Series MC-XII-SP **Q.P. Code MC/SP/09**

SET ~ 1

Roll No. | | | | | | | |

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

MATHEMATICS

Sample Paper 09 • 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 $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ is: **1**

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

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

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

(C) $(0, \pi)$ (D) $[0, \pi]$

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

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

4. If $\begin{bmatrix}2 & 0\\5 & 4\end{bmatrix}$ = P + Q, where P is a symmetric matrix and Q is a skew-symmetric matrix, then Q is equal to: **1**

(A) $\begin{bmatrix}2 & 5/2\\5/2 & 4\end{bmatrix}$ (B) $\begin{bmatrix}0 & 5/2\\-5/2 & 0\end{bmatrix}$

(C) $\begin{bmatrix}0 & -5/2\\5/2 & 0\end{bmatrix}$ (D) $\begin{bmatrix}0 & -5\\5 & 0\end{bmatrix}$

5. Using determinants, the area of the triangle with vertices (1, 0), (6, 0) and (4, 3) is: **1**

(A) 15 sq. units (B) $\frac{15}{2}$ sq. units (C) 12 sq. units (D) 6 sq. units

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

(A) O (B) I (C) 3I (D) A

7. The function f(x) = e^(|x|) is: **1**

(A) differentiable but not continuous at x = 0

(B) continuous and differentiable everywhere

(C) not continuous at x = 0

(D) continuous everywhere but not differentiable at x = 0

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8. If y = log(log x), x > 1, then $\frac{dy}{dx}$ is equal to: **1**

(A) $\frac{1}{x\log x}$ (B) $\frac{1}{\log x}$ (C) $\frac{\log x}{x}$ (D) $\frac{x}{\log x}$

9. The rate of change of the area of a circle with respect to its circumference, when the radius is 3 cm, is: **1**

(A) 3 cm (B) 6 cm (C) 3π cm (D) 1.5 cm

10. The absolute maximum value of $f(x) = 2x^3 - 24x + 107$ on the interval [1, 3] is: **1**

(A) 75 (B) 85 (C) 89 (D) 107

11. Which of the following is a differential equation of order 2? **1**

(A) $(y')^2 + x = y^2$ (B) $y'y'' + y = \sin x$

(C) $y''' + (y'')^2 + y = 0$ (D) $y' = y^2$

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

(A) $\sin\sqrt{x} + C$ (B) $2\sin\sqrt{x} + C$

(C) $\frac{1}{2}\sin\sqrt{x} + C$ (D) $-2\sin\sqrt{x} + C$

13. If $|\vec{a}| = 4$ and $-3 \le \lambda \le 2$, then the range of $|\lambda\vec{a}|$ is: **1**

(A) [0, 8] (B) [−12, 8]

(C) [8, 12] (D) [0, 12]

14. The position vectors of the points A and B are $2\hat{i} - 3\hat{j} + 2\hat{k}$ and $2\hat{i} + 3\hat{j} + \hat{k}$ respectively. The area of the triangle OAB, O being the origin, is: **1**

(A) $\sqrt{229}$ (B) $\frac{\sqrt{229}}{4}$ (C) $\frac{\sqrt{229}}{2}$ (D) 229

15. The direction ratios of the line joining the points (2, 3, 4) and (−1, −2, 1) are: **1**

(A) 1, 1, 5 (B) 3, 5, 3 (C) −3, 5, 3 (D) 1, 1, 3

16. If A and B are independent events with P(A) = 0.35 and P(B) = 0.6, then P(A|B) is: **1**

(A) 0.35 (B) 0.21 (C) 0.6 (D) 0.95

17. A bag contains 5 red and 3 blue balls. Two balls are drawn one after the other with replacement. The probability that one is red and the other is blue is: **1**

(A) $\frac{15}{64}$ (B) $\frac{1}{2}$ (C) $\frac{15}{56}$ (D) $\frac{15}{32}$

18. A random variable X takes the values −1, 0 and 1 with probabilities 0.3, 0.4 and 0.3 respectively. The mean of X is: **1**

(A) 1 (B) 0.3 (C) 0.6 (D) 0

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): $\int \tan x \, dx = \log|\sec x| + C$. **1**

Reason (R): tan x is an odd function.

20. Assertion (A): The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^4 + y = 0$ is 3. **1**

Reason (R): The degree of a differential equation is the highest power of the derivative of the lowest order appearing in it.

SECTION B

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

21. Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{\sin x \cos x}$. **2**

OR

Find $\int x \sec^2 x \, dx$.

22. If $x = \sqrt{a(\sin^{-1} t)}$ and $y = \sqrt{a(\cos^{-1} t)}$, show that $\frac{dy}{dx} = -\frac{y}{x}$. **2**

23. (A) Show that the line through the points (1, −1, 2) and (3, 4, −2) is perpendicular to the line through the points (0, 3, 2) and (3, 5, 6). **2**

OR

(B) Find the magnitude of each of two vectors $\vec{a}$ and $\vec{b}$, having the same magnitude, such that the angle between them is 60° and their scalar product is $\frac{9}{2}$.

