x) dx$
- Q90.** CBSE 2024 · 3 marks Find: $\int (-1)/(x^2(\log x)^2 - 5 \log x + 4) dx$
- Q91.** CBSE 2024 · 3 marks Find: $\int e^x/(2 + \sin^2 x + 2 \cos x) dx$
- Q92.** CBSE 2024 · 3 marks Evaluate: $\int_0^{\pi/4} x/(1 + \cos 2x + \sin 2x) dx$
- Q93.** CBSE 2024 · 3 marks Find: $\int (3x + 5)/(x^2 + 2x + 4) dx$
- Q94.** CBSE 2024 · 3 marks Find: $\int x/(x^2 + 3x + 3) dx$
- Q95.** CBSE 2023 · 3 marks Evaluate: $\int_0^{2\pi} [\log(\sin x) - \log(2 \cos x)] dx$
- Q96.** CBSE 2023 · 3 marks Find: $\int x/[(x+1)(x+2)] dx$
- Q97.** CBSE 2023 · 3 marks (a) Evaluate: $\int_0^{2\pi} e^x \sin(x) dx$ OR (b) Find: $\int 1/[\cos(a-x)\cos(b-x)] dx$
- Q98.** CBSE 2023 · 3 marks (a) Evaluate: $\int_0^{\pi/2} e^x \sin x dx$ OR (b) Find: $\int 1/(\cos(a-x)\cos(b-x)) dx$
- Q99.** CBSE 2023 · 3 marks Evaluate: $\int_0^{\pi} |\sin x - \cos x| dx$
- Q100.** CBSE 2023 · 3 marks Find: $\int 1/(\sqrt{x}(1-x)(2-x)) dx$
- Q101.** CBSE 2023 · 3 marks Evaluate: $\int_0^{\pi} e^x \sin x dx$
- Q102.** CBSE 2023 · 3 marks Evaluate: $\int_0^{\pi/2} [\log(\sin x) - \log(2 \cos x)] dx$
- Q103.** CBSE 2023 · 3 marks Find: $\int (x dx)/((x^2 + 4)(x^2 + 9))$
- Q104.** CBSE 2023 · 3 marks Evaluate $\int (\log 2 \text{ to } \log 3) 1/((e^x + e^{-x})(e^x - e^{-x})) dx$
- Q105.** CBSE 2023 · 3 marks Evaluate $\int (-1 \text{ to } 1) |x^4 - x| dx$
- Q106.** CBSE 2023 · 3 marks Find $\int e^x((1 - \sin x)/(1 - \cos x)) dx$
- Q107.** CBSE 2023 · 3 marks Evaluate: $\int_1^3 (4x)/(4x + x^4) dx$
- Q108.** CBSE 2023 · 3 marks Evaluate: $\int_1^2 e(1 + 4x - x^2 \log x)/(x^2) dx$
- Q109.** CBSE 2023 · 3 marks Find: $\int \cos x/(\sin^3 x) dx$
- Q110.** CBSE 2023 · 3 marks Find: $\int (e^x x)/(5 - 4e^x - e^{2x}) dx$
- Q111.** CBSE 2023 · 3 marks Evaluate: $\int_{-\pi/2}^{\pi/2} (\sin^{100} x)/(\sin^{100} x + \cos^{100} x) dx$

- Q112.** CBSE 2023 · 3 marks Evaluate: $\int_0^{\pi/4} \log(1 + \tan x) dx$
- Q113.** CBSE 2023 · 3 marks Find: $\int 1/(4 + x^2 - 2x + 1) dx$
- Q114.** CBSE 2023 · 3 marks Find: $\int (6x - 12)/(x^2 - 4x + 1) dx$
- Q115.** CBSE 2023 · 3 marks Evaluate: $\int_0^{\pi/4} e^{2x} \sin^{-1}(2x)/(1 - 4x^2) \cos 2x dx$
- Q116.** CBSE 2023 · 3 marks Find: $\int (5e^x + 4)/(e^{2x} - e^x) dx$
- Q117.** CBSE 2023 · 3 marks Find: $\int 1/((1+x)(1-x^2)) dx$
- Q118.** CBSE 2023 · 3 marks Evaluate: $\int x(x^{13/3} + x^{14/3}) dx$
- Q119.** CBSE 2023 · 3 marks Evaluate: $\int e^x \sin^{-1}(2x)/(\sqrt{1-4x^2}) - 2x \cos(2x) dx$
- Q120.** CBSE 2022 · 3 marks Evaluate: $\int_0^{10} \tan^{-1}(x) dx$
- Q121.** CBSE 2022 · 3 marks Evaluate: $\int_0^1 \tan^{-1} x dx$
- Q122.** CBSE 2022 · 2 marks Find: $\int \cot x \cdot \sin x \cos x dx$
- Q123.** CBSE 2022 · 3 marks Find: $\int dx / (1 + e^{(-x)})$
- Q124.** CBSE 2022 · 2 marks Evaluate: $\int_0^1 x e^x / (x+1)^2 dx$
- Q125.** CBSE 2022 · 3 marks Find: $\int 1/(e^x - 1) dx$
- Q126.** CBSE 2022 · 3 marks Find: $\int_{-1}^1 1/(1+e^{(1/x)}) dx$

LONG ANSWER (10)

- Q127.** CBSE 2026 · 5 marks (a) Find: $\int x^2/((x-1)(x+4)) dx$
- Q128.** CBSE 2024 · 5 marks Evaluate: $\int [0 \text{ to } \pi/4] (\sin(x) + \cos(x)) / (9 + 16 \sin(2x)) dx$
- Q129.** CBSE 2024 · 5 marks Evaluate: $\int_0^{\pi/2} e^x * (1 + \sin x)/(1 + \cos x) dx$
- Q130.** CBSE 2024 · 5 marks Find: $\int (3 \cos^2 x - 5 \sin x + \sin^2 x)/(4 - \sin x - \cos x) dx$
- Q131.** CBSE 2022 · 4 marks Evaluate: $\int_0^{10} n(x)/(x(1+x)) dx$
- Q132.** CBSE 2022 · 4 marks Evaluate: $\int_0^{\pi/2} (\sin x)/(\sin x + \cos x) dx$
- Q133.** CBSE 2022 · 4 marks Evaluate: $\int_0^1 \ln(x/(1-x)) dx$
- Q134.** CBSE 2022 · 4 marks Evaluate: $\int_0^{\pi/2} (\cos \log x - \sin \log x)^2 dx$
- Q135.** CBSE 2022 · 4 marks Evaluate: $\int_0^{\pi/2} (9 \sin^2 x + 16 \cos^2 x) / \sqrt{x} dx$
- Q136.** CBSE 2022 · 4 marks Evaluate: $\int (e^x(x/3))/((3-4e^x)^3) dx$

CASE-BASED (3)**CASE STUDY · CBSE 2026**

A racing track is built around an elliptical ground whose equation is given by $9x^2 + 16y^2 = 144$. The width of the track is 3 m.

- Q137.** CBSE 2026 · 1 mark Integrate the function obtained in part (i) with respect to x.



CASE STUDY · CBSE 2026

A racing track is build around an elliptical ground whose equation is given by $9x^2 + 16y^2 = 144$. The width of the track is 3 m.

Q138. CBSE 2026 · 1 mark Integrate the function obtained in (i) with respect to x.

CASE STUDY · CBSE 2026

There is a triangular park in the society. The park is divided into two sections. In the region OAC, children are allowed to play games like cricket, football, while in the region AOB, activities which involve running are not allowed. The vertices of the triangular park ABC are A(0, 4), B(-2, 0) and C(3, 0).

Q139. CBSE 2026 · 1 mark Write the equation of the boundary line AB of the park.

8 Application of Integrals

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (5)

Q1. CBSE 2026 · 1 mark The area bounded by the curve $y = x|x|$, x-axis and the ordinates $x = -1$ and $x = 1$ is given by

- (a) 0 (b) $1/3$ (c) $2/3$ (d) $4/3$

Q2. CBSE 2026 · 1 mark Which of the following expressions will give the area of region bounded by the curve $y = x^2$ and line $y = 16$?

- (a) $\int_0^4 x^2 dx$ (b) $2\int_0^4 x^2 dx$ (c) $\int_0^{16} \sqrt{y} dy$ (d) $2\int_0^{16} \sqrt{y} dy$

Q3. CBSE 2026 · 1 mark The area of the shaded region of the circle given below is equal to:

- (a) $\int_{-1}^3 \sqrt{9 - y^2} dy$ (b) $\int_{-1}^3 2\sqrt{9 - y^2} dy$
(c) $\int_0^3 \sqrt{9 - x^2} dx$ (d) $\int_0^3 2\sqrt{9 - x^2} dx$

Q4. CBSE 2026 · 1 mark The area of the region bounded by the curve $y = \sqrt{x}$ and x-axis, between $x = 0$ and $x = 2$ is:

- (a) 2 sq. units (b) $1/2$ sq. unit (c) 1 sq. unit (d) 4 sq. units

Q5. CBSE 2026 · 1 mark An ant is observed crawling on a sheet of paper along a straight line given by equation $y = 2x - 4$. Area of the surface covered by the ant bounded by y-axis, x-axis and $x = 1$ is:

- (a) 1 sq. unit (b) 3 sq. units (c) 2 sq. units (d) 4 sq. units

SHORT ANSWER (4)

Q6. CBSE 2025 · 3 marks Sketch the graph of $y = |x + 3|$ and find the area of the region enclosed by the curve, x-axis, between $x = -6$ and $x = 0$, using integration.

Q7. CBSE 2022 · 3 marks Find the area of the region $\{(x, y) : x^2 \leq y \leq x + 2\}$, using integration.

Q8. CBSE 2022 · 3 marks Using integration, find the area of the region $\{(x, y) : y^2 \leq x \leq y\}$.

Q9. CBSE 2022 · 3 marks If the area of the region bounded by the line $y = mx$ and the curve $x^2 = y$ is $32/3$ sq. units, then find the positive value of m, using integration.

LONG ANSWER (22)

Q10. CBSE 2026 · 5 marks A rectangle of perimeter 36 cm is revolved around one of its sides to sweep out a cylinder of maximum volume. Find the dimensions of the rectangle.

Q11. CBSE 2026 · 5 marks Find the area of the region bounded by the line $y = 3x + 2$, the x-axis and the ordinates $x = -1$ and $x = 1$.

Q12. CBSE 2026 · 5 marks Using integration, find the area of the region enclosed by the curve $y = |x - 6|$, the x-axis, and between $x = 4$ and $x = 8$.

Q13. CBSE 2026 · 5 marks Using integration, find the area of the region bounded by the curve $y = x|x|$, x-axis, $x = -2$ and $x = 2$.

Q14. CBSE 2026 · 5 marks Using integration, find the area of the region bounded by $y = 5x + 4$, $y = 0$, $x = -1$ and $x = 1$.

Q15. CBSE 2026 · 5 marks Sketch the curve $\{(x, y) : 100x^2 + 25y^2 = 2500\}$ and find the area of the region enclosed by it, using integration.

Q16. CBSE 2026 · 5 marks Sketch the curve described by $\{(x, y) : 9x^2 + 16y^2 = 144\}$ and find the area of the region enclosed by it, using integration.

Q17. CBSE 2026 · 5 marks Sketch the graph defined by $\{(x, y) : x^2/125 + y^2/25 = 1\}$. Find the area of the region of minor segment cut off by the line $x = 5/2$, using integration.

Q18. CBSE 2024 · 5 marks Using integration, find the area of the region bounded by the curve $y = x^2$, $x = -1$, $x = 1$ and the x-axis.

Q19. CBSE 2024 · 5 marks Using integration, find the area of the ellipse $16x^2 + 4y^2 = 1$, included between the lines $x = -2$ and $x = 2$.

Q20. CBSE 2024 · 5 marks If A_1 denotes the area of region bounded by $y^2 = 4x$, $x = 1$ and x-axis in the first quadrant and A_2 denotes the area of region bounded by $y^2 = 4x$, $x = 4$, find $A_1 : A_2$.

Q21. CBSE 2024 · 5 marks Using integration, find the area of the region enclosed between the circle $x^2 + y^2 = 16$ and the lines $x = -2$ and $x = 2$.

Q22. CBSE 2024 · 5 marks Find the area of the region bounded by the lines $x - 2y = 4$, $x = -1$, $x = 6$ and x-axis, using integration.

Q23. CBSE 2024 · 5 marks Sketch the graph of $y = x|x|$ and hence find the area bounded by this curve, X-axis and the ordinates $x = -2$ and $x = 2$, using integration.

Q24. CBSE 2023 · 5 marks Find the area of the region bounded by the curves $x^2 = y$, $y = x + 2$ and x-axis, using integration.

Q25. CBSE 2023 · 5 marks Find the area of the region $\{(x, y) : x^2 + y^2 \leq 1 \leq x + y\}$, using integration.

Q26. CBSE 2023 · 5 marks Find the area of the region bounded by the lines $y = 4x + 5$, $x + y = 5$ and $4y = x + 5$, using integration.



Q27. CBSE 2023 · 5 marks Using Integration, find the area of triangle whose vertices are $(-1, 1)$, $(0, 5)$ and $(3, 2)$.

Q28. CBSE 2023 · 5 marks The area of the region bounded by the line $y = mx$ ($m \neq 0$), the curve $x^2 + y^2 = 4$ and the x-axis in the first quadrant is 2 units. Using integration, find the value of m .

Q29. CBSE 2023 · 5 marks Using integration, find the area of the region bounded by the circle $x^2 + y^2 = 16$, line $y = x$ and y-axis, but lying in the 1st quadrant.

Q30. CBSE 2023 · 5 marks Using integration, find the area of the region bounded by the parabola $y^2 = 4ax$ and its latus rectum.

Q31. CBSE 2022 · 4 marks Using integration, find the area of the smaller region enclosed by the curve $4x^2 + 4y^2 = 9$ and the line $2x + 2y = 3$.

CASE-BASED (8)

CASE STUDY · CBSE 2026

Roundabouts are often made on busy roads to ease the traffic and avoid red lights. One such round-about is made such that equation representing its boundary is given by $C_1: x^2 + y^2 = 64$. There is a circular pond with a fountain in the middle of the roundabout whose equation is given by $C_2: x^2 + y^2 = 4$.

Q32. CBSE 2026 · 1 mark Roundabouts are often made on busy roads to ease the traffic and avoid red lights. One such round-about is made such that equation representing its boundary is given by $C_1: x^2 + y^2 = 64$. There is a circular pond with a fountain in the middle of the roundabout whose equation is given by $C_2: x^2 + y^2 = 4$. Represent the given equations C_1 and C_2 with the help of a diagram.

Q33. CBSE 2026 · 1 mark Represent the given equations $C_1: x^2 + y^2 = 64$ and $C_2: x^2 + y^2 = 4$ with the help of a diagram.

CASE STUDY · CBSE 2026

A racing track is built around an elliptical ground whose equation is given by $9x^2 + 16y^2 = 144$. The width of the track is 3 m.

Q34. CBSE 2026 · 1 mark Express y as a function of x from the given equation of ellipse.

CASE STUDY · CBSE 2026

A racing track is built around an elliptical ground whose equation is given by $9x^2 + 16y^2 = 144$. The width of the track is 3 m.

Q35. CBSE 2026 · 1 mark Express y as a function of x from the given equation of ellipse $9x^2 + 16y^2 = 144$.

Q36. CBSE 2026 · 1 mark Express y as a function of x from the given equation of ellipse.

CASE STUDY · CBSE 2026

There is a triangular park in the society. The park is divided into two sections. In the region OAC, children are allowed to play games like cricket, football, while in the region AOB, activities which involve running are not allowed. The vertices of the triangular park ABC are $A(0, 4)$, $B(-2, 0)$ and $C(3, 0)$.

Q37. CBSE 2026 · 4 marks There is a triangular park in the society. The park is divided into two sections. In the region OAC, children are allowed to play games like cricket, football, while in the region AOB, activities which involve running are not allowed. The vertices of the triangular park ABC are $A(0, 4)$, $B(-2, 0)$ and $C(3, 0)$. (i) Write the equation of the boundary line AB of the park. (ii) Write the equation of the boundary line AC of the park. (iii) (a) Using integration, find the area of region OAC, in which children are allowed to play cricket, football.

Q38. CBSE 2026 · 2 marks Using integration, find the area of region OAC, in which children are allowed to play cricket, football.

CASE STUDY · CBSE 2023

A father of Suraj wants to construct a rectangular garden using a brick wall on one side and wire fencing for the other three sides. He has 200 metres of fencing wire.

Q39. CBSE 2023 · 2 marks Let x be the length of the side parallel to the brick wall. Determine the relation representing the total length of fencing wire and also write $A(x)$, the area of the garden.

