INDIAN SCHOOL SOHAR **SET 2**

UNIT TEST- I (2024-25)

MATHEMATICS (CODE -041)

CLASS: XII **MAX. MARKS: 20**

DATE:20/05/2024 **TIME: 40 MINUTES**

General Instructions:

1. This Question paper contains - four sections A, B, C and D. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 4 MCQ's and 1 Assertion-Reason based questions of 1 mark each.
3. Section B has 2 Very Short Answer (VSA)-type questions of 2 mark each.
4. Section C has 2 Short Answer (SA)-type questions of 3 mark each.
5. Section D has 1 Long Answer (LA)-type questions of 5 marks.

	SECTION – A (Multiple Choice Questions) Each question carries 1 mark	
1.	The function $f: R \to R$ defined by $f(x) = 3 + 4\ \sin x$ is (a) many one and onto (b) many one and into (c) one-one and into (d) one one and onto **OR** For real numbers p and q, defined *pRq* if and only $p - q + \sqrt{13}$ is and irrational number. Then the relation R is (a) reflexive (b) transitieve (c) symmetric (d) equivalence	**Marks** 1
2.	The domain of the function defined by $f(x) = \cos^{-1}(2x - 1)$ is (a) [0, -1] (b) [-1, 1] (c) [0, 1] (d) $[0, \pi]$	1
3.	Differential coefficient of $cos^3(x^2)$ (a) 1 (b) 6 (c) -1 (d) -6	1
4.	If for a square matrix A, $A^2 - A + I = O$ then the inverse of A equals to (a) A (b) A + I (c) I – A (d) A $-$ I	1
5.	**Assertion (A):** If A is an invertible square matrix of order 3 and $\lvert A \rvert = 5$, then $\lvert adjA \rvert = 25$. **Reason (R)**: Inverse of invertible symmetic matrix is a symmetric matrix. Select the correct answer from the codes (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 and but R is not the correct explanation of A (c) A is true and R is false. (d) A is false and R is true.	**1**
	SECTION – B [This section comprises of very short answer type questions (VSA) of 2 marks each]	
6.	Show that : $tan\left(\frac{1}{2}\sin^{-1}\frac{5}{6}\right) = \frac{6-\sqrt{11}}{5}$ **OR** Solve for x: $\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$	2

7.	For the following matrices P and Q, $P = \begin{bmatrix} -2 \\ 4 \\ 5 \end{bmatrix}$, $Q = \begin{bmatrix} 1 & 3 & -6 \end{bmatrix}$, check whether the $(PQ)'$ is equal to $Q'P'$ or not ?	2
SECTION – C [This section comprises of short answer type questions (SA) of 3 marks each]		
8.	Consider $f: R - \left\{-\frac{4}{3}\right\} \rightarrow R - \left\{\frac{4}{3}\right\}$ be a function defined as $f(x) = \frac{4x+3}{3x+4}$. Show that *f* is bijetive.	3
9.	Find 'a' and 'b', if the function given by $f(x) = \begin{cases} \frac{1-sin^3x}{3cos^2x}, & if\ x < \frac{\pi}{2} \\ a, & if\ \ x = \frac{\pi}{2} \\ b\left(\frac{1-\sin x}{(\pi-2x)^2}\right), & if\ x > \frac{\pi}{2} \end{cases}$, is continuous at x= $\frac{\pi}{2}$. **OR** Differentiate with respect to x: (i) $\sin(\cos x^2)$ (ii) $2x \sec\left(tan\sqrt{2x} + 2x^2 \sec\left(tan\sqrt{2x}\right) tantan\sqrt{2x}\right). sex^2\sqrt{2x} . \frac{1}{2\sqrt{2x}}$	3 1+2
SECTION – D [This section comprises of long answer type question (LA) of 5 marks]		
10.	Solve the following system of equations by matrix method: $x + 3y + 4z = 8,\ \ 2x + y + 2z = 5,\ \ 5x + y + z = 7$ **OR** Determine the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and use it to solve the system of equations $x - y + z = 4,\quad x - 2y - 2z = 9,\ \ 2x + y + 3z = 1$	5

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INDIAN SCHOOL SOHAR **SET 2**

PERIODIC TEST/ UNIT TESTI (2024-25)

