

MATHEMATICS · JEE MAIN

Matrices

Chapter-wise previous year questions, with answer key

94

PYQS

2020–2025

PAPERS

4

TOPICS

Transpose, Symmetric and Skew-Symmetric

Types of Matrices and Operations

Orthogonal Matrix

Inverse of a Matrix

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

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Transpose, Symmetric and Skew-Symmetric · 11 PYQs

Q1 JEE Main 2025 · 28 Jan · Shift 1

Let M denote the set of all real matrices of order 3×3 and let $S = \{-3, -2, -1, 1, 2\}$. Let

$$S_1 = \{A = [a_{ij}] \in M : A = A^T \text{ and } a_{ij} \in S, \forall i, j\},$$

$$S_2 = \{A = [a_{ij}] \in M : A = -A^T \text{ and } a_{ij} \in S, \forall i, j\},$$

$$S_3 = \{A = [a_{ij}] \in M : a_{11} + a_{22} + a_{33} = 0 \text{ and } a_{ij} \in S, \forall i, j\}.$$

If $n(S_1 \cup S_2 \cup S_3) = 125\alpha$, then α equals _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/qYUugtiKQg](https://www.prepwiser.in/questions/qYUugtiKQg)

Q2 JEE Main 2024 · 29 Jan · Shift 1

Let A be a square matrix such that $AA^T = I$. Then $\frac{1}{2}A \left[(A + A^T)^2 + (A - A^T)^2 \right]$ is equal to

(A) $A^2 + A^T$

(B) $A^3 + I$

(C) $A^3 + A^T$

(D) $A^2 + I$

[Step-by-step solution ► prepwiser.in/questions/FiWs3uOlhW](https://www.prepwiser.in/questions/FiWs3uOlhW)

Q3 JEE Main 2023 · 13 Apr · Shift 1

The number of symmetric matrices of order 3, with all the entries from the set $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ is :

(A) 10^9

(B) 9^{10}

(C) 10^6

(D) 6^{10}

[Step-by-step solution ► prepwiser.in/questions/XxBbbYRezQ](https://www.prepwiser.in/questions/XxBbbYRezQ)

Q4 JEE Main 2023 · 11 Apr · Shift 1

Let A be a 2×2 matrix with real entries such that $A' = \alpha A + I$, where $\alpha \in \mathbb{R} - \{-1, 1\}$. If $\det(A^2 - A) = 4$, then the sum of all possible values of α is equal to :

(A) 2

(B) $\frac{3}{2}$

(C) 0

(D) $\frac{5}{2}$

[Step-by-step solution ► prepwiser.in/questions/PLY6YDmLa6](https://www.prepwiser.in/questions/PLY6YDmLa6)

Q5 JEE Main 2023 · 30 Jan · Shift 2

If P is a 3×3 real matrix such that $P^T = aP + (a - 1)I$, where $a > 1$, then :

(A) $|Adj P| = 1$

(B) $|Adj P| > 1$

(C) $|Adj P| = \frac{1}{2}$

(D) P is a singular matrix

[Step-by-step solution ► prepwiser.in/questions/Q12ol_xaGC](https://www.prepwiser.in/questions/Q12ol_xaGC)

Q6 JEE Main 2023 · 25 Jan · Shift 2

Let A, B, C be 3×3 matrices such that A is symmetric and B and C are skew-symmetric. Consider the statements

(S1) $A^{13} B^{26} - B^{26} A^{13}$ is symmetric

(S2) $A^{26} C^{13} - C^{13} A^{26}$ is symmetric

Then,

(A) Only S2 is true

(B) Only S1 is true

(C) Both S1 and S2 are false

(D) Both S1 and S2 are true

[Step-by-step solution ► prepwisar.in/questions/ChdeUKbQ_a](https://www.prepwisar.in/questions/ChdeUKbQ_a)

Q7 JEE Main 2022 · 28 Jul · Shift 2

Let A and B be any two 3×3 symmetric and skew symmetric matrices respectively. Then which of the following is NOT true?

(A) $A^4 - B^4$ is a symmetric matrix

(B) $AB - BA$ is a symmetric matrix

(C) $B^5 - A^5$ is a skew-symmetric matrix

(D) $AB + BA$ is a skew-symmetric matrix

[Step-by-step solution ► prepwisar.in/questions/NixFzy9xg1](https://www.prepwisar.in/questions/NixFzy9xg1)

Q8 JEE Main 2022 · 27 Jul · Shift 1

Let S be the set containing all 3×3 matrices with entries from $\{-1, 0, 1\}$. The total number of matrices $A \in S$ such that the sum of all the diagonal elements of $A^T A$ is 6 is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/kbH7ZKEKYO](https://www.prepwisar.in/questions/kbH7ZKEKYO)

Q9 JEE Main 2022 · 26 Jul · Shift 2

Let $A = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ and $B = \begin{bmatrix} 9^2 & -10^2 & 11^2 \\ 12^2 & 13^2 & -14^2 \\ -15^2 & 16^2 & 17^2 \end{bmatrix}$, then the value of $A'BA$ is:

(A) 1224

(B) 1042

(C) 540

(D) 539

[Step-by-step solution ► prepwisar.in/questions/cCT8fciAIG](https://www.prepwisar.in/questions/cCT8fciAIG)

Q10 JEE Main 2021 · 20 Jul · Shift 1

Let $A = \begin{bmatrix} 2 & 3 \\ a & 0 \end{bmatrix}$, $a \in \mathbb{R}$ be written as $P + Q$ where P is a symmetric matrix and Q is skew symmetric matrix.