9 Differential Equations

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (46)

Q1. CBSE 2026 · 1 mark The integrating factor of differential equation $R(dy/dx) + Px = Q$ where P, Q, R are functions of y is

- (a) $e^{\int Q/P dy}$ (b) $e^{\int P dy}$ (c) $e^{\int R/P dy}$
(d) $e^{\int R/P dx}$

Q2. CBSE 2026 · 1 mark The order and degree of the differential equation $d/dx(e^x y) = 0$ respectively are

- (a) 0, 1 (b) 1, 1 (c) 2, 1 (d) 1, not defined

Q3. CBSE 2026 · 1 mark The order and degree of the differential equation: $d/dx(\sin y) = y^2$ respectively are

- (a) 1, 1 (b) 2, 1 (c) 2, 2 (d) 1, 2

Q4. CBSE 2026 · 1 mark The order and degree of the differential equation $d/dx(y')^3 + (y')^3 = 1$ respectively are, where $y' = dy/dx$

- (a) 1, 3 (b) 2, 1 (c) 3, 1 (d) 3, 2



Q5. CBSE 2026 · 1 mark The general solution of the differential equation $dy/dx = y/x$ is

- (a) $\log y = \log x + C$ (b) $y + x = C$ (c) $y - x = C$
(d) $\log y + \log x = C$

Q6. CBSE 2026 · 1 mark The integrating factor of the differential equation $2x(dy/dx) - y = 3$ is

- (a) x (b) $1/x$ (c) e^x (d) e^{-x}

Q7. CBSE 2026 · 1 mark The general solution of the differential equation $dy/dx = e^y(y - x)$ is :

- (a) $e^x - e^y = C$ (b) $e^x(-y) + e^x = C$
(c) $e^x(-y) - e^x(-x) = C$ (d) $e^x(-x) + e^x(-y) = C$

Q8. CBSE 2026 · 1 mark The integrating factor of $(1 + y^2) dx = (\tan^{-1} y - x) dy$ is :

- (a) $\tan y$ (b) $\tan^{-1} y$ (c) $e^{\tan^{-1} y}$ (d) $e^{\tan^{-1} x}$

Q9. CBSE 2026 · 1 mark The general solution of the differential equation: $x^2 dy + y^2 dx = 0$ is

- (a) $x^3 + y^3 = k$ (b) $1/x - 1/y = k$ (c) $1/x + 1/y = k$
(d) $\log y^2 + \log x^2 = k$

Q10. CBSE 2026 · 1 mark $dy/dx = F(x, y)$ will be a homogeneous differential equation for which of the following functions? (i) $F(x, y) = 3x + 2y$ (ii) $F(x, y) = \sin(y/x) + \log y - \log x$ (iii) $F(x, y) = e^{\lambda(y/x)} + 1$ (iv) $F(x, y) = \sqrt{x^2 y^2} - y$

- (a) (i) and (ii) (b) (i), (ii) and (iii) (c) (ii), (iii) and (iv)
(d) (ii) and (iii)

Q11. CBSE 2026 · 1 mark Product of the order and degree of differential equation $1 + (dy/dx)^3 = (d^3y/dx^3)^2$ is:

- (a) 5 (b) 6 (c) 2 (d) 3

Q12. CBSE 2026 · 1 mark Which of the following is not a Linear Differential Equation?

- (a) $(1 + x^2) dy + 2xy dx = \cot x dx$
(b) $y + d/dx(xy) = x(\sin x + \log x)$
(c) $x(1 + y^2) dx - y(1 + x^2) dy = 0$
(d) $y dx - (x + 3y^2) dy = 0$

Q13. CBSE 2026 · 1 mark The sum of the order and the degree of the differential equation $d^2y/dx^2 + 4(dy/dx) + 3(1 - y^2) = 0$ is:

- (a) 2 (b) 3 (c) not defined (d) 4

Q14. CBSE 2026 · 1 mark The sum of the order and the degree of the differential equation $y(d^2y/dx^2) + (dy/dx)^2 - 3(dy/dx) - 2 = x$ is:

- (a) not defined (b) 3 (c) 1 (d) 2

Q15. CBSE 2026 · 1 mark The order and degree of the differential equation $1 + (dy/dx)^{3/3} = (d^2y/dx^2)^2$ is :

- (a) Order = 3, Degree = 3 (b) Order = 2, Degree = 2
(c) Order = 3, Degree = 1 (d) Order = 2, Degree = 1

Q16. CBSE 2026 · 1 mark The general solution for the differential equation $dy/dx = e^{3x-y}$ is :

- (a) $3ey = e^{3x} + C$ (b) $\log(3x - y) = C$ (c) $e^{3x-y} = C$
(d) $-ey + 3e^{3x} = C$

Q17. CBSE 2026 · 1 mark The order and degree of differential equation $d^2y/dx^2 = 1 - (3(dy/dx)^2)^{2/3}$ is:

- (a) Order = 3, Degree = 3 (b) Order = 2, Degree = 2
(c) Order = 3, Degree = 2 (d) Order = 2, Degree = 1

Q18. CBSE 2026 · 1 mark The order and degree of differential equation $(d^2y/dx^2)^2 - (dy/dx) = y^3$ is:

- (a) Order = 2, Degree = 2 (b) Order = 2, Degree = 3
(c) Order = 1, Degree = 2 (d) Order = 2, Degree = 4

Q19. CBSE 2025 · 1 mark The integrating factor of differential equation $(x + 2y^3) dy/dx = y^2$ is:

- (a) $e^{\lambda(y^2/2)}$ (b) $1/y$ (c) $1/(2y)$ (d) $e^{\lambda(-y^2/2)}$

Q20. CBSE 2024 · 1 mark The solution of the differential equation $dy/dx = 1 - x + y - xy$ is

- (a) $\log |1 + y| = x - x^2/2 + c$ (b) $\log |1 + y| = -x + x^2/2 + c$
(c) $e^{\lambda y} = x - x^2/2 + c$ (d) $e^{\lambda(1+y)} = -x + x^2/2 + c$

Q21. CBSE 2024 · 1 mark The degree of the differential equation $x(d^2y/dx^2)^3 + y(dy/dx)^4 + y^5 = 0$ is

- (a) 2 (b) 3 (c) 4 (d) 5

Q22. CBSE 2024 · 1 mark The integrating factor of the differential equation $dy/dx + y \tan x = 2x + x^2 \tan x$ is

- (a) $e^{\lambda(\sec x)}$ (b) $\sec x + \tan x$ (c) $\sec x$ (d) $\cos x$

Q23. CBSE 2024 · 1 mark The order and degree of the differential equation $[1 + (dy/dx)^2]^{3/2} = d^2y/dx^2$ respectively are:

- (a) 1, 2 (b) 2, 3 (c) 2, 1 (d) 2, 6

Q24. CBSE 2024 · 1 mark The integrating factor of the differential equation $x dy/dx - y = x^4 - 3x$ is:

- (a) x (b) $-x$ (c) x^{-1} (d) $\log(x^{-1})$

Q25. CBSE 2024 · 1 mark The solution of the differential equation $dy/dx = 1/\log y$ is:

- (a) $\log y = x + c$ (b) $y \log y - y = x + c$ (c) $\log y - y = x + c$
(d) $y \log y + y = x + c$

Q26. CBSE 2024 · 1 mark The differential equation $dy/dx = F(x, y)$ will not be a homogeneous differential equation, if $F(x, y)$ is:

- (a) $\cos x - \sin(y/x)$ (b) y/x (c) $(x^2 + y^2)/(xy)$ (d) $\cos^2(y/x)$

Q27. CBSE 2024 · 1 mark The degree of the differential equation $(y''')^2 + (y')^3 = x \sin(y')$ is:

- (a) 1 (b) 2 (c) 3 (d) not defined

Q28. CBSE 2024 · 1 mark The number of solutions of differential equation $dx/dy - y = 1$, given that $y(0) = 1$, is:

- (a) 0 (b) 1 (c) 2 (d) infinitely many

Q29. CBSE 2024 · 1 mark The degree and order of differential equation $y'' + \log(y') = x^5$ respectively are:

- (a) not defined, 5 (b) not defined, 2 (c) 5, not defined
(d) 2, 2



Q30. CBSE 2024 · 1 mark $x \log x (dy/dx) + y = 2 \log x$ is an example of a :

- (a) variable separable differential equation
(b) homogeneous differential equation
(c) first order linear differential equation
(d) differential equation whose degree is not defined

Q31. CBSE 2024 · 1 mark The general solution of the differential equation $x dy + y dx = 0$ is:

- (a) $xy = c$ (b) $x + y = c$ (c) $x^2 + y^2 = c^2$
(d) $\log y = \log x + c$

Q32. CBSE 2024 · 1 mark The integrating factor of the differential equation $(x + 2y^2)x(dy/dx) = y (y > 0)$ is:

- (a) $1/x$ (b) x (c) y (d) $1/y$

Q33. CBSE 2024 · 1 mark The number of arbitrary constants in the particular solution of the differential equation $\log(dy/dx) = 3x + 4y$; $y(0) = 0$ is/are:

- (a) 2 (b) 1 (c) 0 (d) 3

Q34. CBSE 2023 · 1 mark The sum of the order and the degree of the differential equation $\sin(d^2y/dx^2) = d/dx(dy/dx)^2$ is:

- (a) 5 (b) 2 (c) 3 (d) 4

Q35. CBSE 2023 · 1 mark The general solution of the differential equation $x dy - (1 + x^2) dx = dx$ is:

- (a) $y = 2x + 3x^3 + C$ (b) $y = 2 \log x + 3x^3 + C$
(c) $y = 2x^2 + C$ (d) $y = 2 \log x + 2x^2 + C$

Q36. CBSE 2023 · 1 mark The sum of the order and the degree of the differential equation $y \sin(d^2y/dx^2) + (dy/dx)^3$ is:

- (a) 5 (b) 2 (c) 3 (d) 4

Q37. CBSE 2023 · 1 mark The sum of the order and the degree of the differential equation $y \sin(d^2y/dx^2) = (d^3y/dx^3)^2$ is:

- (a) 5 (b) 2 (c) 3 (d) 4

Q38. CBSE 2023 · 1 mark Degree of the differential equation $\sin x + \cos(dy/dx) = y^2$ is

- (a) 2 (b) 1 (c) not defined (d) 0

Q39. CBSE 2023 · 1 mark The solution of the differential equation $x dx + y dy = 0$ is:

- (a) $1/x + 1/y = C$ (b) $\log x - \log y = C$ (c) $xy = C$
(d) $x + y = C$

Q40. CBSE 2023 · 1 mark What is the product of the order and degree of the differential equation $d^2y/dx^2 + \sin(dy/dx) + y \cos y = 0$?

- (a) 3 (b) 2 (c) 6 (d) not defined

Q41. CBSE 2023 · 1 mark What is the product of the order and degree of the differential equation $d^2y/dx^2 - \sin(dy/dx) + y \cos(dy/dx) = y^2$?

- (a) 3 (b) 2 (c) 6 (d) not defined

Q42. CBSE 2023 · 1 mark What is the product of the order and degree of the differential equation $d^2y/dx^2 + y \sin(dy/dx) + y \cos(dy/dx) = 0$?

- (a) 3 (b) 2 (c) 6 (d) not defined

Q43. CBSE 2023 · 1 mark The integrating factor for solving the differential equation $dy/dx - 2xy = x^2$ is:

- (a) e^y (b) e^x (c) x (d) $1/x$

Q44. CBSE 2023 · 1 mark The number of solutions of the differential equation $dy/dx = 1/(1 - y)$, when $y(1) = 2$, is:

- (a) zero (b) one (c) two (d) infinite

Q45. CBSE 2023 · 1 mark The order and degree (if defined) of the differential equation $d^3y/dx^3 + (d^2y/dx^2)^2 = \sin x \cdot dy/dx$ respectively are:

- (a) 2, 2 (b) 1, 3 (c) 2, 3 (d) 2, degree not defined

Q46. CBSE 2023 · 1 mark The integrating factor for solving the differential equation $dy/dx + 2x^2y = x$ is:

- (a) e^y (b) e^x (c) x (d) $1/x$

VERY SHORT ANSWER (4)

Q47. CBSE 2024 · 2 marks (b) If $y = A \sin 2x + B \cos 2x$ and $d^2y/dx^2 - ky = 0$, find the value of k .

Q48. CBSE 2022 · 2 marks Find the product of the order and the degree of the differential equation $d^2y/dx^2 - xy(dy/dx) = 0$.

Q49. CBSE 2022 · 2 marks Find the particular solution of the differential equation $2y^2 dx/dy$, given $y = 1$ when $x = 1$.

Q50. CBSE 2022 · 2 marks Find the general solution of the differential equation $\sec^2 x \cdot \tan y dx + \sec^2 y \cdot \tan x dy = 0$.

SHORT ANSWER (27)

Q51. CBSE 2026 · 3 marks Find the general solution of the following differential equation: $x^2 dy/dx = x^2 + xy + y^2$.

Q52. CBSE 2026 · 3 marks Find the general solution of the differential equation: $y^2 dx + (x^2 - xy + y^2) dy = 0$

Q53. CBSE 2026 · 3 marks Find the general solution of the differential equation $(y^2 - x^2) dx = 2xy dy$

Q54. CBSE 2026 · 3 marks Solve the following differential equation: $x(dy/dx) = y - x \sin^2(y/x)$, given that $y(1) = \pi/6$.

Q55. CBSE 2026 · 3 marks Solve the differential equation: $x(dy/dx) = y - x \tan(y/x)$

Q56. CBSE 2026 · 3 marks Find the general solution of the differential equation $(x^2 + y^2) dy = xy dx$.

Q57. CBSE 2026 · 3 marks Find the general solution of the differential equation $(x^2 - y^2) dx + 2xy dy = 0$.

Q58. CBSE 2026 · 3 marks Solve the differential equation $(x + 2y^3) dy = y dx$.

Q59. CBSE 2026 · 3 marks Solve the differential equation $y dx + (x - y^3) dy = 0$.

Q60. CBSE 2026 · 3 marks Solve the differential equation $(x - \sin y) dy + \tan y dx = 0$.

Q61. CBSE 2024 · 3 marks Find the particular solution of the differential equation $2xy dy/dx = x^2 + 3y^2$, given that $y(1) = 0$.

Q62. CBSE 2024 · 3 marks Find the particular solution of the differential equation given by $x^2 dy/dx - xy = x^2 \cos^2(y/(2x))$, given that when $x = 1$, $y = \pi/2$.



Q63. CBSE 2024 · 3 marks Find the general solution of the differential equation $dy/dx = (x^2 + y^2)/(2xy)$.

Q64. CBSE 2024 · 3 marks Solve the following differential equation: $(\tan^{-1} y - x) dy = (1 + y^2) dx$

Q65. CBSE 2024 · 3 marks (a) Find the particular solution of the differential equation given by $2xy + y^2 - 2x^2 dy/dx = 0$; $y = 2$, when $x = 1$.

Q66. CBSE 2024 · 3 marks If $x \cos(p + y) + \cos p \sin(p + y) = 0$, prove that $\cos p dy/dx = -\cos^2(p + y)$, where p is a constant.

Q67. CBSE 2024 · 3 marks Find the particular solution of the differential equation $x(dy/dx) = y \cot 2x$, given that $y(\pi/4) = 2$.

Q68. CBSE 2023 · 3 marks (a) Find the particular solution of the differential equation $dy/dx + \sec^2(x) \cdot y = \tan(x) \cdot \sec^2(x)$, given that $y(0) = 0$. OR (b) Solve the differential equation given by $x dy - y dx - \sqrt{(y^2 + x^2)} dx = 0$.

Q69. CBSE 2023 · 3 marks (a) Find the general solution of the differential equation: $dy/dx = (e^{(11y/x)} - y/x)/(e^{(11y/x)} + y/x)$. OR (b) Find the particular solution of the differential equation $dy/dx + \cot x \cdot y = \cos^2 x$, given that when $x = \pi/2$, $y = 0$.

Q70. CBSE 2023 · 3 marks Find the general solution of the differential equation: $dy/dx - xy^2 = (x \sin x)/x$

Q71. CBSE 2023 · 3 marks Find the general solution of the differential equation: $(xy - x^2) dy = y^2 dx$.

Q72. CBSE 2023 · 3 marks Find the general solution of the differential equation: $(x + y)^2 dy/dx = (x + y)^2 - 1$.

Q73. CBSE 2023 · 3 marks Find the general solution of the differential equation $(x^2 + y^2)dy/dx = 2(1 - x)y$

Q74. CBSE 2023 · 3 marks Find the general solution of the differential equation: $(x - y)dy/dx = (x + 2y)^2 - 1$

Q75. CBSE 2022 · 3 marks Find the particular solution of the differential equation $(y + 3x^2) dy/dx = x$, given that $y = 1$, when $x = 1$.

Q76. CBSE 2022 · 3 marks Find the general solution of the differential equation $x dy/dx + y \sin(xy) = 0$.

Q77. CBSE 2022 · 3 marks Solve the following differential equation: $(1 + e^{y/x}) dy + e^{y/x}(1 - y/x) dx = 0$

LONG ANSWER (4)

Q78. CBSE 2026 · 5 marks (a) Solve the differential equation $y e^y dx = (y^3 + 2x e^y) dy$, when $y(0) = 1$.

Q79. CBSE 2022 · 4 marks Find the particular solution of the differential equation $x dy - y dx = x\sqrt{1 + (y/x)^2} dx$, given that $y(1) = 0$.

Q80. CBSE 2022 · 4 marks Find the particular solution of the differential equation $2x dy/dx - 11y = x\sqrt{y}$, given that $y(1) = 0$.

Q81. CBSE 2022 · 4 marks Find the particular solution of the differential equation $(1 - x^2)(dy/dx) - xy = 0$, given that $y(1) = 0$.

CASE-BASED (4)

CASE STUDY · CBSE 2026

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

Q82. CBSE 2026 · 1 mark Assertion (A) : One of the particular solutions of the differential equation $dy/dx = e^{(x+y)}$ can be $e^x + e^{(-y)} = -2$. Reason (R) : $e^x + e^{(-y)} = C$ is the general solution of the differential equation $dy/dx = e^{(x+y)}$.

Q83. CBSE 2026 · 1 mark Assertion (A): One of the particular solutions of the differential equation $dy/dx = e^{(x+y)}$ can be $e^x + e^{(-y)} = -2$. Reason (R): $e^x + e^{(-y)} = C$ is the general solution of the differential equation $dy/dx = e^{(x+y)}$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A)
- (c) Assertion (A) is true, but Reason (R) is false
- (d) Assertion (A) is false, but Reason (R) is true

CASE STUDY · CBSE 2024

A bacteria sample of certain number of bacteria is observed to grow exponentially in a given amount of time. Using exponential growth model, the rate of growth of this sample of bacteria is calculated. The differential equation representing the growth of bacteria is given as: $dP/dt = kP$, where P is the population of bacteria at any time 't'.

