CUET Mathematics Test

Chapter: Section B2: Algebra (Matrices and Determinants)

General Instructions

1. Total Questions: **20**
2. Duration: **60 Minutes**
3. All questions are compulsory.
4. Each question carries **5 marks**.
5. For each correct answer: **+5 marks**.
6. For each incorrect answer: **-1 mark**.
7. No negative marking for unanswered questions.
8. Use of calculator or electronic devices is strictly prohibited.
9. Choose the most appropriate answer from the given options.

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1. Find the values of x and y if the matrices $A = \begin{bmatrix} 2x+y & 3 \\ 1 & x-2y \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 3 \\ 1 & 0 \end{bmatrix}$ are equal.

2. If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$, then verify that $A^T A = I$, where I is the identity matrix of order 2.

3. Let A be a square matrix. Prove that $A + A^T$ is a symmetric matrix and $A - A^T$ is a skew-symmetric matrix.

4. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ -1 & 2 \end{bmatrix}$, find the matrix X such that $2A + 3X = 5B$.

5. Evaluate the determinant using properties: $\Delta = \begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix}$.

6. If A is a square matrix of order 3 and $|A| = 4$, find the value of $|2A|$.

7. Find the inverse of the matrix $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$ using the adjoint method.

8. Solve the following system of equations using the matrix method:
   $2x + 3y = 5$
   $x - 2y = -1$

9. If $A = \begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 4 \\ -1 & 7 \end{bmatrix}$, find the matrix $(AB)^T$.

10. If A is a skew-symmetric matrix of order 3, prove that $|A| = 0$.

11. Let $A = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 1 & 3 \\ 0 & 1 & 1 \end{bmatrix}$. Find the determinant of A by expanding along the first row.

12. If A is a non-singular matrix of order n, prove that $|adj(A)| = |A|^{n-1}$.

13. Find the value of k if the area of the triangle with vertices $(1, 3)$, $(0, 0)$, and $(k, 0)$ is 3 square units using the determinant method.

14. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, show that $A^2 - 5A + 7I = O$, where O is the null matrix.

15. For a matrix $A = \begin{bmatrix} 1 & 5 \\ 6 & 7 \end{bmatrix}$, express A as the sum of a symmetric and a skew-symmetric matrix.

16. If $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, find A^{-1} and use it to solve the matrix equation $AX = B$ where $B = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$.

17. Given $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, if $ad - bc \neq 0$, derive the formula for A^{-1} in terms of a, b, c, and d.

18. If A and B are invertible matrices of the same order, prove the reversal law of inverses: $(AB)^{-1} = B^{-1}A^{-1}$.

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19. Solve for x, y, and z using the matrix method:
$x + y + z = 6$
$y + 3z = 11$
$x - 2y + z = 0$

20. Find the minor and cofactor of the element a_{21} in the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$.

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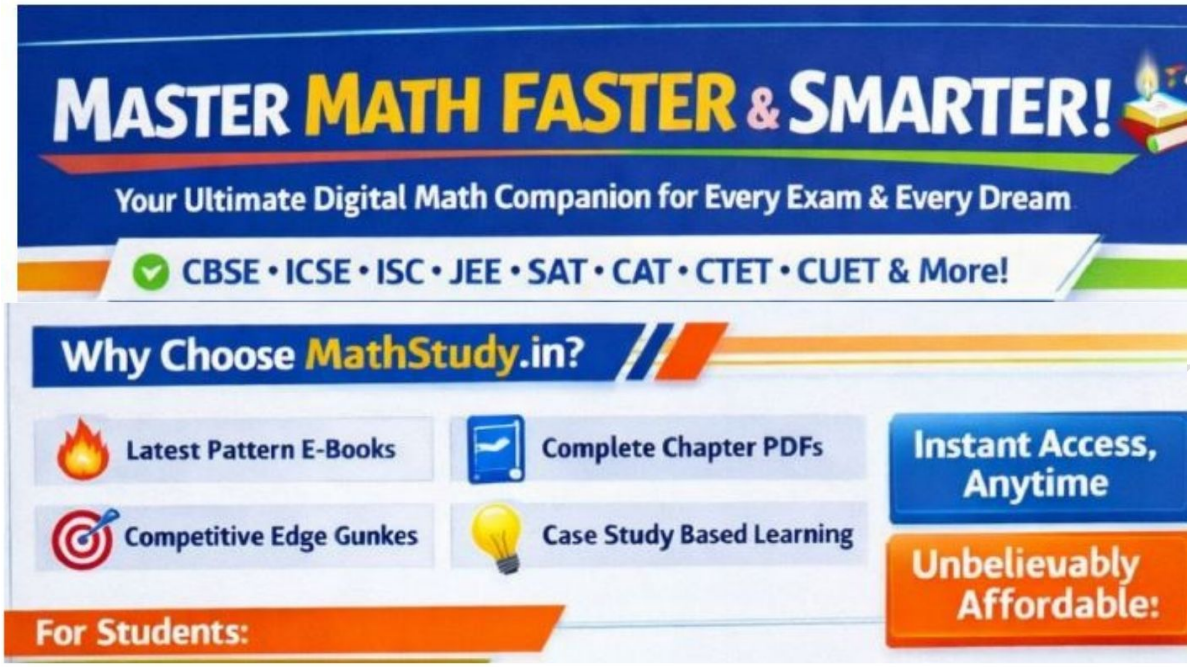

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