If $\det(Q) = 9$, then the modulus of the sum of all possible values of determinant of P is equal to :

(A) 36

(B) 24

(C) 45

(D) 18

[Step-by-step solution ► prepwisar.in/questions/N-Qft1_aOB](https://www.prepwisar.in/questions/N-Qft1_aOB)

Q11 JEE Main 2021 · 26 Feb · Shift 1

Let A be a symmetric matrix of order 2 with integer entries. If the sum of the diagonal elements of A^2 is 1, then the possible number of such matrices is :

- (A) 6 (B) 4
(C) 1 (D) 12

[Step-by-step solution ► prepwiser.in/questions/XqhZdrb8L8](#)

Types of Matrices and Operations · 52 PYQs

Q12 JEE Main 2025 · 4 Apr · Shift 2

Let the matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ satisfy $A^n = A^{n-2} + A^2 - I$ for $n \geq 3$. Then the sum of all the elements of A^{50} is :

- (A) 44 (B) 39
(C) 52 (D) 53

[Step-by-step solution ► prepwiser.in/questions/UpYy1QtIML](#)

Q13 JEE Main 2025 · 4 Apr · Shift 1

Let $A = \begin{bmatrix} \cos \theta & 0 & -\sin \theta \\ 0 & 1 & 0 \\ \sin \theta & 0 & \cos \theta \end{bmatrix}$. If for some $\theta \in (0, \pi)$, $A^2 = A^T$, then the sum of the diagonal elements of the matrix $(A + I)^3 + (A - I)^3 - 6A$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/eIQR8OwQ-a](#)

Q14 JEE Main 2025 · 2 Apr · Shift 1

Let $A = \begin{bmatrix} \alpha & -1 \\ 6 & \beta \end{bmatrix}$, $\alpha > 0$, such that $\det(A) = 0$ and $\alpha + \beta = 1$. If I denotes 2×2 identity matrix, then the matrix $(I + A)^8$ is :

- (A) $\begin{bmatrix} 257 & -64 \\ 514 & -127 \end{bmatrix}$
(B) $\begin{bmatrix} 766 & -255 \\ 1530 & -509 \end{bmatrix}$
(C) $\begin{bmatrix} 1025 & -511 \\ 2024 & -1024 \end{bmatrix}$
(D) $\begin{bmatrix} 4 & -1 \\ 6 & -1 \end{bmatrix}$

[Step-by-step solution ► prepwiser.in/questions/2qTkclSP_T](#)

Q15 JEE Main 2025 · 2 Apr · Shift 2

Let A be a 3×3 real matrix such that $A^2(A - 2I) - 4(A - I) = O$, where I and O are the identity and null matrices, respectively. If $A^5 = \alpha A^2 + \beta A + \gamma I$, where α, β , and γ are real constants, then $\alpha + \beta + \gamma$ is equal to :

(A) 76

(B) 12

(C) 4

(D) 20

[Step-by-step solution ► prepwiser.in/questions/buKtTSYZzw](https://www.prepwiser.in/questions/buKtTSYZzw)

Q16 JEE Main 2025 · 29 Jan · Shift 1

Let $S = \{m \in \mathbf{Z} : A^{m^2} + A^m = 3I - A^{-6}\}$, where $A = \begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix}$. Then $n(S)$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Izav6KzKD9](https://www.prepwiser.in/questions/Izav6KzKD9)

Q17 JEE Main 2025 · 29 Jan · Shift 2

Let $A = [a_{ij}]$ be a matrix of order 3×3 , with $a_{ij} = (\sqrt{2})^{i+j}$. If the sum of all the elements in the third row of A^2 is $\alpha + \beta\sqrt{2}$, $\alpha, \beta \in \mathbf{Z}$, then $\alpha + \beta$ is equal to :

(A) 210

(B) 280

(C) 224

(D) 168

[Step-by-step solution ► prepwiser.in/questions/PPTlxx8ixG](https://www.prepwiser.in/questions/PPTlxx8ixG)

Q18 JEE Main 2024 · 8 Apr · Shift 1

Let

$$A = \begin{bmatrix} 2 & a & 0 \\ 1 & 3 & 1 \\ 0 & 5 & b \end{bmatrix}$$

. If $A^3 = 4A^2 - A - 21I$, where I is the identity matrix of order 3×3 , then $2a + 3b$ is equal to

(A) -10

(B) -12

(C) -13

(D) -9

[Step-by-step solution ► prepwiser.in/questions/77-aof3kwb](https://www.prepwiser.in/questions/77-aof3kwb)

Q19 JEE Main 2024 · 8 Apr · Shift 1

Let

$$A = \begin{bmatrix} 2 & -1 \\ 1 & 1 \end{bmatrix}$$

. If the sum of the diagonal elements of A^{13} is 3^n , then n is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/oM4-evQD-o](https://www.prepwiser.in/questions/oM4-evQD-o)

Q20 JEE Main 2024 · 27 Jan · Shift 2

Let A be a 2×2 real matrix and I be the identity matrix of order 2. If the roots of the equation $|A - xI| = 0$ be -1 and 3 , then the sum of the diagonal elements of the matrix A^2 is

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/QAeBFWLga9](https://www.prepwisser.in/questions/QAeBFWLga9)

Q21 JEE Main 2023 · 12 Apr · Shift 1

Let

$$A = \begin{bmatrix} 1 & \frac{1}{51} \\ 0 & 1 \end{bmatrix}$$

. If

$$B = \begin{bmatrix} 1 & 2 \\ -1 & -1 \end{bmatrix} A \begin{bmatrix} -1 & -2 \\ 1 & 1 \end{bmatrix}$$

, then the sum of all the elements of the matrix $\sum_{n=1}^{50} B^n$ is equal to

(A) 50

(B) 75

(C) 100

(D) 125

[Step-by-step solution ► prepwisser.in/questions/uPA6_8RkL0](https://www.prepwisser.in/questions/uPA6_8RkL0)

Q22 JEE Main 2023 · 11 Apr · Shift 1

Let

$$A = \begin{bmatrix} 0 & 1 & 2 \\ a & 0 & 3 \\ 1 & c & 0 \end{bmatrix}$$

, where $a, c \in \mathbb{R}$. If $A^3 = A$ and the positive value of a belongs to the interval $(n-1, n]$, where $n \in \mathbb{N}$, then n is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/-h0TKWaOX2](https://www.prepwisser.in/questions/-h0TKWaOX2)

Q23 JEE Main 2023 · 6 Apr · Shift 2

Let P be a square matrix such that $P^2 = I - P$. For $\alpha, \beta, \gamma, \delta \in \mathbb{N}$, if $P^\alpha + P^\beta = \gamma I - 29P$ and $P^\alpha - P^\beta = \delta I - 13P$, then $\alpha + \beta + \gamma - \delta$ is equal to :

(A) 18

(B) 22

(C) 24

(D) 40

[Step-by-step solution ► prepwisser.in/questions/YqtjiHZvxM](https://www.prepwisser.in/questions/YqtjiHZvxM)

Q24 JEE Main 2023 · 31 Jan · Shift 1

Let

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 4 & -1 \\ 0 & 12 & -3 \end{pmatrix}$$

. Then the sum of the diagonal elements of the matrix $(A + I)^{11}$ is equal to :