Q84. CBSE 2024 · 4 marks (i) Obtain the general solution of the given differential equation $dP/dt = kP$ and express it as an exponential function of 't'.

Q85. CBSE 2024 · 2 marks Obtain the general solution of the given differential equation $dt/dP = kP$ and express it as an exponential function of 't'.

10 Vector Algebra

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (55)

Q1. CBSE 2026 · 1 mark The value of p for which vectors $\hat{i} + 2\hat{j} + 3\hat{k}$ and $2\hat{i} - p\hat{j} + \hat{k}$ are perpendicular to each other is
(a) 0 (b) 1 (c) 5/2 (d) -5/2

Q2. CBSE 2026 · 1 mark The value of m for which the points with position vectors $-\hat{i} - \hat{j} + 2\hat{k}$, $2\hat{i} + m\hat{j} + 5\hat{k}$ and $3\hat{i} + 11\hat{j} + 6\hat{k}$ are collinear, is

- (a) 8 (b) -8 (c) 2 (d) 5/2



Q3. CBSE 2026 · 1 mark If $|a| = 8$, $|b| = 3$ and $|a \times b| = 12$, then the value of $|a \cdot b|$ is

- (a) $6\sqrt{3}$ (b) $8\sqrt{3}$ (c) $12\sqrt{3}$ (d) $\sqrt{3 \cdot 12}$

Q4. CBSE 2026 · 1 mark The value of p for which vectors $i + 2j + 3k$ and $2i - pj + k$ are perpendicular to each other is

- (a) 0 (b) 1 (c) $5/2$ (d) $-5/2$

Q5. CBSE 2026 · 1 mark If $|a| = 5$ and $a \cdot b = -2$ and $|a \cdot b| = 1$, then the sum of greatest and the smallest value of $|a|$ is

- (a) -5 (b) 5 (c) 10 (d) 15

Q6. CBSE 2026 · 1 mark Vector of magnitude 3 making equal angles with x and y axes and perpendicular to z axis is

- (a) $\hat{i} + 2\sqrt{2}\hat{j}$ (b) $3\hat{k}$ (c) $(3\sqrt{2}/2)\hat{i} + (3\sqrt{2}/2)\hat{j}$ (d) $3\hat{i} + 3\hat{j} + 3\hat{k}$

Q7. CBSE 2026 · 1 mark Assertion (A): For two vectors a and b , $|a \times b|^2 + (a \cdot b)^2 = |a|^2 |b|^2$. Reason (R): $|a \times b| = (a \cdot b) \tan \theta$, where $0 \leq \theta \leq \pi/2$.

- (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.

Q8. CBSE 2026 · 1 mark If $|a| = 5$ and $-2 \leq a \cdot b \leq 1$, then the sum of greatest and the smallest value of $|b|$ is

- (a) -5 (b) 5 (c) 10 (d) 15

Q9. CBSE 2026 · 1 mark Assertion (A): A line can have direction cosines $< 1, 1, 1 >$. Reason (R): $\cos \theta = 1$ is possible for $\theta = 0$.

- (a) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q10. CBSE 2026 · 1 mark For two vectors a and b Assertion (A): $|a \times b|^2 + (a \cdot b)^2 = |a|^2 |b|^2$. Reason (R): $|a \times b| = (a \cdot b) \tan \theta$, where $0 \leq \theta \leq \pi/2$.

- (a) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q11. CBSE 2026 · 1 mark Let a and b be two unit vectors and θ is the angle between them. Then $a + 2b$ is a unit vector if:

- (a) $\theta = 2\pi/3$ (b) $2\theta = 3\pi$ (c) $3\theta = 4\pi$ (d) $\theta = \pi$

Q12. CBSE 2026 · 1 mark The area (in square units) of a parallelogram, whose diagonals are $a = \hat{i} + \hat{j} - 2\hat{k}$ and $b = \hat{i} - 3\hat{j} + 4\hat{k}$ is:

- (a) $2\sqrt{14}$ (b) $\sqrt{14}$ (c) $\sqrt{38}$ (d) $\sqrt{26}$

Q13. CBSE 2026 · 1 mark If $|a| = 5$ and $-2 \leq a \cdot b \leq 1$, then the sum of greatest and the smallest value of $|a \times b|$ is

- (a) -5 (b) 5 (c) 10 (d) 15

Q14. CBSE 2026 · 1 mark For two vectors a and b , Assertion (A): $|a \times b|^2 + (a \cdot b)^2 = |a|^2 |b|^2$. Reason (R): $|a \times b| = |a||b|\sin \theta$, $\pi/2 \geq \theta \geq 0$

- (a) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A)
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A)
(c) Assertion (A) is true, but Reason (R) is false
(d) Assertion (A) is false, but Reason (R) is true

Q15. CBSE 2026 · 1 mark If $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = 198$ and $|\vec{a}| = 10|\vec{b}|$, then:

- (a) $|\vec{a}| = \sqrt{2}$ (b) $|\vec{b}| = \sqrt{2}$ (c) $|\vec{b}| = 10\sqrt{2}$
(d) $|\vec{a}| = 10\sqrt{2}$

Q16. CBSE 2026 · 1 mark If $(3\hat{i} - 2\hat{j} + 5\hat{k}) \times (4\hat{i} + p\hat{j} + q\hat{k}) = \mathbf{0}$, then the values of p and q are:

- (a) $p = -2/3$, $q = 5/3$ (b) $p = -8/3$, $q = 20/3$
(c) $p = 20/3$, $q = -8/3$ (d) $p = 0$, $q = 0$

Q17. CBSE 2026 · 1 mark Three points $A(0, 1, 1)$, $B(2, 0, -1)$ and $C(1, 0, 3)$ form triangle ABC. The ar(ABC) is:

- (a) $\sqrt{53}/2$ sq. units (b) $\sqrt{53}$ sq. units (c) $\sqrt{11}/2$ sq. units
(d) $\sqrt{11}$ sq. units

Q18. CBSE 2026 · 1 mark If position vector $\vec{p}$ of a point $(24, n)$ is such that $|\vec{p}| = 25$, then the value of n is:

- (a) 49 (b) 5 (c) 1 (d) 7

Q19. CBSE 2026 · 1 mark If vectors $a = 3\hat{i} + 2\hat{j} + \hat{k}$ and $b = 2\hat{i} - 4\hat{j} + 5\hat{k}$, represent the two strips of the Red Cross sign placed outside a doctor's clinic, then the value of $a \cdot b$ is:

- (a) 1 (b) $5/2$ (c) $2/5$ (d) 0

Q20. CBSE 2025 · 1 mark If vector $a = 3\hat{i} + 2\hat{j} - \hat{k}$ and vector $b = \hat{i} - \hat{j} + \hat{k}$, then which of the following is correct?

- (a) $a \parallel b$ (b) $a \perp b$ (c) $|b| > |a|$ (d) $|a| = |b|$

Q21. CBSE 2024 · 1 mark Let the vectors a and b be such that $|a| = 3$ and $|b| = (3\sqrt{2})$, then $a \times b$ is a unit vector, if the angle between a and b is

- (a) $\pi/3$ (b) $\pi/4$ (c) $\pi/6$ (d) $\pi/2$

Q22. CBSE 2024 · 1 mark If $a = 2\hat{i} - 2\hat{j} + \hat{k}$, $b = \hat{i} + 2\hat{j} - 3\hat{k}$ and $c = 2\hat{i} - \hat{j} + 4\hat{k}$, then the projection of $(c - b)$ along a is

- (a) 15 (b) 5 (c) $3/2$ (d) 1

Q23. CBSE 2024 · 1 mark If a , b and c are unit vectors such that $a + b + c = 0$, then $(a \cdot b + b \cdot c + c \cdot a)$ is equal to

- (a) $3/2$ (b) $1/2$ (c) $-1/2$ (d) $-3/2$

Q24. CBSE 2024 · 1 mark Let θ be the angle between two unit vectors $\hat{a}$ and $\hat{b}$ such that $\sin \theta = 3/5$. Then, $\hat{a} \cdot \hat{b}$ is equal to:

- (a) $\pm 3/5$ (b) $\pm 4/3$ (c) $\pm 4/5$ (d) $\pm 3/4$

Q25. CBSE 2024 · 1 mark The vector with terminal point $A(2, -3, 5)$ and initial point $B(3, -4, 7)$ is:

- (a) $\hat{i} - \hat{j} + 2\hat{k}$ (b) $\hat{i} + \hat{j} + 2\hat{k}$ (c) $-\hat{i} - \hat{j} - 2\hat{k}$ (d) $-\hat{i} + \hat{j} - 2\hat{k}$

Q26. CBSE 2024 · 1 mark For any two vectors a and b , which of the following statements is always true?

- (a) $a \cdot b \geq |a||b|$ (b) $a \cdot b = |a||b|$ (c) $a \cdot b \leq |a||b|$ (d) $a \cdot b < |a||b|$



Q27. CBSE 2024 · 1 mark The unit vector perpendicular to both vectors $\hat{i} + \hat{k}$ and $\hat{i} - \hat{k}$ is:

- (a) $2\hat{j}$ (b) $\hat{j}$ (c) $\hat{i} - 2\hat{k}$ (d) $\hat{i} + 2\hat{k}$

Q28. CBSE 2024 · 1 mark Assertion (A): For two non-zero vectors a and b , $a \cdot b = b \cdot a$. Reason (R): For two non-zero vectors a and b , $a \times b = b \times a$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true, but Reason (R) is false.
 (d) Assertion (A) is false, but Reason (R) is true.

Q29. CBSE 2024 · 1 mark The unit vector perpendicular to both vectors $\hat{i} + \hat{k}$ and $\hat{i} - \hat{k}$ is:

- (a) $2\hat{j}$ (b) $\hat{j}$ (c) $-\hat{i} + 2\hat{k}$ (d) $\hat{i} + 2\hat{k}$

Q30. CBSE 2024 · 1 mark If $\mathbf{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\mathbf{b} = \hat{i} + \hat{j} - \hat{k}$, then $\mathbf{a}$ and $\mathbf{b}$ are :

- (a) collinear vectors which are not parallel
 (b) parallel vectors (c) perpendicular vectors
 (d) unit vectors

Q31. CBSE 2024 · 1 mark If $|\mathbf{a}| = 2$ and $-3 \leq k \leq 2$, then $|\mathbf{ka}| \in$:

- (a) $[-6, 4]$ (b) $[0, 4]$ (c) $[4, 6]$ (d) $[0, 6]$

Q32. CBSE 2024 · 1 mark Assertion (A): Projection of $\mathbf{a}$ on $\mathbf{b}$ is same as projection of $\mathbf{b}$ on $\mathbf{a}$. Reason (R): Angle between $\mathbf{a}$ and $\mathbf{b}$ is same as angle between $\mathbf{b}$ and $\mathbf{a}$ numerically.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true, but Reason (R) is false.
 (d) Assertion (A) is false, but Reason (R) is true.

Q33. CBSE 2024 · 1 mark If vectors $\mathbf{a}$ and $\mathbf{b}$ are such that $|\mathbf{a}| = 1$, $|\mathbf{b}| = 2$ and $\mathbf{a} \cdot \mathbf{b} = \sqrt{3}$, then the angle between $2\mathbf{a}$ and $-\mathbf{b}$ is:

- (a) $\pi/6$ (b) $\pi/3$ (c) $5\pi/6$ (d) $11\pi/6$

Q34. CBSE 2024 · 1 mark The vectors $\mathbf{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\mathbf{b} = \hat{i} - 3\hat{j} - 5\hat{k}$ and $\mathbf{c} = -3\hat{i} + 4\hat{j} + 4\hat{k}$ represent the sides of

- (a) an equilateral triangle (b) an obtuse-angled triangle
 (c) an isosceles triangle (d) a right-angled triangle

Q35. CBSE 2024 · 1 mark Let $\mathbf{a}$ be any vector such that $|\mathbf{a}| = a$. The value of $|\mathbf{a} \times \hat{i}|^2 + |\mathbf{a} \times \hat{j}|^2 + |\mathbf{a} \times \hat{k}|^2$ is:

- (a) a^2 (b) $2a^2$ (c) $3a^2$ (d) 0

Q36. CBSE 2024 · 1 mark A vector perpendicular to the line $\mathbf{r} = \hat{i} + \hat{j} - \hat{k} + \lambda(3\hat{i} - \hat{j})$ is:

- (a) $5\hat{i} + \hat{j} + 6\hat{k}$ (b) $\hat{i} + 3\hat{j} + 5\hat{k}$ (c) $2\hat{i} - 2\hat{j}$ (d) $9\hat{i} - 3\hat{j}$

Q37. CBSE 2024 · 1 mark The vectors $\mathbf{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\mathbf{b} = \hat{i} - 3\hat{j} - 5\hat{k}$ and $\mathbf{c} = -3\hat{i} + 4\hat{j} + 4\hat{k}$ represents the sides of:

- (a) an equilateral triangle (b) an obtuse-angled triangle
 (c) an isosceles triangle (d) a right-angled triangle

Q38. CBSE 2024 · 1 mark If $\mathbf{a}$ and $\mathbf{b}$ are two vectors such that $|\mathbf{a}| = 1$, $|\mathbf{b}| = 2$ and $\mathbf{a} \cdot \mathbf{b} = \sqrt{3}$, then the angle between $2\mathbf{a}$ and $-\mathbf{b}$ is:

- (a) $\pi/6$ (b) $\pi/3$ (c) $5\pi/6$ (d) $11\pi/6$

Q39. CBSE 2023 · 1 mark The value of p for which the vectors $2\hat{i} + p\hat{j} + \hat{k}$ and $-4\hat{i} - 6\hat{j} + 26\hat{k}$ are perpendicular to each other, is:

- (a) 3 (b) -3 (c) -3/17 (d) 3/17

Q40. CBSE 2023 · 1 mark The value of $(\hat{i} \times \hat{j}) \cdot \hat{j} + (\hat{j} \times \hat{i}) \cdot \hat{k}$ is:

- (a) 2 (b) 0 (c) 1 (d) -1

Q41. CBSE 2023 · 1 mark If $\mathbf{a} + \mathbf{b} = \hat{i}$ and $\mathbf{a} = 2\hat{i} - 2\hat{j} + 2\hat{k}$, then $|\mathbf{b}|$ equals:

- (a) $\sqrt{14}$ (b) 3 (c) $\sqrt{12}$ (d) $\sqrt{17}$

Q42. CBSE 2023 · 1 mark If the vector $\hat{i} - b\hat{j} + \hat{k}$ is equally inclined to the coordinate axes, then the value of b is:

- (a) -1 (b) 1 (c) $-\sqrt{3}$ (d) $-1/\sqrt{3}$

Q43. CBSE 2023 · 1 mark If $\mathbf{a} + \mathbf{b} = \hat{i}$ and $\mathbf{a} = 2\hat{i} - 2\hat{j} + 2\hat{k}$, then $|\mathbf{b}|$ equals:

- (a) $\sqrt{14}$ (b) 3 (c) $\sqrt{12}$ (d) $\sqrt{17}$

Q44. CBSE 2023 · 1 mark The value of p for which the vectors $2\hat{i} + p\hat{j} + \hat{k}$ and $-4\hat{i} - 6\hat{j} + 26\hat{k}$ are perpendicular to each other, is:

- (a) 3 (b) -3 (c) -3/17 (d) 3/17

Q45. CBSE 2023 · 1 mark For what value of λ , the projection of vector $\hat{i} + \lambda\hat{j}$ on vector $\hat{i} - \hat{j}$ is 2?

