Series MC-XII-SP **Q.P. Code MC/SP/05**

SET ~ 1

Roll No. | | | | | | | |

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

MATHEMATICS

Sample Paper 05 • 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 $\text{cosec}^{-1}(-\sqrt{2})$ is: **1**

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

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

(A) $[-1, 0]$ (B) $(-\infty, -1] \cup [0, \infty)$
(C) $(-1, 0)$ (D) R

3. The value of $\tan\left(\cos^{-1}\frac{3}{5} + \tan^{-1}\frac{1}{4}\right)$ is: **1**

(A) $\frac{19}{12}$ (B) $\frac{8}{19}$ (C) $\frac{19}{8}$ (D) $\frac{3}{4}$

4. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, then A^{2026} is equal to: **1**

(A) A (B) 2026A (C) O (D) I

5. The value of the determinant $\begin{vmatrix} 102 & 18 & 36 \\ 1 & 3 & 4 \\ 17 & 3 & 6 \end{vmatrix}$ is: **1**

(A) 102 (B) 6 (C) 0 (D) −17

6. If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ and $A + A' = I$, then the value of $\alpha \left(0 < \alpha < \frac{\pi}{2}\right)$ is: **1**

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{5}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{3}$

7. The value of k for which $f(x) = \frac{x^2 - 9}{x - 3}$, $x \neq 3$, and $f(3) = k$ is continuous at $x = 3$ is: **1**

(A) 6 (B) 3 (C) 0 (D) 9

8. If $x = a\cos^3\theta$ and $y = a\sin^3\theta$, then $\frac{dy}{dx}$ is equal to: **1**

(A) $\tan\theta$ (B) $-\tan\theta$ (C) $\cot\theta$ (D) $-\cot\theta$

9. The maximum value of $\sin x + \cos x$ is: **1**

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

10. The least value of a such that the function $f(x) = x^2 + ax + 1$ is increasing on [1, 2] is: **1**

(A) 1 (B) 2 (C) −4 (D) −2

11. The number of arbitrary constants in the particular solution of a differential equation of order three is: **1**

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

12. The value of $\int_0^{\frac{\pi}{2}} \cos x\, e^{(\sin x)}\, dx$ is: **1**

(A) e (B) e − 1 (C) e + 1 (D) 1

13. If $|\vec{a}| = 8$, $|\vec{b}| = 3$ and $|\vec{a} \times \vec{b}| = 12$, and the angle between $\vec{a}$ and $\vec{b}$ is acute, then $\vec{a} \cdot \vec{b}$ is equal to: **1**

(A) $12\sqrt{3}$ (B) 12 (C) $8\sqrt{3}$ (D) 24

14. The Cartesian equation of a line is $6x - 2 = 3y + 1 = 2z - 2$. The direction ratios of the line are: **1**

(A) 6, 3, 2 (B) 2, 3, 6 (C) 1, 2, 3 (D) 1, 1, 1

15. The vector $\vec{a} + \vec{b}$ bisects the angle between the non-collinear vectors $\vec{a}$ and $\vec{b}$ if: **1**

(A) $\vec{a} \perp \vec{b}$ (B) $|\vec{a}| = |\vec{b}|$

(C) $\vec{a} \parallel \vec{b}$ (D) none of these

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16. If $P(A) = \frac{2}{5}$, $P(B) = \frac{3}{10}$ and $P(A \cap B) = \frac{1}{5}$, then $P(A|B) \cdot P(B'|A')$ is equal to: **1**

(A) $\frac{5}{6}$ (B) $\frac{5}{7}$ (C) $\frac{25}{42}$ (D) $\frac{5}{9}$

17. A die is thrown twice. The probability that the sum of the numbers obtained is 8, given that the first throw shows an even number, is: **1**

(A) $\frac{1}{6}$ (B) $\frac{5}{36}$ (C) $\frac{1}{12}$ (D) $\frac{1}{3}$

18. A random variable X has the probability distribution $P(X = x) = kx$ for $x = 1, 2, 3, 4$ (and 0 otherwise). Then $P(X \geq 3)$ is: **1**

(A) $\frac{3}{10}$ (B) $\frac{2}{5}$ (C) $\frac{7}{10}$ (D) $\frac{1}{10}$

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): $\int \frac{\log x}{x}\, dx = \frac{(\log x)^2}{2} + C$. **1**

Reason (R): $\int [f(x)]^n f'(x)\, dx = \frac{[f(x)]^{n+1}}{n+1} + C$, $n \neq -1$.

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20. Assertion (A): $y = e^{-3x}$ is a solution of the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$. **1**

Reason (R): $y = e^{3x}$ is also a solution of the differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = 0$.

SECTION B

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

21. Evaluate $\int_0^1 x e^{(x^2)}\, dx$. **2**

OR

Find $\int \sin 2x \cos 3x\, dx$.

22. If $y^x = x^y$, find $\frac{dy}{dx}$. **2**

23. (A) Show that the points A(2, 3, −4), B(1, −2, 3) and C(3, 8, −11) are collinear. **2**

OR

(B) Find the projection of the vector $\vec{b} + \vec{c}$ on the vector $\vec{a}$, where $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$.

24. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are mutually perpendicular vectors of equal magnitudes, show that the vector $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}$, $\vec{b}$ and $\vec{c}$. **2**

25. Find the corner points of the feasible region determined by $x + 2y \le 8$, $3x + 2y \le 12$, $x \ge 0$, $y \ge 0$, and hence find the minimum value of $Z = -3x + 4y$. **2**

SECTION C

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

26. Show that the matrix $B'AB$ is symmetric or skew-symmetric according as A is symmetric or skew-symmetric (A and B being square matrices of the same order). **3**

27. Find the local maximum and local minimum values of the function $f(x) = x^3 - 6x^2 + 9x + 15$. **3**

28. Find $\frac{dy}{dx}$ if $y = (\cos x)^x + (\sin x)^{\wedge}(1/x)$. **3**

OR

Show that the function $f(x) = |x - 3|$, $x \in R$, is continuous but not differentiable at $x = 3$.

29. Find the general solution of the differential equation $x^2\frac{dy}{dx} = x^2 - 2y^2 + xy$. **3**

OR

Find the general solution of the differential equation $\frac{dy}{dx} + 2y = \sin x$.

30. Find the shortest distance between the lines $\vec{r} = (6\hat{i} + 2\hat{j} + 2\hat{k}) + \lambda(\hat{i} - 2\hat{j} + 2\hat{k})$ and $\vec{r} = (-4\hat{i} - \hat{k}) + \mu(3\hat{i} - 2\hat{j} - 2\hat{k})$. **3**

OR

Find the angle between the lines $x/2 = y/2 = z/1$ and $(x - 5)/4 = (y - 2)/1 = (z - 3)/8$.

31. Solve the following linear programming problem graphically: Minimise $Z = x + 2y$ subject to $2x + y \ge 3$, $x + 2y \ge 6$, $x \ge 0$, $y \ge 0$. **3**

SECTION D

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

32. Show that the relation R in the set R of real numbers, defined as $R = \{(a, b) : 1 + ab > 0\}$, is reflexive and symmetric but not transitive. **5**

OR

Let $A = R - \{3\}$ and $B = R - \{1\}$. Consider the function $f : A \to B$ defined by $f(x) = \frac{x-2}{x-3}$.

Show that f is one-one and onto.

33. Evaluate $\int_0^{\frac{\pi}{2}} \sin 2x \tan^{-1}(\sin x)\,dx$. **5**

34. Using integration, find the area of the region bounded by the curve $y = x^2$, the x-axis and the lines $x = -1$ and $x = 2$. **5**

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OR

Using integration, find the area of the region $\{(x, y) : 0 \le y \le x^2 + 1, 0 \le x \le 2\}$.

35. The number of electric cars X sold per day by a dealer has the following probability distribution, where k is a constant:

X :	0	1	2	3	4
P(X) :	0.1	k	2k	2k	k

(a) Find the value of k. **1**

(b) Find the probability that at least 2 cars are sold on a day. **1**

(c) Find the mean number of cars sold per day. **2**

(d) Given that at least 2 cars are sold on a day, find the probability that 4 cars are sold. **1**

SECTION E

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

36. At a hot-air balloon festival, an observer stands at the origin O(0, 0, 0). Balloon A rises along the straight path $L_1 : (x - 3)/1 = (y + 3)/(-2) = (z - 3)/1$, and Balloon B moves along the path $L_2 : x/2 = y/1 = z/(-2)$.

Based on the above information, answer the following questions:

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

(ii) Check whether the point (5, −7, 5) lies on the path of Balloon A. **1**

(iii) (a) Find the coordinates of the foot of the perpendicular from O to the path L_1, and the perpendicular distance of O from L_1. **2**

OR

(iii) (b) Find the angle between the paths L_1 and L_2. **2**

37. A transport company runs a truck over a distance of 300 km. At a steady speed of v km/h, the fuel cost is ₹$\frac{v^2}{25}$ per hour, and the driver's wages and other charges are ₹144 per hour.

Based on the above information, answer the following questions:

(i) Show that the total cost T (in ₹) of the journey is $T(v) = 12v + 43200/v$. **1**

(ii) Find dT/dv. **1**

(iii) (a) Find the most economical speed of the truck and the minimum cost of the journey. **2**

OR

(iii) (b) Show that, at the most economical speed, the total fuel cost equals the total wages and other charges. **2**

38. Mrs. Mehta invests a total of ₹50 thousand in three schemes A, B and C, paying simple interest at 6%, 8% and 9% per annum respectively. The total annual interest received is ₹4.05 thousand, and the amount invested in scheme C equals the sum of the amounts invested in A and B. Let the amounts invested in A, B and C be ₹x, ₹y and ₹z thousand 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 $A = \begin{bmatrix} -17 & 2 & 1 \\ 15 & -2 & -3 \\ -2 & 0 & 2 \end{bmatrix}$, find the amount invested in each scheme. **2**

• • • End of Question Paper • • •

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