(A) 4094

(B) 2050

(C) 6144

(D) 4097

[Step-by-step solution ► prepwisser.in/questions/O7PuwLY7EL](https://www.prepwisser.in/questions/O7PuwLY7EL)

Q25 JEE Main 2023 · 31 Jan · Shift 2

If a point $P(\alpha, \beta, \gamma)$ satisfying

$$(\alpha \quad \beta \quad \gamma) \begin{pmatrix} 2 & 10 & 8 \\ 9 & 3 & 8 \\ 8 & 4 & 8 \end{pmatrix} = (0 \quad 0 \quad 0)$$

lies on the plane $2x + 4y + 3z = 5$, then $6\alpha + 9\beta + 7\gamma$ is equal to :

(A) $\frac{11}{5}$

(B) 11

(C) -1

(D) $\frac{5}{4}$

[Step-by-step solution ► prepwisser.in/questions/kB_IjvuchM](https://www.prepwisser.in/questions/kB_IjvuchM)

Q26 JEE Main 2023 · 29 Jan · Shift 2

The set of all values of $t \in \mathbb{R}$, for which the matrix

$$\begin{bmatrix} e^t & e^{-t}(\sin t - 2 \cos t) & e^{-t}(-2 \sin t - \cos t) \\ e^t & e^{-t}(2 \sin t + \cos t) & e^{-t}(\sin t - 2 \cos t) \\ e^t & e^{-t} \cos t & e^{-t} \sin t \end{bmatrix}$$

is invertible, is :

(A) $\{k\pi, k \in \mathbb{Z}\}$

(B) $\mathbb{R}$

(C) $\{(2k+1)\frac{\pi}{2}, k \in \mathbb{Z}\}$

(D) $\{k\pi + \frac{\pi}{4}, k \in \mathbb{Z}\}$

[Step-by-step solution ► prepwisser.in/questions/Y4D9twZKNk](https://www.prepwisser.in/questions/Y4D9twZKNk)

Q27 JEE Main 2023 · 29 Jan · Shift 2

Let A be a symmetric matrix such that $|A| = 2$ and

$$\begin{bmatrix} 2 & 1 \\ 3 & \frac{3}{2} \end{bmatrix} A = \begin{bmatrix} 1 & 2 \\ \alpha & \beta \end{bmatrix}$$

. If the sum of the diagonal elements of A is s , then $\frac{\beta s}{\alpha^2}$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/Vmcccad4XP](https://www.prepwisar.in/questions/Vmcccad4XP)

Q28 JEE Main 2023 · 29 Jan · Shift 1

Let α and β be real numbers. Consider a 3×3 matrix A such that $A^2 = 3A + \alpha I$. If $A^4 = 21A + \beta I$, then

(A) $\alpha = 1$

(B) $\alpha = 4$

(C) $\beta = 8$

(D) $\beta = -8$

[Step-by-step solution ► prepwisar.in/questions/WK6ZFLLazrv](https://www.prepwisar.in/questions/WK6ZFLLazrv)

Q29 JEE Main 2023 · 24 Jan · Shift 1

If A and B are two non-zero $n \times n$ matrices such that $A^2 + B = A^2B$, then :

(A) $A^2B = I$

(B) $A^2 = I$ or $B = I$

(C) $A^2B = BA^2$

(D) $AB = I$

[Step-by-step solution ► prepwisar.in/questions/ePQeljYndZ](https://www.prepwisar.in/questions/ePQeljYndZ)

Q30 JEE Main 2022 · 29 Jul · Shift 2

Let

$$X = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

and

$$A = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 1 & 6 \\ 0 & 0 & -1 \end{bmatrix}$$

. For $k \in N$, if $X^T A^k X = 33$, then k is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/0033PQTQjb](https://www.prepwisar.in/questions/0033PQTQjb)

Q31 JEE Main 2022 · 29 Jul · Shift 2

Which of the following matrices can NOT be obtained from the matrix

$$\begin{bmatrix} -1 & 2 \\ 1 & -1 \end{bmatrix}$$

by a single elementary row operation ?

(A) $\begin{bmatrix} 0 & 1 \\ 1 & -1 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & -1 \\ -1 & 2 \end{bmatrix}$

(C) $\begin{bmatrix} -1 & 2 \\ -2 & 7 \end{bmatrix}$

(D) $\begin{bmatrix} -1 & 2 \\ -1 & 3 \end{bmatrix}$

[Step-by-step solution ► prepwiser.in/questions/smIK0Pb_GC](https://www.prepwiser.in/questions/smIK0Pb_GC)

Q32 JEE Main 2022 · 29 Jul · Shift 1

Let A and B be two 3×3 non-zero real matrices such that AB is a zero matrix. Then

- (A) the system of linear equations $AX = 0$ has a unique solution
(B) the system of linear equations $AX = 0$ has infinitely many solutions
(C) B is an invertible matrix
(D) $\text{adj}(A)$ is an invertible matrix

[Step-by-step solution ► prepwiser.in/questions/9OFPTGTqs9](https://www.prepwiser.in/questions/9OFPTGTqs9)

Q33 JEE Main 2022 · 28 Jul · Shift 1

Let

$$A = \begin{bmatrix} 1 & -1 \\ 2 & \alpha \end{bmatrix}$$

and

$$B = \begin{bmatrix} \beta & 1 \\ 1 & 0 \end{bmatrix}, \alpha, \beta \in \mathbf{R}$$

. Let α_1 be the value of α which satisfies

$$(A + B)^2 = A^2 + \begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$$

and α_2 be the value of α which satisfies $(A + B)^2 = B^2$. Then $|\alpha_1 - \alpha_2|$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/rR1j49R1VU](https://www.prepwiser.in/questions/rR1j49R1VU)

Q34 JEE Main 2022 · 27 Jul · Shift 2

Let

$$A = \begin{pmatrix} 4 & -2 \\ \alpha & \beta \end{pmatrix}$$

.

If $A^2 + \gamma A + 18I = O$, then $\det(A)$ is equal to _____.