- (a) -1 (b) 1 (c) 0 (d) 3

Q46. CBSE 2023 · 1 mark Unit vector along PQ, where coordinates of P and Q respectively are (2, 1, -1) and (4, 4, -7), is

- (a) $2\hat{i} + 3\hat{j} - 6\hat{k}$ (b) $-2\hat{i} - 3\hat{j} + 6\hat{k}$ (c) $(-2\hat{i}/7) - (3\hat{j}/7) + (6\hat{k}/7)$
 (d) $(2\hat{i}/7) + (3\hat{j}/7) - (6\hat{k}/7)$

Q47. CBSE 2023 · 1 mark If in triangle ABC, $BA = 2\mathbf{a}$ and $BC = 3\mathbf{b}$, then AC is

- (a) $2\mathbf{a} + 3\mathbf{b}$ (b) $2\mathbf{a} - 3\mathbf{b}$ (c) $3\mathbf{b} - 2\mathbf{a}$ (d) $-2\mathbf{a} - 3\mathbf{b}$

Q48. CBSE 2023 · 1 mark If $|\mathbf{a} \times \mathbf{b}| = 3$ and $\mathbf{a} \cdot \mathbf{b} = -3$, then angle between $\mathbf{a}$ and $\mathbf{b}$ is

- (a) $2\pi/3$ (b) $\pi/6$ (c) $\pi/3$ (d) $5\pi/6$

Q49. CBSE 2023 · 1 mark If a vector makes an angle of $\pi/4$ with the positive directions of both x-axis and y-axis, then the angle which it makes with positive z-axis is:

- (a) $\pi/4$ (b) $3\pi/4$ (c) $\pi/2$ (d) 0

Q50. CBSE 2023 · 1 mark $\mathbf{a}$ and $\mathbf{b}$ are two non-zero vectors such that the projection of $\mathbf{a}$ on $\mathbf{b}$ is 0. The angle between $\mathbf{a}$ and $\mathbf{b}$ is:

- (a) $\pi/2$ (b) π (c) $\pi/4$ (d) 0

Q51. CBSE 2023 · 1 mark The direction cosines of vector BA, where coordinates of A and B are (1, 2, -1) and (3, 4, 0) respectively, are:

- (a) -2, -2, -1 (b) $1/3, 2/3, 2/3$ (c) 2, 2, 1 (d) $-1/3, -2/3, -2/3$

Q52. CBSE 2023 · 1 mark In triangle ABC, $\mathbf{AB} = \hat{i} + \hat{j} + 2\hat{k}$ and $\mathbf{AC} = 3\hat{i} - \hat{j} + 4\hat{k}$. If D is mid-point of BC, then vector AD is equal to

- (a) $4\hat{i} + 6\hat{k}$ (b) $2\hat{i} - 2\hat{j} + 2\hat{k}$ (c) $\hat{i} - \hat{j} + \hat{k}$ (d) $2\hat{i} + 3\hat{k}$

Q53. CBSE 2023 · 1 mark A unit vector along the vector $4\hat{i} - 3\hat{k}$ is:

- (a) $1/7(4\hat{i} - 3\hat{k})$ (b) $1/5(4\hat{i} - 3\hat{k})$ (c) $-1/7(4\hat{i} - 3\hat{k})$
 (d) $-1/5(4\hat{i} - 3\hat{k})$



Q54. CBSE 2023 · 1 mark If θ is the angle between two vectors $\mathbf{a}$ and $\mathbf{b}$, then $\mathbf{a} \cdot \mathbf{b} \geq 0$ only when:

- (a) $0 \leq \theta \leq \pi/2$ (b) $0 \leq \theta < \pi/2$ (c) $0 < \theta \leq \pi$
(d) $0 < \theta \leq \pi/2$

Q55. CBSE 2023 · 1 mark The sine of the angle between the vectors $\mathbf{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\mathbf{b} = \hat{i} + \hat{j} + 2\hat{k}$ is:

- (a) $2/\sqrt{15}$ (b) $-2/\sqrt{15}$ (c) $2/\sqrt{13}$ (d) $2/\sqrt{14}$

VERY SHORT ANSWER (32)

Q56. CBSE 2026 · 2 marks Find the vector of magnitude 14 in the direction of $\overrightarrow{QP}$, where P and Q are the points (1, 3, 2) and (-1, 0, 8) respectively.

Q57. CBSE 2026 · 2 marks Vectors $\mathbf{a} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ and $\mathbf{b} = \hat{i} + 2\hat{k}$ represent the two adjacent sides of a parallelogram. Find the vectors representing its diagonals and hence find their lengths.

Q58. CBSE 2026 · 2 marks A vector $\mathbf{a}$ of magnitude 14 has direction ratios $\langle 2, 3, -6 \rangle$. Find the projection of the vector $\mathbf{a}$ on $\hat{i}$.

Q59. CBSE 2026 · 2 marks Using vectors, find the area of triangle ABC with vertices A(1, 2, 3), B(2, -1, 4) and C(4, 5, -1).

Q60. CBSE 2026 · 2 marks Vectors $\mathbf{a} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ and $\mathbf{b} = \hat{i} + 2\hat{k}$ represent the two adjacent sides of a parallelogram. Find the vectors representing its diagonals and hence find their lengths.

Q61. CBSE 2026 · 2 marks If $\overrightarrow{AB} = \hat{j} + \hat{k}$ and $\overrightarrow{AC} = 3\hat{i} - \hat{j} + 4\hat{k}$ represent the two vectors along the sides AB and AC of triangle ABC, prove that the median is $2\overrightarrow{AD} = \overrightarrow{AB} + \overrightarrow{AC}$, where D is midpoint of BC. Hence, find the length of median AD.

Q62. CBSE 2026 · 2 marks If $\overrightarrow{AB} = \hat{j} + \hat{k}$ and $\overrightarrow{AC} = 3\hat{i} - \hat{j} + 4\hat{k}$ represent the two vectors along the sides AB and AC of $\triangle ABC$, prove that the median $\overrightarrow{AD} = (1/2)(\overrightarrow{AB} + \overrightarrow{AC})$, where D is midpoint of BC. Hence, find the length of median AD.

Q63. CBSE 2026 · 2 marks Find a unit vector perpendicular to both of the vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$, where A, B and C are (3, -1, 2), (1, -1, -3) and (4, -3, 1), respectively.

Q64. CBSE 2026 · 2 marks If for two unit vectors $\rightarrow \mathbf{a}$ and $\rightarrow \mathbf{b}$, $|\rightarrow \mathbf{a} + 2\rightarrow \mathbf{b}| = |2\rightarrow \mathbf{a} - \rightarrow \mathbf{b}|$, then find the angle between $\rightarrow \mathbf{a}$ and $\rightarrow \mathbf{b}$.

Q65. CBSE 2026 · 2 marks If the position vectors of three points A, B and C are $3\hat{i} + \hat{j}$, $5\hat{i} + 6\hat{j} - 3\hat{k}$ and $4\hat{j}$ respectively, then show that they form an isosceles triangle.

Q66. CBSE 2026 · 2 marks (a) Let two rods placed on the ground be represented by vectors $4\hat{i} - \hat{j} + 3\hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$. Find a vector representing a flag-post of height 5 m that has to be erected perpendicular to both the rods.

Q67. CBSE 2026 · 2 marks If $(2\hat{i} + 3\hat{j} + \hat{k})$ and $(2\hat{i} + \hat{j} - \hat{k})$ represent the sides AB and AC respectively of triangle ABC, find the vector representing the median through A.

Q68. CBSE 2026 · 2 marks If in a parallelogram PQRS, $\overrightarrow{PQ} = 2\hat{i} + 3\hat{j} + \hat{k}$ and $\overrightarrow{QR} = \hat{i} - 2\hat{j} + \hat{k}$, then find the unit vectors parallel to the diagonals $\overrightarrow{PR}$ and $\overrightarrow{SQ}$.

Q69. CBSE 2026 · 2 marks Three honey bees were found flying along the vectors $\mathbf{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\mathbf{b} = 4\hat{j} - 2\hat{k}$ and $\mathbf{c} = 3\hat{i} + 2\hat{k}$ respectively. Find the value of λ such that the path for $\mathbf{a} + \lambda\mathbf{b}$ is perpendicular to $\mathbf{c}$.

Q70. CBSE 2026 · 2 marks Three honey bees were found flying along the vectors $\mathbf{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\mathbf{b} = \lambda\hat{j} - 2\hat{k}$ and $\mathbf{c} = 3\hat{i} + 2\hat{k}$ respectively. Find the value of λ such that the path for $\lambda\mathbf{a} + \mathbf{b}$ is perpendicular to $\mathbf{c}$.

Q71. CBSE 2025 · 2 marks The diagonals of a parallelogram are given by $\mathbf{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\mathbf{b} = \hat{i} + \hat{j} - 3\hat{k}$. Find the area of the parallelogram.

Q72. CBSE 2025 · 2 marks (a) Two friends while flying kites from different locations, find the strings of their kites crossing each other. The strings can be represented by vectors $\mathbf{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\mathbf{b} = \hat{i} - 2\hat{j} + 4\hat{k}$. Determine the angle formed between the kite strings.

Q73. CBSE 2024 · 2 marks If $\mathbf{a}$ and $\mathbf{b}$ are two non-zero vectors such that $(\mathbf{a} + \mathbf{b}) \perp \mathbf{a}$ and $(2\mathbf{a} + \mathbf{b}) \perp \mathbf{b}$, then prove that $|\mathbf{b}| = 2|\mathbf{a}|$.

Q74. CBSE 2024 · 2 marks If $\vec{a}$ and $\vec{b}$ are two non-zero vectors such that $(\vec{a} + \vec{b}) \perp \vec{a}$ and $(2\vec{a} + \vec{b}) \perp \vec{b}$, then prove that $|\vec{b}| = 2|\vec{a}|$.

Q75. CBSE 2024 · 2 marks Find the position vector of point C which divides the line segment joining points A and B having position vectors $\hat{i} + 2\hat{j} - \hat{k}$ and $-\hat{i} + \hat{j} + \hat{k}$ respectively in the ratio 4 : 1 externally. Further, find $|\overrightarrow{AB}| : |\overrightarrow{BC}|$.

Q76. CBSE 2024 · 2 marks Let $\mathbf{a}$ and $\mathbf{b}$ be two non-zero vectors. Prove that $|\mathbf{a} \times \mathbf{b}| \leq |\mathbf{a}||\mathbf{b}|$. State the condition under which equality holds, i.e., $|\mathbf{a} \times \mathbf{b}| = |\mathbf{a}||\mathbf{b}|$.

Q77. CBSE 2024 · 2 marks If $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are three unit vectors such that $\mathbf{a} + \mathbf{b} - \mathbf{c} = \mathbf{0}$, find the angle between vectors $\mathbf{a}$ and $\mathbf{c}$.

Q78. CBSE 2023 · 2 marks (a) Position vectors of the points A, B and C are $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ respectively. If $\overrightarrow{AC} = (4/5)\overrightarrow{AB}$, express $\mathbf{c}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. OR (b) Check whether the lines given by equations $x = 2 + 2\lambda$, $y = 7 + \lambda$, $z = -3 - 3\lambda$ and $x = -\mu - 2$, $y = 2 + 8\mu$, $z = 4 + 5\mu$ are perpendicular to each other or not.

Q79. CBSE 2023 · 2 marks For two non-zero vectors $\mathbf{a}$ and $\mathbf{b}$, if $|\mathbf{a} - \mathbf{b}| = |\mathbf{a} + \mathbf{b}|$, then find the angle between $\mathbf{a}$ and $\mathbf{b}$.

Q80. CBSE 2023 · 2 marks Find all the vectors of magnitude $3\sqrt{3}$ which are collinear to vector $\hat{i} + \hat{j} + \hat{k}$.

Q81. CBSE 2023 · 2 marks If $\mathbf{a}$, $\mathbf{b}$, $\mathbf{c}$ are three non-zero unequal vectors such that $\mathbf{a} \cdot \mathbf{b} = \mathbf{a} \cdot \mathbf{c}$, then find the angle between $\mathbf{a}$ and $\mathbf{b} - \mathbf{c}$.

Q82. CBSE 2023 · 2 marks If $\mathbf{r} = 3\hat{i} - 2\hat{j} + 6\hat{k}$, find the value of $(\mathbf{r} \cdot \hat{\mathbf{j}}) \cdot (\mathbf{r} \cdot \hat{\mathbf{k}}) - 12$.

Q83. CBSE 2023 · 2 marks If $\mathbf{r} = 3\hat{i} - 2\hat{j} + 6\hat{k}$, find the value of $(\mathbf{r} \cdot \hat{\mathbf{j}}) \cdot (\mathbf{r} \cdot \hat{\mathbf{k}}) - 12$.

Q84. CBSE 2023 · 2 marks If $\mathbf{a} = 4\hat{i} - \hat{j} + \hat{k}$ and $\mathbf{b} = 2\hat{i} - 2\hat{j} + \hat{k}$, then find a unit vector along the vector $\mathbf{a} \times \mathbf{b}$.

Q85. CBSE 2023 · 2 marks If the projection of the vector $\hat{i} + \hat{j} + \hat{k}$ on the vector $\hat{p} + \hat{j} - 2\hat{k}$ is $1/3$, then find the value(s) of $\hat{p}$.

Q86. CBSE 2022 · 2 marks $\mathbf{a}$ and $\mathbf{b}$ are two unit vectors such that $|2\mathbf{a} + 3\mathbf{b}| = |3\mathbf{a} - 2\mathbf{b}|$. Find the angle between $\mathbf{a}$ and $\mathbf{b}$.

Q87. CBSE 2022 · 2 marks If $|\mathbf{a} \times \mathbf{b}|^2 + |\mathbf{a} \cdot \mathbf{b}|^2 = 400$ and $|\mathbf{b}| = 5$, then find the value of $|\mathbf{a}|$.



SHORT ANSWER (10)

Q88. CBSE 2026 · 3 marks If $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are mutually perpendicular vectors of equal magnitudes, show that the vector $\mathbf{a} + \mathbf{b} + \mathbf{c}$ is equally inclined to $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$.

Q89. CBSE 2026 · 3 marks Let three toys A, B and C be placed in the same straight line. If the position vectors of A, B and C are $55\hat{i} - 2\hat{j}$, $5\hat{i} + 8\hat{j}$ and $a\hat{i} - 52\hat{j}$ respectively, find the value of 'a'.

Q90. CBSE 2024 · 3 marks The position vectors of vertices of ΔABC are $A(2\hat{i} - \hat{j} + \hat{k})$, $B(\hat{i} - 3\hat{j} - 5\hat{k})$ and $C(3\hat{i} - 4\hat{j} - 4\hat{k})$. Find all the angles of ΔABC .

Q91. CBSE 2024 · 3 marks If vectors $\mathbf{a}$, $\mathbf{b}$ and $2\mathbf{a} + 3\mathbf{b}$ are unit vectors, then find the angle between $\mathbf{a}$ and $\mathbf{b}$.

Q92. CBSE 2022 · 3 marks ABCD is a parallelogram such that $\mathbf{AC} = \hat{i} + \hat{j}$ and $\mathbf{BD} = 2\hat{i} + \hat{j} + \hat{k}$. Find AB and AD. Also, find the area of the parallelogram ABCD.

Q93. CBSE 2022 · 3 marks $A(1, 1, 2)$, $B(2, b, 5)$ and $C(3, 11, 6)$ are collinear. Also, determine the ratio in which the point B divides the line-segment AC internally.

Q94. CBSE 2022 · 3 marks If $\mathbf{a}$ and $\mathbf{b}$ are two vectors such that $\mathbf{a} = \hat{i} - \hat{j} + \hat{k}$ and $\mathbf{b} = 2\hat{i} - \hat{j} - 3\hat{k}$, then find the vector $\mathbf{c}$, given that $\mathbf{a} \times \mathbf{c} = \mathbf{b}$ and $\mathbf{a} \cdot \mathbf{c} = 4$.

Q95. CBSE 2022 · 3 marks If $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ are mutually perpendicular vectors of equal magnitude, then prove that the vector $(2\mathbf{a} + \mathbf{b} + 2\mathbf{c})$ is equally inclined to both $\mathbf{a}$ and $\mathbf{c}$. Also, find the angle between $\mathbf{a}$ and $(2\mathbf{a} + \mathbf{b} + 2\mathbf{c})$.

Q96. CBSE 2022 · 3 marks If $\mathbf{a}$ and $\mathbf{b}$ are two vectors of equal magnitude and θ is the angle between them, then prove that $|\mathbf{a} - \mathbf{b}|/|\mathbf{a} + \mathbf{b}| = \cot(\theta/2)$.

Q97. CBSE 2022 · 3 marks If $\mathbf{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\mathbf{b} = \hat{i} + \hat{j} - 2\hat{k}$ and $\mathbf{c} = \hat{i} + 3\hat{j} - \hat{k}$ and the projection of vector $\lambda\mathbf{c} + \mathbf{b}$ on vector $\mathbf{a}$ is $6\sqrt{2}$, then find the value of λ .

CASE-BASED (6)**CASE STUDY · CBSE 2026**

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

Q98. CBSE 2026 · 1 mark Assertion (A) : The vectors $\rightarrow{\mathbf{a}}$ and $(-2\rightarrow{\mathbf{a}})$, where $\rightarrow{\mathbf{a}} \neq \rightarrow{\mathbf{0}}$ are collinear vectors. Reason (R) : $\rightarrow{\mathbf{a}} \cdot (-2\rightarrow{\mathbf{a}}) = 0$.

Q99. CBSE 2026 · 1 mark Assertion (A): The vectors $\mathbf{a}$ and $(-2\mathbf{a})$, where $\mathbf{a} \neq \mathbf{0}$ are collinear vectors. Reason (R): $\mathbf{a} \cdot (-2\mathbf{a}) = 0$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A)
- (c) Assertion (A) is true, but Reason (R) is false
- (d) Assertion (A) is false, but Reason (R) is true

Q100. CBSE 2024 · 1 mark Assertion (A): $(\mathbf{b} \cdot \mathbf{c})\mathbf{a}$ is a scalar quantity. Reason (R): Dot product of two vectors is a scalar quantity.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

CASE STUDY · CBSE 2024

A cricket match is organised between two clubs P and Q for which a team from each club is chosen. Remaining players of club P and club Q are respectively sitting along the lines AB and CD, where the points are $A(3, 4, 0)$, $B(5, 3, 3)$, $C(6, -4, 1)$ and $D(13, -5, -4)$.

Q101. CBSE 2024 · 1 mark Write the direction ratios of vector AB.

CASE STUDY · CBSE 2024

An instructor at the astronomical centre shows three among the brightest stars in a particular constellation. Assume that the telescope is located at $O(0, 0, 0)$ and the three stars have their locations at the points D, A and V having position vectors $2\hat{i} + 3\hat{j} + 4\hat{k}$, $7\hat{i} + 5\hat{j} + 8\hat{k}$ and $-3\hat{i} + 7\hat{j} + 11\hat{k}$ respectively.

Q102. CBSE 2024 · 1 mark How far is the star V from star A?

Q103. CBSE 2024 · 1 mark An instructor at the astronomical centre shows three among the brightest stars in a particular constellation. Assume that the telescope is located at $O(0, 0, 0)$ and the three stars have their locations at the points D, A and V having position vectors $2\hat{i} + 3\hat{j} + 4\hat{k}$, $7\hat{i} + 5\hat{j} + 8\hat{k}$ and $-3\hat{i} + 7\hat{j} + 11\hat{k}$ respectively. How far is the star V from star A?

