



MATHS

BOOKS - CENGAGE MATHS (HINGLISH)

MATRICES

Examples

1. If
$$e^A$$
 is defined as $e^A = I + A + \frac{A^2}{2!} + \frac{A^3}{3!} + ... = \frac{1}{2} \begin{bmatrix} f(x) & g(x) \\ g(x) & f(x) \end{bmatrix}$, where $A = \begin{bmatrix} x & x \\ x & x \end{bmatrix}$, $0 < x < 1$ and I is identity matrix, then find the functions $f(x)$ and $g(x)$.

2. Prove that matrix
$$\begin{bmatrix} \frac{b^2 - a^2}{a^2 + b^2} & \frac{-2ab}{a^2 + b^2} \\ \frac{-2ab}{a^2 + b^2} & \frac{a^2 - b^2}{a^2 + b^2} \end{bmatrix}$$
 is orthogonal.

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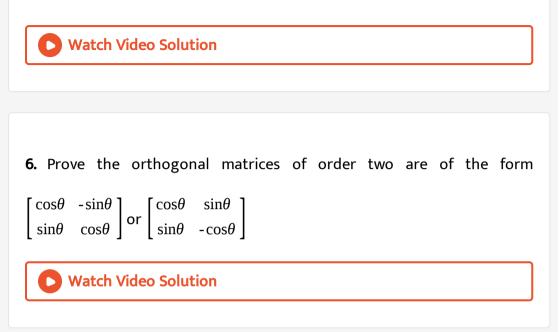
3. If
$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$
, where a, b, c and d are real numbers, then prove that $A^2 - (a + d)A + (ad - bc)I = O$. Hence or therwise, prove that if $A^3 = O$ then $A^2 = O$

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4. Statement 1: If $A = \left(\left[a_{ij} \right] \right)_{n \times n}$ is such that $(a)_{ij} = a_{ji}, \forall i, jandA^2 = O$,

then matrix A null matrix. Statement 2: |A| = 0.

5. Find the possible square roots of the two-rowed unit matrix I.



7. Let
$$A = \begin{bmatrix} \tan \frac{\pi}{3} & \sec \frac{2\pi}{3} \\ \\ \cot \left(2013 \frac{\pi}{3} \right) & \cos(2012\pi) \end{bmatrix}$$
 and P be a 2 × 2 matrix such that

 $PP^{T} = I$, where I is an identity matrix of order 2. If $Q = PAP^{T}$ and $R = \left[r_{ij}\right]_{2 \times 2} = P^{T}Q^{8}P$, then find r_{11} .

8. Consider, $A = \begin{bmatrix} a & 2 & 1 \\ 0 & b & 0 \\ 0 & -3 & c \end{bmatrix}$, where a, b and c are the roots of the equation $x^3 - 3x^2 + 2x - 1 = 0$. If matric B is such that $AB = BA, A + B - 2I \neq O$ and $A^2 - B^2 = 4I - 4B$, then find the value of det. (B)



9. If A and B are square matrices of order 3 such that det. (A) = -2 and det. (B) = 1, then det. $(A^{-1}adjB^{-1}.adj(2A^{-1}))$ is equal to

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10. If a matrix has 28 elements, what are the possible orders it can have ?

11. Construct a 2×2 matrix, where

(i)
$$a_{ij} = \frac{(i-2j)^2}{2}$$
 (ii) $a_{ij} = |-2i+3j|$

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12. What is the maximum number of different elements required to form

a symmetric matrix of order 12?

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13. If a square matix a of order three is defined $A = \begin{bmatrix} a_{ij} \end{bmatrix}$ where

 $a_{ii} = sgn(i - j)$, then prove that A is skew-symmetric matrix.



14. For what values of x and y are the following matrices equal ?

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

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15. For α , β , $\gamma \in R$, let

$$A = \begin{bmatrix} \alpha^2 & 6 & 8 \\ 3 & \beta^2 & 9 \\ 4 & 5 & \gamma^2 \end{bmatrix} \text{ and } B = \begin{bmatrix} 2\alpha & 3 & 5 \\ 2 & 2\beta & 6 \\ 1 & 4 & 2\gamma - 3 \end{bmatrix}$$

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16. Find the values of x for which matrix $\begin{bmatrix} 3 & -1+x & 2\\ 3 & -1 & x+2\\ x+3 & -1 & 2 \end{bmatrix}$ is singular.

17. If
$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$$
 and $B = \begin{bmatrix} -3 & -2 \\ 1 & -5 \\ 4 & 3 \end{bmatrix}$, then find $D = \begin{bmatrix} p & q \\ r & s \\ t & u \end{bmatrix}$ such that $A + B - D = O$.