(A) -18

(B) 18

(C) -50

(D) 50

[Step-by-step solution ► prepwiser.in/questions/a7kZT2le2j](https://www.prepwiser.in/questions/a7kZT2le2j)

Q35 JEE Main 2022 · 25 Jul · Shift 1

Let

$$A = \begin{pmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \\ 1 & -1 & 0 \end{pmatrix}$$

and $B = A - I$. If $\omega = \frac{\sqrt{3}i-1}{2}$, then the number of elements in the

$$\text{set } \{n \in \{1, 2, \dots, 100\} : A^n + (\omega B)^n = A + B\}$$

is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/QHQhLI6vT](https://www.prepwiser.in/questions/QHQhLI6vT)

Q36 JEE Main 2022 · 25 Jul · Shift 2

Let

$$A = \begin{bmatrix} 1 & a & a \\ 0 & 1 & b \\ 0 & 0 & 1 \end{bmatrix}, a, b \in \mathbb{R}$$

. If for some

$$n \in \mathbb{N}, A^n = \begin{bmatrix} 1 & 48 & 2160 \\ 0 & 1 & 96 \\ 0 & 0 & 1 \end{bmatrix}$$

then $n + a + b$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/zRrK-oiYe6](https://www.prepwiser.in/questions/zRrK-oiYe6)

Q37 JEE Main 2022 · 29 Jun · Shift 2

Let

$$M = \begin{bmatrix} 0 & -\alpha \\ \alpha & 0 \end{bmatrix}$$

, where α is a non-zero real number and $N = \sum_{k=1}^{49} M^{2k}$. If $(I - M^2)N = -2I$, then the positive integral value of α is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/iwOHUHI6Pv](https://www.prepwiser.in/questions/iwOHUHI6Pv)

Q38 JEE Main 2022 · 28 Jun · Shift 2

Let $A = \begin{pmatrix} 1+i & 1 \\ -i & 0 \end{pmatrix}$ where $i = \sqrt{-1}$. Then, the number of elements in the set $\{n \in \{1, 2, \dots, 100\} : A^n = A\}$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/kjMuDE-tDh](https://www.prepwiser.in/questions/kjMuDE-tDh)

Q39 JEE Main 2022 · 27 Jun · Shift 2

Let A be a matrix of order 2×2 , whose entries are from the set $\{0, 1, 2, 3, 4, 5\}$. If the sum of all the entries of A is a prime number p , $2 < p < 8$, then the number of such matrices A is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/pACmO8vnjv](https://www.prepwiser.in/questions/pACmO8vnjv)

Q40 JEE Main 2022 · 25 Jun · Shift 1

Let A be a 3×3 matrix having entries from the set $\{-1, 0, 1\}$. The number of all such matrices A having sum of all the entries equal to 5, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/I98ncJ174p](https://www.prepwiser.in/questions/I98ncJ174p)

Q41 JEE Main 2022 · 25 Jun · Shift 1

Let A be a 3×3 real matrix such that

$$A \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}; A \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}$$

and

$$A \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix}$$

If $X = (x_1, x_2, x_3)^T$ and I is an identity matrix of order 3, then the system $(A - 2I)X = \begin{pmatrix} 4 \\ 1 \\ 1 \end{pmatrix}$ has :

- (A) no solution
(B) infinitely many solutions
(C) unique solution
(D) exactly two solutions

[Step-by-step solution ► prepwiser.in/questions/aiwrRnwPS8](https://www.prepwiser.in/questions/aiwrRnwPS8)

Q42 JEE Main 2022 · 25 Jun · Shift 1

Let $A = \begin{bmatrix} 0 & -2 \\ 2 & 0 \end{bmatrix}$. If M and N are two matrices given by $M = \sum_{k=1}^{10} A^{2k}$ and $N = \sum_{k=1}^{10} A^{2k-1}$ then MN^2 is :

- (A) a non-identity symmetric matrix
(B) a skew-symmetric matrix
(C) neither symmetric nor skew-symmetric matrix
(D) an identity matrix

[Step-by-step solution ► prepwiser.in/questions/B2UACUIy_](https://www.prepwiser.in/questions/B2UACUIy_)

Q43 JEE Main 2022 · 25 Jun · Shift 2

Let $A = \begin{pmatrix} 2 & -2 \\ 1 & -1 \end{pmatrix}$ and $B = \begin{pmatrix} -1 & 2 \\ -1 & 2 \end{pmatrix}$. Then the number of elements in the set $\{(n, m) : n, m \in \{1, 2, \dots, 10\} \text{ and } nA^n + mB^m = I\}$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/3Dy6KuXRmG](https://www.prepwiser.in/questions/3Dy6KuXRmG)

Q44 JEE Main 2021 · 31 Aug · Shift 2

The number of elements in the set

$$\left\{ A = \begin{pmatrix} a & b \\ 0 & d \end{pmatrix} : a, b, d \in \{-1, 0, 1\} \text{ and } (I - A)^3 = I - A^3 \right\}$$

, where I is 2×2 identity matrix, is :

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/SqNdpks2eN](https://www.prepwiser.in/questions/SqNdpks2eN)

Q45 JEE Main 2021 · 27 Aug · Shift 1

If the matrix $A = \begin{pmatrix} 0 & 2 \\ K & -1 \end{pmatrix}$ satisfies $A(A^3 + 3I) = 2I$, then the value of K is :

- (A) $\frac{1}{2}$
- (B) $-\frac{1}{2}$
- (C) -1
- (D) 1

[Step-by-step solution ► prepwiser.in/questions/DzHkxrHZAK](https://www.prepwiser.in/questions/DzHkxrHZAK)

Q46 JEE Main 2021 · 26 Aug · Shift 2

Let

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix}$$

. Then $A^{2025} - A^{2020}$ is equal to :

- (A) $A^6 - A$
- (B) A^5
- (C) $A^5 - A$
- (D) A^6

[Step-by-step solution ► prepwiser.in/questions/rBukEaF_1Q](https://www.prepwiser.in/questions/rBukEaF_1Q)

Q47 JEE Main 2021 · 27 Jul · Shift 2

If

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

and $M = A + A^2 + A^3 + \dots + A^{20}$, then the sum of all the elements of the matrix M is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/HPITXqL_IK](https://www.prepwiser.in/questions/HPITXqL_IK)

Q48 JEE Main 2021 · 25 Jul · Shift 2

If

$$P = \begin{bmatrix} 1 & 0 \\ \frac{1}{2} & 1 \end{bmatrix}$$

, then P^{50} is :

- (A) $\begin{bmatrix} 1 & 0 \\ 25 & 1 \end{bmatrix}$
(B) $\begin{bmatrix} 1 & 50 \\ 0 & 1 \end{bmatrix}$
(C) $\begin{bmatrix} 1 & 25 \\ 0 & 1 \end{bmatrix}$
(D) $\begin{bmatrix} 1 & 0 \\ 50 & 1 \end{bmatrix}$

[Step-by-step solution ► prepwisser.in/questions/E1Pg-QMBUn](https://www.prepwisser.in/questions/E1Pg-QMBUn)

