Series MC-XII-SP **Q.P. Code MC/SP/02**

SET ~ 1

Roll No. | | | | | | | |

Candidates must write the Q.P. Code on the title page of the answer-book.

MATHEMATICS

Sample Paper 02 • Class XII • Session 2026–27

(Based on the CBSE Sample Question Paper 2026–27 design and the latest CBSE syllabus)

Time allowed : 3 hours **Maximum Marks : 80**

NOTE

(i) Please check that this question paper contains 6 printed pages.
(ii) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
(iii) Please check that this question paper contains 38 questions.
(iv) Please write down the serial number of the question in the answer-book before attempting it.
(v) 15 minute time has been allotted to read this question paper. The students will read the question paper only and will not write any answer on the answer-book during this period.

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) This question paper contains 38 questions. All questions are compulsory.
(ii) This question paper is divided into five Sections – A, B, C, D and E.
(iii) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
(iv) In Section B, Questions no. 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.
(v) In Section C, Questions no. 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.
(vi) In Section D, Questions no. 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.
(vii) In Section E, Questions no. 36 to 38 are Case Study based questions, carrying 4 marks each.
(viii) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.
(ix) Use of calculators is not allowed.

SECTION A

This section comprises 20 multiple choice questions (MCQs) of 1 mark each.

1. The principal value of $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ is: **1**

(A) $\frac{7\pi}{6}$ (B) $-\frac{\pi}{6}$ (C) $\frac{\pi}{6}$ (D) $\frac{5\pi}{6}$

2. The range of the principal value branch of $\cot^{-1}x$ is: **1**

(A) $(0, \pi)$ (B) $[0, \pi]$ (C) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (D) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$

3. The value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ is: **1**

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $\frac{5\pi}{12}$

4. If $\begin{bmatrix} x+y & 2 \\ 5 & xy \end{bmatrix} = \begin{bmatrix} 6 & 2 \\ 5 & 8 \end{bmatrix}$, then the possible values of (x, y) are: **1**

(A) (3, 3) (B) (2, 4) or (4, 2)

(C) (1, 5) or (5, 1) (D) (−2, −4)

5. If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, then the value of x is: **1**

(A) 3 (B) −6 (C) ±6 (D) ±3

6. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, then $A^2 - 5A + 7I$ is equal to: **1**

(A) O (B) I (C) A (D) 2I

7. The value of k for which $f(x) = kx^2$ for $x \le 2$ and $f(x) = 3$ for $x > 2$ is continuous at x = 2 is: **1**

(A) 12 (B) $\frac{4}{3}$ (C) 3 (D) $\frac{3}{4}$

8. If $y = \log(\sec x + \tan x)$, then $\frac{dy}{dx}$ is: **1**

(A) tan x (B) sec x (C) $\sec^2 x$ (D) sec x tan x

9. The function $f(x) = \tan x - x$, $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$: **1**

(A) sometimes increases and sometimes decreases (B) is always decreasing

(C) never increases (D) is always increasing

10. The maximum value of $\left(\frac{1}{x}\right)^x$, $x > 0$, is: **1**

(A) e (B) e^e (C) e^$\left(\frac{1}{e}\right)$ (D) $\left(\frac{1}{e}\right)$^$\left(\frac{1}{e}\right)$

11. The integrating factor of the differential equation $\frac{dy}{dx} + y \tan x = \sec x$ is: **1**

(A) cos x (B) sec x (C) e^(tan x) (D) tan x

12. $\int e^x(\sin x + \cos x)\,dx$ is equal to: **1**

(A) $e^x \sin x + C$ (B) $e^x \cos x + C$

(C) $-e^x \sin x + C$ (D) $e^x(\sin x - \cos x) + C$

13. The projection of $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ on $\vec{b} = \hat{i} - 2\hat{j} + \hat{k}$ is: **1**

(A) $\frac{5}{6}$ (B) $\frac{5}{\sqrt{6}}$ (C) $\sqrt{6}$ (D) $\frac{\sqrt{6}}{5}$

14. If $|\vec{a}| = 2$, $|\vec{b}| = 3$ and $\vec{a} \cdot \vec{b} = 3$, then $|\vec{a} \times \vec{b}|$ is: **1**

(A) 3 (B) $\sqrt{3}$ (C) $3\sqrt{3}$ (D) 6

15. The vectors $2\hat{i} + 3\hat{j} - 6\hat{k}$ and $6\hat{i} + \lambda\hat{j} - 18\hat{k}$ are collinear if λ equals: **1**

(A) 9 (B) 6 (C) 3 (D) 18

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16. If A and B are independent events with P(A) = 0.2 and P(B) = 0.5, then P(A ∪ B) is: **1**

(A) 0.7 (B) 0.1 (C) 0.4 (D) 0.6

17. Two dice are thrown together. If the sum of the numbers obtained is 7, the probability that one of the dice shows 2 is: **1**

(A) $\frac{1}{3}$ (B) $\frac{1}{6}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$

18. If P(A) = $\frac{1}{2}$, P(B) = $\frac{1}{3}$ and P(A ∩ B) = $\frac{1}{6}$, then P(A′ ∩ B′) is: **1**

(A) $\frac{5}{6}$ (B) $\frac{2}{3}$ (C) $\frac{1}{6}$ (D) $\frac{1}{3}$

Questions number 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below.

(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.

19. **1**

Assertion (A): $\int_0^{\pi} \sin^2 x\, dx = \frac{\pi}{2}$.

Reason (R): $\int_0^{2a} f(x)\, dx = 2\int_0^{a} f(x)\, dx$ if f(2a − x) = f(x).

20. **1**

Assertion (A): The particular solution of $\frac{dy}{dx}$ = y with y(0) = 1 is $y = e^x$.

