SUBJECT: MATHEMATICS (041)
SAMPLE QUESTION PAPER
CLASS- XII (2026 - 27)

Maximum Marks:80 | **Time Allowed: 3 Hours**

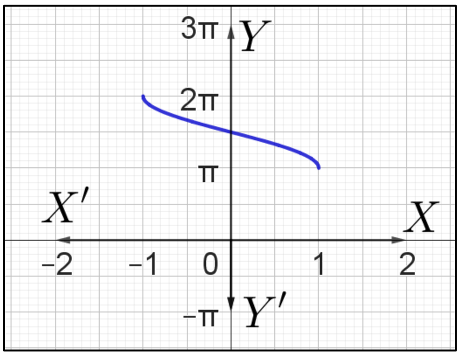
General Instructions:

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 38 questions. All questions are compulsory.
2. This question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Question no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Question no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Question no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Question no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Question no. 36 to 38 are case study-based questions carrying 4 marks each.
8. 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 sub-part each in 2 questions of Section E.
9. Draw neat and clean figures wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated.
10. Use of calculators is not allowed.

SECTION – A **(20 x 1 = 20)**

This section comprises of 18 multiple choice questions and two assertion and reason type questions of 1 mark each.

Q.No.	Questions	Marks
Q1.	Identify the function whose graph is given below:  (A) $\cos^{-1}\left(\frac{x}{2}\right)$ (B) $\cos^{-1}(2x)$ (C) $\pi - \cos^{-1} x$ (D) $\pi + \cos^{-1} x$	**1**

*There is no change in the Question Paper Design and Assessment Pattern for Academic Session 2026-27

	For Visually Impaired: Find the range of $\frac{\pi}{2} + \sec^{-1}\left(\frac{x}{2}\right)$ (A) $[0, \pi]$ (B) $[0, \pi] - \left\{\frac{\pi}{2}\right\}$ (C) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$ (D) $\left[\frac{\pi}{2}, \frac{3\pi}{2}\right] - \{\pi\}$	
Q2.	Domain of the function: $\sec^{-1}(2x)$ is (A) $(-\infty, \infty)$ (B) $\left(-\frac{1}{2}, \frac{1}{2}\right)$ (C) $\left(-\infty, -\frac{1}{2}\right) \cup \left(\frac{1}{2}, \infty\right)$ (D) $\left(-\infty, -\frac{1}{2}\right] \cup \left[\frac{1}{2}, \infty\right)$	**1**
Q3.	Value of $\cot^{-1}\left(2\cos\left(\frac{1}{2}\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)\right)$ (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$	**1**
Q4.	If $A = \begin{bmatrix} 2 & 1 & -2 \\ 3a & 0 & 4 \\ b & 2c & 1 \end{bmatrix}$ is a symmetric matrix, then value of $\sqrt{6a + 2b + 3c}$ is: (A) -2 (B) 2 (C) ± 2 (D) 4	**1**
Q5.	If P and Q are matrices of same order such that $P = \begin{bmatrix} 2 & 1 \\ 0 & 1 \end{bmatrix}$, $\|Q\| = 3$, then find $\|adj(PQ)\|$ (A) -3 (B) 1 (C) 6 (D) 36	**1**
Q6.	If $[1 \quad x]\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}\begin{bmatrix} 4 \\ -1 \end{bmatrix} = O$, then value of x is (A) -2 (B) -1 (C) 1 (D) 2	**1**
Q7.	The derivative of $\cos^{-1}(2x^2 - 1)$ with respect to $\cos^{-1}(x)$ is (A) 2 (B) ± 1 (C) $\frac{1}{2}$ (D) -2	**1**
Q8.	If a, b, c are arbitrary constants such that the function defined by $f(x) = \begin{cases} ax^2 + b\,,\ b \neq 0\ ,\ x \leq 1 \\ bx^2 + ax + c\,, x > 1 \end{cases}$ is differentiable at $x = 1$, then which of the following could be a triplet for (a, b, c)? (A) (3,2,0) (B) (0,0,3) (C) $\left(\frac{3}{2}, 2, 0\right)$ (D) $\left(3, \frac{3}{2}, 0\right)$	**1**
Q9.	If $y = a\left\{x + 2a\ \sin\left(\frac{x}{a}\right)\right\}, a > 0, x \in [0, \pi a]$; is a decreasing function, then the interval in which x lies is (A) $\left(\frac{5\pi}{6}, \pi\right]$ (B) $\left(\frac{2\pi}{3}, \pi\right]$ (C) $\left(\frac{5\pi a}{6}, \pi a\right]$ (D) $\left(\frac{2\pi a}{3}, \pi a\right]$	**1**

