Series MC-XII-SP **Q.P. Code MC/SP/01**

SET ~ 1

Roll No. | | | | | | | |

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

MATHEMATICS

Sample Paper 01 • 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 $\tan^{-1}\left(\tan\frac{3\pi}{5}\right)$ is: **1**

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

2. The domain of the function $f(x) = \sin^{-1}(2x - 3)$ is: **1**

(A) [1, 3] (B) [−1, 1] (C) [0, 1] (D) [1, 2]

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

(A) $\frac{1}{2}$ (B) 1 (C) $\frac{\sqrt{3}}{2}$ (D) 0

4. If A is a matrix of order 3 × n, B is a matrix of order m × 5 and 5A − 3B is defined, then: **1**

(A) m = 3, n = 5 (B) m = 5, n = 3

(C) m = n = 3 (D) m = n = 5

5. If A is a non-singular square matrix of order 3 and |adj A| = 64, then |A| is: **1**

(A) 8 (B) ±8 (C) 64 (D) ±4

6. If the matrix $A = \begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew-symmetric, then the values of a and b are: **1**

(A) a = 2, b = 3 (B) a = 2, b = −3

(C) a = −2, b = −3 (D) a = −2, b = 3

7. The value of k for which $f(x) = \frac{1-\cos 4x}{8x^2}$ for $x \neq 0$ and f(0) = k is continuous at x = 0 is: **1**

(A) 1 (B) 2 (C) $\frac{1}{2}$ (D) 0

8. The derivative of $\cos^{-1}(2x^2 - 1)$ with respect to $\cos^{-1}x$, for $0 < x < 1$, is: **1**

(A) −2 (B) $\frac{1}{2}$ (C) 2 (D) 1

9. The function $f(x) = x e^{-x}$ is strictly increasing on: **1**

(A) R (B) (1, ∞) (C) (0, ∞) (D) (−∞, 1)

10. The absolute maximum value of $f(x) = 4x - \frac{x^2}{2}$ on $\left[-2, \frac{9}{2}\right]$ is: **1**

(A) $\frac{63}{8}$ (B) 8 (C) −10 (D) 4

11. The general solution of the differential equation x dy + y dx = 0 is: **1**

(A) $x^2 + y^2 = C$ (B) x + y = C (C) xy = C (D) x = Cy

12. $\int \frac{dx}{x \log x}$ is equal to: **1**

(A) log|log x| + C (B) $\frac{1}{\log x}$ + C (C) log|x| + C (D) $(\log x)^2$ + C

13. If $\vec{a}$ is a unit vector and $(\vec{x} - \vec{a}) \cdot (\vec{x} + \vec{a}) = 8$, then $|\vec{x}|$ is: **1**

(A) $\sqrt{8}$ (B) 9 (C) 3 (D) 2

14. The area of the parallelogram whose diagonals are $2\hat{i} - \hat{j} + \hat{k}$ and $\hat{i} + 3\hat{j} - \hat{k}$ is: **1**

(A) $\sqrt{62}$ (B) $\frac{\sqrt{62}}{2}$ (C) $\sqrt{31}$ (D) 31

15. If $|\vec{a}| = 3$, $|\vec{b}| = \frac{2}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector, then the angle between $\vec{a}$ and $\vec{b}$ is: **1**

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$

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16. If P(A) = 0.4, P(B) = 0.3 and P(B | A) = 0.5, then P(A | B) is: **1**

(A) $\frac{1}{5}$ (B) $\frac{1}{2}$ (C) $\frac{3}{10}$ (D) $\frac{2}{3}$

17. Two cards are drawn at random, one after the other without replacement, from a well-shuffled pack of 52 cards. The probability that both are kings is: **1**

(A) $\frac{1}{169}$ (B) $\frac{1}{221}$ (C) $\frac{1}{13}$ (D) $\frac{2}{13}$

18. The probabilities of A and B solving a problem independently are $\frac{1}{2}$ and $\frac{1}{3}$. The probability that the problem is solved is: **1**

(A) $\frac{2}{3}$ (B) $\frac{1}{6}$ (C) $\frac{5}{6}$ (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. Assertion (A): $\int_{-1}^{1} x|x|dx = 0$. **1**

Reason (R): If f is an odd function, then $\int_{-a}^{a} f(x)dx = 0$.

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20. Assertion (A): The degree of the differential equation $\frac{d^2y}{dx^2} + \sin\left(\frac{dy}{dx}\right) = 0$ is 1. **1**

Reason (R): The degree of a differential equation is defined only when it is a polynomial equation in its derivatives.

SECTION B

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

21. Evaluate $\int_{0}^{\frac{\pi}{4}} \sqrt{1+\sin 2x}\,dx$. **2**

OR

Find $\int \frac{sec^2 x}{\sqrt{\tan^2 x + 4}}$ dx.

22. Find $\frac{dy}{dx}$ if $y = \sin^{-1}(x\sqrt{x})$, $0 \le x \le 1$. **2**

23. (A) Find the angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$. **2**

OR

(B) Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$.

