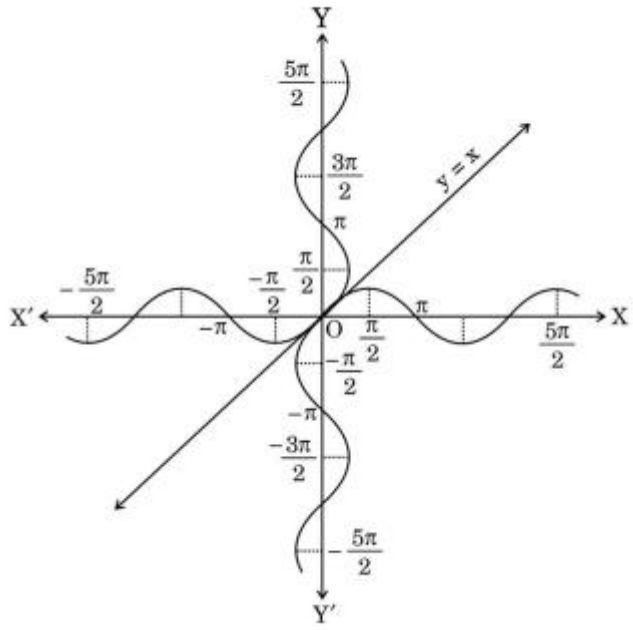
KENDRIYA VIDYALAYA SANGHATHAN LUCKNOW REGION
XII - MATHEMATICS (041)
PRE BOARD-1 (2025-26)

Maximum Marks: 80 Time: 3 hours

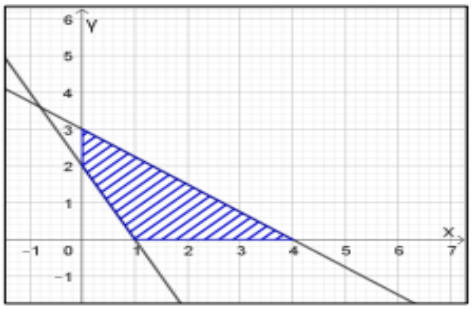
General Instructions:

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, Questions no. 1 to 18 are multiple choice questions (MCQs) with only one correct option and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Questions 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 subpart each in 2 questions of Section E.
9. Use of calculator is not allowed.

SECTION-A (Q.NO. 1-20)		
Q.NO.	**QUESTIONS**	**MARK**
1	The following graph is a combination of :  (A) $y = \sin^{-1} x$ and $y = \cos^{-1} x$ (B) $y = \cos^{-1} x$ and $y = \cos x$ (C) $y = \sin^{-1} x$ and $y = \sin x$ (D) $y = \cos^{-1} x$ and $y = \sin x$	1

