Series MC-XII-SP **Q.P. Code MC/SP/08**

SET ~ 1

Roll No. | | | | | | | |

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

MATHEMATICS

Sample Paper 08 • 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 value of $\sin^{-1}\left(\frac{1}{2}\right) - 2\sin^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is: **1**

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

2. Which of the following is NOT defined? **1**

(A) $\sin^{-1}\left(\frac{1}{2}\right)$ (B) $\sec^{-1}2$ (C) $\tan^{-1}2$ (D) $\cos^{-1}2$

3. The value of $\sin(2\sin^{-1}(0.6))$ is: **1**

(A) 0.48 (B) 1.2 (C) 0.96 (D) 0.6

4. If $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, then A^2 is equal to: **1**

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

5. The value of the determinant $\begin{vmatrix} x & x+1 \\ x-1 & x \end{vmatrix}$ is: **1**

(A) 0 (B) x^2 (C) 2x (D) 1

6. If A is a skew-symmetric matrix, then A^2 is: **1**

(A) a symmetric matrix (B) a skew-symmetric matrix

(C) a null matrix (D) an identity matrix

7. The number of points of discontinuity of the greatest integer function f(x) = [x] in the open interval (0, 3) is: **1**

(A) 0 (B) 1 (C) 2 (D) 3

8. If $e^x + e^y = e^{\wedge}(x + y)$, then $\frac{dy}{dx}$ is equal to: **1**

(A) $e^{\wedge}(y - x)$ (B) $-e^{\wedge}(y - x)$

(C) $-e^{\wedge}(x - y)$ (D) $e^{\wedge}(x + y)$

9. The volume of a cube is increasing at the rate of 9 cm^3/s. When the edge is 10 cm, its surface area is increasing at the rate of: **1**

(A) 3.6 cm^2/s (B) 0.03 cm^2/s (C) 1.8 cm^2/s (D) 36 cm^2/s

10. The function $f(x) = x^3 - 27x + 5$ is strictly increasing when: **1**

(A) $x < -3$ (B) $|x| < 3$

(C) $x \leq -3$ (D) $|x| > 3$

11. The differential equation representing the family of curves $y = a e^x$, where a is an arbitrary constant, is: **1**

(A) $\frac{dy}{dx} = -y$ (B) $\frac{dy}{dx} = y$

(C) $\frac{dy}{dx} = a$ (D) $\frac{d^2y}{dx^2} = y$

12. $\int \sec x (\sec x + \tan x)\, dx$ is equal to: **1**

(A) $\sec x \tan x + C$ (B) $\tan x - \sec x + C$

(C) $\tan x + \sec x + C$ (D) $\sec^2 x + C$

13. If $\vec{a}$ and $\vec{b}$ are unit vectors such that $\vec{a} + \vec{b}$ is also a unit vector, then the angle between $\vec{a}$ and $\vec{b}$ is: **1**

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

14. The projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$ is: **1**

(A) 1 (B) 0 (C) $\sqrt{2}$ (D) −1

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15. If the direction cosines of a line are k, k and k, then: **1**

(A) $k > 0$ (B) $0 < k < 1$

(C) $k = 1$ (D) $k = \frac{1}{\sqrt{3}}$ or $-\frac{1}{\sqrt{3}}$

16. If $P(A) = 0.6$, $P(B) = 0.3$ and $P(A \cup B) = 0.7$, then $P(A|B)$ is equal to: **1**

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

17. A card is drawn at random from a well-shuffled pack of 52 cards. If E: 'the card drawn is a spade' and F: 'the card drawn is an ace', then E and F are: **1**

(A) exhaustive (B) mutually exclusive

(C) independent (D) dependent

18. A random variable X has $P(X = 0) = 0.2$, $P(X = 1) = 0.5$ and $P(X = 2) = k$, and X takes no other value. The mean of X is: **1**

(A) 1.1 (B) 0.8 (C) 1.3 (D) 0.5

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): $\int \frac{dx}{x^2+9} = \tan^{-1}\left(\frac{x}{3}\right) + C$.

Reason (R): $\int \frac{dx}{x^2+a^2} = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + C$.

20. **1**

Assertion (A): The differential equation $x\frac{dy}{dx} = y + x$ is a linear differential equation.

Reason (R): A differential equation of the form $\frac{dy}{dx} + Py = Q$, where P and Q are functions of x only, is linear.

SECTION B

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

21. Find $\int \frac{x^2}{1+x^6}\,dx$. **2**

OR

Find $\int \sqrt{1-\sin 2x}\,dx$, $\frac{\pi}{4} < x < \frac{\pi}{2}$.

22. If $y = 5\cos x - 3\sin x$, prove that $\frac{d^2y}{dx^2} + y = 0$. **2**

23. (A) Find the vector equation of the line joining the points (1, 2, 3) and (−3, 4, 3), and show that it is perpendicular to the z-axis. **2**

OR

(B) Find the position vector of the point R which divides the line joining the points P($\hat{i} + 2\hat{j} - \hat{k}$) and Q($-\hat{i} + \hat{j} + \hat{k}$) externally in the ratio 2 : 1.