11 Three Dimensional Geometry

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (38)

Q1. CBSE 2026 · 1 mark The length of perpendicular drawn from point $(2, 5, 7)$ on line $x/1 = y/0 = z/0$ is

- (a) 2 (b) 5 (c) $\sqrt{74}$ (d) $\sqrt{78}$



Q2. CBSE 2026 · 1 mark Assertion (A): Lines given by $x = py + q$, $z = ry + s$ and $x = p'y + q'$, $z = r'y + s'$ are perpendicular to each other when $pp' + rr' = 1$. Reason (R): Two lines $r = a_1 + \lambda b_1$ and $r = a_2 + \mu b_2$ are perpendicular to each other if $b_1 \cdot b_2 = 0$.

- (a) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true and Reason (R) is false.
 (d) Assertion (A) is false and Reason (R) is true.

Q3. CBSE 2026 · 1 mark The length of perpendicular drawn from the point (1, 2, 3) on line $x/0 = y/1 = z/0$ is

- (a) 2 (b) 6 (c) 10 (d) 14

Q4. CBSE 2026 · 1 mark The length of perpendicular drawn from the point (3, 4, 2) on the line $x/0 = y/0 = z/1$ is

- (a) 2 (b) 9 (c) 5 (d) $\sqrt{29}$

Q5. CBSE 2026 · 1 mark The value of m for which the points with position vectors $-i - j + 2k$, $2i + mj + 5k$ and $3i + 11j + 6k$ are collinear, is

- (a) 8 (b) -8 (c) 2 (d) $5/2$

Q6. CBSE 2026 · 1 mark Direction cosines of the line given by equations: $(2x - 1)/4 = (y - 1)/3 = (z - 6)/6$ are

- (a) 2, -3, -6 (b) $-6/7, -3/7, 2/7$ (c) $6/7, -3/7, 2/7$
 (d) $-6/\sqrt{61}, -3/\sqrt{61}, 4/\sqrt{61}$

Q7. CBSE 2026 · 1 mark Assertion (A): A line can have direction cosines $< 1, 1, 1 >$. Reason (R): $\cos \alpha = 1$ is possible for $\alpha = 0$.

- (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.

Q8. CBSE 2026 · 1 mark Direction ratios of lines l_1 and l_2 are $< 12, -3, 9 >$ and $< 4, q, -p >$ respectively. The values of p and q for which l_1 and l_2 are parallel are respectively :

- (a) -1, 3 (b) 3, 1 (c) -3, -1 (d) -1, -3

Q9. CBSE 2026 · 1 mark Direction ratios of lines l_1 and l_2 respectively are $< 1, -2, 3 >$ and $< -2, p, -6 >$. The value of p for which $l_1 \parallel l_2$, is:

- (a) -4 (b) 4 (c) -10 (d) 10

Q10. CBSE 2026 · 1 mark Direction ratios of lines l_1 and l_2 respectively are $< 1, 0, 0 >$ and $< 0, -1, 0 >$. The direction ratios of the line perpendicular to both l_1 and l_2 are:

- (a) $< 1, 1, 0 >$ (b) $< 0, 0, -1 >$ (c) $< 1, 1, 1 >$ (d) $< 1, 0, -1 >$

Q11. CBSE 2026 · 1 mark Three points A(0, 1, 1), B(2, 0, -1) and C(1, 0, 3) form triangle ABC. The area of triangle ABC is:

- (a) $(\sqrt{53})/2$ sq. units (b) $\sqrt{53}$ sq. units (c) $(\sqrt{11})/2$ sq. units
 (d) $\sqrt{11}$ sq. units

Q12. CBSE 2024 · 1 mark The angle between the lines $(x+1)/2 = (y-2)/(-2) = (z+5)/4$ and $(x-3)/1 = (y+5)/(-2) = (z-7)/3$ is

- (a) $\pi/4$ (b) $\pi/2$ (c) $\pi/3$ (d) $\pi/6$

Q13. CBSE 2024 · 1 mark The Cartesian equations of a line are given as $6x - 2 = 3y + 1 = 2z - 2$. The direction ratios of the line are

- (a) 2, -1, 3 (b) 1, -2, -3 (c) 1, 2, 3 (d) 3, 1, 2

Q14. CBSE 2024 · 1 mark If the direction cosines of a line are $3k, 3k, 3k$, then the value of k is:

- (a) ± 1 (b) ± 3 (c) $\pm 1/\sqrt{3}$ (d) $\pm 1/3$

Q15. CBSE 2024 · 1 mark The distance of point P(a, b, c) from y-axis is:

- (a) b (b) $|b|$ (c) $\sqrt{a^2 + c^2}$ (d) $a^2 + c^2$

Q16. CBSE 2024 · 1 mark Assertion (A): A line in space cannot be drawn perpendicular to x, y and z axes simultaneously. Reason (R): For any line making angles α, β, γ with the positive directions of x, y and z axes respectively, $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
 (c) Assertion (A) is true, but Reason (R) is false.
 (d) Assertion (A) is false, but Reason (R) is true.

Q17. CBSE 2024 · 1 mark The coordinates of the foot of the perpendicular drawn from the point (0, 1, 2) on the x-axis are given by:

- (a) (1, 0, 0) (b) (2, 0, 0) (c) $(\sqrt{5}, 0, 0)$ (d) (0, 0, 0)

Q18. CBSE 2024 · 1 mark Direction ratios of a vector parallel to line $(1-x)/2 = -y = (z+1)/6$ are:

- (a) 2, -1, 6 (b) 2, 1, 6 (c) 2, 1, 3 (d) 2, -1, 3

Q19. CBSE 2024 · 1 mark If a line makes an angle of 30° with the positive direction of x-axis, 120° with the positive direction of y-axis, then the angle which it makes with the positive direction of z-axis is:

- (a) 90° (b) 120° (c) 60° (d) 0°

Q20. CBSE 2024 · 1 mark Direction ratios of a vector parallel to line $(1-x)/2 = -y = (2+z)/6$ are:

- (a) 2, -1, 6 (b) 2, 1, 6 (c) 2, 1, 3 (d) 2, -1, 3

Q21. CBSE 2024 · 1 mark Direction ratios of a vector parallel to line $(x-1)/2 = -y = (z+2)/6$ are:

- (a) 2, -1, 6 (b) 2, 1, 6 (c) 2, 1, 3 (d) 2, -1, 3

Q22. CBSE 2024 · 1 mark If α, β and γ are the angles which a line makes with positive directions of x, y and z axes respectively, then which of the following is not true ?

- (a) $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$
 (b) $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = 2$
 (c) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = -1$
 (d) $\cos \alpha + \cos \beta + \cos \gamma = 1$

Q23. CBSE 2024 · 1 mark If a line makes an angle of $\pi/4$ with the positive directions of both x-axis and z-axis, then the angle which it makes with the positive direction of y-axis is :

- (a) 0 (b) $\pi/4$ (c) $\pi/2$ (d) π



Q24. CBSE 2024 · 1 mark The vector equation of a line passing through the point $(1, -1, 0)$ and parallel to Y-axis is:

- (a) $r = \hat{i} - \hat{j} + \lambda(\hat{i} - \hat{j})$ (b) $r = \hat{i} - \hat{j} + \lambda\hat{j}$ (c) $r = \hat{i} - \hat{j} + \lambda\hat{k}$
(d) $r = \lambda\hat{j}$

Q25. CBSE 2024 · 1 mark The lines $(x-1)/2 = (1-y)/3 = z/1$ and $(2x-2p-3)/2 = (y-1)/1 = (z-4)/7$ are perpendicular to each other for p equal to:

- (a) $-1/2$ (b) $1/2$ (c) 2 (d) 3

Q26. CBSE 2024 · 1 mark The lines $(x-1)/2 = (1-y)/3 = (z-1)/1$ and $(x-2)/(2p-3) = (y-1)/(-1) = (z-4)/7$ are perpendicular to each other for p equal to:

- (a) $-1/2$ (b) $1/2$ (c) 2 (d) 3

Q27. CBSE 2023 · 1 mark Direction cosines of the line $(x-1)/2 = 3y/1 = (z-2)/(-12)$ are:

- (a) $\sqrt{7}/2, \sqrt{7}/3, \sqrt{7}/6$ (b) $15/\sqrt{72}, -15/\sqrt{73}, 15/\sqrt{712}$
(c) $\sqrt{7}/2, -\sqrt{7}/3, -\sqrt{7}/6$ (d) $2/\sqrt{7}, 3/\sqrt{7}, -12/\sqrt{7}$

Q28. CBSE 2023 · 1 mark Assertion (A): Equation of a line passing through the points $(1, 2, 3)$ and $(3, -1, 3)$ is $(x-2)/3 = (y-3)/(-1) = (z-0)/3$. Reason (R): Equation of a line passing through points $(x_1, y_1, z_1), (x_2, y_2, z_2)$ is given by $(x-x_1)/(x_2-x_1) = (y-y_1)/(y_2-y_1) = (z-z_1)/(z_2-z_1)$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true and Reason (R) is false.
(d) Assertion (A) is false and Reason (R) is true.

Q29. CBSE 2023 · 1 mark Direction cosines of a line perpendicular to both x-axis and z-axis are:

- (a) 1, 0, 1 (b) 1, 1, 1 (c) 0, 0, 1 (d) 0, 1, 0

Q30. CBSE 2023 · 1 mark Assertion (A): Equation of a line passing through the points $(1, 2, 3)$ and $(3, -1, 3)$ is $(x-2)/(3-1) = (y-3)/(-1-2) = (z-0)/(3-3)$. Reason (R): Equation of a line passing through points $(x_1, y_1, z_1), (x_2, y_2, z_2)$ is given by $(x-x_1)/(x_2-x_1) = (y-y_1)/(y_2-y_1) = (z-z_1)/(z_2-z_1)$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true and Reason (R) is false.
(d) Assertion (A) is false and Reason (R) is true.

Q31. CBSE 2023 · 1 mark The direction ratios of a line parallel to z-axis are:

- (a) $\langle 1, 1, 0 \rangle$ (b) $\langle 1, 1, 1 \rangle$ (c) $\langle 0, 0, 0 \rangle$ (d) $\langle 0, 0, 1 \rangle$

Q32. CBSE 2023 · 1 mark Equation of line passing through origin and making $30^\circ, 60^\circ$ and 90° with x, y, z axes respectively is

- (a) $2x/3 = y/2 = z/0$ (b) $2x/3 = 2y/1 = z/0$
(c) $2x/1 = 2y/3 = z/1$ (d) $2x/3 = 2y/1 = z/1$

Q33. CBSE 2023 · 1 mark The value of λ for which the angle between the lines $r = \hat{i} + \hat{j} + \hat{k} + p(2\hat{i} + \hat{j} + 2\hat{k})$ and $r = (1 + q)\hat{i} + (1 + q)\hat{j} + (1 + q)\hat{k}$ is $\pi/2$ is:

- (a) $-\pi/4$ (b) $\pi/4$ (c) $\pi/2$ (d) $-\pi/2$

Q34. CBSE 2023 · 1 mark If the point $P(a, b, 0)$ lies on the line $(x-1)/2 = (y-2)/3 = (z-4)/3$, then (a, b) is:

- (a) (1, 2) (b) $(1/2, 2/3)$ (c) $(1/4, 1/2)$ (d) (0, 0)

Q35. CBSE 2023 · 1 mark Distance of the point (p, q, r) from y-axis is:

- (a) q (b) -q (c) $q + r$ (d) $\sqrt{p^2 + r^2}$

Q36. CBSE 2023 · 1 mark If the direction cosines of a line are a, $1/a$, $1/a$, then:

- (a) $0 < a < 1$ (b) $a \geq 2$ (c) $a \geq 0$ (d) $a \leq 3$

Q37. CBSE 2023 · 1 mark The point $(x, y, 0)$ on the xy-plane divides the line segment joining the points $(1, 2, 3)$ and $(3, 2, 1)$ in the ratio:

- (a) 1 : 2 internally (b) 2 : 1 internally (c) 3 : 1 internally
(d) 3 : 1 externally

Q38. CBSE 2023 · 1 mark Assertion (A): The lines $r = a_1 + \lambda b_1$ and $r = a_2 + \mu b_2$ are perpendicular, when $b_1 \cdot b_2 = 0$. Reason (R): The angle θ between the lines $r = a_1 + \lambda b_1$ and $r = a_2 + \mu b_2$ is given by $\cos \theta = |b_1 \cdot b_2| / (|b_1||b_2|)$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true and Reason (R) is false.
(d) Assertion (A) is false and Reason (R) is true.

VERY SHORT ANSWER (17)

Q39. CBSE 2026 · 2 marks Find the co-ordinates of the point on the line $r = -\hat{j} + 3\hat{k} + \lambda(2\hat{i} - 2\hat{j} + \hat{k})$ such that the sum of co-ordinates is 3.

Q40. CBSE 2026 · 2 marks Find the co-ordinates of foot of perpendicular drawn from $(0, 0, 0)$ to line $(x-1)/1 = (y-1)/1 = (3-z)/2$.

Q41. CBSE 2026 · 2 marks Find the image of the point $(2, -1, 5)$ in the line $r = (11\hat{i} - 2\hat{j} - 8\hat{k}) + \lambda(10\hat{i} - 4\hat{j} - 11\hat{k})$.

Q42. CBSE 2026 · 2 marks Find the co-ordinates of the point on line $(y - 1/2) = (z - 2/3) = (x - 3)$ whose y co-ordinate is 3 times the x co-ordinate.

Q43. CBSE 2026 · 2 marks If the lines $(x - 3)/1 = (1 - y)/1 = (z + 2)/p$ and $(2 - x)/3 = (y + 1)/5 = (z + 56)/(2p)$ are perpendicular to each other, then find the value(s) of p.

Q44. CBSE 2026 · 2 marks If the lines $(x - 3)/1 = (1 - y)/1 = (z + 2)/p$ and $(2 - x)/3 = (y + 1)/5 = (z + 5)/(2p)$ are perpendicular to each other, then find the value(s) of p.

Q45. CBSE 2026 · 2 marks Find the angle between the following pair of lines : $(x - 6)/-2 = (y + 5)/-3 = (1 - z)/-2$ and $(x - 2)/2 = (y + 6)/-1 = (7 - z)/1$

Q46. CBSE 2026 · 2 marks Find the angle between the following pair of lines: $(x - 6)/(-5) = (y + 5)/(-2) = (z - 1)/3$ and $(x - 2)/(-7) = (y - 6)/(-1) = (z - 2)/2$

Q47. CBSE 2026 · 2 marks Find the angle between the following pair of lines: $(x + 5)/(-6) = (y + 1)/3 = (z - 1)/2$ and $(x - 6)/2 = (y - 1)/(-7) = (z)/(-2)$



Q48. CBSE 2023 · 2 marks If the equation of a line is $x = ay + b$, $z = cy + d$, then find the direction ratios of the line and a point on the line.

Q49. CBSE 2023 · 2 marks If the angle between the lines $(x-5)/5 = (y-2)/2 = (z-4)/5$ and $(x-1)/1 = (y-0)/0 = (z-1)/1$ is $\pi/4$, find the relation between α and β .

Q50. CBSE 2023 · 2 marks Find the value of p , so that lines $(x-1)/2 = (y-3)/4 = (z-p)/3$ and $(x-4)/p = (y-5)/2 = (z-1)/2$ are perpendicular to each other.

Q51. CBSE 2023 · 2 marks Find the direction cosines of the line whose Cartesian equations are $5x - 3 = 15y + 7 = 3 - 10z$.

Q52. CBSE 2023 · 2 marks Find the vector equation of the line passing through the point $(2, 1, 3)$ and perpendicular to both the lines $(x-1)/2 = (y-2)/3 = (z-3)/1$ and $3x - 2y + 5z = 0$.

Q53. CBSE 2023 · 2 marks Find the vector equation of the line passing through the point $(2, 1, 3)$ and perpendicular to both the lines $(x-1)/1 = (y-2)/2 = (z-3)/3$ and $(3x - 2y + 5z = 0)$.

Q54. CBSE 2022 · 2 marks Write the cartesian equation of the line PQ passing through points $P(2, 2, 1)$ and $Q(5, 1, -2)$. Hence, find the y -coordinate of the point on the line PQ whose z -coordinate is -2 .

Q55. CBSE 2022 · 2 marks The foot of a perpendicular drawn from the point $(2, 1, 3)$ on a plane is $(1, 3, 3)$. Find the equation of the plane.

SHORT ANSWER (4)

Q56. CBSE 2026 · 3 marks (a) Find a point on the line $(x - 2)/3 = (1 - y)/2 = (z - 3)/2$ at a distance of $\sqrt{2}$ units from the point $(1, 2, 3)$.

Q57. CBSE 2025 · 3 marks (a) Verify that lines given by $r = (1 - \lambda)\hat{i} + (2 + \lambda)\hat{j} + (3 - 2\lambda)\hat{k}$ and $r = (1 + \mu)\hat{i} + (2\mu - 1)\hat{j} + (-2\mu + 1)\hat{k}$ are skew lines. Hence, find shortest distance between the lines.

Q58. CBSE 2022 · 3 marks Find the equation of the plane passing through points $(2, 1, 0)$, $(3, -2, -2)$ and $(1, 1, -7)$. Also, obtain its distance from the origin.

Q59. CBSE 2022 · 3 marks If a line makes 60° and 45° angles with the positive directions of x -axis and z -axis respectively, then find the angle that it makes with the positive direction of y -axis. Hence, write the direction cosines of the line.

LONG ANSWER (33)

Q60. CBSE 2026 · 5 marks Check whether the lines given by $(x - 1)/2 = (y - 2)/3 = (z - 3)/4$ and $(x - 4)/5 = (y - 1)/2 = z$ are parallel or not. If parallel, find the distance between them, otherwise find their point of intersection, if the lines are intersecting.

