KENDRIYA VIDYALAYA SANGATHAN , MUMBAI REGION
PREBOARD- I EXAMINATION (2025-2026)
SUB. – MATHEMATICS (041)
CLASS – XII

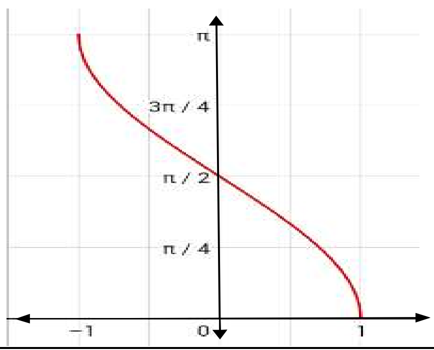
TIME: 3Hrs. **MM – 80**

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		
Q. N.	**QUESTIONS**	**MARKS**
1	If A = [a_{ij}] is a symmetric matrix of order n, then (a) $a_{ij} = 1/a_{ij}$ for all i,j (b) $a_{ij} \neq 0$ for all i,j (c) $a_{ij} = a_{ji}$ for all i,j (d) $a_{ij} = 0$ for all i, j	1
2	If A is a square matrix of order 3, $\lvert A \rvert = 4$, then $\lvert AA' \rvert =$ (a) 9 (b) -9 (c) -12 (d) 16	1
3	The value of $\hat{i}.(\hat{j}\times\hat{k})+\hat{j}\cdot(\hat{i}\times\hat{k})+\hat{k}\cdot(\hat{i}\times\hat{j})$ is (a) 0 (b) -1 (c) 1 (d) 3	1
4	For what value of a, $f(x) = a(x + \sin x)$ is an increasing function (a) $a \leq 0$ (b) $a\epsilon(0, \infty)$ (c) $a\epsilon[0, \infty)$ (d) $a\epsilon R$	1

5	If f ' (x) = sec x, the f(x) is (a) sec x tan x (b) sec x + tan x (c) log (sec x + tan x) (d) log (sec x - tan x)	1
6	If the order and degree of the differential equation $\left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx} - \sin^2 y = 0$ **are** m **and** n **respectively , then the value of** $(m^2 + n)$ **is:** a) 1 (b) -1 (c) 3 (d) 5	1
7	The graph drawn below depicts (a) y=$sin^{-1}x$ (b) y=$cos^{-1}x$ (c) y=$cosec^{-1}x$ (d) y=$cot^{-1}x$ 	1
8	The value of $\int_0^1 x\sqrt{1-x}\,dx$ is (a) -4/15 (b) 4/15 (c) -3/15 (d) 2/15	1
9	The function $f(x) = \begin{cases} \frac{sin^2 3x}{x^2}, x \neq 0 \\ \frac{k}{2} \quad , x = 0 \end{cases}$ is continuous at $x = 0$,then k is equals to (a) 3 (b) 6 (c) 12 (d) 18	1
10	If A , B are non - singular square matrices of the same order, then $(A^{-1}B^{-1})^{-1}$ is (a) BA (b) AB (c) AB^{-1} (d) $A^{-1}B$	1
11	If A = $\begin{vmatrix} \mathbf{1} & \mathbf{2} \\ \mathbf{4} & \mathbf{2} \end{vmatrix}$, then find the value of k if $\|\mathbf{2A}\|$ = k$\|\mathbf{A}\|$. (a) 1 (b) 2 (c) -4 (d) 4	1
12	If A is a square matrix of order 3 and $\|adj.A\|$ = 25, then $\|A\|$ = (a) 5 (b) -5 (c) 0 (d) a and b both	1
13	The maximum value of $\boldsymbol{z = 3x + 4y}$ subject to constraints $\boldsymbol{x + y \leq 1}$ and $\boldsymbol{x, y \geq 0}$ is a) 7 b) 3 c) 4 d) 10	1
14	The point which lies in the half plane 2x + 3y -6 ≤ 0 is: (a) (1, 2) (b) (2, 1) (c) (2, 3) (d) (-3, 2)	1
15	The general solution of the differential equation $\frac{dy}{dx} = e^x + 1$ is: (a) y = $e^x + c$ (b) y = xe^x + c (c) y = x + $e^x + c$ (d) None of these	1

16	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
17	If $y^2 = ax^2 + b$ then $\frac{d^2y}{dx^2}$ is (a) $\frac{ab}{x^3}$ (b) $\frac{x^3}{ab}$ (c) $\frac{ab}{y^2}$ (d) $\frac{ab}{y^3}$	1
18	Differentiate $\log\left\{\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)\right\}$ w.r.t. x. (a) 1/ tan x (b) $sec^2x/tan\ tan\ x$ (c) sec x (d) sec x tan x	1
	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 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):** If $X = \{0,1,2\}$ and the function $f: X \to Y$ defined by $f(x) = x^2 - 2$ is surjective then $Y = \{-2, -1, 2\}$ **Reason (R) :** *If $f: X \to Y$ is surjective then $f(x) = y$.*	1
20	**Assertion (A):** The direction cosines of the vector $2\,\hat{\imath} + 3\hat{\jmath} - 5\hat{k}$ are $< \frac{2}{\sqrt{38}}, \frac{3}{\sqrt{38}}, -\frac{5}{\sqrt{38}} >$. **Reason (R)** : If < a, b, c> are direction ratios then direction cosines are $< \frac{a}{D}, \frac{b}{D}, \frac{c}{D} >$, where D = $\sqrt{a^2 + b^2 + c^2}$.	1
	SECTION – B	
21	Find the value of $cos^{-1}(-cos\ \frac{\pi}{7})$. **OR** Find the domain of $cos^{-1}(3x - 2)$.	2
22	Find the rate of change of the surface area of a sphere with respect to its radius 'r' when r = 6 cm.	2
23	For what value of 'a' the vectors: $-2\,\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and $a\hat{\imath} + 6\hat{\jmath} - 8\hat{k}$ are collinear? **OR** Find the vector equation of the line which passes through the point (1, 2, -5) and is parallel to the vector $3\,\hat{\imath} + 3\hat{\jmath} - 5\hat{k}$.	2
24	If y = xsiny, prove that $x\frac{dy}{dx} = \frac{y}{1 - x\cos y}$	2
25	Find 'k' when $(2\,\hat{\imath} + 6\hat{\jmath} + 14\hat{k}) \times (\hat{\imath} + k\hat{\jmath} + 7\hat{k}) = \vec{0}$	2
	SECTION – C	
26	Evaluate: $\int \frac{2x}{(x^2+3)(x^2+2)}\,dx$ (OR) Evaluate $\int \frac{dx}{\sqrt{3-2x-x^2}}$	3