2	If for three matrices $A = [a_{ij}]_{m\times4}$, $B = [b_{ij}]_{n\times3}$ and $C = [c_{ij}]_{p\times q}$ products AB and AC both are defined and are square matrices of same order, then value of m, n, p and q are: (A) $m = q = 3$ and $n = p = 4$ (B) $m = 2, q = 3$ and $n = p = 4$ (C) $m = q = 4$ and $n = p = 3$ (D) $m = 4, p = 2$ and $n = q = 3$	1
3	If $\begin{bmatrix} 4+x & x-1 \\ -2 & 3 \end{bmatrix}$ is a singular matrix, then the value of x is : (A) 0 (B) 1 (C) -2 (D) -4	1
4	If A and B are square matrices of order m such that $A^2 - B^2 = (A - B)(A + B)$, then which of the following is always correct ? (A) A = B (B) AB = BA (C) A = 0 or B = 0 (D) A = I or B = I	1
5	The inverse of the matrix $\begin{bmatrix} 3 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is... (A) $\begin{bmatrix} 0 & 0 & 3 \\ 0 & 2 & 0 \\ 5 & 0 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} \frac{1}{3} & 0 & 0 \\ 0 & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ (C) $\begin{bmatrix} -\frac{1}{3} & 0 & 0 \\ 0 & -\frac{1}{2} & 0 \\ 0 & 0 & -\frac{1}{5} \end{bmatrix}$ (D) $\begin{bmatrix} -3 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -5 \end{bmatrix}$	1
6	Value of the determinant $\begin{vmatrix} \cos 67^o & \sin 67^o \\ \sin 23^o & \cos 23^o \end{vmatrix}$ is (A) 0 (B) $\frac{1}{2}$ (C) $\frac{\sqrt{3}}{2}$ (D) 1	1
7	If $f(x) = \begin{cases} 3x - 2, & 0 < x \le 1 \\ 2x^2 + ax, & 1 < x < 2 \end{cases}$ is continuous for $x \in (0, 2)$, then a is equal to : (A) -4 (B) $-\frac{7}{2}$ (C) -2 (D) -1	1
8	The slope of the curve $y = -x^3 + 3x^2 + 8x - 20$ is maximum at : (A) $(1, -10)$ (B) $(1, 10)$ (C) $(10, 1)$ (D) $(-10, 1)$	1
9	If $f(x) = x\tan^{-1}x$, then $f'(1)$is equal to (A) $\frac{\pi}{4} - \frac{1}{2}$ (B) $\frac{\pi}{4} + \frac{1}{2}$ (C) $-\frac{\pi}{4} - \frac{1}{2}$ (D) $-\frac{\pi}{4} + \frac{1}{2}$	1
10	The solution of the differential equation $xdx + ydy = 0$ represents a family of (A) straight lines (B) parabolas (C) Circles (D) Ellipses	1
11	$\int_{-1}^{1} \frac{\lvert x \rvert}{x} dx,\ x \neq 0$ is equal to (A) -1 (B) 0 (C) 1 (D) 2	1
12	A person observed the first 4 digits of your 6-digit PIN. What is the probability that the person can guess your PIN? (A) $\frac{1}{81}$ (B) $\frac{1}{100}$ (C) $\frac{1}{90}$ (D) 1	1

13	A bird flies through a distance in a straight line given by the vector $\hat{\imath} + 2\hat{\jmath} + \hat{k}$. A man standing beside a straight metro rail track given by $\vec{r} = (3 + \lambda)\hat{\imath} + (2\lambda - 1)\hat{\jmath} + 3\lambda\hat{k}$ is observing the bird. The projected length of its flight on the metro track is (A) $\frac{6}{\sqrt{14}}$ units (B) $\frac{14}{\sqrt{6}}$ units (C) $\frac{8}{\sqrt{14}}$ units (D) $\frac{5}{\sqrt{6}}$ units	1
14	Position vector of the mid-point of line segment AB is $3\hat{i} + 2\hat{j} - 3\hat{k}$. If position vector of the point A is $2\hat{i} + 3\hat{j} - 4\hat{k}$, then position vector of the point B is (A) $\frac{5\hat{i}}{2} + \frac{5\hat{j}}{2} - \frac{7\hat{k}}{2}$ (B) $4\hat{i} + \hat{j} - 2\hat{k}$ (C) $5\hat{i} + 5\hat{j} - 7\hat{k}$ (D) $\frac{\hat{i}}{2} - \frac{\hat{j}}{2} + \frac{\hat{k}}{2}$	1
15	The line $x = 1 + 5\mu$, $y = -5 + \mu$, $z = -6 - 3\mu$ passes through which of the following point ? (A) $(1, -5, 6)$ (B) $(1, 5, 6)$ (C) $(1, -5, -6)$ (D) $(-1, -5, 6)$	1
16	Let $\vec{a}$ be a position vector whose tip is the point $(2, -3)$. If $\overrightarrow{AB} = \vec{a}$, where coordinates of A are $(-4, 5)$, then the coordinates of B are : (A) $(-2, -2)$ (B) $(2, -2)$ (C) $(-2, 2)$ (D) $(2, 2)$	1
17	A student of class XII studying Mathematics comes across an incomplete question in a book. Maximise $Z = 3x + 2y + 1$ Subject to the constraints $x \geq 0, y \geq 0, 3x + 4y \leq 12,$ He/ She notices the below shown graph for the said LPP problem, and finds that a constraint is missing in it: Help him/her choose the required constraint from the graph.  The missing constraint is (A) $x + 2y \leq 2$ (B) $2x + y \geq 2$ (C) $2x + y \leq 2$ (D) $x + 2y \geq 2$	1
18	A linear programming problem deals with the optimization of a/an (A) logarithmic function (B) linear function (C) quadratic function (D) exponential function	1
	(Question numbers 19 and 20 are Assertion-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 (A) and (R) are true and (R) is the correct explanation of (A). (B) Both (A) and (R) are true but (R) is not the correct explanation of (A). (C) (A) is true but (R) is false. (D) (A) is false but (R) is true.	
19	*Assertion (A) :* Range of $[\sin^{-1} x + 2\cos^{-1} x]$ is $[0, \pi]$. *Reason (R) :* Principal value branch of $\sin^{-1} x$ has range $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.	1