*There is no change in the Question Paper Design and Assessment Pattern for Academic Session 2026-27

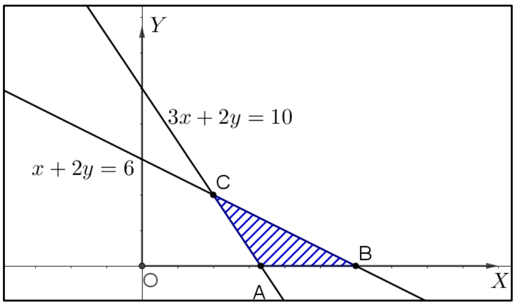
Q10.	The values of x for which the derivative of the function $y = x^4$ is greater than the value of the function are (A) $0 < x < 4$ (B) $0 < x \leq 4$ (C) $x < 0$ or $x > 4$ (D) $x < 0$ or $x \geq 4$	**1**
Q11.	The degree and order of the differential equation $y - x\left(\frac{dy}{dx}\right)^3 = a\left(y + \frac{d^2y}{dx^2}\right)^2$ are respectively (A) $3, 1$ (B) $2, 2$ (C) $3, 2$ (D) $4, 2$	**1**
Q12.	If $\int \frac{1}{1+e^{2x}} dx = x - P \log(1 + e^{2x}) + C$, then '$P$' is equal to (A) $-\frac{1}{2}$ (B) $-\frac{1}{3}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$	**1**
Q13.	If vector $2\hat{i} - u\hat{j} + 3\hat{k}$ has magnitude 4, then value of 'u' is (A) 1 (B) $\sqrt{2}$ (C) $\pm\sqrt{3}$ (D) ± 2	**1**
Q14.	Angle made by the vector $\hat{i} + \hat{j} + \sqrt{2}\,\hat{k}$ with positive direction of z-axis is (A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{\pi}{2}$	**1**
Q15.	A vector perpendicular to the vectors $\hat{i} + \hat{j}$ and $\hat{i} - \hat{j}$ is (A) $-2\,\hat{j}$ (B) $3\hat{k}$ (C) $2\hat{i}$ (D) $2\hat{i} + \hat{k}$	**1**
Q16.	The probability that it rains on a particular day is $\frac{1}{5}$. Assuming weather conditions of any two days are independent, find the probability that it rains on three consecutive days. (A) $\frac{4}{5}$ (B) $\frac{1}{5}$ (C) $\frac{1}{25}$ (D) $\frac{1}{125}$	**1**
Q17.	A die is thrown twice. What is the probability that at least one number is 4, given the sum of the numbers appearing is a multiple of 5? (A) $\frac{3}{5}$ (B) $\frac{4}{5}$ (C) $\frac{3}{7}$ (D) $\frac{4}{7}$	**1**
Q18.	A and B are two independent events such that $P(A) = \frac{1}{6}, P(B) = k$. If the probability of occurrence of exactly one of them is $\frac{1}{3}$, then find the value of k. (A) $\frac{1}{4}$ (B) $\frac{2}{3}$ (C) $\frac{3}{4}$ (D) $\frac{5}{6}$	**1**

*There is no change in the Question Paper Design and Assessment Pattern for Academic Session 2026-27

	Assertion-Reason Based Questions **Directions: Question numbers 19 and 20 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R).** **Select the correct answer from the options (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 Assertion (A). (B) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A). (C) Assertion (A) is true but Reason (R) is false. (D) Assertion (A) is false but Reason (R) is true.	
Q19.	Assertion: The value of the integral $\int_{-1}^{1}\lvert x-2\rvert\,dx$ is 4 Reason: If $f(-x) = f(x)$ then $\int_{-a}^{a} f(x)dx = 2\int_{0}^{a} f(x)dx$	**1**
Q20.	Assertion: The general solution of a differential equation represents a family of curves. Reason: The derivative of an arbitrary constant is zero.	**1**
	SECTION – B (5 x 2 = 10) **This section comprises of 5 very short answer (VSA) type questions of 2 marks each**	
Q21 (A).	Evaluate $\int \frac{1}{x\sqrt{x^6-1}}dx$	**2**
	OR	
Q21 (B).	Evaluate $\int \frac{\cos x-\sin x}{\sqrt{\sin(2x)}}\,dx$	
Q22.	If $y=\sin(x+y)$ and $\frac{dy}{dx}=0$, then prove that $y=\pm 1$.	**2**
Q23 (A).	A line passing through the points $(2,6,5), and\ (3,p,7)$ is parallel to the line joining the points $(-4,3,4)$ and $(-1,0,q)$. Find the value of $\frac{q}{p}$.	**2**
	OR	
Q23 (B).	A rectangle ABCD is such that $\overrightarrow{AC}=\vec{u}, and\ \overrightarrow{BD}=\vec{v}$, then find the vectors representing four sides of the rectangle (in a cyclic order starting from $\overrightarrow{AB}$).	
Q24.	For two non-zero vectors $\vec{a}$ and $\vec{b}$, $\lvert\vec{a}\rvert=\sqrt{6}$, $\vec{a}\cdot\vec{b}=1$ and $\vec{b}\times\vec{a}=3\hat{\imath}+4\hat{\jmath}-2\hat{k}$. Find $\lvert\vec{b}\rvert$.	**2**

