KENDRIYA VIDYALAYA SANGATHAN, BHUBANESWAR REGION

PRE- BOARD EXAMINATION- 2024

CLASS-XII

SUBJECT- MATHEMATICS (041)

TIME- 3:00 Hrs M.M. 80

General Instructions:

1. This 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) 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 (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 Sections D, Questions no. 32 to 35 are Long Answer (LA)- type questions, carrying 5 marks each.
7. In Section E, Question 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.

Q.NO.	**Section-A (MCQs)**	
1	What is the domain of $cos^{-1}(2x-3)$? a) $[-1,1]$ b) $(1,2)$ c) $(-1,1)$ d) $[1,2]$.	1
2	If $f(\alpha)=\begin{pmatrix} cos\alpha & sin\alpha \\ -sin\alpha & cos\alpha \end{pmatrix}$ then $f(\alpha)f(\beta)=$ a) $f(\alpha)$ b)$f(\alpha\beta)$ c) $f(\alpha+\beta)$ d)$f(\alpha-\beta)$	1
3	If $A=\begin{pmatrix} 2 & 3 \\ -1 & 2 \end{pmatrix}$ then $A^2-4A+7I$ is a) null matrix b) an identity matrix c) diagonal matrix d) none of these	1
4	If $A=\begin{pmatrix} 0 & 2 \\ 3 & -4 \end{pmatrix}$ and If $kA=\begin{pmatrix} 0 & 3a \\ 2b & 24 \end{pmatrix}$, then the values of k, a and b are a) -6, -12, -8 b) -6,-4, -9 c) -6, 4, 9 d) -6, 12, 18	1
5	If $\lvert A\rvert=\lvert kA\rvert$ and A is a 2×2 matrix then sum of all possible values of k is a) 1 b) -1 c) 2 d) 0	1
6	If A is a skew symmetric matrix of order 3×3 and$\lvert A\rvert=x$ then $(2025)^x=$ a)$\frac{1}{2025}$ b) 2025 c)$(2025)^2$ d) 1	1
7	If $y=e^{-x}$ then $\frac{d^2y}{dx^2}=$ a) $-y$ b) y c) x d)$-x$	1
8	The rate of change of area of a circle with respect to its radius at $r=3cm$ is a)3π b) 4π c) 6π d) 12π	1
9	$\int 3^{x+2}dx=$ a) $3^{x+2}+c$ b) $3^{x+2}log3+c$ c)$\frac{3^{x+2}}{log3}+c$ d) $\frac{3^{x+2}}{2log3}+c$	1
10	$\int_0^{\frac{\pi}{3}} sec^2\left(\frac{\pi}{3}-x\right)dx=$ a) $\frac{1}{\sqrt{3}}$ b) $\sqrt{3}$ c) $-\sqrt{3}$ d) 1	1
11	The area of the curve $y=sinx$ between 0 and π is a) 1 sq. unit b) 2 sq. unit c) 4 sq. unit d) 8 sq. unit	1

12	The solution of differential equation $\frac{dy}{dx}+\frac{2y}{x}=0$ is a) $y=\frac{c}{x^2}$ b) $x=\frac{c}{y^2}$ c) $xy=cx$ $d)y=c$	1
13	The integrating factor of the differential equation $x\frac{dy}{dx}+2y=x^2$ is a) $\frac{1}{x}$ b) x c) x^2 d) $\frac{1}{x^2}$	1
14.	The value of $\left(\hat{i}\times\hat{j}\right).\hat{k}+2.\left(\hat{j}\times\hat{i}\right).\hat{k}$ is a) 1 b) -1 c) 2 d) -2	1
15.	Projection of $2\hat{i}+\hat{j}$ on the vector $\hat{i}-2\hat{j}$ is a) 4 b) 0 c) -4 d) 2	1
16.	The maximum value of $z=3x+4y$ subject to constraints $x+y\leq 1$ and $x,y\geq 0$ is a) 7 b) 3 c) 4 d) 10	1
17.	The optimal value of the objective function is attained at the points a) given by intersection of inequation with y-axis only b) given by intersection of inequation with x-axis only c) given by corner points of the feasible region d) None of these.	1
18.	Two dice are thrown. If it is known that the sum of numbers on the dice was less than 5, the probability of getting a sum 3 is a) $\frac{1}{6}$ b) $\frac{2}{3}$ c) $\frac{1}{3}$ d) $\frac{5}{6}$	1
19.	The following question contains STATEMENT-1 (Assertion) and STATEMENT-2 (Reason) and has the following choice (a), (b), (c) and (d), only one of which is the correct answer. Mark the correct choice. 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. **Assertion(A):** Principal value of $tan^{-1}(-1)=\frac{\pi}{4}$ **Reason**(R): $tan^{-1}:R\to(-\frac{\pi}{2},\frac{\pi}{2})$	1
20.	The following question contains STATEMENT-1 (Assertion) and STATEMENT-2 (Reason) and has the following choice (a), (b), (c) and (d), only one of which is the correct answer. Mark the correct choice. 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. **Assertion(A)** : |sinx| is continuous for all x ∈R **Reason**(R) : sinx and |x| are continuous in R .	1
	Section-B (VSA)	
21.	Find the value of $\sin\left\{2\cot^{-1}\left(-\frac{5}{12}\right)\right\}$	2
22.	Determine the values of the constants k so that the given function is continuous at $x=0$. $f(x)=\begin{cases}\frac{sin3x}{sin5x} & , \ if\ x<0\\ k & , \ if\ x\geq 0\end{cases}$	2
23.	Find $\frac{dy}{dx}$ where $x^6y^5=(x+y)^{11}$. OR Given $e^x+e^y=e^{x+y}$. Show that $\frac{dy}{dx}+e^{y-x}=0$	2
24	If $\vec{a}=8\hat{j}+x\hat{k}$ and $\vec{b}=y\hat{i}-2\hat{j}+\hat{k}$ are mutually perpendicular and $\lvert\vec{a}\rvert=\lvert\vec{b}\rvert$, then find the values of $x$and y	2

