Series MC-XII-SP **Q.P. Code MC/SP/10**

SET ~ 1

Roll No. | | | | | | | |

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

MATHEMATICS

Sample Paper 10 • 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 $\tan^{-1}\left(-\frac{1}{\sqrt{3}}\right)$ is: **1**

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

2. The value of $\sec\left(\tan^{-1}\frac{y}{2}\right)$ is: **1**

(A) $\frac{\sqrt{4+y^2}}{2}$ (B) $\frac{\sqrt{4+y^2}}{y}$

(C) $\frac{2}{\sqrt{4+y^2}}$ (D) $\frac{\sqrt{4-y^2}}{2}$

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

(A) $\frac{3\pi}{2}$ (B) $-\frac{\pi}{2}$ (C) $\frac{\pi}{2}$ (D) 0

4. If A and B are square matrices of the same order such that AB = A and BA = B, then B^2 is equal to: **1**

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

5. If each element of a determinant of order 3 is multiplied by 3, then the value of the new determinant is: **1**

(A) 27 times the original (B) 9 times the original

(C) 3 times the original (D) unchanged

6. The total number of diagonal matrices of order 3 × 3 in which each entry is either 0 or 1 is: **1**

(A) 3 (B) 512 (C) 9 (D) 8

7. The value of k for which the function $f(x) = \sin\frac{1}{x}$, $x \neq 0$, and $f(0) = k$ is continuous at x = 0 is: **1**

(A) 0 (B) no such value of k

(C) −1 (D) 1

8. The derivative of x^2 with respect to x^3 is: **1**

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

9. Water is poured into a cylindrical tank of radius 10 m at the rate of 314 m^3/h. The rate at which the water level rises is (take π = 3.14): **1**

(A) 0.1 m/h (B) 3.14 m/h (C) 1 m/h (D) 10 m/h

10. For the function $f(x) = x^3$, the point x = 0 is: **1**

(A) a point of local maximum

(B) a critical point which is neither a local maximum nor a local minimum

(C) a point of local minimum

(D) not a critical point

11. The solution of the differential equation $\frac{dy}{dx} + y = 0$ with y(0) = 5 is: **1**

(A) $y = 5e^{-x}$ (B) $y = 5e^{x}$ (C) $y = e^{-x} + 4$ (D) $y = 5 - x$

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

(A) $x^x \log x + C$ (B) $x \log x + C$ (C) $e^{xx} + C$ (D) $x^x + C$

13. The value of $(\hat{i} \times \hat{j}) \cdot \hat{k} + \hat{i} \cdot \hat{j}$ is: **1**

(A) 0 (B) 1 (C) −1 (D) 2

14. If $|\vec{a} \times \vec{b}| = \sqrt{3}$ and $\vec{a} \cdot \vec{b} = 1$, 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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15. The vector equation of the line passing through the point (2, −1, 3) and having direction ratios 1, 2, −2 is: **1**

(A) $\vec{r} = (2\hat{i} - \hat{j} + 3\hat{k}) + \lambda(\hat{i} + 2\hat{j} - 2\hat{k})$

(B) $\vec{r} = (\hat{i} + 2\hat{j} - 2\hat{k}) + \lambda(2\hat{i} - \hat{j} + 3\hat{k})$

(C) $\vec{r} = 2\hat{i} - \hat{j} + 3\hat{k}$

(D) $\vec{r} = \lambda(3\hat{i} + \hat{j} + \hat{k})$

16. If $P(A) = \frac{2}{5}$, $P(B) = \frac{1}{4}$ and $P(A \cap B) = \frac{1}{10}$, then the events A and B are: **1**

(A) mutually exclusive (B) dependent

(C) exhaustive (D) independent

17. A fair die is rolled. The probability that the number obtained is greater than 4, given that it is odd, is: **1**

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

18. A random variable X has the probability distribution P(X = 0) = 0.1, P(X = 1) = 0.2, P(X = 2) = 0.3, P(X = 3) = 0.4. The mean of X is: **1**

(A) 2 (B) 1.5 (C) 2.5 (D) 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): $\int_0^1 x(1-x)^{99}\,dx = \frac{1}{10100}$. **1**

Reason (R): $\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$.

20. Assertion (A): The general solution of the differential equation $\frac{dy}{dx} = \frac{y}{x}$ (x, y > 0) is y = cx. **1**

Reason (R): The equation $\frac{dy}{dx} = \frac{y}{x}$ can be written as $\frac{dy}{y} = \frac{dx}{x}$, a variables separable form.

SECTION B

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

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

OR

Evaluate $\int_{-1}^{1} e^{(|x|)}\,dx$.

