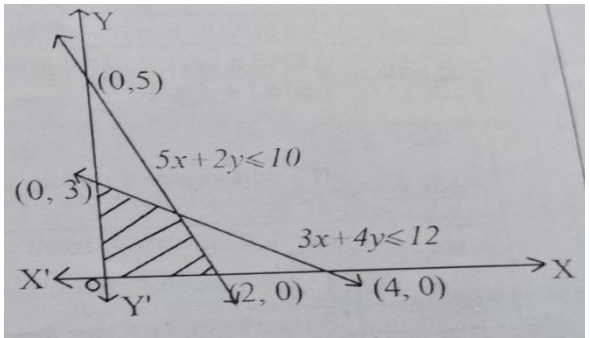


KENDRIYA VIDYALAYA SANGATHAN CHANDIGARH REGION**PRE-BOARD-II 2025-26****Class: XII****Subject: MATHEMATICS (041)****Max Marks: 80****Time Allowed: 3 Hours****General Instructions: Read the following instructions very carefully and strictly follow them:**

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, 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. Section B consists of 5 Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. Section C consists of 6 Short Answer (SA)-type questions, carrying 3 marks each.
6. Section D consists of 4 Long Answer (LA)-type questions, carrying 5 marks each.
7. Section E consists of 3 Case study-based questions, carrying 4 marks each with sub-parts.
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. Use of calculator is not allowed.

Q.N.	<u>SECTION A</u> Each question carries 1 mark	Marks
1	If $A = \begin{bmatrix} \sin \alpha & \cos \alpha \\ -\cos \alpha & \sin \alpha \end{bmatrix}$ then the value of the product AA^T is a) null matrix b) I c) A^2 d) A	1
2	The set of points where the function given by $f(x) = x - 3 \cos x$ is differentiable is a) R b) $R - \{3\}$ c) $(0, \infty)$ d) $(-\infty, 0)$	1
3	The maximum number of equivalence relations on the set $A = \{1, 2, 3\}$ are a) 1 b) 2 c) 3 d) 5	1
4	If $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, then A^{2023} is equal to a) $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 0 & 2023 \\ 0 & 0 \end{bmatrix}$ c) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ d) $\begin{bmatrix} 2023 & 0 \\ 0 & 2023 \end{bmatrix}$	1
5	The principal value of $\sin^{-1}(\cos \frac{43\pi}{5})$ is a) $\frac{-7\pi}{5}$ b) $\frac{-\pi}{10}$ c) $\frac{\pi}{10}$ d) $\frac{3\pi}{5}$	1
6	The area of triangle with vertices $(-1, 2)$, $(4, 0)$ and $(3, 9)$ is a) $\frac{43}{2}$ sq units b) $\frac{43}{4}$ sq units c) 21 sq units d) 42 sq units	1
7	If A is a square matrix of order 3 and $ A = 5$ then $ \text{adj } A $ is equal to a) 5 b) 9 c) 25 d) 125	1
8	A function $f(x) = 10 - x - 2x^2$ is increasing on the interval	1

