Series MC-XII-SP **Q.P. Code MC/SP/07**

SET ~ 1

Roll No. | | | | | | | |

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

MATHEMATICS

Sample Paper 07 • 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 $\tan^{-1}(-1) + \cos^{-1}\left(-\frac{1}{\sqrt{2}}\right)$ is: **1**

(A) $\frac{3\pi}{4}$ (B) π (C) 0 (D) $\frac{\pi}{2}$

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

(A) $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$ (B) $(0, \pi)$

(C) $[0, \pi] - \{\frac{\pi}{2}\}$ (D) $[0, \pi]$

3. For $|x| < 1$, $\sin(\tan^{-1}x)$ is equal to: **1**

(A) $\frac{x}{\sqrt{1-x^2}}$ (B) $\frac{x}{\sqrt{1+x^2}}$

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

4. If $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$, then A^3 is equal to: **1**

(A) 4A (B) 2A (C) A (D) 8A

5. If $x \in N$ and $\begin{vmatrix} x+3 & -2 \\ -3x & 2x \end{vmatrix} = 8$, then the value of x is: **1**

(A) 4 (B) 2 (C) 3 (D) −2

6. The product of a 3 × 1 matrix and a 1 × 3 matrix is a matrix of order: **1**

(A) 3 × 3 (B) 1 × 1 (C) 1 × 3 (D) 3 × 1

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

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

8. If $f(x) = |\cos x|$, then $f'\left(\frac{3\pi}{4}\right)$ is equal to: **1**

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

9. The radius of a circle is increasing at the rate of 3 cm/s. The rate of increase of its area when the radius is 10 cm is: **1**

(A) 60π cm²/s (B) 30π cm²/s (C) 20π cm²/s (D) 100π cm²/s

10. Which of the following functions is decreasing on $\left(0, \frac{\pi}{2}\right)$? **1**

(A) sin 2x (B) cos x

(C) tan x (D) cos 3x

11. The general solution of the differential equation $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$ is: **1**

(A) y = x + C (B) $\sin^{-1}y + \sin^{-1}x = C$

(C) $\cos^{-1}y = \sin^{-1}x + C$ (D) $\sin^{-1}y - \sin^{-1}x = C$

12. The value of $\int_0^1 \frac{\tan^{-1}x}{1+x^2}\,dx$ is: **1**

(A) $\frac{\pi^2}{16}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi^2}{32}$ (D) $\frac{\pi^2}{8}$

13. The scalar components of the vector with initial point (2, 1) and terminal point (−5, 7) are: **1**

(A) 7, −6 (B) −7, 6 (C) −3, 8 (D) 3, 8

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

(A) 3 (B) $6\sqrt{3}$ (C) 6 (D) $3\sqrt{3}$

15. The distance of the point (3, 4, 5) from the x-axis is: **1**

(A) 3 (B) 5 (C) $\sqrt{41}$ (D) $\sqrt{34}$

16. If A and B are events with $P(A) \neq 0$, then $P(B|A) + P(B'|A)$ is equal to: **1**

(A) 1 (B) 0 (C) P(B) (D) P(A)

17. The probability that a leap year selected at random contains 53 Sundays is: **1**

(A) $\frac{2}{7}$ (B) $\frac{1}{7}$ (C) $\frac{3}{7}$ (D) $\frac{53}{366}$

18. A fair die is thrown once. If X denotes the number obtained, the mean of X is: **1**

(A) 3 (B) $\frac{7}{2}$ (C) 4 (D) $\frac{21}{2}$

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

Reason (R): $\log(1 + x^2)$ is defined for every real number x.

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

Reason (R): The order of the differential equation $\frac{d^2y}{dx^2} - y = 0$ is 2.

SECTION B

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

21. Find $\int \frac{(x-3)e^x}{(x-1)^3}\,dx$. **2**

OR

Evaluate $\int_0^{\frac{\pi}{2}} \frac{\cos 2x}{\cos x + \sin x}\,dx$.

22. If $\sin y = x \sin(a + y)$, prove that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$. **2**

23. (A) Find the cartesian equation of the line which passes through the points (3, −2, −5) and (3, −2, 6). **2**

OR

(B) Find the angle between the vectors $\vec{a} = \hat{i} - 2\hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} - 2\hat{j} + \hat{k}$.