Q49 JEE Main 2021 · 25 Jul · Shift 1

Let

$$S = \left\{ n \in N \mid \begin{pmatrix} 0 & i \\ 1 & 0 \end{pmatrix}^n \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \forall a, b, c, d \in R \right\}$$

, where $i = \sqrt{-1}$. Then the number of 2-digit numbers in the set S is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/ckD51BS0dN](https://www.prepwisser.in/questions/ckD51BS0dN)

Q50 JEE Main 2021 · 22 Jul · Shift 2

Let

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

. Then the number of 3×3 matrices B with entries from the set $\{1, 2, 3, 4, 5\}$ and satisfying $AB = BA$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/51wiiSBnCO](https://www.prepwisser.in/questions/51wiiSBnCO)

Q51 JEE Main 2021 · 22 Jul · Shift 2

Let $A = [a_{ij}]$ be a real matrix of order 3×3 , such that $a_{i1} + a_{i2} + a_{i3} = 1$, for $i = 1, 2, 3$. Then, the sum of all the entries of the matrix A^3 is equal to :

- (A) 2 (B) 1
(C) 3 (D) 9

[Step-by-step solution ► prepwisser.in/questions/8UY8inD2q8](https://www.prepwisser.in/questions/8UY8inD2q8)

Q52 JEE Main 2021 · 20 Jul · Shift 1

Let

$$A = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{pmatrix}$$

and $B = 7A^{20} - 20A^7 + 2I$, where I is an identity matrix of order 3×3 . If $B = [b_{ij}]$, then b_{13} is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/3-vsBjcFTn](https://www.prepwisser.in/questions/3-vsBjcFTn)

Q53 JEE Main 2021 · 18 Mar · Shift 2

Let I be an identity matrix of order 2×2 and $P = \begin{bmatrix} 2 & -1 \\ 5 & -3 \end{bmatrix}$. Then the value of $n \in \mathbb{N}$ for which $P^n = 5I - 8P$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/7qONzcZgnA](https://www.prepwisser.in/questions/7qONzcZgnA)

Q54 JEE Main 2021 · 18 Mar · Shift 1

Let

$$A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -3 & 3 \\ -5 & 3 & 1 \end{bmatrix}$$

and

$$2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$$

. If $\text{Tr}(A)$ denotes the sum of all diagonal elements of the matrix A , then $\text{Tr}(A) - \text{Tr}(B)$ has value equal to

(A) 1

(B) 2

(C) 0

(D) 3

[Step-by-step solution ► prepwisser.in/questions/ZIT_IwLViO](https://www.prepwisser.in/questions/ZIT_IwLViO)

Q55 JEE Main 2021 · 16 Mar · Shift 1

The total number of 3×3 matrices A having entries from the set $\{0, 1, 2, 3\}$ such that the sum of all the diagonal entries of AA^T is 9, is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/0n9VpCTQF8](https://www.prepwisser.in/questions/0n9VpCTQF8)

Q56 JEE Main 2021 · 26 Feb · Shift 2

If the matrix

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 3 & 0 & -1 \end{bmatrix}$$

satisfies the equation

$$A^{20} + \alpha A^{19} + \beta A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

for some real numbers α and β , then $\beta - \alpha$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/pjnLyq6S1D](https://www.prepwisser.in/questions/pjnLyq6S1D)

Q57 JEE Main 2021 · 25 Feb · Shift 1

Let

$$A = \begin{bmatrix} x & y & z \\ y & z & x \\ z & x & y \end{bmatrix}$$

, where x, y and z are real numbers such that $x + y + z > 0$ and $xyz = 2$. If $A^2 = I_3$, then the value of $x^3 + y^3 + z^3$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/ezob55Q4qb](https://www.prepwisser.in/questions/ezob55Q4qb)

Q58 JEE Main 2021 · 24 Feb · Shift 1

Let M be any 3×3 matrix with entries from the set $\{0, 1, 2\}$. The maximum number of such matrices, for which the sum of diagonal elements of $M^T M$ is seven, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/oxBNhCApMJ](https://www.prepwisser.in/questions/oxBNhCApMJ)

Q59 JEE Main 2020 · 4 Sep · Shift 1

If

$$A = \begin{bmatrix} \cos \theta & i \sin \theta \\ i \sin \theta & \cos \theta \end{bmatrix}$$

$$, (\theta = \frac{\pi}{24})$$

and $A^5 = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, where $i = \sqrt{-1}$ then which one of the following is not true?

(A) $a^2 - c^2 = 1$

(B) $0 \leq a^2 + b^2 \leq 1$

(C) $a^2 - d^2 = 0$

(D) $a^2 - b^2 = \frac{1}{2}$

[Step-by-step solution ► prepwiser.in/questions/hn0wDp-Nju](https://www.prepwiser.in/questions/hn0wDp-Nju)

Q60 JEE Main 2020 · 3 Sep · Shift 1

Let $A = \begin{bmatrix} x & 1 \\ 1 & 0 \end{bmatrix}$, $x \in \mathbb{R}$ and $A^4 = [a_{ij}]$.

If $a_{11} = 109$, then a_{22} is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/2Nc5-mpX4g](https://www.prepwiser.in/questions/2Nc5-mpX4g)

Q61 JEE Main 2020 · 2 Sep · Shift 1

Let A be a 2×2 real matrix with entries from $\{0, 1\}$ and $|A| \neq 0$. Consider the following two statements :

(P) If $A \neq I_2$, then $|A| = -1$

(Q) If $|A| = 1$, then $\text{tr}(A) = 2$,

where I_2 denotes 2×2 identity matrix and $\text{tr}(A)$ denotes the sum of the diagonal entries of A . Then :

(A) (P) is true and (Q) is false

(B) Both (P) and (Q) are false

(C) Both (P) and (Q) are true

(D) (P) is false and (Q) is true

[Step-by-step solution ► prepwiser.in/questions/6CvybWaNUs](https://www.prepwiser.in/questions/6CvybWaNUs)

Q62 JEE Main 2020 · 8 Jan · Shift 1

The number of all 3×3 matrices A , with entries from the set $\{-1, 0, 1\}$ such that the sum of the diagonal elements of AA^T is 3, is

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/uTvRbIIhYX](https://www.prepwiser.in/questions/uTvRbIIhYX)

Q63 JEE Main 2020 · 8 Jan · Shift 2

If $A = \begin{pmatrix} 2 & 2 \\ 9 & 4 \end{pmatrix}$ and $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ then $10A^{-1}$ is equal to :