27	Bag I contains 3 red and 4 black ball and Bag II contains 4 red and 5 black balls. One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II. The ball so drawn is found to be red in colour. Find the probability that the transferred ball is black .	3
28	Let $\vec{a}=\hat{\imath}+4\hat{\jmath}+2\hat{k}$, $\vec{b}=3\hat{\imath}-2\hat{\jmath}+7\hat{k}$and $\vec{c}=2\hat{\imath}-\hat{\jmath}+4\hat{k}$ .Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ *and* $\vec{b}$,and $\vec{c}.\vec{d}=15$. **OR** If $\vec{a},\vec{b}$ and $\vec{c}$ are three unit vectors such that $\vec{a}+\vec{b}+\vec{c}=\vec{0}$, then find $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$.	3
29	Solve the differential equation: $\frac{dy}{dx}-3y\cot x=\sin 2x$, given that $y=2$ when $x=\frac{\pi}{2}$ **OR** Solve the differential equation: $xdy-ydx=\sqrt{x^2+y^2}dx$	3
30	Solve the following Linear Programming Problem graphically: Maximize Z = 5x + 2y subject to the constraints: $x - 2y \leq 2$, $3x + 2y \leq 12$, $-3x + 2y \leq 3$, $x \geq 0$, $y \geq 0$.	3
31	Evaluate $\int_0^{2\pi}\frac{1}{1+e^{\sin x}}dx$	3
SECTION – D		
32	Using integration, find the area of the region in the first quadrant enclosed by the line x + y = 2, the parabola $y^2 = x$ and the x-axis.	5
33	Find ' a ' and ' b ', if the function given by $f(x)=\begin{cases}ax^2+b\,, & if\ x<1\\ 2x+1\,, & if\ x\geq 1\end{cases}$ is differentiable at x=1 **OR** Differentiate w.r.t. x : $(\sin x)^x+(\cos x)^{\sin x}$	5
34	Two bikers are running at the speed more than allowed on the road along the lines $\vec{r}=(\hat{\imath}+\hat{\jmath}-\hat{k})+\lambda(3\hat{\imath}-\hat{\jmath})$ and $\vec{r}=(4\hat{\imath}-\hat{k})+\mu(2\hat{\imath}+3\hat{k})$.Find the Shortest distance between them at any moment. Also check whether they meet to an accident or not. **OR** Find the image of the point (1, 6, 3) in the line $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$	5

35	Solve the following system of equations by matrix method. $3x - 2y + 3z = 8$ $2x + y - z = 1$ $4x - 3y + 2z = 4$	5
	SECTION – E	
36	**Case-Study 1**: Read the following passage and answer the questions given below : A telephone company in Gurgaon has 500 subscribers on its list and collect fixed charge of Rs.300 per subscriber. The company proposes to increase the annual subscription and it is believed that every increase of Rs. 1, One subscriber will discontinue the service. Based on the above information answer the following : (i) If the annual subscription is increased by Rs. x per subscriber then find the total revenue are of the company .(R) (ii) Find dR/dx (iii) Find the maximum annual revenue of the company **(OR)** Find R'' at x = 50	1 1 2
37	**Case-Study 2**: Read the following passage and answer the questions given below 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 **1** and two from Category **2** were selected for the final race. Ravi forms two sets ***B*** and ***G*** with these participants for his college project. Let ***B*** $=\{b_1,b_2,b_3\}$, ***G*** $=\{g_1,g_2\}$ where ***B*** represents the set of boys selected and ***G*** the set of girls who were selected for the final race. Ravi decides to explore these sets for various types of relations and functions. On the basis of the 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)** Ravi wants to find the numbers of injective functions from B to G. How many number of injective functions are possible. **(iii)** Let R: B→ G be defined by R=$\{(b_1,g_1),(b_2,g_2),(b_3,g_1)\}$.Check whether R is injective / surjective / bijective ? **OR** If the track of the final race (for the biker b_1) follows the curve $x^2 = 4y$; (where $0 \le x \le 20\sqrt{2}$ & $0 \le y \le 200$), then state whether the track represents a one-one and onto function or not.(Justify).	1 1 2

38	**Case-Study 3**: Read the following passage and answer the questions given below : An insurance company believes that people can be divided into two classes: those who are accident prone and those who are not. The company's statistics show that an accident-prone person will have an accident at sometime within a fixed one-year period with probability 0.6, whereas this probability is 0.2 for a person who is not accident prone. The company knows that 20 percent of the population is accident prone. Based on the above information answer the following: (i) What is the probability that a new policyholder will have an accident within a year of purchasing a policy? (ii) Suppose that a new policyholder has an accident within a year of purchasing a policy. What is the probability that he or she is accident prone?	 2 2