CBSE Class 12 Mathematics: Sample Paper 1

Based on NCERT · the board's 2026-27 pattern | Time: 3 hours · **Maximum marks: 80**

1. This question paper contains 38 questions. All questions are compulsory.
2. Section A has 20 questions of 1 mark each: 18 multiple-choice and 2 assertion-reason. Section B has 5 very short answer questions of 2 marks, Section C 6 short answer questions of 3 marks, Section D 4 long answer questions of 5 marks and Section E 3 case study-based questions of 4 marks.
3. There is no overall choice. Internal choice is given in 2 questions in Section B, 3 in Section C, 2 in Section D and one part each of 2 questions in Section E; attempt only one of the alternatives.
4. Calculators are not allowed.
5. For the assertion-reason questions, choose: (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.

Section A (20 × 1 mark)

1. The vector $12\hat{i} + y\hat{j} - 4\hat{k}$, with $y > 0$, has magnitude 13. The value of y is [1]

(a) 5 (b) 9
(c) 1 (d) 3

2. In a linear programming problem with decision variables x and y, which of the following is a non-negative restriction? [1]

(a) $x + y \le 12$ (b) $x - 2y \ge 0$
(c) $Z = 5x + 3y$ (d) $y \ge 0$

3. $\int_1^3 (2x + 1)\,dx$ equals [1]

(a) 9 (b) 8
(c) 12 (d) 10

4. For a value of x at which $\sin x \neq 0$, the expression $(\sin x)^{-1}$ means [1]

(a) $-\sin x$ (b) $\sin^{-1} x$
(c) cosec x (d) $\sin(-x)$

5. Let R be the feasible region of a linear programming problem and $Z = ax + by$ the objective function. If R is bounded, then [1]

(a) Z has a maximum value on R but may have no minimum value
(b) the maximum of Z occurs only at a point inside R, not on its boundary
(c) Z may have neither a maximum nor a minimum value on R
(d) Z has both a maximum and a minimum value on R, each occurring at a corner point of R

6. The principal value branch of which of the following functions has the open interval $(0, \pi)$ as its range? [1]

(a) $\cos^{-1}$ (b) $\cot^{-1}$
(c) $\sec^{-1}$ (d) $\tan^{-1}$

7. If $\begin{pmatrix} x+y & 3 \\ 2 & x-y \end{pmatrix} = \begin{pmatrix} 9 & 3 \\ 2 & 1 \end{pmatrix}$, then xy equals [1]

(a) 1 (b) 9
(c) 20 (d) 16

8. The area of the region bounded by $y = |x - 2|$, the x-axis and the ordinates $x = 0$ and $x = k$, where $k > 2$, is 10 square units. Then k equals [1]

(a) 6 (b) 4

(c) $2 + 2\sqrt{5}$ (d) 10

9. The degree of the differential equation $(y'')^2 + (y')^3 - 7y = 0$ is [1]

(a) 1 (b) 3

(c) 2 (d) 5

10. If $(p - 2)\hat{i} + 3\hat{j} - q\hat{k} = 5\hat{i} + (r + 1)\hat{j} + 4\hat{k}$, then $p + q + r$ equals [1]

(a) 9 (b) 13

(c) 5 (d) 1

11. A and B are mutually exclusive events with $P(A) = 0.3$ and $P(B) = 0.4$. Which of the following is true? [1]

(a) A and B are independent (b) $P(A \cap B) = 0.12$

(c) $P(A|B) = 0$ (d) $P(A \cup B) = 0.58$

12. The number of relations in the set {1, 2, 3} that are both reflexive and symmetric is [1]

(a) 6 (b) 64

(c) 8 (d) 512

13. The line joining the origin O to the point $P(1, 1, \sqrt{2})$ makes with the positive direction of the z-axis an angle of [1]

(a) 60° (b) 45°

(c) 30° (d) 90°

14. The function $f(x) = \frac{x^3 - 8}{x - 2}$ for $x \neq 2$, and $f(2) = k$, is continuous at $x = 2$. The value of k is [1]

(a) 4 (b) 6

(c) 12 (d) 0

15. A jar at a school fair holds n coupons, exactly 2 of which win a prize. Two coupons are drawn one after the other without replacement. If the probability that both coupons win is $\frac{1}{15}$, then n is [1]

(a) 5 (b) 15

(c) 6 (d) 30

16. A and B are independent events with $P(A) = 0.3$ and $P(A \cap B) = 0.12$. Then $P(B')$ is [1]

(a) 0.6 (b) 0.4

(c) 0.88 (d) 0.036

17. The critical points of $f(x) = x^3 - 27x$ are [1]

(a) $x = 3$ only (b) $x = -3$ and $x = 3$

(c) $x = 0$ and $x = 3$ (d) $x = 0$ only

18. Two lines in space that are neither parallel nor intersecting are called [1]

(a) coplanar lines (b) skew lines

(c) concurrent lines (d) perpendicular lines

19. Assertion (A): The area of the region bounded by $y = -x^2$, the x-axis and the ordinates $x = 0$ and $x = 3$ is 9 square units. Reason (R): If $f(x) \le 0$ on $[a, b]$, the area bounded by $y = f(x)$, the x-axis and the ordinates $x = a$ and $x = b$ is $\left|\int_a^b f(x)\,dx\right|$. [1]

(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.