*There is no change in the Question Paper Design and Assessment Pattern for Academic Session 2026-27

Q25. The feasible region of a linear programming problem is shown in the given figure: **2**



Write all the constraints on the decision variables involved

For Visually Impaired:

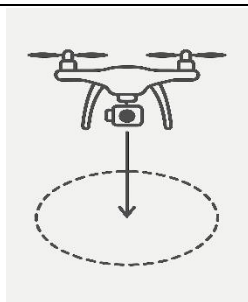
For a linear programming problem, the maximum value of an objective function $Z = 3x + 4y$ exists at the points (p, q) and $\left(2p, \frac{q}{2}\right)$. Find the relation between p and q.

SECTION – C (6 x 3 = 18)

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

Q26. For two matrices, $P = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 2 \end{bmatrix}$ and $Q = \begin{bmatrix} 1 & 0 \\ 0 & 2 \\ 1 & 0 \end{bmatrix}$, find PQ and QP, whichever is defined. Also, find the inverse of the product matrix, if it exists. **3**

Q27. The circular area of vision on the ground by a surveillance drone fitted with camera increases at the rate of $44\, m^2$ per metre as it gains vertical height. The radius of the circle on the ground increases at the rate of 6 m/s. Find the rate at which the height of the drone increases with time, at the instant when the radius of the circular area on the ground is 14 m. $\left(Use\ \pi = \frac{22}{7}\right)$ **3**



Q28 (A). If $x = sin^3 t\,, y = cos^3 t\,, Evaluate\ \frac{d^2y}{dx^2}\ at\ \left(\frac{1}{2\sqrt{2}}, \frac{1}{2\sqrt{2}}\right)$. **3**

OR

Q28 (B). If $y = x^{logx} + (logx)^x$; $x > 1$, then evaluate $\frac{dy}{dx}$

Q29 (A). Find the particular solution of the differential equation **3**

$xdy + (y - x^2 e^x)dx = 0$, given that y (1) =0

OR

Q29 (B). Find the particular solution of the differential equation $(x^2 + y^2)dy = xydx$, given that $y(0) = 1$

*There is no change in the Question Paper Design and Assessment Pattern for Academic Session 2026-27

Q30 (A).	Find the foot of the perpendicular drawn from the point (2,1,4) on the line $x-2=\frac{2y+3}{4}=2-z$. Also find the equation of the line passing through this point and the point (2,1,4).	**3**
	OR	
Q30 (B).	Find the angle between the lines: $\frac{x-1}{2}=\frac{y-1}{2}=\frac{z-2}{1}$ and $\frac{x-5}{2}=y-\frac{1}{2}=\frac{3-z}{2}$. Also find the cartesian equation of a line passing through the point (1,1,1) and perpendicular to both lines.	
Q31.	Solve the linear programming problem graphically: Maximize $Z=40x+30y$ Subject to constraints: $x+y\leq 6, 2x\geq y, y\geq 2$ **For Visually Impaired:** For a linear programming problem, vertices of the feasible region are $(20,0),(40,0),(30,10),(0,20)$ and $(0,10)$. Minimize and maximize the objective function $Z=50x-20y$	**3**
	SECTION – D (4 x 5 = 20) **This section comprises of 4 long answer (LA) type questions of 5 marks each**.	
Q32 (A).	Let $A=N\times N$, where N is the set of natural numbers and a relation R is defined on A such that $(a,b)R(c,d)\ if\ and\ only\ if\ a^2+d^2=b^2+c^2$. Check whether R is an equivalence relation or not?	**5**
	OR	
Q32 (B).	A relation $R:(-\infty,\infty)\to[0,\infty)$ is defined as $R=\{(x,y): y=x^2+5\}$ Draw its graph and check whether it is a function or not. If the given relation is a function, then examine whether the function is injective, and whether it is surjective or not. **For Visually Impaired:** A relation $R:(-\infty,\infty)\to[0,\infty)$ is defined as $R=\{(x,y): y=x^2+7\}$. Check whether it is a function or not. If the given relation is a function, then examine whether the function is injective, surjective, or both, and conclude whether it is bijective or not.	
Q33.	Evaluate $\int_{-a}^{a}\sqrt{\frac{a-x}{a+x}}\,dx$	**5**
Q34 (A).	Using Integration, find the area of the region $\{(x,y): 0\leq y\leq\sqrt{4-x^2}, x\geq 2-y\}$.	**5**
	OR	
Q34 (B).	Using Integration, find the area of the region bounded by the curve $y^2=2x$ and the line $x-2y=0$.	

