SET 2 **Code: KVS(DR)/2025/SU**

KENDRIYA VIDYALAYA SANGATHAN, DELHI REGION

Pre-Board-I Examination-2025-26

Class- XII Subject: Mathematics (041)

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

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

This section comprises of multiple choice questions (MCQs) of 1 mark each. Select the correct option (Question 1 - Question 18)

1.	A relation S in the set of real numbers is defined as $xSy \Rightarrow x - y + \sqrt{3}$ is an irrational number, then relation S is (a) reflexive (b) reflexive and symmetric (c) transitive (d) symmetric and transitive	1

2.	If A is square matrix such that $A^2 = I$, then $(A-I)^3+(A+I)^2-7A$ is equal to (a) -A (b) I-A (c) I+A (d) 3A	1
3.	If $[x - 2\ 5 + y][0\ 1\ 1\ 0] = 0,$ then $x + y =$ (a)0 (b) -2 (c) -1 (d) -3	1
4.	$A^{-1} = [3\ 1\ 2\ 0\ 1\ 2\ 0\ 2\ 1],$ then $\lvert adjA \rvert =$ (a) $\frac{1}{9}.$ (b) $\frac{1}{81}.$ (c) -9 (d) 81	1
5.	If A is a non-singular square matrix of order 3 such that $\lvert A \rvert = 3$, then value of $\lvert 2A^T \rvert$ is (a)3 (b) 6 (c) 12 (d) 24	1
6.	If A is a square matrix of order 3 such that IAI = - 5 , then value of $\lvert - AA' \rvert$ is (a) 125 (b) - 125 (c) 25 (d) – 25	1
7.	The function given below at $x = 4$ is $f(x) = \{2x + 3,\ x \le 4\ x^2 - 5, x > 4$ (a) Continuous but not differentiable (b) Differentiable but not continuous (c) Continuous as well as differentiable (d) Neither continuous nor differentiable	1
8.	If $x = sin^3 t,\ y = cos^3 t$ then $\frac{dy}{dx}$ $(a)\ \tan tan\, t$ (b) $\cot cot\, t$ (c) $-\ \tan tan\, t$ (d) $-\ \cot cot\, t$	1
9.	The interval in which y = $x^{1/x}$ is increasing is (a) $(-\infty, e)$ (b) $(0, \infty)$ (c) $(0, e)$ (d) (e, ∞)	1
10	$\int \frac{3e^x - 5e^{-x}}{4e^x + 5e^{-x}}\, dx = ax + b \log log \left(4e^x + 5e^{-x}\right) + C$ then the value of a – b = ? (a) 2 (b) 3/4 (c) 0 (d) 1	1

11.	$\int \frac{dx}{\sqrt{9x-4x^2}}$ equals (a) $\frac{1}{9}\sin^{-1}\left(\frac{9x-8}{8}\right)+C$ (b) $\frac{1}{2}\sin^{-1}\left(\frac{8x-9}{9}\right)+C$ (c) $\frac{1}{3}\sin^{-1}\left(\frac{9x-8}{8}\right)+C$ (d) $-\frac{1}{2}\sin^{-1}\left(\frac{9x-8}{8}\right)+C$	1
12.	If m is the order and n is the degree of diff. Equation $\left(1+3\frac{dy}{dx}\right)^{\frac{2}{3}} = 4\frac{d^2y}{dx^2}$ .The value of (3m - 2n) is (a) 2 (b) 5/3 (c) 0 (d) 1	1
13.	If x(i+ j + k) is a unit vector then the value of x is (a) $\frac{1}{\sqrt{3}}$ (b) $\frac{1}{-\sqrt{3}}$ (c) $\pm\frac{1}{\sqrt{3}}$ (d) 1	1
14.	The projection of the vector $\vec{a}=2\hat{i}+3\hat{j}+2\hat{k}$ on the vectors $\vec{b}=\hat{i}+2\hat{j}+\hat{k}$ is $(a)\frac{5}{3}\sqrt{6}$ $(b)\ \frac{1}{3}$ $(c)\frac{1}{2}$ $(d)\ \sqrt{6}$	1
15.	If a line makes angles α, β, γ with x-axis, y-axis and z-axis respectively, then $sin^2\alpha + sin^2\beta + sin^2\gamma =$ (a) 1 (b) 2 (c) 0 (d) 3	1
16.	Feasible region (shaded) for a LPP is shown in the fig. Minimum of Z = 4x + 3y occurs at the point	1