CLASS- XII MATHEMATICS

SCORING KEY

1)	(b) **OR** (a)	1
2)	(a)	1
3)	(d)	1
4)	(c)	1
5)	(a)	1+1
6)	Proper steps **OR** $(1-x) = \sin\left(\frac{\pi}{2} + 2\sin^{-1}x\right) \Rightarrow (1-x) = \cos\left(2\sin^{-1}x\right)$ $\Rightarrow (1-x) = 1 - 2\sin^2\left(\sin^{-1}x\right) \Rightarrow (1-x) = 1 - 2\left(\sin\left(\sin^{-1}x\right)\right)^2$ $\Rightarrow 1 - x = 1 - 2x^2 \Rightarrow 2x^2 - x = 0 \Rightarrow x = 0,\ x = \frac{1}{2} (N.A)$ **ans: x=0**	2
7)	Yes, proper steps	2
8)	Proper steps	3
9)	Since continuous at $x = \frac{\pi}{2}$ $then\ f\left(\frac{\pi}{2}\right) = a,$ $LHL: \lim_{x\to\frac{\pi}{2}^-} \frac{1 - sin^3x}{3cos^2x} \Rightarrow \lim_{x\to\frac{\pi}{2}^-} \frac{(1-sinx)(1+sin^2x+sinx)}{3(1-sinx)(1+sinx)} \Rightarrow \lim_{x\to\frac{\pi}{2}^-} \frac{(1+sin^2x+sinx)}{3(1+sinx)} \Rightarrow \frac{1}{2}$ $RHL: \lim_{x\to\frac{\pi}{2}^+} b\left(\frac{1-\sin x}{(\pi-2x)^2}\right) \Rightarrow \lim_{x\to\frac{\pi}{2}^+} b\left(\frac{1-\sin x}{(\pi-2x)^2}\right)\left(\frac{1+sinx}{1+sinx}\right) \Rightarrow \lim_{x\to\frac{\pi}{2}^+} b\left(\frac{cos^2x}{(\pi-2x)^2(1+sinx)}\right)$ $\Rightarrow$ $\lim_{x\to\frac{\pi}{2}^+} b\frac{sin^2(\frac{\pi}{2}-x)}{4(\frac{\pi}{2}-x)^2(1+sinx)} \Rightarrow \frac{b}{8}\ \because f\left(\frac{\pi}{2}\right) = LHL = RHL\ \therefore\ \boldsymbol{a} = \frac{\mathbf{1}}{\mathbf{2}}\ \&\ \boldsymbol{b} = \mathbf{4}$ **OR** (i) $-2x\sin x^2 \cos(\cos x^2)$ (ii)	3
10)	system of eq. can be written as $A = \begin{bmatrix} 1 & 3 & 4 \\ 2 & 1 & 2 \\ 5 & 1 & 1 \end{bmatrix},\ X = \begin{bmatrix} x \\ y \\ z \end{bmatrix},\ B = \begin{bmatrix} 8 \\ 5 \\ 7 \end{bmatrix}$ $\lvert A \rvert = 1(1-2) - 3(2-10) + 4(2-5) = 11$ $adj\ A = \begin{bmatrix} -1 & 1 & 2 \\ 8 & -19 & 6 \\ -3 & 14 & -5 \end{bmatrix}$, Now $X = A^{-1}B \Rightarrow \frac{1}{11}\begin{bmatrix} -1 & 1 & 2 \\ 8 & -19 & 6 \\ -3 & 14 & -5 \end{bmatrix}\begin{bmatrix} 8 \\ 5 \\ 7 \end{bmatrix} \Rightarrow \frac{1}{11}\begin{bmatrix} -8+5+14 \\ 64-95+42 \\ -24+70\pm35 \end{bmatrix} \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ **Ans: x = y = z = 1** **OR** $let\ A = \begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}, C = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}\ then\ AC = \begin{bmatrix} -4+4+8 & 4-8+4 & -4-8+12 \\ -7+1+6 & 7-2+3 & -7-2+9 \\ 5-3-2 & -5+6-1 & 5+6-3 \end{bmatrix} = 8I$ $\therefore \frac{1}{8}C\ A = I \Rightarrow A^{-1} = \frac{1}{8}C \Rightarrow A^{-1} = \frac{1}{8}\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ Now using equations : A= $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}, X = \begin{bmatrix} x \\ y \\ z \end{bmatrix},\ B = \begin{bmatrix} 4 \\ 9 \\ 1 \end{bmatrix} \therefore X = A^{-1}B \Rightarrow \frac{1}{8}\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}\begin{bmatrix} 4 \\ 9 \\ 1 \end{bmatrix} \Rightarrow$ $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{8}\begin{bmatrix} -16+36+4 \\ -28+9+3 \\ 20-27-1 \end{bmatrix} \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ -2 \\ -1 \end{bmatrix},\quad \therefore \boldsymbol{Ans}:\ \boldsymbol{x = 3, y = -2, z = -1}$	5