Matrices

MCQ-Single Correct

1. If A = $\begin{bmatrix} 2 & -3 \\ -4 & 1 \end{bmatrix}$, then $adj(3A^2 + 12A)$ is equal to:

(1) $\begin{bmatrix} 72 & -84 \\ -63 & 51 \end{bmatrix}$ (2) $\begin{bmatrix} 51 & 63 \\ 84 & 72 \end{bmatrix}$

(3) $\begin{bmatrix} 51 & 84 \\ 63 & 72 \end{bmatrix}$ (4) $\begin{bmatrix} 72 & -63 \\ -84 & 51 \end{bmatrix}$ **[2017]**

2. If A = $\begin{bmatrix} 5a & -b \\ 3 & 2 \end{bmatrix}$ and $A\,adj\,A = AA^T$, then 5a +b is equal to :

(1) 5 (2) 4

(3) 13 (4) -1 **[2016]**

3. If A = $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix}$ is a matrix satisfying the equation $AA^T = 9I$, where I is 3×3 identity matrix, then ordered pair (a,b) is equal to :

(1) (-2,1) (2) (2,1)

(3) (-2,-1) (4) (2,-1) **[2015]**

4. If A is a 3×3 non-singular matrix such that AA'=A'A and $B = A^{-1}A$, then BB' equals

(1) I + B (2) I

(3) B^{-1} (4) $\left(B^{-1}\right)'$ **[2014]**

5. If P = $\begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and |A|=4, then α is equal to

(1) 11 (2) 5

(3) 0 (4) 4 **[2013]**

6. Let A = $\begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{pmatrix}$. If u_1 and u_2 are column matrices such that $Au_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ and $Au_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$, then $u_1 + u_2$ is equal to

(1) $\begin{pmatrix} -1 \\ -1 \\ 0 \end{pmatrix}$ (2) $\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$

(3) $\begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}$ (4) $\begin{pmatrix} -1 \\ 1 \\ -1 \end{pmatrix}$ **[2012]**

7. If $\omega \neq 1$ is the complex cube root of unity and matrix H = $\begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, then H^{70} is equal to

(1) H^2 (2) H

(3) 0 (4) -H **[2011]**

8. The number of 3×3 non-singular matrices, with four entries as 1 and all other entries as 0, is

(1) 5 (2) 6

(3) at least 7 (4) less than 4 **[2010]**

9. Let A be a square matrix all of whose entries are integers. Then which one of the following is true?

(1) If detA = ±1 , then A^{-1} exists but all its entries are not necessarily integers

(2) If detA = ±1 , then A^{-1} exists and all its entries are non-integers

(3) If detA = ±1 , then A^{-1} exists and all its entries are integers

(4) If detA = ±1 , then A^{-1} need not exist **[2008]**

10. Let A = $\begin{bmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{bmatrix}$. If $|A^2|$ = 25, then $|\alpha|$ equals

(1) 5^2 (2) 1

(3) 1/5 (4) 5 **[2007]**

11. If A and B are square matrices of size $n\times n$ such that $A^2 - B^2 = (A-B)(A+B)$, then which of the following will be always true?

(1) A = B

(2) AB = BA

(3) Either of A or B is a zero matrix

(4) Either of A or B is an identity matrix **[2006]**

12. Let A = $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and B = $\begin{pmatrix} a & 0 \\ 0 & b \end{pmatrix}$, a , b $\in$ N. Then

(1) there cannot exist any B such that AB = BA

(2) there exist more than one but finite number of B's such that AB = BA
(3) there exists exactly one B such that AB = BA
(4) there exist infinitely many B's such that AB = BA **[2006]**

13. If $A^2 - A + I = 0$, then the inverse of A is

(1) A + I
(2) A
(3) A – I
(4) I – A

14. If A = $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and I = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then which one of the following holds for all $n \geq 1$, by the principle of mathematical induction

(1) $A^n = nA - (n-1)I$
(2) $A^n = 2^{n-1}A - (n-1)I$
(3) $A^n = nA + (n-1)I$
(4) $A^n = 2^{n-1}A + (n-1)I$ **[2005]**

15. Let $A = \begin{pmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$. The only correct statement about the matrix A is

(1) A is a zero matrix
(2) $A^2 = I$
(3) A^{-1} does not exist
(4) A = (-1)I, where I is a unit matrix

[2004]

16. Let $A = \begin{pmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{pmatrix}$ (10) and $B = \begin{pmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{pmatrix}$. If B is the inverse of matrix A , then α is

(1) -2
(2) 5
(3) 2
(4) -1 **[2004]**

17. If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$, then

(1) $\alpha = a^2 + b^2$, $\beta = ab$
(2) $\alpha = a^2 + b^2$, $\beta = 2ab$
(3) $\alpha = a^2 + b^2$, $\beta = a^2 - b^2$
(4) $\alpha = 2ab$ $\beta = a^2 + b^2$ **[2003]**

Assertion-Reason type

1. Consider the following relation **R** on the set of real square matrices of order 3. **[2011]**
R = {(A,B)|A = $P^{-1}BP$ for some invertible matrix P}.
Statement – I : R is an equivalence relation.
Statement-II : For any two invertible 3×3 matrices M and N, $(MN)^{-1} = N^{-1}M^{-1}$.

(1) Statement-I is True; Statement-II is true; Statement-II is **not** a correct explaination of Statement-I.
(2) Statement-I is True; Statement-II is False.
(3) Statement-I is False; Statement-II is true
(4) Statement-I is True; Statement-II is true; Statement-II is a **correct** explaination of Statement-I.

2. Let A be a 2×2 matrix with non-zero entries and let $A^2 = I$, where I is 2×2 identity matrix. Define Tr(A) = sum of diagonal elements of A and |A| = determinant of matrix A.**[2010]**

Statement-I : Tr(A) = 0

Statement-II : |A|=1

(1) Statement-I is True; Statement-II is true; Statement-II is **not** a correct explaination of Statement-I.
(2) Statement-I is True; Statement-II is False.
(3) Statement-I is False; Statement-II is true
(4) Statement-I is True; Statement-II is true; Statement-II is a **correct** explaination of Statement-I.

3. Let A be a 2×2 matrix **[2009]**

Statement-I : adj(adj A) = A

Statement-II : |adj A| = |A|

(1) Statement-I is True; Statement-II is true; Statement-II is **not** a correct explaination of Statement-I.
(2) Statement-I is True; Statement-II is False.
(3) Statement-I is False; Statement-II is true
(4) Statement-I is True; Statement-II is true; Statement-II is a **correct** explaination of Statement-I.

4. Let A be a 2×2 matrix with real entries. Let I be the 2×2 identity matrix. Denote by tr(A), the sum of diagonal entries of A. Assume that $A^2 = I$ **[2008]**

Statement-I : If $A \neq I$ and $A \neq -I$, then det A = -1.

Statement-II : If $A \neq I$ and $A \neq -I$, then $tr(A) \neq 0$

(1) Statement-I is True; Statement-II is true; Statement-II is **not** a correct explaination of Statement-I.
(2) Statement-I is True; Statement-II is False.
(3) Statement-I is False; Statement-II is true
(4) Statement-I is True; Statement-II is true; Statement-II is a **correct** explaination of Statement-I.