	OR If $\vec{a}=3, \vec{b}=5, \vec{c}=7$ and $\vec{a}+\vec{b}+\vec{c}=\vec{0}$ then find the angle between $\vec{a}$ and $\vec{b}$.	
25	Find a unit vector perpendicular to both of the vectors $\vec{p}+\vec{q}$ and $\vec{p}-\vec{q}$ where $\vec{p}=2\hat{i}-\hat{j}+2\hat{k}$, $\vec{q}=3\hat{i}+4\hat{j}+5\hat{k}$.	2
	Section-C (SA)	
26	The area of an expanding rectangle is increasing at the rate of $48cm^2/s$. The length of the rectangle is always equal to square of breadth. At what rate, the length is increasing when breadth is 4.5cm.	3
27.	Find the interval in which the function $f(x)=tan^{-1}(sinx+cosx), x\in(0,\pi)$ is increasing or decreasing.	3
28	. Evaluate $\int(\frac{1}{logx}-\frac{1}{(logx)^2})dx$	3
29.	Find the points on the line $\frac{x+2}{3}=\frac{y+1}{2}=\frac{z-3}{2}$ at a distance of 5 units from $P(1,3,3)$. OR Find the equation of a line passing through $(1,2,-4)$ and perpendicular to the lines $\vec{r}=8\hat{i}+2\hat{j}-5\hat{k}+\lambda(3\hat{i}-16\hat{j}+7\hat{k})$ $\vec{r}=3\hat{i}-\hat{j}+5\hat{k}+\mu(3\hat{i}+8\hat{j}-5\hat{k})$.	3
30.	Solve the following LPP graphically. Maximize $Z=10x+15y$ Subject to constraints: $3x+y\le 12,\quad x+2y\le 10 \ \ and\ x,y\ge 0$	3
31.	Assume that each born child is equally likely to be a boy or a girl. If a family has two children, what is the conditional probability that both are girls given that $i)$The youngest is a girl? $ii)$At least one is a girl? OR Two defective bulbs are mixed with 8 good ones. Find the probability distribution of number of defective bulbs if two bulbs are drawn at random. What is the average number of defective bulbs drawn?	3
	Section-D (LA)	
32.	If $A=\begin{bmatrix}2&4&6\\3&-6&9\\10&5&-20\end{bmatrix}$. Find A^{-1} and hence solve the equations $\frac{2}{x}+\frac{3}{y}+\frac{10}{z}=2$, $\frac{4}{x}-\frac{6}{y}+\frac{5}{z}=5$, $\frac{6}{x}+\frac{9}{y}-\frac{20}{z}=-4$	5
33	If $x=sint$ and $y=sinpt$ then prove that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}+p^2y=0$. OR If $x=acos\theta+bsin\theta$ and $y=asin\theta-bcos\theta$ then show that $y^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+y=0$.	5
34.	Using integration, find the area bounded between two curves $x^2 = 4y$ and the line $x = 4y - 2$	5
35. .	Find the foot of the perpendicular from $A(1,2,-3)$ on the line $\frac{x+1}{2}=\frac{y-3}{-2}=\frac{z-0}{-1}$ Also find the image of the point A in the line. OR Find the value of 'a' so that the lines $\frac{x-1}{2}=\frac{y-a}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=\frac{z-0}{1}$ and are intersecting lines. Also, find the point of intersection	5

	Section-E (Case-Based) (4 marks)	
36	Rahul visited the amusement park along with his family. The amusement park had a huge swing, which attracted many children. He found that the swing traced the path of a parabola as given by $y = 3x^2$  Answer the following questions using the above information. (i) If f: R→R be defined by $f(x) = 3x^2$, then check whether f is an injective function or not. (ii) Let f: N→N be defined by $(x) = 3x^2$. Check whether f is a bijective function or not. (iii)Let $f: \{1,2,3,\ldots\} \to \{3,12,27,\ldots\}$ be defined by $f(x) = 3x^2$. Check whether the function f is bijective or not by giving suitable reason. OR Let f: N→R be defined by $f(x) = 3x^2$. Determine the range of the function f. Also find f (3)	 1 1 2 2
37.	The relation between the heights of the plant (y in cm) with respect to exposure to sunlight is governed by the following equation $y = 4x - \frac{1}{2}x^2$, where x is the number of days exposed to  sunlight Answer the following based on above information: (i) Find the rate of growth of the plant with respect to sunlight. (ii) What are the number of days it will take for the plant to grow to the maximum height? (iii) What is the maximum height of the plant? OR What will be the height of the plant after 2 days?	 1 1 2 2
38	In answering a question on a multiple-choice test for class XII, a student either knows the answer or guesses. Let 3/5 be the probability that he knows the answer and 2/5 be the probability that he guesses. Assume that a student who guesses at the answer will be correct with probability 1/3. Let E_1, E_2 and E be the events that the student knows the answer, guesses the answer and answers. Based on the above information, answer the following: (i) What is the value of $P(E_1)$? (ii) Find the value of $P(E\|E_1)$? (iii) Find the value of $\sum_{k=1}^{2} P(E/E_k)P(E_k)$ OR What is the probability that the student knows the answer given that he answered it correctly?	 1 1 2 2

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