Reason (R): Every differential equation has exactly one solution, which contains no arbitrary constant.

SECTION B

This section comprises 5 very short answer (VSA) type questions of 2 marks each.

21. **2**

Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin x - \cos x}{1 + \sin x \cos x}\, dx$.

OR

Find $\int \frac{\cos 2x}{(\cos x + \sin x)^2}\, dx$.

22. If x = a(θ − sin θ) and y = a(1 + cos θ), find $\frac{dy}{dx}$ at θ = $\frac{\pi}{3}$. **2**

23. (A) Show that the line through the points (4, 7, 8) and (2, 3, 4) is parallel to the line through the points (−1, −2, 1) and (1, 2, 5). **2**

OR

(B) If $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, find the value of λ.

24. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{j} - \hat{k}$, find a vector $\vec{c}$ such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$. **2**

25. The corner points of the feasible region of an LPP are (0, 2), (3, 0), (6, 0), (6, 8) and (0, 5). Find the maximum and minimum values of Z = 3x + 5y. **2**

SECTION C

This section comprises 6 short answer (SA) type questions of 3 marks each.

26. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, show that $A^2 - 4A - 5I = O$. **3**

27. Find the intervals in which the function $f(x) = 2x^3 - 9x^2 + 12x + 15$ is strictly increasing or strictly decreasing. **3**

28. If y = Ae^(mx) + Be^(nx), show that $\frac{d^2y}{dx^2} - (m + n)\frac{dy}{dx} + mny = 0$. **3**

OR

If $(x^2 + y^2)^2 = xy$, find $\frac{dy}{dx}$.

29. Find the particular solution of the differential equation $\frac{dy}{dx} + y \cot x = 4x \operatorname{cosec} x$, given that y = 0 when $x = \frac{\pi}{2}$. **3**

OR

Find the general solution of the differential equation $x\,dy - y\,dx = \sqrt{x^2 + y^2}\,dx$.

30. Find the shortest distance between the lines $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$. **3**

OR

Show that the lines $\frac{x+1}{3} = \frac{y+3}{5} = \frac{z+5}{7}$ and $\frac{x-2}{1} = \frac{y-4}{3} = \frac{z-6}{5}$ intersect. Also find their point of intersection.

31. Solve the following linear programming problem graphically: Maximise Z = 5x + 3y subject to $3x + 5y \le 15$, $5x + 2y \le 10$, $x \ge 0$, $y \ge 0$. **3**

SECTION D

This section comprises 4 long answer (LA) type questions of 5 marks each.

32. Show that the relation R on the set $A = \{x \in Z : 0 \le x \le 12\}$, given by $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$, is an equivalence relation. Also find the set of all elements related to 1. **5**

OR

Show that the function $f : R \to \{x \in R : -1 < x < 1\}$ defined by $f(x) = x/(1 + |x|)$ is one-one and onto.

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33. Evaluate $\int_{-1}^{2} |x^3 - x|\,dx$. **5**

34. Using integration, find the area of the region bounded by the line y = 3x + 2, the x-axis and the ordinates x = −1 and x = 1. **5**

OR

Using integration, find the area of the region bounded by the curve y = |x + 3|, the x-axis and the lines x = −6 and x = 0.

35. A girl throws a die. If she gets 5 or 6, she tosses a coin three times and notes the number of heads. If she gets 1, 2, 3 or 4, she tosses a coin once and notes whether it shows a head or a tail.

(a) Find the probability that she obtains exactly one head. **2**

(b) If she obtains exactly one head, find the probability that she threw 1, 2, 3 or 4 with the die. **2**

(c) Find the probability that she threw 5 or 6, given that she obtained exactly one head. **1**

SECTION E

This section comprises 3 case study based questions of 4 marks each.

36. Laser Show: At a science fair, two laser beams are fixed along the lines $L_1 : \frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $L_2 : \frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1}$. The organisers want the two beams to meet at a point so that they light up a single spot on a screen.

Based on the above information, answer the following questions:

(i) Write the direction ratios of the two beams. **1**

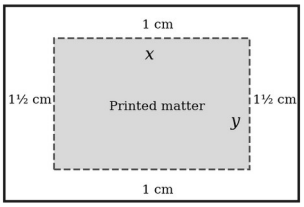
(ii) Are the two beams parallel? Justify. **1**

(iii) (a) Find the value of k for which the two beams intersect. **2**

OR

(iii) (b) Find the angle between the two beams. **2**

37. A rectangular visiting card is to contain 24 cm² of printed matter. The margins at the top and bottom of the card are to be 1 cm each, and the margins on the left and right are to be 1½ cm each, as shown. Let x cm and y cm be the length and breadth of the printed matter.



Based on the above information, answer the following questions:

(i) Write the expression for the area A of the visiting card in terms of x. **1**

(ii) Find dA/dx. **1**

(iii) (a) Obtain the dimensions of the card of minimum area. **2**

OR

(iii) (b) Using the second derivative test, find the minimum area of the card. **2**

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38. At a school fair, tickets were sold for a Magic show (₹x each), a Puppet show (₹y each) and a Science show (₹z each). Stall P sold 3 Magic, 2 Puppet and 1 Science ticket for ₹250; Stall Q sold 1 Magic, 2 Puppet and 3 Science tickets for ₹230; Stall R sold 2 Magic, 1 Puppet and 2 Science tickets for ₹210.

Based on the above information, answer the following questions:

(i) Write the given information as a matrix equation AX = B and find |A|. **2**

(ii) Given that adj $A = \begin{bmatrix} 1 & -3 & 4 \\ 4 & 4 & -8 \\ -3 & 1 & 4 \end{bmatrix}$, find the price of each ticket. **2**

• • • End of Question Paper • • •

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