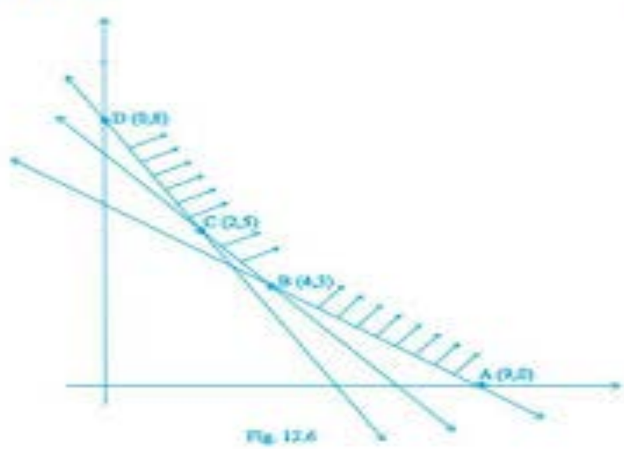

Fig. 12.6

(a) (0, 8)   (b) (2, 5)   (c) (4, 3)   (d) (9, 0)

17. The corner points of the feasible region determined by the following system of linear inequalities: $2x + y \leq 10$, $x + 3y \leq 15$, $x, y \geq 0$ are (0,0), (5,0), (3,4), (0,5). Let $Z = px + qy$, where $p, q > 0$. Condition on p and q so that the maximum of Z occurs at both (3,4) and (0,5) is — 1

p = q   b) p = 2q   c) p = 3q   d) q = 3p

18. Given two independent events A and B such that P(A) =0.3, P(B) = 0.6 and $P(A' \cap B)$ is — 1

(a) 0.42   (b) 0.18   (c) 0.28   (d) 0.12

ASSERTION-REASON BASED QUESTIONS

(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): A function f: N→N, given by f(x) = [x] { where [ ] denotes greatest integral function } is bijective. Reason (R): A function f: A→B is bijective if x_1, $x_2 \in$ X, f(x_1)=f(x_2) $\Rightarrow x_1 = x_2$ and co-domain = Range.	1
20.	Assertion(A): Given two non-zero vectors $\vec{a}$ and $\vec{b}$. If $\vec{r}$ is another non-zero vector such that $\vec{r} \times (\vec{a} + \vec{b}) = \vec{0}$. Then $\vec{r}$ is perpendicular to $\vec{a} + \vec{b}$. Reason (R): The vector ($\vec{a} + \vec{b}$) is perpendicular to the plane of $\vec{a}$ and $\vec{b}$	1
	SECTION – B This section comprises of 5 very short answer (VSA) type questions of 2 marks each.	
21(a) OR	Find domain of $(2x^2)$	2.
21(b)	Find the value of $\tan^{-1}\sqrt{3} - \cot^{-1}(-\sqrt{3})$.	
22.	Find the values of a and b such that the function defined by $f(x) = \{5,\ if\ x \leq 2\ ax + b,\ if\ 2 < x < 10\ 21,\ if\ x \geq 10$ is a continuous function	2
23.	If $e^x + e^y = e^{x+y}$ · prove that $\frac{dy}{dx} = -e^{y-x}$	2
24(a) OR	Find the area bounded by the curve y = cos x between x = 0 and x = 2π.	2
24(b)	Sketch the graph $y = \|x + 1\|$, Evaluate $\int_{-4}^{2} \|x + 1\| dx$	
25.	If $\|\vec{a}\| = 2$, $\|\vec{b}\| = 5$ and angle between them is 60˚ , find $\|\vec{a} - \vec{b}\|$	2
	SECTION C This section comprises of 6 short answer (SA) type questions of 3 marks each	
26(a)		3