Q61. CBSE 2026 · 5 marks Prove that the line through points $A(0, -1, -1)$ and $B(4, 5, 1)$ intersects the line through points $C(3, 9, 4)$ and $D(-4, 4, 4)$. Hence, write the equation of line passing through the point of intersection of lines AB and CD as well as origin.

Q62. CBSE 2026 · 5 marks Show that line AB passing through points $A(0, 4, 1)$, $B(2, 3, -1)$ and the line CD passing through points $C(4, 5, 0)$, $D(2, 6, 2)$ are parallel. Also, find distance between them.

Q63. CBSE 2026 · 5 marks A line passing through the points $A(1, 2, 3)$ and $B(5, 8, 11)$ intersects the line $r = 4\hat{i} + \hat{j} + \lambda(5\hat{i} + 2\hat{j} + \hat{k})$. Find the co-ordinates of the point of intersection. Hence, write the equation of a line passing through the point of intersection and perpendicular to both the lines.

Q64. CBSE 2026 · 5 marks A line passing through the points $A(1, 2, 3)$ and $B(5, 8, 11)$ intersects the line $r = 4\hat{i} + \hat{j} + \mu(5\hat{i} + 2\hat{j} + \hat{k})$. Find the co-ordinates of the point of intersection. Hence, write the equation of a line passing through the point of intersection and perpendicular to both the lines.

Q65. CBSE 2026 · 5 marks Find the shortest distance between the lines: $r = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - 3\hat{j} + 2\hat{k})$ and $r = (4\hat{i} + 5\hat{j} + 6\hat{k}) + \mu(2\hat{i} + 3\hat{j} + \hat{k})$.

Q66. CBSE 2026 · 5 marks Represent the equations of lines l_1 and l_2 in vector form and check whether they are intersecting or not. $l_1 : (x + 3)/(-3) = (y - 1)/1 = (z - 5)/5$, $l_2 : (x + 1)/(-1) = (2 - y)/(-2) = (z - 5)/5$

Q67. CBSE 2026 · 5 marks Find the equation of a line (in vector and cartesian form) that passes through the point of intersection of lines $(x - 1)/2 = (y - 2)/3 = (z - 3)/4$ and $(x - 4)/5 = (y - 1)/2 = z$ and is parallel to the vector $3\hat{i} + 2\hat{j} - 8\hat{k}$.

Q68. CBSE 2026 · 5 marks Find the vector and cartesian equations of the line passing through the point of intersection of the lines $r = (\hat{i} + \hat{j} - \hat{k}) + \lambda(3\hat{i} - \hat{j})$ and $r = (4\hat{i} - \hat{k}) + \mu(2\hat{i} + 3\hat{k})$ and parallel to the line $(x - 1)/(-2) = (7 - y)/(-3) = z$.

Q69. CBSE 2026 · 5 marks Find the length of the perpendicular drawn from the point $P(1, 2, 3)$ to the line $(x - 6)/3 = (y - 7)/2 = (z - 7)/(-2)$. Also, find the equation of the perpendicular line joining P and the foot of the perpendicular.

Q70. CBSE 2026 · 5 marks Find the foot of the perpendicular from the point $(0, 2, 3)$ on the line $(-x - 3)/(-5) = (1 - y)/(-2) = (3z + 12)/9$ and hence find the length of the perpendicular.

Q71. CBSE 2025 · 5 marks (a) Find the image A' of the point $A(1, 6, 3)$ in the line $(x-1)/1 = (y-2)/2 = (z-3)/3$. Also, find the equation of the line joining A and A' .

Q72. CBSE 2024 · 5 marks Write the vector equations of the following lines and hence find the shortest distance between them: $(x+1)/2 = (y+1)/1 = (z+1)/1$ and $(x-3)/1 = (y-5)/(-2) = (z-7)/1$

Q73. CBSE 2024 · 5 marks The image of point $P(x, y, z)$ with respect to line $x/1 = (1-y)/2 = (z-2)/3$ is $P'(1, 0, 7)$. Find the coordinates of point P.

Q74. CBSE 2024 · 5 marks Equations of sides of a parallelogram ABCD are as follows: AB: $(x+1)/1 = (y-2)/-2 = (z-1)/2$, BC: $(x-1)/3 = (y+2)/5 = (z-5)/3$, CD: $(x-4)/1 = (y+7)/-2 = (z-8)/2$, DA: $(x-2)/3 = (y+3)/5 = (z-4)/3$. Find the equation of diagonal BD.

Q75. CBSE 2024 · 5 marks Find the equation of a line l_2 which is the mirror image of the line l_1 with respect to line l : $x/1 = (1-y)/2 = (z-2)/3$, given that line l_1 passes through the point $P(1, 6, 3)$ and parallel to line l .



Q76. CBSE 2024 · 5 marks Find the equation of the line which bisects the line segment joining points A(2, 3, 4) and B(4, 5, 8) and is perpendicular to the lines $(x-8)/3 = (y+19)/16 = (z-10)/7$ and $(x-15)/3 = (y-29)/8 = (z+5)/5$.

Q77. CBSE 2024 · 5 marks Find the value of p for which the lines $r = li + (2l + 1)j + (3l + 2)k$ and $r = i - 3mj + (pm + 7)k$ are perpendicular to each other and also intersect. Also, find the point of intersection of the given lines.

Q78. CBSE 2024 · 5 marks The vertices of ΔABC are A(1, 1, 0), B(1, 2, 1) and C(-2, 2, -1). Find the equations of the medians through A and B. Use the equations so obtained to find the coordinates of the centroid.

Q79. CBSE 2024 · 5 marks Find the equation of the line passing through the point of intersection of the lines $(x/1) = (1-y)/2 = (2-z)/3$ and $(1-x)/0 = (-y)/3 = (7-z)/2$ and perpendicular to these given lines.

Q80. CBSE 2024 · 5 marks Find the distance between the line $(x-1)/2 = (6-2y)/4 = (z+1)/(-1)$ and another line parallel to it passing through the point (4, 0, -5).

Q81. CBSE 2023 · 5 marks (a) Find the vector and the Cartesian equations of a line passing through the point (1, 2, -4) and parallel to the line joining the points A(3, 3, -5) and B(1, 0, -11). Hence, find the distance between the two lines. OR (b) Find the equations of the line passing through the points A(1, 2, 3) and B(3, 5, 9). Hence, find the coordinates of the points on this line which are at a distance of 14 units from point B.

Q82. CBSE 2023 · 5 marks Find the vector and the Cartesian equations of a line passing through the point (1, 2, -4) and parallel to the line joining the points A(3, 3, -5) and B(1, 0, -11). Hence, find the distance between the two lines.

Q83. CBSE 2023 · 5 marks Find the equations of the diagonals of the parallelogram PQRS whose vertices are P(4, 2, -6), Q(5, -3, 1), R(12, 4, 5) and S(11, 9, -2). Use these equations to find the point of intersection of diagonals.

Q84. CBSE 2023 · 5 marks Find the value of b so that the lines $(x-1)/2 = (y-3)/(2b) = (z-4)/3$ and $(x-5)/4 = (y-2)/1 = (z-1)/2$ are intersecting lines. Also, find the point of intersection of these given lines.

Q85. CBSE 2023 · 5 marks Find the value of b so that the lines $(x-1)/2 = (y-3)/4 = (z-3)/b$ and $(x-4)/5 = (y-2)/1 = (z-1)/2$ are intersecting lines. Also, find the point of intersection of these given lines.

Q86. CBSE 2023 · 5 marks Find the value of b so that the lines $(x-1)/2 = (y-2)/b = (z-3)/4$ and $(x-4)/5 = (y-1)/4 = (z-2)/1$ are intersecting lines. Also, find the point of intersection of these given lines.

Q87. CBSE 2023 · 5 marks Show that the following lines do not intersect each other: $(x-2)/4 = (y-3)/1 = (z-3)/2$ and $(x-3)/1 = (y-2)/(-1) = (z-5)/5$

Q88. CBSE 2023 · 5 marks Find the image of the point (2, -1, 5) in the line $(11-x)/10 = (y-2)/4 = (z-8)/11$.

Q89. CBSE 2022 · 4 marks Find the distance of the point (-1, -5, -10) from the point of intersection of the line $(x-3)/2 = (y-4)/1 = (z-2)/2$ and the plane $x - y + z = 5$.

Q90. CBSE 2022 · 4 marks Find the distance of the point (-1, -5, -10) from the point of intersection of the line $(x-2)/3 = (y-4)/(-1) = (z-2)/2$ and the plane $x - y + z = 5$.

Q91. CBSE 2022 · 4 marks Find the coordinates of the point where the line through (5, 1, 6) and (3, 4, 1) crosses the zx -plane.

Q92. CBSE 2022 · 4 marks Find the equations of the planes passing through the line of intersection of the planes $r \cdot (\hat{i} + 3\hat{j}) = 6$ and $r \cdot (3\hat{i} - \hat{j} - 4\hat{k}) = 0$, which are at a distance of 1 unit from the origin.

CASE-BASED (5)

CASE STUDY · CBSE 2023

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer: (A) Both (A) and (R) are true and (R) is the correct explanation of (A). (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A). (C) (A) is true, but (R) is false. (D) (A) is false, but (R) is true.

Q93. CBSE 2023 · 1 mark Assertion (A): If a line makes angles α , β , γ with positive direction of the coordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$. Reason (R): The sum of squares of the direction cosines of a line is 1.

Q94. CBSE 2023 · 1 mark Assertion (A): A line through the points (4, 7, 8) and (2, 3, 4) is parallel to a line through the points (-1, -2, 1) and (1, 2, 5). Reason (R): Lines $r = \lambda_1 a + \mu_1 b$ and $r = \lambda_2 a + \mu_2 b$ are parallel if $\mu_1 b \cdot \mu_2 b = 0$.

Q95. CBSE 2023 · 1 mark Assertion (A): A line through the points (4, 7, 8) and (2, 3, 4) is parallel to a line through the points (-1, -2, 1) and (1, 2, 5). Reason (R): Lines $r = a_1 + \lambda b_1$ and $r = a_2 + \mu b_2$ are parallel if $b_1 \cdot b_2 = 0$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true and Reason (R) is false.
- (d) Assertion (A) is false and Reason (R) is true.

Q96. CBSE 2023 · 1 mark Assertion (A): A line through the points (4, 7, 8) and (2, 3, 4) is parallel to a line through the points (-1, -2, 1) and (1, 2, 5). Reason (R): Lines $r = a_1 + \lambda b_1$ and $r = a_2 + \mu b_2$ are parallel if $b_1 \cdot b_2 = 0$. Select the correct answer

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A)
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A)
- (c) Assertion (A) is true and Reason (R) is false
- (d) Assertion (A) is false and Reason (R) is true

CASE STUDY · CBSE 2023



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

Q97. CBSE 2023 · 1 mark Assertion (A): The lines $r = a_1 + \lambda b_1$ and $r = a_2 + \mu b_2$ are perpendicular, when $b_1 \cdot b_2 = 0$. Reason (R): The angle θ between the lines $r = a_1 + \lambda b_1$ and $r = a_2 + \mu b_2$ is given by $\cos \theta = (b_1 \cdot b_2) / (|b_1||b_2|)$.

12 Linear Programming

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (24)

Q1. CBSE 2026 · 1 mark The degree of an objective function of a linear programming problem is

- (a) 0 (b) 1 (c) 2 (d) Any natural number

Q2. CBSE 2026 · 1 mark In a linear programming problem, the linear function which has to be maximized or minimized is called

- (a) a feasible function (b) an objective function
(c) an optimal function (d) a constraint

Q3. CBSE 2026 · 1 mark The corner points of the feasible region for an LPP are (0, 2), (6, 0), (6, 8) and (0, 5). Let $Z = 4x + 6y$ be the objective function. (Maximum of Z) – (Minimum of Z) is equal to :

- (a) 60 (b) 48 (c) 42 (d) 18

Q4. CBSE 2026 · 1 mark In an LPP, if the objective function has the same minimum value on two corner points of the feasible region, then the number of points at which the minimum value of objective function occurs is :

- (a) 0 (b) 2 (c) Infinite (d) Finite

Q5. CBSE 2026 · 1 mark The region represented by the system of inequations $3x + y \leq 3$, $2x - y \leq -5$, $x, y \geq 0$ is:

- (a) unbounded in 1st quadrant (b) bounded in 1st quadrant
(c) unbounded in 2nd quadrant
(d) bounded in 2nd quadrant

Q6. CBSE 2026 · 1 mark In the graph, the feasible region representing the Linear Programming Problem for maximising objective function $Z = px + qy$, $p, q > 0$ is shaded. If all points on segment AB give max (Z), then which of the following is true?

- (a) $p = 2q$ (b) $p = 3q$ (c) $q = 3p$ (d) $q = 2p$

Q7. CBSE 2026 · 1 mark The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0, 40), (20, 40) (60, 20) and (60, 0). If the objective function of an LPP is $Z = 4x + 3y$, then the maximum value is :

- (a) 200 (b) 300 (c) 240 (d) 120

Q8. CBSE 2025 · 1 mark The corner points of the feasible region in graphical representation of a L.P.P. are (2, 72), (15, 20) and (40, 15). If $Z = 18x + 9y$ be the objective function, then

- (a) Z is maximum at (2, 72), minimum at (15, 20)
(b) Z is maximum at (15, 20) minimum at (40, 15)
(c) Z is maximum at (40, 15), minimum at (15, 20)
(d) Z is maximum at (40, 15), minimum at (2, 72)

Q9. CBSE 2025 · 1 mark If the feasible region of a linear programming problem with objective function $Z = ax + by$, is bounded, then which of the following is correct?

- (a) It will only have a maximum value.
(b) It will only have a minimum value.
(c) It will have both maximum and minimum values.
(d) It will have neither maximum nor minimum value.

Q10. CBSE 2024 · 1 mark The solution set of the inequation $2x + 3y < 6$ is

- (a) open half-plane not containing origin
(b) whole xy-plane except the points lying on the line $2x + 3y = 6$
(c) open half-plane containing origin
(d) half-plane containing the origin and the points lying on the line $2x + 3y = 6$

Q11. CBSE 2024 · 1 mark The maximum value of the objective function $z = 3x + 5y$ subject to the constraints $x \geq 0$, $y \geq 0$ and $4x + 3y \leq 12$ is

- (a) 15 (b) 29 (c) 9 (d) 20

Q12. CBSE 2024 · 1 mark A linear programming problem deals with the optimization of a/an:

- (a) logarithmic function (b) linear function
(c) quadratic function (d) exponential function

Q13. CBSE 2024 · 1 mark The number of corner points of the feasible region determined by constraints $x \geq 0$, $y \geq 0$, $x + y \geq 4$ is:

- (a) 0 (b) 1 (c) 2 (d) 3

Q14. CBSE 2024 · 1 mark The common region determined by all the constraints of a linear programming problem is called:

- (a) an unbounded region (b) an optimal region
(c) a bounded region (d) a feasible region

Q15. CBSE 2024 · 1 mark The restrictions imposed on decision variables involved in an objective function of a linear programming problem are called :

- (a) feasible solutions (b) constraints (c) optimal solutions
(d) infeasible solutions

Q16. CBSE 2024 · 1 mark Of the following, which group of constraints represents the feasible region given below ?

- (a) $x + 2y \leq 76$, $2x + y \geq 104$, $x, y \geq 0$
(b) $x + 2y \leq 76$, $2x + y \leq 104$, $x, y \geq 0$
(c) $x + 2y \geq 76$, $2x + y \leq 104$, $x, y \geq 0$
(d) $x + 2y \geq 76$, $2x + y \geq 104$, $x, y \geq 0$



Q17. CBSE 2024 · 1 mark The maximum value of $Z = 4x + y$ for a L.P.P. whose feasible region is given below is:

- (a) 50 (b) 110 (c) 120 (d) 170

Q18. CBSE 2023 · 1 mark The corner points of the feasible region in the graphical representation of a linear programming problem are (2, 72), (15, 20) and (40, 15). If $z = 18x + 9y$ be the objective function, then:

- (a) z is maximum at (2, 72), minimum at (15, 20)
 (b) z is maximum at (15, 20), minimum at (40, 15)
 (c) z is maximum at (40, 15), minimum at (15, 20)
 (d) z is maximum at (40, 15), minimum at (2, 72)

Q19. CBSE 2023 · 1 mark The number of corner points of the feasible region determined by the constraints $x - y \leq 0$, $2y - x + 2 \geq 0$, $x \geq 0$, $y \geq 0$ is:

- (a) 2 (b) 3 (c) 4 (d) 5

Q20. CBSE 2023 · 1 mark The objective function $Z = ax + by$ of an LPP has maximum value 42 at (4, 6) and minimum value 19 at (3, 2). Which of the following is true?

- (a) $a = 9$, $b = 1$ (b) $a = 5$, $b = 2$ (c) $a = 3$, $b = 5$
 (d) $a = 5$, $b = 3$

Q21. CBSE 2023 · 1 mark The corner points of the feasible region of a linear programming problem are (0, 4), (8, 0) and (20/3, 4/3). If $Z = 30x + 24y$ is the objective function, then (maximum value of Z - minimum value of Z) is equal to

- (a) 40 (b) 96 (c) 120 (d) 136

Q22. CBSE 2023 · 1 mark The number of feasible solutions of the linear programming problem given as Maximize $z = 15x + 30y$ subject to constraints: $3x + y \leq 12$, $x + 2y \leq 10$, $x \geq 0$, $y \geq 0$ is:

- (a) 1 (b) 2 (c) 3 (d) infinite

Q23. CBSE 2023 · 1 mark Which of the following points satisfies both the inequations $2x + y \leq 10$ and $x + 2y \geq 8$?

