विद्या सर्वार्थ साधिका

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PERIODIC TEST -1
Class: XII

Subject : Mathematics (041) M.M: 40
Date : 16 – 07– 2025 Time: 1 Hour 30 min

General Instructions:
1. The question paper consists of 22 questions divided into 3 sections A, B and C.
2. All questions are compulsory.
3. Section A comprises of 10 questions of 1 mark each.
4. Section B comprises of 6 questions of 2 marks each. Internal choice has been provided in two questions.
5. Section C comprises of 6 questions of 3 marks each. Internal choice has been provided in two questions.

SECTION – A

1. Let $A = \{1, 2, 3\}$, a relation R on A is given by $R = \{(1,1),(2,2),(3,3),(1,2),(2,1),(2,3),(3,2)\}$ is ________. (1)
(A) Reflexive and Transitive (B) Reflexive and Symmetric
(C) Symmetric and Transitive (D) Equivalence relation

2. Evaluate: $\sin\left\{\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right\}$. (1)
(A) $\frac{\pi}{2}$ (B) $\frac{1}{2}$ (C) 1 (D) -1

3. If $|A| = 3$ and $A^{-1} = \begin{bmatrix} 3 & -1 \\ -\frac{5}{3} & \frac{2}{3} \end{bmatrix}$, then $adj\ A =$ ______. (1)
(A) $\begin{bmatrix} 9 & 3 \\ -5 & -2 \end{bmatrix}$ (B) $\begin{bmatrix} 9 & -3 \\ -5 & 2 \end{bmatrix}$ (C) $\begin{bmatrix} -9 & 3 \\ 5 & -2 \end{bmatrix}$ (D) $\begin{bmatrix} 9 & -3 \\ 5 & -2 \end{bmatrix}$

4. If $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}\begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} -4 & 6 \\ -9 & x \end{bmatrix}$ find the value of x. (1)
(A) 13 (B) -13 (C) 11 (D) 28

5. Find the value of k so that the points $(5,5), (k,1), and\ (10,7)$ are collinear. (1)
(A) 5 (B) 2 (C) 10 (D) -5

6. The value of $\cos^{-1}\frac{1}{2} + 2\ \sin^{-1}\frac{1}{2} =$ _____ (1)
(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{4}$

7. For the matrix $X = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}, then\ X^2 - X\ is$ _______. (1)
(A) $5I$ (B) $2I$ (C) O (D) $8I$

8. In the following question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (1)
Assertion (A): In set $A = \{1, 2, 3\}$ a relation R defined as $R = \{(1,1),(2,2)\}$ is reflexive.
Reason (R): A relation R is reflexive in a set A if $(a, a) \in R$ for all $a \in A$.
(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 and 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

9. Let the function $f: N \longrightarrow N$ be defined by $f(x) = 2x + 3$ $for\ all\ x \in N$. Then f is _____. (1)
(A) Not onto (B) Bijective function (C) Many one onto (D) None of these

10. If A is a square matrix of order 3 such that $|adjA| = 36$, then $|A| =$ _____. (1)
(A) 3 (B) 6 (C) 5 (D) 36

SECTION – B

11. Simplify: $\tan^{-1}\sqrt{\frac{1-cosx}{1+cosx}}$ **OR** Find the value of $\tan^{-1}\left\{2\ cos\left(2\ \sin^{-1}\frac{1}{2}\right)\right\}$ (2)

12. Show that the function $f: R \longrightarrow R$, defined by $f(x) = \begin{cases} 1, if\ x > 0 \\ 0, if\ x = 0 \\ -1, if\ x < 0 \end{cases}$ is neither one – one nor onto. (2)

13. If $A = \begin{bmatrix} -3 \\ 5 \\ 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 6 & -4 \end{bmatrix}$. Then find $(AB)'$. (2)

14. For any square matrix A with real number entries, prove that $A + A'$ is symmetric and $A - A'$ is skew- symmetric. (2)

15. A relation R in the set of real numbers is defined as $xRy = x - y + \sqrt{3}$ is an irrational number, show that the relation R is reflexive but not symmetric. (2)

OR

Let $A = \{1, 2, 3\}$. Write an example of a relation in $A \times A$ which is:
(i) Reflexive and transitive but not symmetric
(ii) Transitive but neither reflexive nor symmetric.

16. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, show that $A^2 - 4A - 5I = O$. (2)

SECTION – C

17. Let Z be the set of all integers and R be the relation on Z defined as (3)
$R = \{(a, b): a, b \in Z\ and\ a - b\ is\ divisible\ by\ 5\}$. prove that R is an equivalence relation.

18. The sum of three numbers is 6. If we multiply third number by 3 and add second number to it, we get 11. By adding first and third numbers, we get double of the second number. Represent it algebraically and find the numbers using matrix method. (3)

OR

Given $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ 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 of equations $x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$

19. If $f(\alpha) = \begin{bmatrix} cos\alpha & -sin\alpha & 0 \\ sin\alpha & cos\alpha & 0 \\ 0 & 0 & -1 \end{bmatrix}$, then show that $f(\alpha) \times f\left(\frac{\pi}{2}\right) = \begin{bmatrix} -sin\alpha & -cos\alpha & 0 \\ cos\alpha & -sin\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$ (3)

20. Find the equation of line passing through the points $A(1, 2)$, $B(3, 6)$ using determinants. (3)

OR

If the points $A\ (a, 0)$, $B(0, b)$, $C\ (1, 1)$ are collinear, prove that $\frac{1}{a} + \frac{1}{b} = 1$.

21. If $A = \begin{bmatrix} 3 & 1 \\ 7 & 5 \end{bmatrix}$, verify that $A. adj\ A = |A|I$. (3)

22. Let $A = R - \{3\}$ and $B = R - \{1\}$ consider the function $f : A \longrightarrow B$ defined by $f(x) = \frac{x-2}{x-3}$. Show that f is one – one and onto. (3)