24. Let $\vec{a} = \hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{j} + 7\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$, and $\vec{c} \cdot \vec{d} = 15$. **2**

25. Find the maximum value of Z = 3x + 2y subject to the constraints $x + y \le 6$, $x \le 4$, $x \ge 0$, $y \ge 0$. **2**

SECTION C

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

26. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, show that $A^3 - 23A - 40I = O$. **3**

27. Find two positive numbers x and y such that x + y = 60 and xy^3 is maximum. **3**

28. Differentiate $x^x - 2^{\wedge}(\sin x)$ with respect to x. **3**

OR

If $x = a \sin 2t(1 + \cos 2t)$ and $y = b \cos 2t(1 - \cos 2t)$, find $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$.

29. Find the general solution of the differential equation $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$, $x > 1$. **3**

OR

Find the particular solution of the differential equation $e^{\wedge}(dy/dx) = x + 1$, given that y = 3 when x = 0.

30. Find the shortest distance between the lines $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - 3\hat{j} + 2\hat{k})$ and $\vec{r} = (4\hat{i} + 5\hat{j} + 6\hat{k}) + \mu(2\hat{i} + 3\hat{j} + \hat{k})$. **3**

OR

Show that the line through the points A(0, −1, −1) and B(4, 5, 1) intersects the line through the points C(3, 9, 4) and D(−4, 4, 4). Also find the point of intersection.

31. Solve the following linear programming problem graphically: Minimise Z = 6x + 3y subject to $4x + y \ge 80$, $x + 5y \ge 115$, $3x + 2y \le 150$, $x \ge 0$, $y \ge 0$. **3**

SECTION D

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

32. Check whether the relation R in R defined by $R = \{(a, b) : a^2 - 4ab + 3b^2 = 0\}$ is reflexive, symmetric or transitive. **5**

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OR

Let f : R − $\{-\frac{4}{3}\}$ → R be the function defined by f(x) = $\frac{4x}{3x+4}$. Show that f is one-one, and find the range of f.

33. Find $\int \frac{dx}{\sin x + \sin 2x}$. **5**

34. Using integration, find the area of the region $\{(x, y) : x^2 + y^2 \leq 4, x \geq 1\}$. **5**

OR

Using integration, find the area of the region bounded by the curve $x = y^2$, the y-axis and the lines y = 1 and y = 3.

35. The probability that Ravi pays his electricity bill on time is 0.8 and the probability that he pays his water bill on time is 0.7. The two events are independent.

(a) Find the probability that he pays both bills on time. **1**

(b) Find the probability that he pays exactly one of the two bills on time. **2**

(c) Find the probability that he pays at least one of the bills on time. **1**

(d) Given that he pays at least one bill on time, find the probability that he pays both on time. **1**

SECTION E

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

36. In a museum, a laser security beam passes through the points A(1, 1, 2) and B(3, 2, 0). A precious painting hangs with its corner at the point P(5, 2, 2) (units in metres, with respect to a fixed origin).

Based on the above information, answer the following questions:

(i) Write the cartesian equation of the laser beam AB. **1**

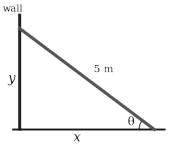
(ii) Write the direction cosines of the beam. **1**

(iii) (a) Find the coordinates of the foot of the perpendicular from P to the beam, and the distance of P from the beam. **2**

OR

(iii) (b) Find the image of the point P in the line of the beam. **2**

37. A ladder 5 m long is leaning against a vertical wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 0.5 m/s. Let x m be the distance of the foot of the ladder from the wall and y m the height of its top above the ground at time t, and θ the angle the ladder makes with the ground.



Based on the above information, answer the following questions:

(i) Write the relation between x and y. **1**

(ii) Express dy/dt in terms of x, y and dx/dt. **1**

(iii) (a) At what rate is the top of the ladder sliding down the wall when the foot is 4 m away from the wall? **2**

OR

(iii) (b) At what rate is the angle θ changing when the foot is 4 m away from the wall? **2**

38. In a class test, Anu's total marks in Mathematics, Physics and Chemistry are 240. Her marks in Mathematics exceed those in Physics by 10, and the sum of her marks in Mathematics and Chemistry is 30 more than twice her marks in Physics. Let her marks in Mathematics, Physics and Chemistry 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 $A = \begin{bmatrix} -1 & -3 & 1 \\ -1 & 0 & 1 \\ -1 & 3 & -2 \end{bmatrix}$, find her marks in each subject. **2**

• • • End of Question Paper • • •

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