20	*Assertion (A) :* A line through the points (4, 7, 8) and (2, 3, 4) is parallel to a line through the points (– 1, – 2, 1) and (1, 2, 5). *Reason (R):* Lines $\vec{r} = \vec{a_1} + \lambda\vec{b_1}$ and $\vec{r} = \vec{a_2} + \mu\vec{b_2}$ are parallel if $\vec{b_1} \cdot \vec{b_2} = 0$.	1
	SECTION-B (Q.NO. 21-25)	
21	Evaluate $\tan\left(\tan^{-1}(-1) + \frac{\pi}{3}\right)$ **OR** Find the domain of $\cos^{-1}(3x - 2)$	2
22	If $y = x^{\frac{1}{x}}$, then find $\frac{dy}{dx}$ at x = 1.	2
23	Evaluate : $\int_0^{\frac{\pi}{4}} \sqrt{1+\sin 2x}\ dx$ **OR** Sketch the region bounded by the lines $2x + y = 8$, $y = 2$, $y = 4$ and the y-axis. Hence, obtain its area using integration.	2
24	If $f(x + y) = f(x)f(y)$ for all $x, y \in R$ and $f(5) = 2$, $f'(0) = 3$, then using the definition of derivatives, find $f'(5)$.	2
25	If the angle between the lines $\frac{x-5}{\alpha} = \frac{y+2}{-5} = \frac{z+\frac{24}{5}}{\beta}$ and $\frac{x}{1} = \frac{y}{0} = \frac{z}{1}$ is $\frac{\pi}{4}$, find the relation between α and β.	2
	SECTION-C (Q.NO. 26-31)	
26	The side of an equilateral triangle is increasing at the rate of 3 cm/s. At what rate its area increasing when the side of the triangle is 15 cm ?	3
27	If $x^y = e^{x-y}$ prove that $\frac{dy}{dx} = \frac{\log x}{(\log(xe))^2}$ and hence find its value at $x = e$. **OR** If $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ find $\frac{d^2y}{dx^2}$.	3
28	**Find the area of the following region using integration** $\{(x, y) : y^2 \leq 2x \text{ and } y \geq x - 4\}$ **OR** Sketch the graph $y = \lvert x + 1\rvert$. Evaluate $\int_{-4}^{2} \lvert x + 1\rvert dx$. What does the value of this integral represent on the graph?	3
29	Verify that lines given by $\vec{r} = (1 - \lambda)\hat{i} + (\lambda - 2)\hat{j} + (3 - 2\lambda)\hat{k}$ and $\vec{r} = (\mu + 1)\hat{i} + (2\mu - 1)\hat{j} - (2\mu + 1)\hat{k}$ are skew lines. Hence, find shortest distance between the lines. **OR** Find the distance of the point (2, –1,3) from the line $\vec{r} = (2\hat{i} - \hat{j} + 2\hat{k}) + \mu(3\hat{i} + 6\hat{j} + 2\hat{k})$ measured parallel to the z-axis.	3
30	Solve graphically: Maximise $Z = 2x + y$ subject to $x + y \leq 1200$ $x + y \geq 600$ $y \leq \frac{x}{2}$ $x \geq 0, y \geq 0$.	3