24. If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ with $|\vec{a}| = 3$, $|\vec{b}| = 5$ and $|\vec{c}| = 7$, find the angle between $\vec{a}$ and $\vec{b}$. **2**

25. Find the corner points of the feasible region determined by x + 2y ≥ 10, 3x + 4y ≤ 24, x ≥ 0, y ≥ 0, and hence find the minimum value of Z = 200x + 500y. **2**

SECTION C

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

26. Find the matrix X such that $X\begin{bmatrix}1 & 2 & 3\\ 4 & 5 & 6\end{bmatrix} = \begin{bmatrix}-7 & -8 & -9\\ 2 & 4 & 6\end{bmatrix}$. **3**

27. Find the absolute maximum and absolute minimum values of f(x) = 12x^(4/3) − 6x^(1/3), x ∈ [−1, 1]. **3**

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

OR

If x = e^(cos 2t) and y = e^(sin 2t), prove that $\frac{dy}{dx} = -\frac{y \log x}{x \log y}$.

29. Find the particular solution of the differential equation $\frac{dy}{dx} - 3y \cot x = \sin 2x$, given that y = 2 when $x = \frac{\pi}{2}$. **3**

OR

Find the general solution of the differential equation $(x^2 + xy)\,dy = (x^2 + y^2)\,dx$.

30. Find the shortest distance between the lines $\vec{r} = (1 - t)\hat{i} + (t - 2)\hat{j} + (3 - 2t)\hat{k}$ and $\vec{r} = (s + 1)\hat{i} + (2s - 1)\hat{j} - (2s + 1)\hat{k}$. **3**

OR

Find the value of k so that the line through the points (4, 1, 2) and (5, k, 0) is perpendicular to the line through the points (2, 1, 1) and (3, 3, −1).

31. Solve the following linear programming problem graphically: Maximise Z = −x + 2y subject to x ≥ 3, x + y ≥ 5, x + 2y ≥ 6, y ≥ 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 Z of integers given by R = {(a, b) : 2 divides a − b} is an equivalence relation. Also write the equivalence class [0]. **5**

OR

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Let f : N → N be defined by f(n) = $\frac{n+1}{2}$ if n is odd and f(n) = $\frac{n}{2}$ if n is even, for all n ∈ N. State whether f is bijective. Justify your answer.

33. Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin x + \cos x}\, dx$. **5**

34. Using integration, find the area of the region in the first quadrant bounded by the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$, the x-axis and the lines x = 0 and x = 3. **5**

OR

Using integration, find the area of the region bounded by the curve y = sin x and the x-axis, between x = 0 and x = 2π.

35. A laboratory blood test is 99% effective in detecting a certain disease when it is in fact present. However, the test also yields a false positive result for 0.5% of the healthy persons tested. It is known that 0.1% of the population actually has the disease. A person is tested at random.

(a) Find the probability that the test result is positive. **2**

(b) If the test result is positive, find the probability that the person actually has the disease. **2**

(c) If the test result is positive, find the probability that the person does not have the disease. **1**

SECTION E

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

36. A paraglider flies in a straight line along the path L : (x + 1)/2 = (y − 3)/(−1) = (z − 2)/2, with respect to a fixed origin (units in hundreds of metres). The top of a signal tower is at the point T(5, 3, 5).

Based on the above information, answer the following questions:

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

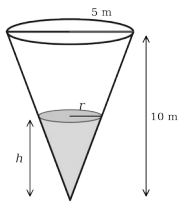
(ii) Check whether the paraglider passes through the point (7, 0, 10). **1**

(iii) (a) Find the coordinates of the point on the path nearest to the top of the tower, and the shortest distance of the path from T. **2**

OR

(iii) (b) Find the angles which the path makes with the y-axis and the z-axis. **2**

37. Water is being poured into an inverted conical tank of base radius 5 m and height 10 m at the rate of 8π m³ per hour. When the depth of water in the tank is h m, the radius of the water surface is r m.



Based on the above information, answer the following questions:

(i) Show that the volume of water in the tank is $V = \pi h^3/12$. **1**

(ii) Find dV/dh. **1**

(iii) (a) Find the rate at which the water level is rising when the depth of water is 4 m. **2**

OR

(iii) (b) Find the rate at which the radius of the water surface is increasing when the depth of water is 4 m. **2**

38. In a school canteen, Ravi buys 3 sandwiches, 2 juices and 1 cake for ₹170; Meena buys 1 sandwich, 2 juices and 3 cakes for ₹190; and Kabir buys 2 sandwiches, 1 juice and 2 cakes for ₹160. Let the prices of a sandwich, a juice and a cake 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 $A = \begin{bmatrix} 1 & -3 & 4 \\ 4 & 4 & -8 \\ -3 & 1 & 4 \end{bmatrix}$, find the price of each item. **2**

• • • End of Question Paper • • •

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