22. Differentiate $\log(x + \sqrt{x^2 + a^2})$ with respect to x. **2**

23. (A) Find the angle between the lines whose direction ratios are 1, 1, 2 and $\sqrt{3} - 1, -\sqrt{3} - 1, 4$. **2**

OR

(B) Find the values of p for which the vectors $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are (i) parallel (ii) perpendicular.

24. Using vectors, show that the points A(1, −2, −8), B(5, 0, −2) and C(11, 3, 7) are collinear, and find the ratio in which B divides AC. **2**

25. Find the minimum value of Z = 5x + 7y subject to the constraints $x + y \geq 6$, $x \leq 4$, $y \leq 5$, $x \geq 0$, $y \geq 0$. **2**

SECTION C

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

26. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 0 & 2 \\ 3 & 1 & 1 \end{bmatrix}$ using the adjoint method. **3**

27. A wire of length 28 m is to be cut into two pieces. One piece is to be made into a square and the other into a circle. What should be the lengths of the two pieces so that the combined area of the square and the circle is minimum? **3**

28. Find $\frac{dy}{dx}$ if $y = (\sin x)^x + \sin^{-1}\sqrt{x}$, $0 < x < 1$. **3**

OR

If $x^m y^n = (x + y)^{m+n}$, prove that $\frac{dy}{dx} = \frac{y}{x}$.

29. Find the general solution of the differential equation $(x + y)\frac{dy}{dx} = 1$. **3**

OR

Find the particular solution of the differential equation $2xy + y^2 - 2x^2\frac{dy}{dx} = 0$, given that y = 2 when x = 1.

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

OR

A line makes angles α, β, γ and δ with the four diagonals of a cube. Prove that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = 4/3$.

31. Solve the following linear programming problem graphically: Maximise Z = 10500x + 9000y subject to $x + y \leq 50$, $2x + y \leq 80$, $x \geq 0$, $y \geq 0$. **3**

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SECTION D

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

32. Let f : X → Y be a function. Define a relation R in X given by R = {(a, b) : f(a) = f(b)}. Examine whether R is an equivalence relation. For f : R → R, f(x) = x^2, write the set of all elements related to 3. **5**

OR

(i) Show that the function f : N → N given by f(x) = 2x is one-one but not onto. (ii) Show that the function g : N → N given by g(1) = 1 and g(n) = n − 1 for n ≥ 2 is onto but not one-one.

33. Evaluate $\int_0^{\pi} x \sin^3 x \, dx$. **5**

34. Using integration, find the area enclosed by the circle $x^2 + y^2 = a^2$. **5**

OR

Using integration, find the area of the region bounded by the curve $y = \sqrt{x}$, the x-axis and the line x = 9.

35. A lot of 10 electric bulbs contains 3 defective bulbs. Two bulbs are drawn at random, one after the other without replacement. Let X denote the number of defective bulbs drawn.

(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 bulbs drawn is defective. **1**

SECTION E

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

36. A hall is in the shape of a cuboid 6 m long, 3 m wide and 2 m high. Taking one corner of the floor as the origin O and the edges through it as the axes, the corners of the hall are O(0, 0, 0), A(6, 0, 0), B(6, 3, 0), C(0, 3, 0), D(0, 0, 2), E(0, 3, 2), F(6, 0, 2) and G(6, 3, 2). A decorative light string is stretched from O to G, and another from A to E.

Based on the above information, answer the following questions:

(i) Find the length of the string OG. **1**

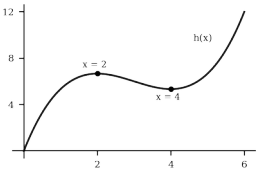
(ii) Write the direction cosines of OG. **1**

(iii) (a) Find the angle between the strings OG and AE. **2**

OR

(iii) (b) Show that the two strings intersect, and find the point of intersection. **2**

37. A section of a roller coaster track is designed so that the height h (in metres) of the track above the ground at a horizontal distance x (in tens of metres) from the start is given by h(x) = (1/3) ($x^3 - 9x^2 + 24x$), 0 ≤ x ≤ 6.



Based on the above information, answer the following questions:

(i) Find h′(x). **1**

(ii) Find the critical points of h in (0, 6). **1**

(iii) (a) Find the heights of the track at the local maximum and the local minimum. **2**

OR

(iii) (b) Find the intervals in which the track is rising and falling. **2**

38. A plant nursery sells rose, marigold and tulip plants. Order I: 2 rose, 3 marigold and 1 tulip plant for ₹200. Order II: 1 rose, 2 marigold and 3 tulip plants for ₹260. Order III: 3 rose, 1 marigold and 2 tulip plants for ₹260. Let the prices of a rose, a marigold and a tulip plant 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 $A = \begin{bmatrix} 1 & -5 & 7 \\ 7 & 1 & -5 \\ -5 & 7 & 1 \end{bmatrix}$, find the price of each plant. **2**

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