Matrices and Determinants

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Section-A — JEE Advanced/ IIT-JEE

3) Fill in the Blanks:

v) How many 3×3 matrices M with entries from $(0, 1, 2)$ are there, for which the sum of the diagonal entries of M^TM is 5?

i) 126
ii) 198
iii) 162
iv) 135

$(JEEAdv.2017)$

w) Let $M = \begin{bmatrix} \sin^4\theta & -1-\sin^2\theta \\ 1+\cos^2\theta & \cos^4\theta \end{bmatrix} = \alpha I + \beta M^{-1}$
Where $\alpha = \alpha(\theta)$ and $\beta = \beta(\theta)$ are real numbers, and I is the 2×2 identity matrix. If a^* is the minimum of the set $(\alpha(\theta) : \theta \in [0, 2\pi))$ and b^* is the minimum of the set $(\beta(\theta) : \theta \in [0, 2\pi))$. Then the value of $a^* + b^*$ is

i) $-\frac{31}{16}$
ii) $-\frac{17}{16}$
iii) $-\frac{37}{16}$
iv) $-\frac{29}{16}$

$(JEEAdv.2019)$

4) MCQs with More than One Correct

a) The determinant $\begin{vmatrix} a & b & a\alpha+b \\ b & c & b\alpha+c \\ a\alpha+b & b\alpha+c & 0 \end{vmatrix}$ is equal to zero, if

i) a, b, c are in A.P.
ii) a, b, c are in G.P.
iii) a, b, c are in H.P.
iv) α is a root of the equation $ax^2+bx+c = 0$
v) $(x - \alpha)$ is a factor of $ax^2 + bx + c$

$(1986 - 2Marks)$

b) If $\begin{vmatrix} 6i & -3i & 1 \\ 4 & 3i & -1 \\ 20 & 3 & i \end{vmatrix} = x + iy$, then

i) $x = 3, y = 1$
ii) $x = 1, y = 3$
iii) $x = 0, y = 3$
iv) $x = 0, y = 0$

$(1998 - 2Marks)$

c) Let M and N be two 3×3 non-singulr skew-symmetric matrices such that $MN = NM$. If P^T denotes the transpose of P, then $M^2N^2\left(M^TN^{-1}\right)^{-1}\left(MN^{-1}\right)^T$ is equal to

i) M^2
ii) $-N^2$
iii) $-M^2$
iv) MN

(2011)

d) If the adjoint of a 3×3 matrix P is $\begin{bmatrix} 1 & 4 & 4 \\ 2 & 1 & 7 \\ 1 & 1 & 3 \end{bmatrix}$, then the possible value(s) of the determinant of P is (are)

i) -2
ii) -1
iii) 1
iv) 2

(2012)

e) For 3×3 matrices M and N, which of the following statement(s) is (are) NOT correct?

i) N^TMN is symmetric or skew symmetric, according as M is symmetric or skew symmetric
ii) MN-NM is skew symmetric for all matrices M and N.
iii) MN is symmetric for all symmetric matrices M and N.
iv) $(adjM)(adjN) = \text{adj}(MN)$ for all invertible matrices M and N.