20. Assertion (A): The differential equation $(y''')^2 + \log(y') = x$ has order 3, and its degree is not defined. Reason (R): The degree of a differential equation is defined only when it is a polynomial equation in its derivatives. [1]

(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.

Section B (5 × 2 marks)

21. Find the general solution of the differential equation $3y^2 \frac{dy}{dx} = \sec^2 x$. [2]

Or *Find the general solution of the differential equation* $\frac{dy}{dx} = x\,e^{-2y}$.

22. Let $f : R \to R$, $f(x) = x^2 - 4x$, and let $R = \{(a, b) : f(a) = f(b)\}$ in R, an equivalence relation. Find the equivalence class [1]. [2]

Or *Let $g : Z \to Z$, $g(x) = |x - 2|$, and let $R = \{(a, b) : g(a) = g(b)\}$ in Z, an equivalence relation. Find the equivalence class [5].*

23. For events A and B, $P(A) = 0.5$, $P(B) = 0.4$ and $P(A \cup B) = 0.7$. Find $P(A'|B')$. [2]

24. A line through the origin O makes angles of 120° and 60° with the positive directions of the x-axis and the y-axis, and an acute angle with the positive direction of the z-axis. Find the coordinates of the point P on this line, on the side of that acute angle, with OP = 4 units. [2]

25. Find the values of x for which $\begin{vmatrix} x & 6 \\ 2 & x \end{vmatrix} = \begin{vmatrix} 4 & 5 \\ -1 & 2 \end{vmatrix}$. [2]

Section C (6 × 3 marks)

26. Find the value of $\sin(2\tan^{-1}(1/3)) + \cos(\tan^{-1}(2\sqrt{2}))$. [3]

Or *Find the value of $\sin(2\tan^{-1}(1/4)) - \cos(\tan^{-1}\sqrt{15})$.*

27. Maximise $Z = 4x + 3y$ subject to $x + y \le 8$, $x \le 5$, $y \le 6$, $x \ge 0$, $y \ge 0$, by the corner point method. By how much would the maximum value increase if the constraint $x \le 5$ were removed? [3]

Or *Maximise $Z = 2x + 5y$ subject to $x + y \le 9$, $x \le 7$, $y \le 6$, $x \ge 0$, $y \ge 0$, by the corner point method. By how much would the maximum value increase if the constraint $y \le 6$ were removed?*

28. Show that $f(x) = x^2$ for $x \le 1$ and $f(x) = 2x - 1$ for $x > 1$ is differentiable at $x = 1$. [3]

Or *Show that $f(x) = x^2$ for $x \le 1$ and $f(x) = 3x - 2$ for $x > 1$ is continuous but not differentiable at $x = 1$.*

29. Using vectors, prove that the diagonals of a rhombus are perpendicular to each other. [3]

30. A is a symmetric matrix and B a skew symmetric matrix of the same order. Prove that AB + BA is skew symmetric and AB − BA is symmetric. [3]

31. Arjun remembers every digit of his phone's PIN except the last one. He tries digits from 0 to 9 at random for the last place, never repeating a digit he has tried. Find the probability that he unlocks the phone within his first three attempts. [3]

Section D (4 × 5 marks)

32. (a) Find where the curve $y = 2\cos x - 1$ meets the x-axis for $0 \le x \le \pi$. (b) Find the area of the region bounded by the curve, the x-axis and the ordinates $x = 0$ and $x = \pi$. (c) Show that $\int_0^{\pi} (2\cos x - 1)\,dx = -\pi$ and say what this number measures. [5]

Or *(a) Find where the curve $y = 1 - 2\sin x$ meets the x-axis for $0 \le x \le \pi$. (b) Find the area of the region bounded by the curve, the x-axis and the ordinates $x = 0$ and $x = \pi$. (c) Show that $\int_0^{\pi} (1 - 2\sin x)\,dx = \pi - 4$ and say what this number measures.*