(A) $6I - A$

(B) $4I - A$

(C) $A - 6I$

(D) $A - 4I$

[Step-by-step solution ► prepwiser.in/questions/wZQWn1kjcJ](https://www.prepwiser.in/questions/wZQWn1kjcJ)

Orthogonal Matrix · 7 PYQs

Q64 JEE Main 2024 · 1 Feb · Shift 2

Let $A = I_2 - 2MM^T$, where M is a real matrix of order 2×1 such that the relation $M^T M = I_1$ holds. If λ is a real number such that the relation $AX = \lambda X$ holds for some non-zero real matrix X of order 2×1 , then the sum of squares of all possible values of λ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/hywzlGrrgG](https://www.prepwiser.in/questions/hywzlGrrgG)

Q65 JEE Main 2023 · 8 Apr · Shift 1

Let

$$P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}, A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$$

and $Q = PAP^T$. If

$$P^T Q^{2007} P = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

, then $2a + b - 3c - 4d$ equal to :

(A) 2004

(B) 2006

(C) 2007

(D) 2005

[Step-by-step solution ► prepwiser.in/questions/1QOtEruPFJ](https://www.prepwiser.in/questions/1QOtEruPFJ)

Q66 JEE Main 2023 · 1 Feb · Shift 2

If

$$A = \frac{1}{2} \begin{bmatrix} 1 & \sqrt{3} \\ -\sqrt{3} & 1 \end{bmatrix}$$

, then :

(A) $A^{30} - A^{25} = 2I$

(B) $A^{30} + A^{25} - A = I$

(C) $A^{30} = A^{25}$

(D) $A^{30} + A^{25} + A = I$

[Step-by-step solution ► prepwiser.in/questions/OR3TcQ_ZMi](https://www.prepwiser.in/questions/OR3TcQ_ZMi)

Q67 JEE Main 2021 · 16 Mar · Shift 2

Let $A = \begin{bmatrix} a_1 \\ a_2 \end{bmatrix}$ and $B = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$ be two 2×1 matrices with real entries such that $A = XB$, where

$$X = \frac{1}{\sqrt{3}} \begin{bmatrix} 1 & -1 \\ 1 & k \end{bmatrix}$$

, and $k \in \mathbb{R}$.

If $a_1^2 + a_2^2 = \frac{2}{3}(b_1^2 + b_2^2)$ and $(k^2 + 1)b_2^2 \neq -2b_1b_2$, then the value of k is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/rmpfwkjixP](https://www.prepwiser.in/questions/rmpfwkjixP)

Q68 JEE Main 2021 · 25 Feb · Shift 2

If for the matrix,

$$A = \begin{bmatrix} 1 & -\alpha \\ \alpha & \beta \end{bmatrix}$$

, $AA^T = I_2$, then the value of $\alpha^4 + \beta^4$ is :

- (A) 3 (B) 2
(C) 1 (D) 4

[Step-by-step solution ► prepwisser.in/questions/NhR7WuTs2T](https://www.prepwisser.in/questions/NhR7WuTs2T)

Q69 JEE Main 2020 · 2 Sep · Shift 2

Let $a, b, c \in \mathbb{R}$ be all non-zero and satisfy

$a^3 + b^3 + c^3 = 2$. If the matrix

$A =$

$$\begin{pmatrix} a & b & c \\ b & c & a \\ c & a & b \end{pmatrix}$$

satisfies $A^T A = I$, then a value of abc can be :

- (A) 3 (B) $\frac{1}{3}$
(C) $-\frac{1}{3}$ (D) $\frac{2}{3}$

[Step-by-step solution ► prepwisser.in/questions/weMMb8P5Qq](https://www.prepwisser.in/questions/weMMb8P5Qq)

Q70 JEE Main 2020 · 7 Jan · Shift 1

Let α be a root of the equation $x^2 + x + 1 = 0$ and the matrix $A =$

$$\frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1 & 1 \\ 1 & \alpha & \alpha^2 \\ 1 & \alpha^2 & \alpha^4 \end{bmatrix}$$

then the matrix A^{31} is equal to

- (A) A^2
(B) A
(C) I_3
(D) A^3

[Step-by-step solution ► prepwisser.in/questions/RCUPGjvXeR](https://www.prepwisser.in/questions/RCUPGjvXeR)

Q71 JEE Main 2025 · 23 Jan · Shift 2

Let $A = [a_{ij}]$ be a 3×3 matrix such that $A \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$, $A \begin{bmatrix} 4 \\ 1 \\ 3 \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$ and $A \begin{bmatrix} 2 \\ 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$,

then a_{23} equals :

- (A) 2 (B) -1
(C) 1 (D) 0

Step-by-step solution ► prepwisar.in/questions/qN_Xy-ubPP

Q72 JEE Main 2025 · 23 Jan · Shift 1

If A, B , and $(\text{adj}(A^{-1}) + \text{adj}(B^{-1}))$ are non-singular matrices of same order, then the inverse of $A(\text{adj}(A^{-1}) + \text{adj}(B^{-1}))^{-1}B$, is equal to

- (A) $\frac{AB^{-1}}{|A|} + \frac{BA^{-1}}{|B|}$
(B) $\text{adj}(B^{-1}) + \text{adj}(A^{-1})$
(C) $AB^{-1} + A^{-1}B$
(D) $\frac{1}{|AB|}(\text{adj}(B) + \text{adj}(A))$

Step-by-step solution ► prepwisar.in/questions/DcPt3GuDwf

Q73 JEE Main 2024 · 9 Apr · Shift 2

Let

$$B = \begin{bmatrix} 1 & 3 \\ 1 & 5 \end{bmatrix}$$

and A be a 2×2 matrix such that $AB^{-1} = A^{-1}$. If $BCB^{-1} = A$ and $C^4 + \alpha C^2 + \beta I = O$, then $2\beta - \alpha$ is equal to

- (A) 16 (B) 10
(C) 8 (D) 2

Step-by-step solution ► prepwisar.in/questions/rGARex-8JU

Q74 JEE Main 2024 · 4 Apr · Shift 2

Let A be a 2×2 symmetric matrix such that

$$A \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 7 \end{bmatrix}$$

and the determinant of A be 1. If $A^{-1} = \alpha A + \beta I$, where I is an identity matrix of order 2×2 , then $\alpha + \beta$ equals _____.

Numerical answer — enter the value.

