KENDRIYA VIDYALAYA SANGATHAN,ERNAKULAM REGION

Pre-Board-I Examination, Class-XII-2026-27

Ernakulam region

Class: XII **Max. Marks: 80**

Sub.: Mathematics **Duration: 03 Hours**

GENERAL INSTRUCTIONS:

(i) This question paper contains five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.

(ii) Section A has 18 MCQ`s and 02 Assertion-Reason based questions of 1 mark each.

(iii) Section B has 5 Very Short Answer (VSA) type questions of 2 marks each.

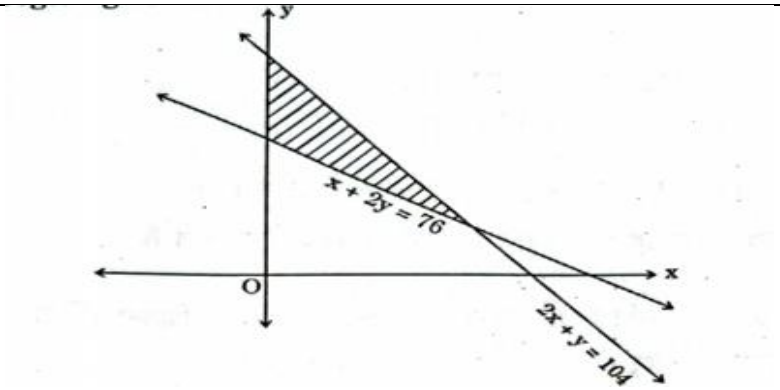
(iv) Section C has 6 Short Answer (SA) type questions of 3 marks each.

(v) Section D has 4 Long Answer (LA) type questions of 5 marks each.

(vi) Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

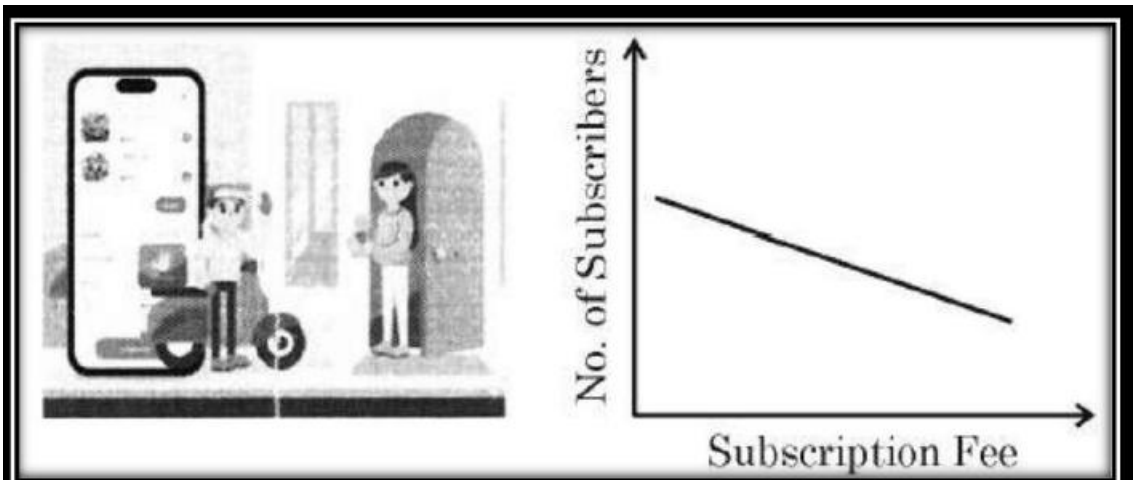
	SECTION A
	Directions (Q. Nos. 1 to 20): Multiple Choice Questions). Each question carries 1 mark.
1	If $A.(adjA) = \begin{bmatrix} -3 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -3 \end{bmatrix}$, then the value of $\lvert A\rvert + \lvert adjA\rvert$ is equal to (a) 9 (b) 12 (c) 6 (d) 27
2	Let A be a skew-symmetric matrix of order 3. If $\lvert A\rvert = x$, then $(2026)^x$ is equal to (a) 2026 (b) $(2026)^2$ (c) $\frac{1}{2026}$ (d) 1
3	If $f(x) = \begin{cases} mx+1 & if x \le \frac{\pi}{2} \\ \sin x + n & if x > \frac{\pi}{2} \end{cases}$ is continuous at $x = \frac{\pi}{2}$, then (a) $m = 1, n = 0$ (b) $m = \frac{n\pi}{2} + 1$ (c) $n = \frac{m\pi}{2}$ (d) $m = n = \frac{\pi}{2}$
4	The number of arbitrary constants in the particular solution of a differential equation of third order is (a) 0 (b) 2 (c) 1 (d) 3
5	If $\left(2\hat{i} + 6\hat{j} + 14\hat{k}\right) \times \left(\hat{i} - \lambda\hat{j} + 7\hat{k}\right) = \vec{0}$, then the value of λ is (a) 3 (b) 12 (c) – 3 (d) – 12

