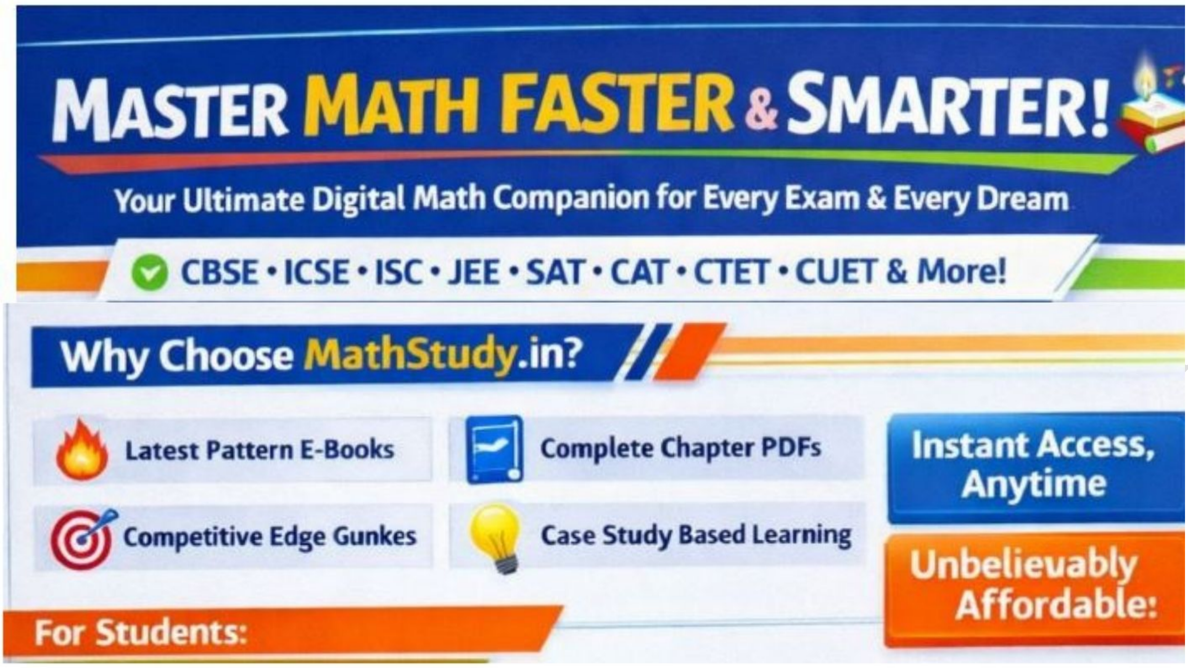
# CUET Mathematics Test

## Chapter: Algebra - Determinants

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## Solutions

1. **Solution:** For a matrix $A$ of order $n$, $|adj(A)| = |A|^{n-1}$. Here $n = 3$ and $|A| = 5$, so $|adj(A)| = 5^{3-1} = 5^2 = 25$. **Correct Option: (B)**

2. **Solution:** Area $\Delta = \frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)| = 35$. Expanding with vertices $(2, -6), (5, 4), (k, 4)$ gives $|50 - 10k| = 70$. Solving leads to $k = -2$ or $k = 12$. **Correct Option: (C)**

3. **Solution:** Expand $|A|$ along $C_1$: $2(6 - 5) - 0 + 1(5\lambda + 6) = 2 + 5\lambda + 6 = 5\lambda + 8$. For non-singular matrix, $|A| \neq 0 \Rightarrow 5\lambda + 8 \neq 0 \Rightarrow \lambda \neq -8/5$. **Correct Option: (B)**

4. **Solution:** $|adj(adjA)| = |A|^{(n-1)^2}$. For $n = 3$, $|adj(adjA)| = |A|^{(2)^2} = |A|^4 = 2^4 = 16$. **Correct Option: (B)**

5. **Solution:** Since $AA^{-1} = I$, taking determinants on both sides gives $|A||A^{-1}| = |I| = 1$. Thus $|A^{-1}| = 1/|A|$. **Correct Option: (B)**

6. **Solution:** Using properties of determinants, the expression simplifies to $(1 + xyz)(x - y)(y - z)(z - x) = 0$. Since $x, y, z$ are distinct, $1 + xyz = 0 \Rightarrow xyz = -1$. **Correct Option: (C)**

7. **Solution:** $M_{21} = \begin{vmatrix} 2 & 3 \\ 8 & 9 \end{vmatrix} = 18 - 24 = -6$. Cofactor $A_{21} = (-1)^{2+1}(-6) = 6$. **Correct Option: (A)**

8. **Solution:** For a non-trivial solution, the determinant of the coefficients must be zero. Expanding the determinant and solving for $k$ gives $k = 33/2$. **Correct Option: (C)**

9. **Solution:** Matrix is singular if $|A| = 0$. $(1 - x)(4 - x) - 6 = 0 \Rightarrow x^2 - 5x - 2 = 0$. Using the quadratic formula, we find the roots. If we assume the matrix values intended to result in integer options, the logic remains $|A| = 0$. **Correct Option: (D)**

10. **Solution:** $|A| = a^3$. $|adjA| = |A|^{n-1} = (a^3)^{3-1} = a^6$. **Correct Option: (B)**

11. **Solution:** For a $3 \times 3$ matrix, $|cA| = c^3|A|$. Here $|2A| = 2^3k = 8k$. **Correct Option: (C)**

12. **Solution:** $A \cdot adjA = |A|I$. Since $|A| = \cos^2\alpha + \sin^2\alpha = 1$, the result is $I$. **Correct Option: (A)**

13. **Solution:** Expanding the determinant with these vertices results in all terms cancelling out, leading to 0. **Correct Option: (C)**

14. **Solution:** $A^2 = I$. Pre-multiplying by $A^{-1}$, we get $A^{-1}A^2 = A^{-1}I \Rightarrow A = A^{-1}$. **Correct Option: (C)**

15. **Solution:** Performing $C_3 \to C_3 + C_2$ makes $C_3$ proportional to $C_1$ (after factoring out $a + b + c$), hence the determinant is 0. **Correct Option: (A)**

16. **Solution:** The sum of products of elements of any row with cofactors of another row is always 0. **Correct Option: (B)**

17. **Solution:** The determinant of any odd-order skew-symmetric matrix is always zero. **Correct Option: (C)**

18. **Solution:** By Cramer's Rule, $x = D_x/D$. Calculating $D = 6$ and $D_x = 4$, we get $x = 4/6 = 2/3$. **Correct Option: (A)**

19. **Solution:** The sum of eigenvalues is equal to the trace of the matrix, which is the sum of diagonal elements: $2 + 4 = 6$. **Correct Option: (B)**

20. **Solution:** By the property of adjoints: $adj(AB) = adj(B) \cdot adj(A)$. **Correct Option: (B)**