OR	If $x\sqrt{1+y}+y\sqrt{1+x}=0$, for , $-1<x<1$, prove that $\frac{dy}{dx}=-\frac{1}{(1+x)^2}$	
26(b)	If $y=\sin(m\sin^{-1}x)$, prove that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}+m^2y=0$	
27(a) OR	Find the area of the region bounded by x^2 = 4y, y = 2, y = 4 and the y-axis in the first quadrant.	3
27(b)	Find the area of the smaller region bounded by the ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$ and the line $\frac{x}{3}+\frac{y}{2}=1$.	
28.	If $\vec{a}\times\vec{b}=\vec{c}\times\vec{d}$ and $\vec{a}\times\vec{c}=\vec{b}\times\vec{d}$, show that $\vec{a}-\vec{d}$ is parallel to $\vec{b}-\vec{c}$, where $\vec{a}\neq\vec{d}$ and $\vec{b}\neq\vec{c}$.	3
29(a) OR	Find the least value of 'a' such that function f given by $f(x)=x^2+ax+1$ is strictly increasing on $(1, 2)$.	3
29(b)	It is given that at $x=1$ function x^4-62x^2+ax+9 attains maximum value on the interval $[0, 2]$. Find the value of a.	
30.	Solve the Linear Programming graphically: Maximize Z= 9x+3y subject to $2x+3y\le 13,\ 3x+y\le 5,\ x,y\ge 0$	3
31(a) OR	A coin is biased so that the head is three times as likely to occur as tail. If the coin is tossed twice then find probability distribution and mean number of tails	3
31(b)	Probability of solving specific problem independently by A and B are $\frac{1}{2}\ and\ \frac{1}{3}$ respectively. If both try to solve the	

	problem independently, find the probability that (i) the problem is solved (ii) exactly one of them solves the problem.	
	SECTION D This section comprises of 4 long answer (LA) type questions of 5 marks each	
32.	Given two matrices A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and B= $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ verify that BA=6I.Use the result to solve the system x - y = 3, 2x + 3y + 4z = 17, y + 2z =7.	5
33(a) OR	Evaluate: $\int \frac{\cos x}{\sqrt{\sin^2 x - 2\sin x - 3}} dx$	5
33(b)	Evaluate: $\int_0^{\Pi} \frac{x \tan x}{\sec x + \tan x} dx$	
34(a) OR	Solve the differential equation $\cos x \frac{dy}{dx} + y = \sin x$	5
34(b)	Solve the differential equation Sec ^{2} y (1+ x ^{2}) dy + 2x tan y dx = 0; y = π/4, x = 1	
35.	Find the image of the point (1, 6, 3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$. Also write the equation of the line joining the given point and its image and find the length of the segment joining the given point and its image.	5
	SECTION- E This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (I), (II), (III) of	

marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each

36. Case Study -1

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. 2

OR

III B. Does the traffic flow represent a function? Justify your answer.

37. Case Study -2

Read the following passage and answer the questions given below:

Some young entrepreneurs started an industry “Young achievers” for casting metal into various shapes. They put up an advertisement online stating the same and expecting order to cast method for toys, sculptures, decorative pieces and more.

A group of friends wanted to make innovative toys and hence contacted the “Young achievers” to order them to cast metal into solid half cylinders with a rectangular base and semi- circular ends.

(i) If r, h and V are radius, length and volume respectively casted half cylinder, then find the total surface area function S of the casted half cylinder in terms of V and r. 1

(ii) For the given volume V, Find the condition for the total surface area S to be minimum. 1

(iii) Use second derivative test to prove that Surface area is minimum for given volume. 2

OR

(iii) Find the ratio h: 2r for S to be minimum.

38. Case Study -3

Mahindra Tractors is India’s leading farm equipment manufacturer. It is the largest tractor selling factory in the world. This factory has two machine A and B . Past record shows that machine A produced 60% and machine B produced 40% of the output(tractors). Further 2% of the tractors produced by machine A and 1% produced by machine B were defective. All the tractors are put into one big store hall and one tractor is chosen at random.

(i) Find the total probability of chosen tractor (at random) is defective. 2

(ii) If in random choosing, chosen tractor is defective ,then find the probability that the chosen tractor is produced by machine ‘A’ 2

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