24. Using vectors, find the area of the triangle ABC with vertices A(1, 2, 3), B(2, −1, 4) and C(4, 5, −1). **2**

25. Find the maximum value of Z = 5x + 2y subject to the constraints $2x + y \le 6$, $x \le 2$, $x \ge 0$, $y \ge 0$. **2**

SECTION C

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

26. Find the values of x, y and z if the matrix $A = \begin{bmatrix} 0 & 2y & z \\ x & y & -z \\ x & -y & z \end{bmatrix}$ satisfies $A'A = I$. **3**

27. Show that, of all the rectangles with a given perimeter, the square has the maximum area. **3**

28. If $y = (x + \sqrt{1+x^2})^n$, show that $(1 + x^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - n^2y = 0$. **3**

OR

Find $\frac{dy}{dx}$ if $(\cos x)^y = (\cos y)^x$.

29. Find the general solution of the differential equation $x\frac{dy}{dx} + y - x + xy \cot x = 0$ ($x \neq 0$). **3**

OR

Find the general solution of the differential equation $(\tan^{-1}y - x)\, dy = (1 + y^2)\, dx$.

30. Find the coordinates of the foot of the perpendicular drawn from the point P(0, 2, 3) to the line $(x + 3)/5 = (y - 1)/2 = (z + 4)/3$. Also find the length of the perpendicular. **3**

OR

Show that the lines $(x - 5)/4 = (y - 7)/4 = (z + 3)/(-5)$ and $(x - 8)/7 = (y - 4)/1 = (z - 5)/3$ intersect. Also find their point of intersection.

31. Solve the following linear programming problem graphically: Minimise Z = 50x + 70y subject to $2x + y \ge 8$, $x + 2y \ge 10$, $x \ge 0$, $y \ge 0$. **3**

SECTION D

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

32. Let A = {1, 2, 3, 4, 5, 6} and let R be the relation on A defined by R = {(a, b) : b is divisible by a}. Write R in roster form and show that R is reflexive and transitive but not symmetric. **5**

OR

Show that (i) the greatest integer function $f : R \to R$, $f(x) = [x]$, and (ii) the modulus function $g : R \to R$, $g(x) = |x|$, are neither one-one nor onto.

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33. Find $\int \frac{x^4}{(x-1)(x^2+1)}\,dx$. **5**

34. Using integration, find the area of the region bounded by the curve $y = 6x - x^2$ and the x-axis. **5**

OR

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

35. On a certain air route, the probability that a flight encounters turbulence is 0.2, independently of other flights. Three flights on this route are observed on a day. Let X denote the number of flights (out of the three) that encounter turbulence.

(a) Find the probability distribution of X. **3**

(b) Find the mean of X. **1**

(c) Find the probability that at least one of the three flights encounters turbulence. **1**

SECTION E

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

36. In a city, an elevated metro track runs along the line $L_1 : \vec{r} = \lambda(\hat{i} - \hat{j})$, and a flyover road runs along the line $L_2 : \vec{r} = (2\hat{i} + \hat{j} + 3\hat{k}) + \mu(\hat{j} - \hat{k})$, with respect to a fixed origin (units in tens of metres).

Based on the above information, answer the following questions:

(i) Write the direction cosines of the line L_1. **1**

(ii) Are the metro track and the flyover perpendicular to each other? Justify. **1**

(iii) (a) Find the shortest distance between the metro track and the flyover. **2**

OR

(iii) (b) Find the angle between the metro track and the flyover. **2**

37. A botanist studies the growth of a plant. The height h (in cm) of the plant t weeks after planting is modelled by $h(t) = 6t^2 - \frac{t^3}{3} + 5$, $0 \le t \le 12$.

Based on the above information, answer the following questions:

(i) Find the rate of growth $h'(t)$ of the plant. **1**

(ii) Find the rate of growth of the plant 3 weeks after planting. **1**

(iii) (a) After how many weeks is the rate of growth maximum? Also find the maximum rate of growth. **2**

OR

(iii) (b) Show that the height of the plant keeps increasing for $0 < t < 12$, and find its height at the end of 12 weeks. **2**

38. A farmer buys three types of fertilizer A, B and C. One bag each of A, B and C costs ₹600 in all. Two bags of A, one bag of B and three bags of C cost ₹1300, while one bag of A, two bags of B and one bag of C cost ₹800. Let the prices of a bag of A, B and C 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**

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(ii) Given that adj A = $\begin{bmatrix} -5 & 1 & 2 \\ 1 & 0 & -1 \\ 3 & -1 & -1 \end{bmatrix}$, find the price of a bag of each fertilizer. **2**

• • • End of Question Paper • • •

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