6	If A = $\begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$, $0 \leq x \leq \frac{\pi}{2}$ and $A + A^T = \sqrt{3}I$, then value of x is (a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{2}$ (d) 0
7	If $\vec{a}$ and $\vec{b}$ are unit vectors inclined to X-axis at angles 30^0 and 120^0 respectively, then $\left\|\vec{a} + \vec{b}\right\|$ equals (a) 2 (b) $\sqrt{\frac{2}{3}}$ (c) $\sqrt{3}$ (d) $\sqrt{2}$
8	If $\vec{a}$ and $\vec{b}$ are two non-zero vectors such that the projection of $\vec{a}$ on $\vec{b}$ is 0. The angle between $\vec{a}$ and $\vec{b}$ is (a) 0 (b) $\frac{\pi}{2}$ (c) π (d) $\frac{\pi}{4}$
9	$\int \frac{e^x(1-\sin x)}{1-\cos x} dx$ equals (a) $-e^x \tan\frac{x}{2} + C$ (b) $-e^x \cot\frac{x}{2} + C$ (c) $e^x \cot\frac{x}{2} + C$ (d) $-2e^x \cot\frac{x}{2} + C$
10	Corner points of the feasible region determined by the system of linear constraints are (0,3), (1,1) and (3 , 0). Let $Z = px + qy$, where $p, q > 0$. Condition on p and q so that the minimum of Z occurs at (3, 0) and (1, 1) is (a) $p = \frac{q}{2}$ (b) $p = 2q$ (c) $p = 3q$ (d) $p = q$
11	If $\begin{bmatrix} x & 2 \\ 3 & x-1 \end{bmatrix}$ is a singular matrix, then the product of all possible values of x is (a) 6 (b) – 6 (c) 5 (d) 0
12	If $\begin{bmatrix} 2x+y & 4x \\ 5x-7 & 4x \end{bmatrix} = \begin{bmatrix} 7 & 7y-13 \\ y & x+6 \end{bmatrix}$, then the value of $x + y$is (a) 5 (b) 4 (c) 6 (d) 9
13	A cylindrical tank of radius 10 cm is being filled with sugar at the rate of 100 π cm^3/s. The rate, at which the height of the sugar inside the tank is increasing, is (a) 0.1 cm/s (b) 0.5 cm/s (c) 1.1 cm/s (d) 1 cm/s
14	$\int_0^{\pi/2} \frac{\sqrt[3]{\sin x}}{\sqrt[3]{\sin x}+\sqrt[3]{\cos x}} dx = a\frac{\pi}{2}$, then the value of a is (a) 1 (b) $\frac{1}{2}$ (c) 2 (d) 4
15	Of the following, which group of constraints represents the feasible region given below?