	a) $(-\infty, -\frac{1}{4}]$ b) $(-\infty, \frac{1}{4})$ c) $[\frac{-1}{4}, \infty)$ d) $[\frac{-1}{4}, \frac{1}{4}]$	
9	Evaluate $\int_{-\pi}^{\pi} \cos 2x \sin 3x \, dx$ a) π b) 2π c) 0 d) $-\pi$	1
10	If m is the order and n is the degree of given differential equation $(\frac{d^2 y}{dx^2})^3 + (\frac{dy}{dx})^5 + x^4 = 0$, then what is the value of m + n, a) 5 b) 9 c) 4 d) 7	1
11	The integrating factor of differential equation : $\frac{dy}{dx} + y \tan x - \sec x = 0$ is a) $\cos x$ b) $\sec x$ c) $e^{\cos x}$ d) $e^{\sec x}$	1
12	A unit vector along the vector $4\hat{i} - 3\hat{k}$ is a) $\frac{1}{5}(4\hat{i} - 3\hat{k})$ b) $\frac{1}{9}(4\hat{i} - 3\hat{k})$ c) $\frac{1}{6}(4\hat{i} - 3\hat{k})$ d) $\frac{1}{3}(4\hat{i} - 3\hat{k})$	1
13	The angle between the lines $2x = 3y = -z$ and $6x = -y = -4z$ is a) 0 b) 30 c) 45 d) 90	1
14	The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{4-z}{k}$ and $\frac{x-1}{k} = \frac{y-4}{2}$ lines $\frac{z-5}{-2}$ are mutually perpendicular, if the value of k is a) $\frac{-2}{3}$ b) $\frac{2}{3}$ c) -2 d) 2	1
15	The corner points of the feasible region of linear programming are (0,4), (8,0) and (20/4, 4/3). If $Z = 30x + 24y$ is the objective function, then difference between Maximum value of Z and Minimum value of Z is given by a) 144 b) 96 c) 120. d) 136	1
16	If for the given graphical solution the objective function $Z = ax + by$ has value 60 at the point (0,3) and 24 at point (2,0) then (a, b) =  a) (20, 12) b) (20, 24) c) (12, 20) d) (24, 20)	1
17	Out of 8 outstanding students of a school, in which there are 3 boys and 5 girls, a team of 4 students is to be selected for a quiz, then the probability that of 2 boys and 2 girls are selected is a) $\frac{1}{7}$ b) $\frac{2}{7}$ c) $\frac{5}{7}$ d) $\frac{3}{7}$	1
18	The critical point in the interval $[0, 2\pi]$ of the curve $f(x) = e^x \cos x$ is	1

	a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$ c) π d) $\frac{5\pi}{2}$	
	ASSERTION – REASON BASED QUESTIONS In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true and R is the 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): If A is a non singular matrix, then A^{-1} exists. REASON (R) : Determinant of a non singular matrix is zero.	1
20	ASSERTION (A): If vector makes α, β, γ with X, Y, Z axes respectively , then $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + 1 = 0$ REASON (R) : Sum of the square of the direction cosines of a vector is equal to 1.	1
	<u>Section – B</u> This section comprises of very short answer type – questions (VSA) of 2 marks each.	
21	If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = 3\pi$, then evaluate the value of $x-4y^2 + 2z$. OR Evaluate: $\cos^{-1} [\cos (-\pi/3)]$.	2
22	The volume of sphere increasing at the rate of the rate of 3cm^3 per second. Find the rate of increase of its surface area when radius is 4cm.	2
23	Find the derivative $\frac{dy}{dx}$ if $xy = e^{x-y}$ OR Differentiate $y = \sqrt{\log \left\{ \sin \left(\frac{x^3}{3} - 1 \right) \right\}}$ with respect to x.	2
24	Evaluate: $\int \sin 4x \sin 8x \, dx$	2
25	Take two vectors $a = \hat{i} + \hat{j} + \hat{k}$ and $b = 3\hat{i} - \hat{j} + 3\hat{k}$. Find the projection of $\vec{a}$ on $\vec{b}$.	2
	<u>SECTION C</u> (This section comprises of short answer type questions (SA) of 3 marks each)	
26	Evaluate: $\int_0^4 (x-1 + x-2) dx$ OR Evaluate: $\int_{-5}^5 \frac{1}{1+e^{\sin x}} dx$.	3
27	Evaluate: $\int \frac{3x-2}{(x+3)(x+1)} dx$	3
28	Solve the differential equation : $y(1 + e^x) dy = (y+1) e^x dx$.	3