Step-by-step solution ► prepwisar.in/questions/ul-RsG75zs

Let

$$A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$$

and

$$B = I + \text{adj}(A) + (\text{adj } A)^2 + \dots + (\text{adj } A)^{10}$$

. Then, the sum of all the elements of the matrix B is:

(A) -110

(B) 22

(C) -124

(D) -88

[Step-by-step solution ► prepwiser.in/questions/h1YAOCsr5k](https://www.prepwiser.in/questions/h1YAOCsr5k)

Let A be a 3×3 real matrix such that

$$A \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} = 2 \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}, A \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix} = 4 \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}, A \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = 2 \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}.$$

Then, the system

$$(A - 3I) \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

has :

(A) exactly two solutions

(B) infinitely many solutions

(C) unique solution

(D) no solution

[Step-by-step solution ► prepwiser.in/questions/wjRuWo3yz8](https://www.prepwiser.in/questions/wjRuWo3yz8)

Let

$$R = \begin{pmatrix} x & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & z \end{pmatrix}$$

be a non-zero 3×3 matrix, where

$$x \sin \theta = y \sin \left(\theta + \frac{2\pi}{3} \right) = z \sin \left(\theta + \frac{4\pi}{3} \right) \neq 0, \theta \in (0, 2\pi)$$

. For a square matrix M , let $\text{trace}(M)$ denote the sum of all the diagonal entries of M . Then, among the statements:

(I) $\text{Trace}(R) = 0$

(II) If $\text{trace}(\text{adj}(\text{adj}(R))) = 0$, then R has exactly one non-zero entry.

(A) Only (I) is true

(B) Only (II) is true

(C) Both (I) and (II) are true

(D) Neither (I) nor (II) is true

[Step-by-step solution ► prepwiser.in/questions/10EB9wDQua](https://www.prepwiser.in/questions/10EB9wDQua)

Let $A = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$, $B = [B_1, B_2, B_3]$, where B_1, B_2, B_3 are column matrices, and

$$AB_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, AB_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}, AB_3 = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}$$

If $\alpha = |B|$ and β is the sum of all the diagonal elements of B , then $\alpha^3 + \beta^3$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/jrGscNqQEO](https://www.prepwiser.in/questions/jrGscNqQEO)

Q79 JEE Main 2024 · 27 Jan · Shift 1

Consider the matrix $f(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$.

Given below are two statements :

Statement I : $f(-x)$ is the inverse of the matrix $f(x)$.

Statement II : $f(x)f(y) = f(x+y)$.

In the light of the above statements, choose the correct answer from the options given below :

- (A) Statement I is false but Statement II is true
- (B) Both Statement I and Statement II are false
- (C) Both Statement I and Statement II are true
- (D) Statement I is true but Statement II is false

[Step-by-step solution ► prepwisser.in/questions/IzuB3JSwpT](https://www.prepwisser.in/questions/IzuB3JSwpT)

Q80 JEE Main 2023 · 13 Apr · Shift 2

Let for

$$A = \begin{bmatrix} 1 & 2 & 3 \\ \alpha & 3 & 1 \\ 1 & 1 & 2 \end{bmatrix}, |A| = 2$$

. If $|2 \operatorname{adj}(2 \operatorname{adj}(2A))| = 32^n$, then $3n + \alpha$ is equal to

- (A) 11
- (B) 9
- (C) 12
- (D) 10

[Step-by-step solution ► prepwisser.in/questions/Oc3J30lwbZ](https://www.prepwisser.in/questions/Oc3J30lwbZ)

Q81 JEE Main 2023 · 8 Apr · Shift 2

If

$$A = \begin{bmatrix} 1 & 5 \\ \lambda & 10 \end{bmatrix}, A^{-1} = \alpha A + \beta I$$

and $\alpha + \beta = -2$, then $4\alpha^2 + \beta^2 + \lambda^2$ is equal to :

- (A) 12
- (B) 10
- (C) 19
- (D) 14

[Step-by-step solution ► prepwisser.in/questions/BsBgB5tmN3](https://www.prepwisser.in/questions/BsBgB5tmN3)

Q82 JEE Main 2023 · 6 Apr · Shift 1

Let $A = [a_{ij}]_{2 \times 2}$, where $a_{ij} \neq 0$ for all i, j and $A^2 = I$. Let a be the sum of all diagonal elements of A and $b = |A|$. Then $3a^2 + 4b^2$ is equal to :

- (A) 4
- (B) 3
- (C) 14
- (D) 7

[Step-by-step solution ► prepwisser.in/questions/q9BHJ2XLWU](https://www.prepwisser.in/questions/q9BHJ2XLWU)

Q83 JEE Main 2023 · 31 Jan · Shift 2

Let A be a $n \times n$ matrix such that $|A| = 2$. If the determinant of the matrix $\text{Adj}(2 \cdot \text{Adj}(2A^{-1}))$ is 2^{84} , then n is equal to :

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/gmAkwKbDO6](https://www.prepwisar.in/questions/gmAkwKbDO6)

Q84 JEE Main 2023 · 25 Jan · Shift 2

Let

$$A = \begin{bmatrix} \frac{1}{\sqrt{10}} & \frac{3}{\sqrt{10}} \\ \frac{-3}{\sqrt{10}} & \frac{1}{\sqrt{10}} \end{bmatrix}$$

and $B = \begin{bmatrix} 1 & -i \\ 0 & 1 \end{bmatrix}$, where $i = \sqrt{-1}$. If $M = A^T B A$, then the inverse of the matrix $A M^{2023} A^T$ is

(A) $\begin{bmatrix} 1 & -2023i \\ 0 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} 1 & 0 \\ 2023i & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 1 & 2023i \\ 0 & 1 \end{bmatrix}$

(D) $\begin{bmatrix} 1 & 0 \\ -2023i & 1 \end{bmatrix}$

[Step-by-step solution ► prepwisar.in/questions/JQIZX3IWA1](https://www.prepwisar.in/questions/JQIZX3IWA1)

Q85 JEE Main 2022 · 27 Jul · Shift 1

Let

$$A = \begin{pmatrix} 1 & 2 \\ -2 & -5 \end{pmatrix}$$

. Let $\alpha, \beta \in \mathbb{R}$ be such that $\alpha A^2 + \beta A = 2I$. Then $\alpha + \beta$ is equal to

(A) -10

(B) -6

(C) 6

(D) 10

[Step-by-step solution ► prepwisar.in/questions/9TXVLoXs7i](https://www.prepwisar.in/questions/9TXVLoXs7i)