- (a) (-2, 4) (b) (3, 2) (c) (-5, 6) (d) (4, 2)

Q24. CBSE 2023 · 1 mark The solution set of the inequation $3x + 5y \geq 7$ is:

- (a) whole xy -plane except the points lying on the line $3x + 5y = 7$
 (b) whole xy -plane along with the points lying on the line $3x + 5y = 7$
 (c) open half plane containing the origin except the points of line $3x + 5y = 7$
 (d) open half plane not containing the origin

SHORT ANSWER (28)

Q25. CBSE 2026 · 3 marks Solve the following linear programming problem graphically: Minimize $Z = 13x - 15y$ subject to constraints $x + y \leq 7$, $2x - 3y + 6 \geq 0$, $x \geq 0$, $y \geq 0$.

Q26. CBSE 2026 · 3 marks Solve the following linear programming problem graphically: Maximize $Z = 10500x + 9000y$ Subject to constraints: $x + y \leq 50$, $2x + y \leq 80$, $x, y \geq 0$

Q27. CBSE 2026 · 3 marks Solve the following linear programming problem graphically: Maximize $Z = 8000x + 12000y$ Subject to constraints $3x + 4y \leq 60$, $x + 3y \leq 30$, $x \geq 0$, $y \geq 0$

Q28. CBSE 2026 · 3 marks The corner points of the feasible region determined by the system of linear constraints in an LPP are (0, 10), (5, 5), (15, 15) and (0, 20). Let $Z = px + qy$, $p, q > 0$, be the objective function, then find the relation between p and q so that the maximum of Z occurs at both the points (15, 15) and (0, 20).

Q29. CBSE 2026 · 3 marks Solve the following linear programming problem graphically: Maximize $Z = 4500x + 5000y$ Subject to constraints $x + y \leq 250$, $25x + 40y \leq 7000$, $x \geq 0$, $y \geq 0$

Q30. CBSE 2026 · 3 marks Solve the following Linear Programming Problem graphically: Maximise $Z = 200x + 120y$ subject to the constraints $x + y \leq 300$, $3x + y \leq 600$, $x - y \leq -100$, $x, y \geq 0$

Q31. CBSE 2026 · 3 marks Solve the following Linear Programming Problem graphically: Minimize $Z = 20x + 10y$ subject to $x + 2y \leq 40$, $3x + y \leq 30$, $4x + 3y \geq 60$, $x, y \geq 0$

Q32. CBSE 2026 · 3 marks Solve the following Linear Programming Problem graphically: Maximize $Z = 20x + 10y$ subject to constraints $x + 2y \leq 28$, $3x + y \leq 24$, $x \geq 2$, $x, y \geq 0$

Q33. CBSE 2026 · 3 marks Solve the following Linear Programming Problem graphically : Maximize $Z = (2x + 3y + 5)/10$ subject to constraints $2x + y \leq 1000$, $x + y \leq 800$, $x, y \geq 0$.

Q34. CBSE 2025 · 3 marks Solve the following linear programming problem graphically: Maximise $Z = x + 2y$ Subject to the constraints: $x - y \geq 0$, $x - 2y \geq -2$, $x \geq 0$, $y \geq 0$

Q35. CBSE 2024 · 3 marks The corner points of the feasible region determined by the system of linear constraints are A(0, 40), B(20, 40), C(60, 20) and D(60, 0). The objective function of the L.P.P. is $z = 4x + 3y$. Find the point of the feasible region at which the value of objective function is maximum and the point at which the value is minimum. Hence, find the maximum and the minimum values.

Q36. CBSE 2024 · 3 marks Solve the following linear programming problem graphically: Maximise $z = 500x + 300y$, subject to constraints $x + 2y \leq 12$, $2x + y \leq 12$, $4x + 5y \geq 20$, $x \geq 0$, $y \geq 0$

Q37. CBSE 2024 · 3 marks Solve the following linear programming problem graphically: Maximise $z = 5x + 4y$ subject to the constraints $x + 2y \geq 4$, $3x + y \leq 6$, $x + y \leq 4$, $x, y \geq 0$

Q38. CBSE 2024 · 3 marks Solve the following linear programming problem graphically: Minimise $z = 5x - 2y$ subject to the constraints $x + 2y \leq 120$, $x + y \geq 60$, $x - 2y \geq 0$, $x, y \geq 0$

Q39. CBSE 2024 · 3 marks Solve the following linear programming problem graphically: Maximise $z = 4x + 3y$, subject to the constraints $x + y \leq 800$, $2x + y \leq 1000$, $x \leq 400$, $x, y \geq 0$.

Q40. CBSE 2024 · 3 marks Solve the following linear programming problem graphically: Minimize $z = 600x + 400y$, subject to the constraints $x + y \geq 8$, $x + 2y \leq 16$, $4x + y \leq 29$, $x, y \geq 0$.

Q41. CBSE 2024 · 3 marks Solve the following linear programming problem graphically: Maximize $z = x + y$ subject to constraints $2x + 5y \leq 100$, $8x + 5y \leq 200$, $x \geq 0$, $y \geq 0$

Q42. CBSE 2024 · 3 marks Solve the following linear programming problem graphically: Maximise $Z = 2x + 3y$ subject to the constraints: $x + y \leq 6$, $x \geq 2$, $y \leq 3$, $x, y \geq 0$.



Q43. CBSE 2024 · 3 marks Solve the following L.P.P. graphically: Maximise $Z = x + 3y$ subject to the constraints: $x + 2y \leq 200$, $x + y \leq 150$, $y \leq 75$, $x, y \geq 0$

Q44. CBSE 2023 · 3 marks Solve graphically the following linear programming problem: Maximise $z = 6x + 3y$, subject to the constraints $4x + y \leq 80$, $3x + 2y \leq 150$, $x + 5y \leq 115$, $x \geq 0$, $y \geq 0$.

Q45. CBSE 2023 · 3 marks Solve the following linear programming problem graphically: Maximize $P = 100x + 5y$ subject to the constraints $x + y \leq 300$, $3x + y \leq 600$, $y \leq x + 200$, $x, y \geq 0$.

Q46. CBSE 2023 · 3 marks Solve the following linear programming problem graphically: Maximize $z = 600x + 400y$ subject to the constraints: $x + 2y \leq 12$, $2x + y \leq 12$, $x + 1.25y \geq 5$, $x, y \geq 0$

Q47. CBSE 2023 · 3 marks Solve the following linear programming problem graphically: Maximize: $Z = x + 2y$ subject to constraints: $x + 2y \leq 100$, $2x - y < 0$, $2x + y \leq 200$, $x \geq 0$, $y \geq 0$.

Q48. CBSE 2023 · 3 marks Determine graphically the minimum value of the following objective function: $z = 500x + 400y$ subject to constraints $x + y \leq 200$, $x \geq 20$, $y \geq 4x$, $y \geq 0$.

Q49. CBSE 2023 · 3 marks Solve the following linear programming problem graphically: Maximize $z = 3x + 9y$ subject to the constraints $x + y \leq 10$, $x + 3y \leq 60$, $x \geq y$, $x \geq 0$, $y \geq 0$.

Q50. CBSE 2023 · 3 marks Solve the following linear programming problem graphically: Minimize $z = x + 2y$ subject to the constraints $2x + y \geq 3$, $x + 2y \geq 6$, $x \geq 0$, $y \geq 0$.

Q51. CBSE 2023 · 3 marks Solve the following linear programming problem graphically: Maximise $z = 3x - 5y$ subject to the constraints $2x + y \leq 4$, $x + y \leq 3$, $x - 2y \leq 2$, $x \geq 0$, $y \geq 0$.

Q52. CBSE 2023 · 3 marks Solve the following linear programming problem graphically: Maximise $z = 5x + 3y$ subject to the constraints $3x + 5y \leq 15$, $5x + 2y \geq 10$, $x, y \geq 0$.

LONG ANSWER (3)

Q53. CBSE 2026 · 5 marks Solve the following Linear Programming Problem graphically : Maximise $Z = 600x + 400y$ subject to the constraints $x + 2y \geq 12$, $4x + 5y \geq 20$, $2x + y \geq 12$, $x, y \geq 0$

Q54. CBSE 2026 · 5 marks Solve the following Linear Programming Problem graphically: Maximise $Z = 12x + 18y$ subject to the constraints $x + y \leq 1200$, $x - 2y \geq 0$, $x + 3y \geq 600$, $x \geq 0$, $y \geq 0$

Q55. CBSE 2026 · 5 marks Solve the following Linear Programming Problem graphically: Maximize $Z = 8x + 8y$ subject to the constraints $x - 20 \geq 0$, $2x + 3y \leq 120$, $2x + y \leq 60$, $x \geq 0$, $y \geq 0$

CASE-BASED (2)

Q56. CBSE 2026 · 1 mark Assertion (A) : Consider a Linear Programming Problem with minimize $Z = x + 2y$ subject to constraints $2x + y \geq 3$, $x + 2y \geq 6$, $x, y \geq 0$ which gives minimum Z at infinitely many points. The corner points of feasible region are (0, 3) and (6, 0). Reason (R) : If two corner points produce the same minimum value of the objective function, then every point on the line segment joining the points will give the same minimum value.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true, but Reason (R) is false.
- (d) Assertion (A) is false, but Reason (R) is true.

Q57. CBSE 2026 · 1 mark Assertion (A): Consider a Linear Programming Problem with minimise $Z = x + 2y$ subject to constraints $2x + y \geq 3$, $x + 2y \geq 6$, $x, y \geq 0$ which gives minimum Z at infinitely many points. The corner points of feasible region are (0, 3) and (6, 0). Reason (R): If two corner points produce the same minimum value of the objective function, then every point on the line segment joining the points will give the same minimum value.

- (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

13 Probability

Notes & MCQs →

MULTIPLE CHOICE AND ASSERTION-REASON (29)

Q1. CBSE 2026 · 1 mark Assertion (A): In an experiment of throwing an unbiased die, the probability of getting a prime number given that number appearing on the die being odd is $2/3$. Reason (R): For any two events A and B, $P(A|B) = P(A \cap B)/P(B)$

- (a) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A).
- (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- (c) Assertion (A) is true and Reason (R) is false.
- (d) Assertion (A) is false and Reason (R) is true.

Q2. CBSE 2026 · 1 mark Assertion (A): In an experiment of throwing an unbiased die, the probability of getting a prime number given that the number appearing on the die being odd is $2/3$. Reason (R): For any two events A and B, $P(A|B) = P(A \cap B)/P(B)$.

- (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 and Reason (R) is false
- (d) Assertion (A) is false and Reason (R) is true

Q3. CBSE 2026 · 1 mark For two events A and B such that $P(A) \neq 0$ and $P(B) \neq 1$, $P(A'|B) =$

- (a) $1 - P(A|B)$ (b) $1 - P(A'|B)$ (c) $[1 - P(A \cap B)]/P(B)$
- (d) $[1 - P(A' \cap B)]/P(B)$



Q4. CBSE 2026 · 1 mark If events A and B are such that $P(A|B) = P(B|A)$, then :

- (a) $A \subset B$ but $A \neq B$ (b) $A = B$ (c) $A \cap B = \emptyset$
(d) $P(A) = P(B)$

Q5. CBSE 2026 · 1 mark The probability of getting an odd prime number on each die, when a pair of dice is rolled, is :

- (a) $1/18$ (b) $1/9$ (c) $1/36$ (d) $1/6$

Q6. CBSE 2026 · 1 mark In a family with three children, the probability that the eldest child is a boy, given that the family has at least one boy, is :

- (a) $1/2$ (b) $1/3$ (c) $2/3$ (d) $4/7$

Q7. CBSE 2026 · 1 mark Assertion (A): For two independent events A and B, $P(A|B) = P(A)$. Reason (R): A and B are independent events, then $P(A \cap B) = P(A) \cdot P(B)$.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Q8. CBSE 2026 · 1 mark If E and F are two independent events such that $P(E) = 3/10$, $P(E \cup F) = 1/2$, then $P(E|F) - P(F|E)$ is equal to :

- (a) $2/7$ (b) $3/35$ (c) $1/70$ (d) $1/7$

Q9. CBSE 2026 · 1 mark A box contains 4 red, 5 blue and 1 green marble. A child randomly takes out a marble from the box, notes down the colour and puts it back in the box. If the activity is repeated 3 times, what is the probability that at least one marble is red?

- (a) $27/125$ (b) $8/125$ (c) $2/125$ (d) $98/125$

Q10. CBSE 2026 · 1 mark The probability that it will rain tomorrow in cities A, B and C is 60%, 70% and 80% respectively. The probability that it will rain tomorrow in at least one of the cities is:

- (a) $3/250$ (b) $244/250$ (c) 1 (d) $9/10$

Q11. CBSE 2026 · 1 mark The probability that a particular item is available in three shops A, B and C is $4/5$, $3/4$ and $2/3$ respectively. If a person visits all the three shops to buy the item, then what is the probability that it will be available in at least one of the shops?

- (a) $59/60$ (b) 1 (c) $1/60$ (d) $9/60$

Q12. CBSE 2026 · 1 mark If $3P(A) = P(B) = 3/5$ and $P(A|B) = 2/3$, then $P(A \cap B)$ is :

- (a) $3/5$ (b) $1/5$ (c) $2/15$ (d) $2/5$

Q13. CBSE 2025 · 1 mark If E and F are two independent events such that $P(E) = 2/3$, $P(F) = 3/7$, then $P(E|F)$ is equal to:

- (a) $1/6$ (b) $1/2$ (c) $2/3$ (d) $7/9$

Q14. CBSE 2024 · 1 mark The probabilities of A, B and C solving a problem are $1/3$, $1/5$ and $1/6$ respectively. The probability that the problem is solved, is

- (a) $4/9$ (b) $5/9$ (c) $1/90$ (d) $1/3$

Q15. CBSE 2024 · 1 mark If $P(A|B) = P(A'|B)$, then which of the following statements is true?

- (a) $P(A) = P(A')$ (b) $P(A) = 2 P(B)$ (c) $P(A \cap B) = (1/2) P(B)$
(d) $P(A \cap B) = 2 P(B)$

Q16. CBSE 2024 · 1 mark Let E be an event of a sample space S of an experiment, then $P(S|E) =$

- (a) $P(S \cap E)$ (b) $P(E)$ (c) 1 (d) 0

Q17. CBSE 2024 · 1 mark Let E and F be two events such that $P(E) = 0.1$, $P(F) = 0.3$, $P(E \cup F) = 0.4$, then $P(F|E)$ is :

- (a) 0.6 (b) 0.4 (c) 0.5 (d) 0

Q18. CBSE 2024 · 1 mark The probability distribution of a random variable X is given. X: 0, 1, 2, 3, 4; P(X): 0.1, k, 2k, k, 0.1. The probability that the random variable X takes the value 2 is:

- (a) $1/5$ (b) $2/5$ (c) $4/5$ (d) 1

Q19. CBSE 2024 · 1 mark The probability distribution of a random variable X is: X: 0, 1, 2, 3, 4; P(X): 0.1, k, 2k, k, 0.1, where k is some unknown constant. The probability that the random variable X takes the value 2 is:

- (a) $1/5$ (b) $2/5$ (c) $4/5$ (d) 1

Q20. CBSE 2023 · 1 mark If $P(B|A) = 0.3$, $P(A) = 0.4$ and $P(B) = 0.8$, then $P(A|B)$ is equal to:

- (a) 0.6 (b) 0.3 (c) 0.06 (d) 0.4

Q21. CBSE 2023 · 1 mark Assertion (A): The number of onto functions from a set P containing 5 elements to a set Q containing 2 elements is 30. Reason (R): Number of onto functions from a set containing m elements to a set containing n elements is n^m .

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true and Reason (R) is false.
(d) Assertion (A) is false and Reason (R) is true.

Q22. CBSE 2023 · 1 mark Ashima can hit a target 2 out of 3 times. She tried to hit the target twice. The probability that she missed the target exactly once is:

- (a) $3/2$ (b) $3/1$ (c) $9/4$ (d) $9/1$

Q23. CBSE 2023 · 1 mark If A and B are two events such that $P(A|B) = 2 P(B|A)$ and $P(A) + P(B) = 2/3$, then $P(B)$ is equal to

- (a) $2/9$ (b) $7/9$ (c) $4/9$ (d) $5/9$

Q24. CBSE 2023 · 1 mark If $P(A \cap B) = 1/8$ and $P(A) = 3/4$, then $P(B|A)$ is equal to:

- (a) $1/2$ (b) $1/3$ (c) $1/6$ (d) $3/2$

Q25. CBSE 2023 · 1 mark For any two events A and B, if $P(A) = 1/2$, $P(B) = 2/3$ and $P(A \cap B) = 1/4$, then $P(A|B)$ equals:

- (a) $3/8$ (b) $8/9$ (c) $1/8$ (d) $1/4$

Q26. CBSE 2023 · 1 mark X and Y are independent events such that $P(X \cap Y) = 2/5$ and $P(X) = 3/5$. Then $P(Y)$ is equal to

- (a) $2/3$ (b) $2/5$ (c) $1/3$ (d) $1/5$



Q27. CBSE 2023 · 1 mark The probability that A speaks the truth is $\frac{5}{4}$ and that of B speaking the truth is $\frac{3}{4}$. The probability that they contradict each other in stating the same fact is :

- (a) $\frac{2}{7}$ (b) $\frac{5}{1}$ (c) $\frac{2}{3}$ (d) $\frac{5}{4}$

Q28. CBSE 2023 · 1 mark For two events A and B, if $P(A) = 0.4$, $P(B) = 0.8$ and $P(B/A) = 0.6$, then $P(A \cap B)$ is:

- (a) 0.24 (b) 0.3 (c) 0.48 (d) 0.96

Q29. CBSE 2023 · 1 mark The events E and F are independent. If $P(E) = 0.3$ and $P(E \cup F) = 0.5$, then $P(E/F) - P(F/E)$ equals:

- (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{35}$ (d) $\frac{1}{70}$

VERY SHORT ANSWER (4)

Q30. CBSE 2022 · 2 marks A pair of dice is thrown. It is given that the sum of numbers appearing on both dice is an even number. Find the probability that the number appearing on at least one die is 3.