31	For the vacancy advertised in the newspaper, 3000 candidates submitted their applications. From the data it was revealed that two third of the total applicants were females and other were males. The selection for the job was done through a written test. The performance of the applicants indicates that the probability of a male getting a distinction in written test is 0.4 and that a female getting a distinction is 0.35. Find the probability that the candidate chosen at random will have a distinction in the written test.	3
	SECTION-D (Q.NO. 32-35)	
32	For two matrices $A = \begin{bmatrix} 3 & -6 & -1 \\ 2 & -5 & -1 \\ -2 & 4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 & -1 \\ 0 & -1 & -1 \\ 2 & 0 & 3 \end{bmatrix}$, find the product AB and hence solve the system of equations: $3x - 6y - z = 3$ $2x - 5y - z + 2 = 0$ $-2x + 4y + z = 5$	5
33	Find : $\int \frac{\cos x}{(4+\sin^2 x)(5-4\cos^2 x)}\,dx$ OR Evaluate : $\int_0^{\pi} \frac{dx}{a^2\cos^2 x + b^2\sin^2 x}$	5
34	Solve the differential equation: $y + \frac{d}{dx}(xy) = x(\sin x + x)$ **OR** Find the particular solution of the differential equation: $2y\,e^{x/y}dx + (y - 2x\,e^{x/y})\,dy = 0$ given that $y(0) = 1$	5
35	Find the value of b so that the lines $\frac{x-1}{2} = \frac{y-b}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = z$ are intersecting lines. Also, find the point of intersection of these given lines.	5
	SECTION-E(Case Based) (Q.NO. 36-38)	
36	A city's traffic management department is planning to optimize traffic flow by analyzing the connectivity between various traffic signals. The city has five major spots labelled $A, B, C, D, and\ E$.  The department has collected the following data regarding one-way traffic flow between spots: 1. Traffic flows from A to B, A to C, and A to D. 2. Traffic flows from B to C and B to E. 3. Traffic flows from C to E. 4. Traffic flows from D to E and D to C. The department wants to represent and analyze this data using relations and functions. Use the given data to answer the following questions: I. Is the traffic flow reflexive? Justify. [1] II. Is the traffic flow transitive? Justify. [1] III A. Represent the relation describing the traffic flow as a set of ordered pairs. Also state the domain and range of the relation. **OR** III B. Does the traffic flow represent a function? Justify your answer. [2]	4

37	A carpenter needs to make a wooden cuboidal box, closed from all sides, which has a square base and fixed volume. Since he is short of the paint required to paint the box on completion, he wants the surface area to be minimum. On the basis of the above information, answer the following questions : (i) Taking length = breadth = x m and height = y m, express the surface area (S) of the box in terms of x and its volume (V), which is constant. (ii) Find $\frac{dS}{dx}$. (iii) (a) Find a relation between x and y such that the surface area (S) is minimum. **OR** (iii) (b) If surface area (S) is constant, the volume (V) = $\frac{1}{4}(Sx - 2x^3)$, x being the edge of base. Show that volume (V) is maximum for $x = \sqrt{\frac{S}{6}}$.	1 1 2 2
38	A gardener wanted to plant vegetables in his garden. Hence he bought 10 seeds of brinjal plant, 12 seeds of cabbage plant and 8 seeds of radish plant. The shopkeeper assured him of germination probabilities of brinjal, cabbage and radish to be 25%, 35% and 40% respectively. But before he could plant the seeds, they got mixed up in the bag and he had to sow them randomly.    Radish Cabbage Brinjal Based upon the above information, answer the following questions : (i) Calculate the probability of a randomly chosen seed to germinate. (ii) What is the probability that it is a cabbage seed, given that the chosen seed germinates ?	2 2 2