	 (a) $x+2y\leq 76, 2x+y\geq 104, x, y\geq 0$ (b) $x+2y\leq 76, 2x+y\leq 104, x, y\geq 0$ (c) $x+2y\geq 76, 2x+y\leq 104, x, y\geq 0$ (d) $x+2y\geq 76, 2x+y\geq 104, x, y\geq 0$
16	Principal value of $tan^{-1}\sqrt{3}-sec^{-1}(-2)$ is (a) π (b) $\frac{\pi}{3}$ (c) $\frac{-\pi}{3}$ (d) $\frac{2\pi}{3}$
17	In set of all real numbers R a relation S defined as S={(a,b)∈R×R:$\lvert a-b\rvert\leq 2$} then S is (a) Reflexive, Symmetric Not Transitive (b) Equivalence (c) Only Reflexive (d) Only Symmetric
18	At x=0 the function f(x)=x$\lvert x\rvert$ is (a) not differentiable (b) continuous but not differentiable (c) not continuous and not differentiable (d) differentiable and continuous
	Directions (Q. Nos. 19 to 20): In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct option: **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.**
19	Assertion (A) : The line through the points A (4 , 7 , 8) and B (2, 3, 4) is parallel to the line through the points P(– 1 , – 2 , 1) and Q(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 $\vec{b_1}.\vec{b_2}=0$
20	Assertion (A) : The range of the function $f(x)=2\,sin^{-1}x+\frac{3\pi}{2}$, where $x\in[-1,1] is \left[\frac{\pi}{2},\frac{5\pi}{2}\right]$ Reason(R): The range of the principal value branch of $sin^{-1}x\,is\left[\frac{-\pi}{2},\frac{\pi}{2}\right]$
	SECTION – B

	Directions (Q.Nos.21 to 25): This section comprises of Very short answer type questions (VSA) of 2 marks each.
21	If $sin\, y = x\, cos(\, a + y)$, then show that $\frac{dy}{dx} = \frac{cos^2(a+y)}{cos\, a}$
22	Find: $\int \frac{dx}{\sqrt{12+4x-x^2}}$ OR Find: $\int \frac{sin\, x - x\, cos\, x}{x(x+sin\, x)} dx$
23	Find a unit vector perpendicular to each of the vectors $\vec{a}\ and\ \vec{b}$ where $\vec{a} = 5\hat{i} + 6\hat{j} - 2\hat{k}$ and $\vec{b} = 7\hat{i} + 6\hat{j} + 2\hat{k}$.
24	If $y = \sqrt{tan\sqrt{x}}$, prove that $\sqrt{x}\frac{dy}{dx} = \frac{1+y^4}{4y}$
25	Find the value of $sin^{-1}\left(cos\left(\frac{43\pi}{5}\right)\right)$ **OR** Find the value of $tan^{-1}(1) + cos^{-1}\left(\frac{-1}{2}\right) + sin^{-1}\left(\frac{-1}{\sqrt{2}}\right)$
	SECTION – C **Directions (Q.Nos.26 to 31): This section comprises of short answer type questions (SA) of 3 marks each.**
26	Find a point P on the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$ such that its distance from the point Q (2 , 4 , – 1) is 7 units.
27	Show that the area of the parallelogram with diagonals $\vec{a}$ and $\vec{b}$ is $\frac{1}{2}\left\vert \vec{a} \times \vec{b}\right\vert$also find the area of the parallelogram with diagonals $\vec{a} = 2\hat{\imath}\text{-}\hat{\jmath}\text{+}\hat{k}$ and $\vec{b} = \hat{\imath} + 3\hat{\jmath} - \hat{k}$ Or If $\vec{a}, \vec{b}$ and $\vec{c}$ are three mutually perpendicular vectors of equal magnitudes prove that $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}$ and $\vec{c}$
28	Solve the following linear programming problem graphically: Minimize $Z = 5x + 10y$ Subject to the constraints: $x + 2y \leq 120$ $x + y \geq 60$ $x - 2y \geq 0$ $x, y \geq 0$
29	Let A=$\begin{bmatrix} 1 \\ 4 \\ -2 \end{bmatrix}$and C=$\begin{bmatrix} 3 & 4 & 2 \\ 12 & 16 & 8 \\ -6 & -8 & -4 \end{bmatrix}$ be two matrices. then, find the matrix B if AB=C
30	If $y = tan\, x + sec\, x$, then prove that $\frac{d^2y}{dx^2} = \frac{cos\, x}{(1-sin\, x)^2}$