*There is no change in the Question Paper Design and Assessment Pattern for Academic Session 2026-27

	For Visually Impaired:	
Q34 (A).	Using Integration, find the area of the region enclosed within $25x^2 + 16y^2 = 400$	
	OR	**5**
Q34 (B).	Using Integration find the area of the region in the first quadrant bounded by the curve $y^2 = 8x,$ and the lines $x = 2, x = 5$ and x-axis.	
Q35.	A fitness app syncs with four types of smartwatches: Alpha, Beta, Gamma and Delta. 45% of the users use Alpha, 30% use Beta,15% use Gamma and 10% use Delta. Due to device errors, the probabilities of getting a false heart-rate alert from the Alpha, Beta, Gamma and Delta smartwatches are respectively 0.01, 0.02, 0.05, and 0.01. Based on the given information, answer the following questions: (i) Find the probability that a randomly selected user gets a false alert. (ii) If a false alert occurs, what is the probability that it came from a Beta smartwatch?	**5**

SECTION – E (3 x 4 = 12)

This section comprises of 3 case-study/passage-based questions of 4 marks each with sub parts. The first two case study questions have three sub parts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two sub parts of 2 marks each.

Q36.	Two security sensors in a multi-storey mall emit laser beams for movement detection. Three of these beams travel along the following lines: $l_1: \vec{r} = (\lambda + 1)\hat{\imath} + (3\lambda + 2)\hat{\jmath} + (3 - \lambda)\hat{k}$ and $l_2: \vec{r} = 2(\mu + 1)\hat{\imath} + (3\mu - 1)\hat{\jmath} + (\mu + 1)\,\hat{k}$ $l_3: \vec{r} = (\gamma + 3)\hat{\imath} + (3\gamma - 1)\hat{\jmath} + (1 - \gamma)\,\hat{k}$  Based on the given information, answer the following questions:	
	(i) Show that the lines l_1 and l_2 are not parallel to each other.	**1**
	(ii) Show that the lines l_1 and l_3 are parallel to each other.	**1**
	(iii) (a) Find the shortest distance between the lines l_1 and l_2. **OR** (b) Find the shortest distance between the lines l_1 and l_3.	**2**

Q37. Water is essential for life, and rivers are vital water sources across the world. The Yamuna Action Plan (YAP), one of India's largest river restoration projects, was launched to clean the Yamuna, but its effectiveness (WQI) the Water Quality Index must be measured through cost-benefit, economic and environmental analysis. Therefore, comprehensive pollutant treatment, prevention of further contamination, and community awareness are crucial for sustainable river management.

Implementing the same concept to the river Yamuna, if an initial base line WQI is 35, a quadratic expression is formed to measure the impact of investment of ₹x crore on the WQI i.e., $W(x)$ as

$W(x) = 35 + 1.6x - 0.02x^2$, where x is in Rupees in crores

Use the given $W(x)$ to answer the following questions:

(i) Find the value of x at the stationary point for the function $W(x)$. **1**

(ii) Find the maximum value of the WQI using the second derivative test? **1**

(iii) (a) If the investment is ₹ 35 crores, find by how much the WQI is short of its maximum achievable value. **2**

Or

(b) Evaluate the WQI when the investment is ₹60 crore. Determine whether this indicates an enhancement or a diminishing return in our objective when compared with the optimum WQI.

Q38. To celebrate their child's birthday, a family decided to distribute fruits among children in three orphanages. The fruit vendor packed three different types of baskets, according to the quantity required at each orphanage, details are given as follows:

Basket A contains 5 kg Apples, 10 kg Oranges and 5 kg Pomegranate

Basket B contains 10 kg Apples, 10 kg Oranges and 5kg Pomegranate

Basket C contains 8 kg Apples, 15 kg Oranges and 7kg Pomegranate

Cost of basket A, B and C are respectively ₹2750, ₹3500, and ₹4100.

Based on the given information, answer the following questions:

(i) Write the matrix form of the equations involved in this situation and find the adjoint of the coefficient matrix involved. **2**

(ii) Using inverse of the matrix, calculate the price of each fruit per kg. **2**

*There is no change in the Question Paper Design and Assessment Pattern for Academic Session 2026-27