Q31. CBSE 2022 · 2 marks Probabilities of A and B solving a specific problem are $\frac{2}{3}$ and $\frac{3}{5}$, respectively. If both of them try independently to solve the problem, then find the probability that the problem is solved.

Q32. CBSE 2022 · 2 marks A bag contains 3 red and 4 white balls. Three balls are drawn at random, one-by-one without replacement from the bag. If the first ball drawn is red in colour, then find the probability that the remaining two balls drawn are also red in colour.

Q33. CBSE 2022 · 2 marks Three friends A, B and C got their photograph clicked. Find the probability that B is standing at the central position, given that A is standing at the left corner.

SHORT ANSWER (19)

Q34. CBSE 2026 · 3 marks Out of two bags, bag I contains 3 red and 4 white balls and bag II contains 8 red and 6 white balls. A die is thrown. If it shows a number less than 3 then a ball is drawn at random from bag I, otherwise a ball is drawn at random from bag II. Find the probability that the ball drawn from one of the bags is a red ball.

Q35. CBSE 2026 · 3 marks The probability of hitting the target by a trained sniper is three times the probability of not hitting the target on a stormy day due to high wind speed. The sniper fired two shots on the target on a stormy day when wind speed was very high. Find the probability that (i) target is hit (ii) at least one shot misses the target.

Q36. CBSE 2026 · 3 marks A survey was conducted on the patients who have undergone knee replacement surgeries. It was found that Robotic Knee replacement surgeries have 90% success rate. On a particular day, robotic surgery was performed on three patients, A, B and C, one after the other. Assuming that the success and failure of each surgery is independent of each other, find the probability that : (i) exactly one surgery is successful, (ii) at most two surgeries are successful.

Q37. CBSE 2026 · 3 marks In a school, the probability of holding a debate competition is $\frac{1}{3}$ and that of a quiz competition is $\frac{2}{3}$. In the two participating teams, A has 4 girls and 6 boys and B has 7 girls and 3 boys. If a debate competition is held, the students are selected from team A and for the quiz competition they are selected from team B. If only two students are to be chosen from the teams, then find the probability that one will be a girl and the other a boy.

Q38. CBSE 2026 · 3 marks A die is rolled. Consider events : $A = \{1, 2, 5\}$, $B = \{3, 5\}$, $C = \{2, 3, 4, 5\}$ and hence find : (i) $P(A|C)$ and $P(C|A)$ (ii) $P(A \cap B|C)$ and $P(A \cup B|C)$

Q39. CBSE 2025 · 3 marks (a) The probability distribution for the number of students being absent in a class on a Saturday is as follows: $X: 0, 2, 4, 5$; $P(X): p, 2p, 3p, p$, where X is the number of students absent. (i) Calculate p. (ii) Calculate the mean of the number of absent students on Saturday.

Q40. CBSE 2024 · 3 marks A card is randomly drawn from a well-shuffled pack of 52 playing cards. Events A and B are defined as under: A: Getting a card of diamond, B: Getting a queen. Determine whether the events A and B are independent or not.

Q41. CBSE 2024 · 3 marks E and F are two independent events such that $P(\neg E) = 0.6$ and $P(E \cap F) = 0.6$. Find $P(F)$ and $P(\neg E \cap \neg F)$.

Q42. CBSE 2024 · 3 marks A pair of dice is thrown simultaneously. If X denotes the absolute difference of the numbers appearing on top of the dice, then find the probability distribution of X.

Q43. CBSE 2024 · 3 marks The chances of P, Q and R getting selected as CEO of a company are in the ratio 4 : 1 : 2 respectively. The probabilities for the company to increase its profits from the previous year under the new CEO, P, Q or R are 0.3, 0.8 and 0.5 respectively. If the company increased the profits from the previous year, find the probability that it is due to the appointment of R as CEO.

Q44. CBSE 2024 · 3 marks A card from a well shuffled deck of 52 playing cards is lost. From the remaining cards of the pack, a card is drawn at random and is found to be a King. Find the probability of the lost card being a King.

Q45. CBSE 2023 · 3 marks (a) The probability distribution of a random variable X is given below: $X: 1, 2, 3$; $P(X): 2k, 3k, 6k$. (i) Find the value of k. (ii) Find $P(1 \leq X < 3)$. (iii) Find $E(X)$, the mean of X. OR (b) A and B are independent events such that $P(A \cap B) = \frac{1}{4}$ and $P(A \cup B) = \frac{1}{6}$. Find $P(A)$ and $P(B)$.

Q46. CBSE 2023 · 3 marks The probability distribution of a random variable X is given below: $X: 1, 2, 3$; $P(X): 2k, 3k, 6k$. (i) Find the value of k. (ii) Find $P(1 \leq X < 3)$. (iii) Find $E(X)$, the mean of X.

Q47. CBSE 2023 · 3 marks Two balls are drawn at random one by one with replacement from an urn containing equal number of red balls and green balls. Find the probability distribution of number of red balls. Also, find the mean of the random variable.

Q48. CBSE 2023 · 3 marks A pair of dice is thrown simultaneously. If X denotes the absolute difference of numbers obtained on the pair of dice, then find the probability distribution of X.



Q49. CBSE 2023 · 3 marks From a lot of 30 bulbs which include 6 defective bulbs, a sample of 2 bulbs is drawn at random one by one with replacement. Find the probability distribution of the number of defective bulbs and hence find the mean number of defective bulbs.

Q50. CBSE 2023 · 3 marks Two fair dice are thrown simultaneously. If X denotes the number of sixes, find the mean of X .

Q51. CBSE 2022 · 2 marks Probabilities of A and B solving a specific problem are $\frac{3}{2}$ and $\frac{5}{3}$, respectively. If both of them try independently to solve the problem, then find the probability that the problem is solved.

Q52. CBSE 2022 · 2 marks There are two bags. Bag I contains 1 red and 3 white balls, and Bag II contains 3 red and 5 white balls. A bag is selected at random and a ball is drawn from it. Find the probability that the ball so drawn is red in colour.

CASE-BASED (28)

CASE STUDY · CBSE 2026

In an online jackpot, there is one first prize of ₹ 3,00,000, two second prizes of ₹ 2,00,000 each and three third prizes of ₹ 50,000 each. A total of 1,00,000 jackpot tickets each costing ₹ 100 were sold thereby raising a fund of ₹ 1,00,00,000. Rohan bought one ticket.

Q53. CBSE 2026 · 1 mark In an online jackpot, there is one first prize of ₹ 3,00,000, two second prizes of ₹ 2,00,000 each and three third prizes of ₹ 50,000 each. A total of 1,00,000 jackpot tickets each costing ₹ 100 were sold thereby raising a fund of ₹ 1,00,00,000. Rohan bought one ticket. What are the possible amounts, the person can win?

Q54. CBSE 2026 · 1 mark What are the possible amounts, the person can win?

CASE STUDY · CBSE 2026

Smoking increases the risk of lung problems. A study revealed that 170 in 1000 males who smoke develop lung complications, while 120 out of 1000 females who smoke develop lung related problems. In a colony, 50 people were found to be smokers of which 30 are males. A person is selected at random from these 50 people and tested for lung related problems.

Q55. CBSE 2026 · 1 mark What is the probability that selected person is a female?

CASE STUDY · CBSE 2026

Two bags contain balls such that Bag I contains 5 red and 6 black balls, while Bag II contains 3 red and 4 black balls.

Q56. CBSE 2026 · 1 mark One ball is drawn at random from each of the two bags. Find the probability of getting both red balls.

CASE STUDY · CBSE 2026

A survey was conducted to find out the success rate of students who qualified the entrance examination by dropping a year after class XII. As per the data collected, 40% students appearing in the examination were dropouts and the remaining students were regular students of class XII. Of the dropouts, 5% qualify the examination while 10% of the regular students qualify the examination.

Q57. CBSE 2026 · 4 marks A survey was conducted to find out the success rate of students who qualified the entrance examination by dropping a year after class XII. As per the data collected, 40% students appearing in the examination were dropouts and the remaining students were regular students of class XII. Of the dropouts, 5% qualify the examination while 10% of the regular students qualify the examination. (i) Find the probability that a student selected at random is a regular student. (ii) A student is selected at random from a group of dropout students. What is the probability that the student will not qualify the examination? (iii) (a) A student selected at random qualified the examination. Find the probability that student is not a dropout.

Q58. CBSE 2026 · 1 mark Find the probability that a student selected at random is a regular student.

Q59. CBSE 2026 · 4 marks A survey was conducted to find out the success rate of students who qualified the entrance examination by dropping a year after class XII. As per the data collected, 40% students appearing in the examination were dropouts and the remaining students were regular students of class XII. Of the dropouts, 5% qualify the examination while 10% of the regular students qualify the examination. (i) Find the probability that a student selected at random is a regular student. (ii) A student is selected at random from a group of dropout students. What is the probability that the student will not qualify the examination? (iii) A student selected at random qualified the examination. Find the probability that student is not a dropout.

CASE STUDY · CBSE 2026

An NGO organises a charity event in which they decide to distribute woollen caps to protect children from winter. The caps to be distributed are in three separate boxes, Box I has 30 red caps, Box II has 20 red and 10 green caps, and Box III has 30 green caps. The probability that a Box i is selected and a cap picked out is $\frac{i}{6}$, where $i = 1, 2, 3$.

Q60. CBSE 2026 · 4 marks (i) What is the probability that he selects a red cap?

Q61. CBSE 2026 · 2 marks A person selects a cap. What is the probability that he selects a red cap?



Q62. CBSE 2026 · 2 marks An NGO organises a charity event in which they decide to distribute woollen caps to protect children from winter. The caps to be distributed are in three separate boxes, Box I has 30 red caps, Box II has 20 red and 10 green caps, and Box III has 30 green caps. The probability that a Box i is selected and a cap picked out is $i/6$, where $i = 1, 2, 3$. A person selects a cap. What is the probability that he selects a red cap?

CASE STUDY · CBSE 2026

There are three types of vaccines A₁, A₂, A₃, available in the market to protect the population of the country from spread of certain infection. According to a survey conducted, it was found that 25% of the population was given Vaccine A₁, 35% of the population was given Vaccine A₂ and 40% of the population was given Vaccine A₃. The survey also stated that the probabilities that Vaccines A₁, A₂ and A₃ would protect against the infection were 60%, 55% and 50% respectively.

Q63. CBSE 2026 · 1 mark The person taking vaccine A₂ will get infected. Find the probability.

Q64. CBSE 2026 · 1 mark There are three types of vaccines A₁, A₂, A₃ available in the market to protect the population of the country from spread of certain infection. According to a survey conducted, it was found that 25% of the population was given Vaccine A₁, 35% of the population was given Vaccine A₂ and 40% of the population was given Vaccine A₃. The survey also stated that the probabilities that Vaccines A₁, A₂ and A₃ would protect against the infection were 60%, 55% and 50% respectively. Find the probability that the person taking vaccine A₂ will get infected.

CASE STUDY · CBSE 2025

A bank offers loan to its customers on different types of interest namely, fixed rate, floating rate and variable rate. From the past data with the bank, it is known that a customer avails loan on fixed rate, floating rate or variable rate with probabilities 10%, 20% and 70% respectively. A customer after availing loan can pay the loan or default on loan repayment. The bank data suggests that the probability that a person defaults on loan after availing it at fixed rate, floating rate and variable rate is 5%, 3% and 1% respectively.

Q65. CBSE 2025 · 4 marks (i) What is the probability that a customer after availing the loan will default on the loan repayment?

CASE STUDY · CBSE 2024

A coach is training 3 players. He observes that player A can hit a target 4 times in 5 shots, player B can hit 3 times in 4 shots and player C can hit 2 times in 3 shots.

Q66. CBSE 2024 · 1 mark Find the probability that all three players miss the target.

CASE STUDY · CBSE 2024

According to recent research, air turbulence has increased in various regions around the world due to climate change. Turbulence makes flights bumpy and often delays the flights. Assume that, an airplane observes severe turbulence, moderate turbulence or light turbulence with equal probabilities. Further, the chance of an airplane reaching late to the destination are 55%, 37% and 17% due to severe, moderate and light turbulence respectively.

Q67. CBSE 2024 · 2 marks Find the probability that an airplane reached its destination late.

CASE STUDY · CBSE 2024

Airplanes are by far the safest mode of transportation when the number of transported passengers are measured against personal injuries and fatality totals. Previous records state that the probability of an airplane crash is 0.00001%. Further, there are 95% chances that there will be survivors after a plane crash. Assume that in case of no crash, all travellers survive. Let E_1 be the event that there is a plane crash and E_2 be the event that there is no crash. Let A be the event that passengers survive after the journey.

Q68. CBSE 2024 · 1 mark Find the probability that the airplane will not crash.

CASE STUDY · CBSE 2024

Self-study helps students to build confidence in learning. It boosts the self-esteem of the learners. Recent surveys suggested that close to 50% learners were self-taught using internet resources and upskilled themselves. A student may spend 1 hour to 6 hours in a day in upskilling self. The probability distribution of the number of hours spent by a student is given below: $P(X = x) = \{kx^2 \text{ for } x = 1, 2, 3; kx \text{ for } x = 4, 5, 6; 0 \text{ otherwise}\}$ where x denotes the number of hours.

Q69. CBSE 2024 · 4 marks (i) Express the probability distribution $P(X = x) = \{kx^2 \text{ for } x = 1, 2, 3; kx \text{ for } x = 4, 5, 6; 0 \text{ otherwise}\}$ in the form of a probability distribution table.

Q70. CBSE 2024 · 1 mark Express the probability distribution given above in the form of a probability distribution table.

CASE STUDY · CBSE 2024

Rohit, Jaspreet and Alia appeared for an interview for three vacancies in the same post. The probability of Rohit's selection is $1/5$, Jaspreet's selection is $1/3$ and Alia's selection is $1/4$. The event of selection is independent of each other.

Q71. CBSE 2024 · 1 mark What is the probability that at least one of them is selected?



Q72. CBSE 2024 · 1 mark Rohit, Jaspreet and Alia appeared for an interview for three vacancies in the same post. The probability of Rohit's selection is $\frac{1}{5}$, Jaspreet's selection is $\frac{1}{3}$ and Alia's selection is $\frac{1}{4}$. The event of selection is independent of each other. What is the probability that at least one of them is selected?

CASE STUDY · CBSE 2023

There are different types of Yoga which involve the usage of different poses of Yoga Asanas, Meditation and Pranayam. The Venn diagram represents the probabilities of three different types of Yoga, A, B and C performed by the people of a society. It is given that probability of a member performing type C Yoga is 0.44.

Q73. CBSE 2023 · 4 marks (i) Find the value of x .

CASE STUDY · CBSE 2023

Recent studies suggest that roughly 12% of the world population is left handed. Depending upon the parents, the chances of having a left handed child are as follows: A: When both father and mother are left handed: Chances of left handed child is 24%. B: When father is right handed and mother is left handed: Chances of left handed child is 22%. C: When father is left handed and mother is right handed: Chances of left handed child is 17%. D: When both father and mother are right handed: Chances of left handed child is 9%. Assuming that $P(A) = P(B) = P(C) = P(D) = \frac{1}{4}$ and L denotes the event that child is left handed.

Q74. CBSE 2023 · 1 mark Find $P(L/C)$

CASE STUDY · CBSE 2023

A building contractor undertakes a job to construct 4 flats on a plot along with parking area. Due to strike the probability of many construction workers not being present for the job is 0.65. The probability that many are not present and still the work gets completed on time is 0.35. The probability that work will be completed on time when all workers are present is 0.80. Let: E_1 : represent the event when many workers were not present for

the job; E_2 : represent the event when all workers were present; and E: represent completing the construction work on time.

Q75. CBSE 2023 · 4 marks (i) What is the probability that all the workers are present for the job? (ii) What is the probability that construction will be completed on time? (iii) What is the probability that many workers are not present given that the construction work is completed on time?

Q76. CBSE 2023 · 1 mark What is the probability that all the workers are present for the job?

CASE STUDY · CBSE 2022

At the start of a cricket match, a coin is tossed and the team winning the toss has the opportunity to choose to bat or bowl. Such a coin is unbiased with equal probabilities of getting head and tail.

Q77. CBSE 2022 · 2 marks If such a coin is tossed 2 times, then find the probability distribution of number of tails.

CASE STUDY · CBSE 2022

In a game of Archery, each ring of the Archery target is valued. The centremost ring is worth 10 points and rest of the rings are allotted points 9 to 1 in sequential order moving outwards. Archer A is likely to earn 10 points with a probability of 0.8 and Archer B is likely to earn 10 points with a probability of 0.9.

Q78. CBSE 2022 · 2 marks If both of them hit the Archery target, then find the probability that exactly one of them earns 10 points.

Q79. CBSE 2022 · 2 marks In a game of Archery, each ring of the Archery target is valued. The centremost ring is worth 10 points and rest of the rings are allotted points 9 to 1 in sequential order moving outwards. Archer A is likely to earn 10 points with a probability of 0.8 and Archer B is likely to earn 10 points with a probability of 0.9. If both of them hit the Archery target, find the probability that exactly one of them earns 10 points.

Q80. CBSE 2022 · 2 marks If both archers hit the Archery target, find the probability that exactly one of them earns 10 points.