	OR If $x^{16} y^9 = (x^2 + y)^{17}$, prove that $\frac{dy}{dx} = \frac{2y}{x}$.
31	Find the intervals in which the function $f(x) = x^4 - \frac{x^3}{3}$ is (a) strictly increasing (b) strictly decreasing.
	SECTION – Dx=4 **Directions (Q.Nos.32 to 35): This section comprises of Long answer type questions (LA) of 5 marks each.**
32	Sketch the graph of $y = \|x + 3\|$ and find the area of the region enclosed by the curve , x-axis, between x= -6 and x=0, using integration. **OR** If the area between the curves $x = y^2 and\ x = 4$ is divided into two equal parts by the line $x = a$, then find the value of $'a'$ using integration.
33	Find: $\int_0^{\pi/2} \frac{x \sin x \cos x}{\sin^4 x + \cos^4 x} dx$ **OR** Find: $\int_0^{3/2} \|x \cos \pi x\| dx$
34	Show that f: R → R defined as f(x)= $\frac{x}{\sqrt{1+x^2}}$ is one−one but not onto.
35	Find the particular solution of the differential equation $\left[x \sin^2\left(\frac{y}{x}\right) - y\right] dx + x dy = 0$, given that $y = \frac{\pi}{4}$ when $x = 1$. **OR** If $\cos x \frac{dy}{dx} - y \sin x = 6x, 0 < x < \frac{\pi}{2} and y\left(\frac{\pi}{3}\right) = 0$, find the value of $y\left(\frac{\pi}{6}\right)$.
	SECTION – E **This section comprises of 3 case-study/passage-based questions of 4 marks each with sub-parts.**
36	**Case-Study 1:** A carpenter needs to design a wooden box in the shape of a cuboid such that the sum of its length and breadth is 3 cm more than its height. Twice of its length, thrice of its breadth and its height add up to 10 cm. Its breadth added to 7 times its height is 1 cm less than 3 times its length. On the basis of the above information, answer the following questions: (i) Write the equations representing the various dimensions & express them as the matrix equation AX=B. (ii) Find if A^{-1}exists. Justify your answer.

	(iii) (a) Find A^{-1}. OR (iii) (b) Find A^2+7I.
37	**Case Study 2:**  An online delivery company in a city has 5000 subscriber and annual subscription fees of ₹ 300 per subscriber for deliveries. The company wishes to increase the annual subscription fee. It is predicted that, for every increase of ₹ 1, ten subscribers will discontinue. Assume that the company increased the annual fee by ₹x. Based on the given information, answer the following questions: (i) How many subscribers will discontinue after an increase of ₹ x in annual fee? (ii) If R(x) denotes the total revenue collected after the increase of ₹x in subscription fee, express R(x) as a function of x. (iii) (a) Find the value of x for which R(x) is maximum. OR (iii) (b) Find the sub-intervals of $(0,5000)$ in which R(x) is increasing and decreasing.
38	**Case Study 3:**  An engineer is designing a new rail network in a city. Initially, two lines, Line A and Line B, each consisting of multiple stations are designed. The track for Line A is represented by $l_1: \frac{x-2}{3} = \frac{y+1}{-2} = \frac{z-3}{4}$, while the track for Line B is represented by $l_2: \frac{x-1}{2} = \frac{y-3}{1} = \frac{z+2}{-3}$ Based on the above information, answer the following questions: (i) Find whether the two tracks are parallel. (ii) To connect the stations, a pedestrian pathway perpendicular to the two metro lines is to be constructed which passes through point (3, 2, 1). Determine the equation of the pedestrian walkway.

END OF PAPER