ANANDALAYA
PERIODIC TEST – 1
Class: XII

विद्या सवर्धि साधिका

Subject: Mathematics (041) M.M: 40
Date : 15 – 07 –2024 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 set X = {1, 2, 3} and a relation R is defined in X as : R = {(1, 3), (2, 2), (3, 2)}, then minimum ordered pairs which should be added in relation R to make it reflexive and symmetric are _______. (1)
(A) {(1, 1), (2, 3), (1, 2)} (B) {(3, 3), (3, 1), (1, 2)}
(C) {(1, 1), (3, 3), (3, 1), (2, 3)} (D) {(1, 1), (3, 3), (3, 1),(1,2)}

2. Let A and B are matrices of order 3 and $|A| = 5$, $|B| = 3$, then $|3AB|$ = ________. (1)
(A) 45 (B) 90 (C) 405 (D) 15

3. If $\begin{vmatrix} 2x+5 & 3 \\ 5x+2 & 9 \end{vmatrix} = 0$, then x is______ (1)
(A) 13 (B) 9 (C) – 9 (D) –13

4. If $A = [a_{ij}]_{m\times n}$ $and\ B = [b_{ij}]_{n\times p}$ be two matrices then order of $(AB)^T$ _____. (1)
(A) $n \times p$ (B) $m \times n$ (C) $m \times p$ (D) $p \times m$

5. Let $X = \{x^2 : x \in N\}$ and the function $f : N \rightarrow X$ is defined by $(x) = x^2$, $x \in N$. Then this function is ________________. (1)
(A) injective only (B) not bijective (C) surjective only (D) bijective

6. The matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ is _________. (1)
(A) Identity matrix (B) symmetric matrix
(C) Skew- symmetric matrix (D) Scalar matrix

7. The value of $\tan^{-1}\left(tan\frac{5\pi}{4}\right) =$ ________. (1)
(A) $\frac{\pi}{4}$ (B) $\frac{5\pi}{4}$ (C) $\frac{\pi}{3}$ (D) $\frac{3\pi}{4}$

8. If A and B are matrices of same order, then $(AB' - BA')$ is a ________ (1)
(A) skew symmetric matrix (B) null matrix
(C) symmetric matrix (D) unit matrix

9. The value of $\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right)$ = ________. (1)
(A) $\frac{\pi}{12}$ (B) $\frac{5\pi}{4}$ (C) $\frac{11\pi}{12}$ (D) $\frac{9\pi}{4}$

In the following Q.10, 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.

10. Assertion (*A*): In set $A = \{a, b, c\}$ relation R in set A, given as $R = \{(a, c)\}$ is transitive. (1)
Reason (*R*): A singleton relation is transitive.

SECTION- B

11. Write the following function in the simplest form: $\tan^{-1}\sqrt{\frac{1-cosx}{1+cosx}}$, $0 < x < \pi$. (2)

OR

Find the value of $tan^{-1}\left\{2sin\left(2\ \cos^{-1}\frac{\sqrt{3}}{2}\right)\right\}$.

12. If $= \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ $and\ B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find the value of α for which $A^2 = B$. (2)

OR

$A = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$, $B = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ then find the product AB.

13. If the co-ordinates of the vertices of an equilateral triangle with sides of length a are (x_1, y_1), (x_2, y_2), (x_3, y_3), then show that $\begin{vmatrix} x_1 & y_1 & 2 \\ x_2 & y_2 & 2 \\ x_3 & y_3 & 2 \end{vmatrix}^2 = 3\ a^4$. (2)

14. Check whether the relation R defined in the set $A = \{1, 2, 3 ,4 ,5 , 6\}$ as $R = \{(x, y): y = x + 1, x , y\ \in A\}$ is reflexive or symmetric. (2)

15. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$, find *k* so that $A^2 = 8A + kI$. (2)

16. Find non-zero values of *x* satisfying the matrix equation: (2)
$x\begin{bmatrix} 2x & 2 \\ 3 & x \end{bmatrix} + 2\begin{bmatrix} 8 & 5x \\ 4 & 4x \end{bmatrix} = 2\begin{bmatrix} x^2+8 & 24 \\ 10 & 6x \end{bmatrix}$.

SECTION- C

17. If *X* and *Y* are 2×2 matrices, then solve the following matrix equations for *X* and *Y*. (3)

$2X + 3Y = \begin{bmatrix} 2 & 3 \\ 4 & 0 \end{bmatrix}$; $3X + 2Y = \begin{bmatrix} -2 & 2 \\ 1 & -5 \end{bmatrix}$

OR

Construct a 3 × 2 matrix whose elements a_{ij} are given by $a_{ij} = \begin{cases} ij - j & ,i < j \\ \frac{i}{j}, & i = j \\ ij - i & , i > j \end{cases}$

18. Let *N* be the set of all natural numbers and let *R* be a relation on $N \times N$ defined by $(a, b)R(c, d) \Rightarrow ad = bc$ for all $(a, b), (c, d) \in N \times N$. Show that *R* is an equivalence relation on $N \times N$. (3)

19. If $A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$, then verify that $A\,.\,adjA = |A|.\,I$ (3)

20. 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.

21. Express the matrix $B = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix. (3)

OR

If A = $\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$, Find $A^2 - 5A + 4I$ and hence find a matrix X such that
$A^2 - 5A + 4I + X = 0$

22. Using matrix method, solve the following system of equations: (3)
$2x - y + z = 3\ ;\quad -x + 2y - z = -4\ ;\quad x - y + 2z = 1$