Q86 JEE Main 2022 · 26 Jul · Shift 2

The number of matrices

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

, where $a, b, c, d \in \{-1, 0, 1, 2, 3, \dots, 10\}$, such that $A = A^{-1}$, is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/qCxcgT0zR-7](https://www.prepwisar.in/questions/qCxcgT0zR-7)

Q87 JEE Main 2022 · 29 Jun · Shift 1

Let $A = [a_{ij}]$ be a square matrix of order 3 such that $a_{ij} = 2^{j-i}$, for all $i, j = 1, 2, 3$. Then, the matrix $A^2 + A^3 + \dots + A^{10}$ is equal to :

- (A) $\left(\frac{3^{10}-3}{2}\right) A$
(B) $\left(\frac{3^{10}-1}{2}\right) A$
(C) $\left(\frac{3^{10}+1}{2}\right) A$
(D) $\left(\frac{3^{10}+3}{2}\right) A$

[Step-by-step solution ► prepwiser.in/questions/f19S4KleH3](https://www.prepwiser.in/questions/f19S4KleH3)

Q88 JEE Main 2022 · 29 Jun · Shift 2

Let $A = \begin{pmatrix} 2 & -1 \\ 0 & 2 \end{pmatrix}$. If

$$B = I - {}^5C_1(\text{adj } A) + {}^5C_2(\text{adj } A)^2 - \dots - {}^5C_5(\text{adj } A)^5$$

, then the sum of all elements of the matrix B is

- (A) -5 (B) -6
(C) -7 (D) -8

[Step-by-step solution ► prepwiser.in/questions/INUw8xl3BO](https://www.prepwiser.in/questions/INUw8xl3BO)

Q89 JEE Main 2022 · 26 Jun · Shift 2

Let

$$X = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}, Y = \alpha I + \beta X + \gamma X^2$$

and $Z = \alpha^2 I - \alpha\beta X + (\beta^2 - \alpha\gamma)X^2$, $\alpha, \beta, \gamma \in \mathbb{R}$. If

$$Y^{-1} = \begin{bmatrix} \frac{1}{5} & \frac{-2}{5} & \frac{1}{5} \\ 0 & \frac{1}{5} & \frac{-2}{5} \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$$

, then $(\alpha - \beta + \gamma)^2$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/IrSP_kgiVD](https://www.prepwiser.in/questions/IrSP_kgiVD)

Q90 JEE Main 2022 · 24 Jun · Shift 2

Let

$$S = \left\{ \begin{pmatrix} -1 & a \\ 0 & b \end{pmatrix}; a, b \in \{1, 2, 3, \dots, 100\} \right\}$$

and let $T_n = \{A \in S : A^{n(n+1)} = I\}$. Then the number of elements in $\bigcap_{n=1}^{100} T_n$ is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/sr38hCK9Uo](https://www.prepwiser.in/questions/sr38hCK9Uo)

If

$$A = \begin{pmatrix} \frac{1}{\sqrt{5}} & \frac{2}{\sqrt{5}} \\ \frac{-2}{\sqrt{5}} & \frac{1}{\sqrt{5}} \end{pmatrix}$$

, $B = \begin{pmatrix} 1 & 0 \\ i & 1 \end{pmatrix}$, $i = \sqrt{-1}$, and $Q = A^T B A$, then the inverse of the matrix $A Q^{2021} A^T$ is equal to :

(A) $\begin{pmatrix} \frac{1}{\sqrt{5}} & -2021 \\ 2021 & \frac{1}{\sqrt{5}} \end{pmatrix}$

(B) $\begin{pmatrix} 1 & 0 \\ -2021i & 1 \end{pmatrix}$

(C) $\begin{pmatrix} 1 & 0 \\ 2021i & 1 \end{pmatrix}$

(D) $\begin{pmatrix} 1 & -2021i \\ 0 & 1 \end{pmatrix}$

[Step-by-step solution ► prepwiser.in/questions/eC0_fC3ZBI](https://www.prepwiser.in/questions/eC0_fC3ZBI)

Let $A = \begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$. If $A^{-1} = \alpha I + \beta A$, $\alpha, \beta \in \mathbb{R}$, I is a 2×2 identity matrix then $4(\alpha - \beta)$ is equal to :

(A) 5

(B) $\frac{8}{3}$

(C) 2

(D) 4

[Step-by-step solution ► prepwiser.in/questions/e6WGa7sRXT](https://www.prepwiser.in/questions/e6WGa7sRXT)

If

$$A = \begin{bmatrix} 0 & -\tan\left(\frac{\theta}{2}\right) \\ \tan\left(\frac{\theta}{2}\right) & 0 \end{bmatrix}$$

and

$$(I_2 + A)(I_2 - A)^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$$

, then $13(a^2 + b^2)$ is equal to

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/rYDhs0v7X0](https://www.prepwiser.in/questions/rYDhs0v7X0)

Let $P =$

$$\begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{bmatrix}$$

, where $\alpha \in \mathbb{R}$. Suppose $Q = [q_{ij}]$ is a matrix satisfying $PQ = kI_3$ for some non-zero $k \in \mathbb{R}$.

If $q_{23} = -\frac{k}{8}$ and $|Q| = \frac{k^2}{2}$, then $a^2 + k^2$ is equal to _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/x3Qqjxk-Qy](https://www.prepwisar.in/questions/x3Qqjxk-Qy)

Answer key — Matrices

Numbers match the question numbers above. For full working, open the solution link under each question.

1	1613	2	C	3	C	4	D	5	A	6	A	7	C	8	5376
9	D	10	A	11	B	12	D	13	6	14	B	15	B	16	2
17	C	18	C	19	7	20	10	21	C	22	2	23	C	24	D
25	B	26	B	27	5	28	D	29	C	30	10	31	C	32	B
33	2	34	B	35	17	36	24	37	1	38	25	39	180	40	414
41	B	42	A	43	1	44	8	45	A	46	A	47	2020	48	A
49	11	50	3125	51	C	52	910	53	6	54	B	55	766	56	4
57	7	58	540	59	D	60	10	61	D	62	672	63	C	64	2
65	D	66	B	67	1	68	C	69	B	70	D	71	B	72	D
73	B	74	5	75	D	76	C	77	D	78	28	79	C	80	A
81	D	82	A	83	5	84	C	85	D	86	50	87	A	88	C
89	100	90	100	91	B	92	D	93	13	94	17				

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