24. $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors with $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $|\vec{c}| = 5$, and each is perpendicular to the sum of the other two. Find $|\vec{a} + \vec{b} + \vec{c}|$. **2**

25. The corner points of the bounded feasible region of an LPP are (0, 10), (5, 5), (15, 15) and (0, 20). Find the maximum and minimum values of Z = x + 2y, and the points where they occur. **2**

SECTION C

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

26. A school buys notebooks, pens and bags for three sections. Section I buys 20 notebooks, 30 pens and 10 bags; Section II buys 25, 20 and 15; Section III buys 30, 25 and 20 of these items. A notebook costs ₹40, a pen ₹10 and a bag ₹300. Using matrix multiplication, find the amount spent by each section and the total amount spent. **3**

27. Find the intervals in which the function f(x) = sin x + cos x, $0 \le x \le 2\pi$, is strictly increasing or strictly decreasing. **3**

28. If $y = (\tan^{-1}x)^2$, show that $(x^2 + 1)^2 \frac{d^2y}{dx^2} + 2x(x^2 + 1)\frac{dy}{dx} = 2$. **3**

OR

If x = a(cos t + t sin t) and y = a(sin t − t cos t), find $\frac{d^2y}{dx^2}$.

29. Find the general solution of the differential equation $(x + 2y^2)\frac{dy}{dx} = y$, y > 0. **3**

OR

Find the general solution of the differential equation (x − y) dy − (x + y) dx = 0.

30. Find the vector and Cartesian equations of the line through the point (1, 2, −4) and perpendicular to the two lines $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$. **3**

OR

Find the coordinates of the foot of the perpendicular drawn from the point A(−1, 8, 4) to the line joining B(0, −1, 3) and C(2, −3, −1).

31. Solve the following linear programming problem graphically: Maximise Z = 400x + 300y subject to $x + y \le 200$, $x \le 40$, $x \ge 20$, $y \ge 0$. **3**

SECTION D

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

32. Let N be the set of natural numbers and R the relation on N × N defined by (a, b) R (c, d) if and only if a + d = b + c. Show that R is an equivalence relation. Also write the equivalence class of (2, 5). **5**

OR

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Show that the function f : N → N defined by f(n) = (n + 1)/2 if n is odd and f(n) = n/2 if n is even is onto but not one-one.

33. Evaluate $\int_0^{\frac{\pi}{2}} \log(\sin x)\, dx$. **5**

34. Using integration, find the area of the region in the first quadrant bounded by the circle $x^2 + y^2 = 16$, the x-axis and the lines x = 0 and x = 2. **5**

OR

Using integration, find the area of the region bounded by the ellipse $4x^2 + 9y^2 = 36$.

35. In a college, 60% of the students reside in the hostel and 40% are day scholars. Past results show that 30% of the hostel students and 20% of the day scholars get an A grade in the annual examination. A student is chosen at random.

(a) Find the probability that the student has an A grade. **2**

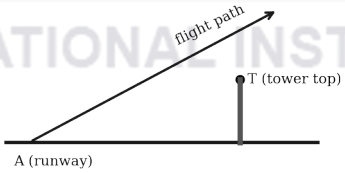
(b) The chosen student has an A grade. Find the probability that the student is a hosteller. **2**

(c) Find the probability that the student is a day scholar, given that the student has an A grade. **1**

SECTION E

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

36. Flight Path: An aeroplane takes off from a point A(2, −1, 0) on the runway and climbs along a straight line in the direction of the vector $3\hat{i} + 2\hat{j} + 6\hat{k}$. A control tower has its top at the point T(7, −2, 6). The air-traffic controller wants to know how close the aeroplane passes to the top of the tower.



Based on the above information, answer the following questions:

(i) Write the vector equation of the flight path. **1**

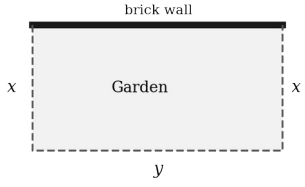
(ii) Write the direction cosines of the flight path. **1**

(iii) (a) Find the coordinates of the point on the flight path nearest to the top of the tower. **2**

OR

(iii) (b) Find the shortest distance between the top of the tower and the flight path. **2**

37. Sooraj's father wants to construct a rectangular garden using a brick wall on one side of the garden and wire fencing for the other three sides, as shown in the figure. He has 200 m of fencing wire. Let x m be the length of each side perpendicular to the wall and y m the length of the side parallel to the wall.



Based on the above information, answer the following questions:

(i) Write the relation between x and y given by the total length of the wire. **1**

(ii) Express the area A of the garden as a function of x. **1**

(iii) (a) Find the dimensions of the garden for which its area is maximum. Also find the maximum area. **2**

OR

(iii) (b) Using the second derivative test, show that the area is maximum when y = 2x. **2**

38. A school wants to award its students for the values of Honesty, Regularity and Hard work with a total cash award of ₹6,000. Three times the award money for Hard work added to that given for Honesty amounts to ₹11,000. The award money given for Honesty and Hard work together is double the one given for Regularity. Let the award money for Honesty, Regularity and Hard work be ₹x, ₹y and ₹z respectively.

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 $A = \begin{bmatrix} 6 & -3 & 3 \\ 2 & 0 & -2 \\ -2 & 3 & -1 \end{bmatrix}$, find the award money for each value. **2**

• • • End of Question Paper • • •

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