33. (a) Using $\int_0^a f(x)\,dx = \int_0^a f(a - x)\,dx$, show that $\int_0^{\pi} x\, g(\sin x)\,dx = \frac{\pi}{2}\int_0^{\pi} g(\sin x)\,dx$ for a continuous function g. (b) Hence evaluate $\int_0^{\pi} x \sin x \cos^2 x\,dx$. [5]

Or *Evaluate $\int_0^{\pi/2} \frac{\sin^2 x}{\sin x + \cos x}\,dx$.*

34. For $f(x) = x^4 - 4x^3 - 8x^2 + 48x + 1$: (a) find the intervals in which f is increasing and in which it is decreasing; (b) find the points of local maxima and local minima and the local maximum and minimum values. [5]

35. A cube has one vertex at the origin O and the edges OA, OC and OD along the positive x, y and z-axes, each of length 2 units. F is the vertex opposite O. [5]
(a) Find the angle between the diagonal OF and the face diagonal AC.
(b) Find the shortest distance between OF and the edge through A parallel to OD.
(c) Find the shortest distance between OF and AC.

Section E (3 × 4 marks)

36. Read the passage and answer the questions that follow. [4]

A dairy cooperative near Anand sells milk, curd and ghee at two outlets. Daily sales are recorded in the matrix S, rows for Outlet 1 and Outlet 2, columns for milk (litres), curd (kg) and ghee (kg). The selling prices per unit form the column matrix P and the cost prices per unit the column matrix C, in rupees, in the same order.

Matrix	Entries
S	[[120, 40, 10], [90, 60, 15]]
P	[[56], [80], [600]]
C	[[48], [65], [520]]

(a) The order of the revenue matrix SP is [1]

(a) order 2 × 1 (b) order 1 × 2
(c) order 3 × 1 (d) order 2 × 3

(b) The daily revenue of Outlet 2 is [1]

(a) ₹18,840 (b) ₹15,920
(c) ₹34,760 (d) ₹2,820

(c) Find the profit matrix S(P − C) and the total daily profit of the cooperative from both outlets. [2]

Or *Find the daily cost matrix SC, and use it with SP to find the profit of each outlet. Which law of matrix multiplication shows this equals S(P − C)?*

37. Read the passage and answer the questions that follow. [4]

A housing society in Jaipur fills its overhead tank with a pump whose output varies as the motor warms up. The caretaker notes that t minutes after switching on, water enters at the rate $r(t) = 3t^2 - 12t + 15$ litres per minute, for $0 \le t \le 6$. The volume added in the first x minutes is the area function $V(x) = \int_0^x r(t)\,dt$, and the volume added between two times is the definite integral of r over that interval.

(a) $V'(2)$ equals [1]

(a) 3 (b) 14
(c) 0 (d) 15

(b) The volume added in the first 3 minutes, in litres, is [1]

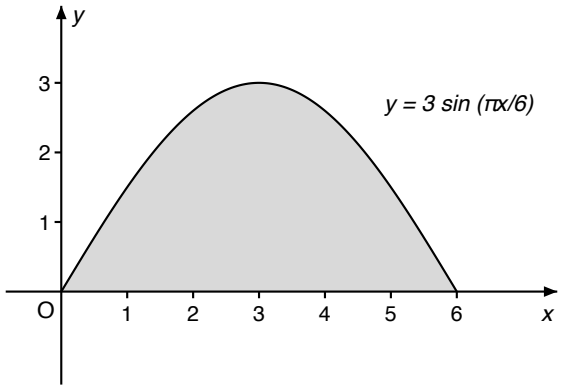
(a) 18 (b) 27
(c) 12 (d) 45

(c) Find the volume of water added from t = 3 to t = 5. [2]

Or *Find the average rate of inflow over the first 6 minutes, $\frac{1}{6}\int_0^6 r(t)\,dt$.*

38. Read the passage and answer the questions that follow. [4]

A carpenter in Jodhpur is making a wooden gate for an arched opening in a haveli wall. Taking the left foot of the opening as the origin and measuring in metres, the floor is the x-axis and the top edge of the opening follows $y = 3 \sin \frac{\pi x}{6}$ for $0 \le x \le 6$, as in the figure. The opening is the region bounded by this curve and the x-axis. To estimate the timber, he treats the opening as a large number of thin vertical strips and adds their areas.



(a) The width of the opening at a height of 1.5 m, in metres, is [1]

(a) 6 (b) 3

(c) 4 (d) 2

(b) The elementary area of a vertical strip of width dx at a distance x metres from the origin is [1]

(a) x dy (b) $3 \sin \frac{\pi x}{6}$ dx

(c) $\frac{\pi x}{6}$ dx (d) 3x dx

(c) Find the area of the opening. [2]