29	Solve the following Linear Programming Problem graphically: Maximize $Z = 5x + 10y$ Subject to constraints : $X + 2y \leq 120$, $x + y \geq 60$, $y \leq x$, $x, y \geq 0$	3
30	Find the shortest distance between the lines whose vector equations are $\vec{r} = (1-t)\hat{i} + (2-t)\hat{j} + (3-2t)\hat{k} \quad \text{and} \quad \vec{r} = (s+1)\hat{i} + (2s-1)\hat{j} - (2s+1)\hat{k}$ OR Find the value of a for which the angle between the lines $r = \hat{i} + \hat{j} + \hat{k} + p(2\hat{i} + \hat{j} + 2\hat{k})$ and $r = (1+q)\hat{i} + (1+aq)\hat{j} + (1+q)\hat{k}$ is $\frac{\pi}{2}$	3
31	A coin is tossed three times . Find the probability distribution of number of heads and evaluate its Expectation. OR Let $P(x)$ is the probability distribution of a random variable X , given by $P(x) = \begin{cases} k & \text{if } x = 0 \\ 2k & \text{if } x = 1 \\ 3k & \text{if } x = 2, \\ P(x) = 0 & \text{otherwise.} \end{cases}$ a) Determine value of k. b) Find $P(X < 2)$, $P(X \geq 2)$.	3
	<u>SECTION D</u> (This section comprises of short answer type questions (SA) of 5 marks each)	
32	Determine the product of $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & -4 \\ 4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$.Using this result to solve the following system of equations : $x - y = 3 \quad , \quad 2x + 3y + 4z = 17 \quad , \quad y + 2z = 7$	5
33	If $x = [\cos t + \log(\sin \frac{t}{2})]$, $y = a(1 + \sin t)$, then find $\frac{dy}{dx}$	5
34	Find the area of the region bounded by ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ OR Using integration find the area of the region bounded by the curve $y = \cos x$ between $x=0$ and $x=2\pi$.	5
35	Find the length of the perpendicular drawn from the point $(2,4,-1)$ to the line $\vec{r} = \hat{i} + \lambda(2\hat{i} + \hat{j} + 2\hat{k})$ OR The two lines $\frac{x-1}{3} = \frac{-y}{1} = \frac{z+1}{0}$ and $\frac{-x}{2} = \frac{y+1}{2} = \frac{z+2}{1}$ intersect at a point whose y-coordinate is 1. Find the co-ordinates of their point of intersection. Also, find the vector equation of a line perpendicular to both the given lines and passing through this point of intersection.	5
	<u>SECTION E</u>	

	(This section comprises of 3 case – study/passage – based questions of 4 marks each with two sub parts. First two case study questions have three sub – parts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study questions have two sub – parts of 2 marks each)	
36	On occasion of National Mathematics Day , Dina was given task of drawing the sketch of Mr. Srinivasan Ramanujam on canvas having total area 24 ft^2 which includes border of 0.5 ft on left and right and a border of 0.75 ft on bottom and top. i) If x is the length of the outer rectangle , then find the length of inner rectangle. ii) Find the area of inner rectangle in terms of x iii) If the area of inner rectangle is maximum , find the value of x. OR Find range of x.	1 1 2
37	There are two antiaircraft guns, named as A and B . The probabilities that the shell fired from them hits an airplane are 0.3 and 0.2 respectively. Both of them fired one shell at an airplane at the same time.  i) What is the probability that the shell fired from exactly one of them hit the plane? ii) If it is known that the shell fired from exactly one of them hit the plane, then what is the probability that it was fired from B?	2 2
38	An organization conducted bike race under 2 different categories boys and girls . In all there were 250 participants .Among all of them finally three from category I and two	

from category II were selected for the final race . Ravi forms two sets B and G with these participants for his college project .



On the basis of above information ,answer the following questions:

- i) Ravi wishes to form all the relations possible from B to G. How many such relations are possible?
- (ii) Write the smallest equivalence relation on G.
- iii) Ravi defines a relation from B to B as $R_1 = \{(b_1, b_2) , (b_2, b_1)\}$.Write minimum ordered pairs to be added in R_1 so that it becomes:
 - (A) reflexive but not symmetric
 - (B) reflexive and symmetric but not transitive.

OR

A function f from B to G be defined by $f: B \rightarrow G$. be defined by

$f = \{(b_1, g_1) , (b_2, g_2), (b_3, g_1)\}$.Check if f is bijective. Justify your answer

1
1
2

***** END OF PAPER *****