18.
$$A = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$$
 and $A + A^T = I$, find the value of α .

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19. Let A be a square matrix. Then prove that $(i)A + A^T$ is a symmetric matrix, $(ii)A - A^T$ is a skew-symmetric matrix and $(iii) \forall^T$ and A^TA are symmetric matrices.



20. If A = [2 - 131] and B = [1472], find 3A - 2B

21. Find non-zero values of x satisfying the matrix equation: $x[2x23x] + 2[85x44x] = 2[x^2 + 824106x]$

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22. Let
$$A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -1 & 3 \\ -5 & 3 & 1 \end{bmatrix}$$
 and $2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$, then find

tr(A) - tr(B).

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23. If $\begin{bmatrix} \lambda^2 - 2\lambda + 1 & \lambda - 2 \\ 1 - \lambda^2 + 3\lambda & 1 - \lambda^2 \end{bmatrix} = A\lambda^2 + B\lambda + C$, where A, B and C are matrices

then find matrices B and C.

24. Prove that every square matrix can be uniquely expressed as the sum

of a symmetric matrix and a skew-symmetric matrix.

25. Matrix A ha s m rows and n+ 5 columns; matrix B has m rows and 11 - *n* columns. If both AB and BA exist, then (A) AB and BA are square matrix (B) AB and BA are of order 8×8 and 3×13 , respectively (C) AB = BA (D) None of these



26. If
$$A = \begin{bmatrix} 2 & 3 & -1 \\ 1 & 4 & 2 \end{bmatrix}$$
 and $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \\ 2 & 1 \end{bmatrix}$ then AB and BA are defined and

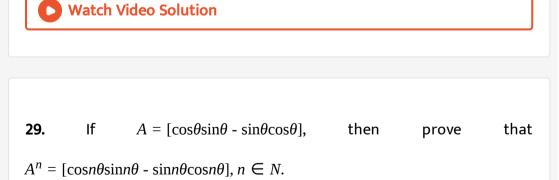
equal.

27. Find the value of x and y that satisfy the equations

$$\begin{bmatrix} 3 & -2 \\ 3 & 0 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} y & y \\ x & x \end{bmatrix} = \begin{bmatrix} 3 & 3 \\ 3y & 3y \\ 10 & 10 \end{bmatrix}$$

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28. Find the values of x, y, z if the matrix A = [02yzxy - zx - yz] satisfy the equation $A^T A = I_3$.



30. If
$$A = \begin{pmatrix} p & q \\ 0 & 1 \end{pmatrix}$$
, then show that $A^8 = \begin{pmatrix} p^8 & q \begin{pmatrix} \frac{p^8 - 1}{p - 1} \\ 0 & 1 \end{pmatrix}$

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31. Let
$$A = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$$
 be a matrix. If $A^{10} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then prove that $a + d$ is

divisible by 13.

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32. Show that the solution of the equation
$$\begin{bmatrix} x & y \\ z & t \end{bmatrix}^2 = O$$
 is $\begin{bmatrix} x & y \\ z & t \end{bmatrix} = O$ is

$$\begin{bmatrix} x & y \\ z & t \end{bmatrix} = \begin{bmatrix} \pm \sqrt{\alpha\beta} & -\beta \\ \alpha & \pm \sqrt{\alpha\beta} \end{bmatrix}$$
 where α, β are arbitrary.

33. Let a be square matrix. Then prove that AA^T and A^TA are symmetric

matrices.

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34. If A, B are square materices of same order and B is a skewsymmetric matrix, show that $A^{T}BA$ is skew-symmetric.

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35. If a and B are square matrices of same order such that AB + BA = O,

then prove that
$$A^3 - B^3 = (A + B)(A^2 - AB - B^2)$$
.

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36. Let $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$. If $A^6 = kA - 205I$ then then numerical quantity of k - 40 should be

37. Let A, B, C, D be (not necessarily square) real matrices such that $A^T = BCD$: $B^T = CDA$; $C^T = DAB$ and $D^T = ABC$. For the matrix S = ABCD, consider the two statements. I. $S^3 = S$ II. $S^2 = S^4$ (A) II is true but not I (B) I is true but not II (C) both I and II are true (D) both I and II are false

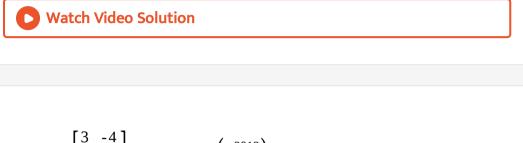
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38. If A and B are square matrices of the same order such that AB = BA, then proveby induction that $AB^n = B^nA$. Further, prove that $(AB)^n = A^nB^n$ for all $n \in N$.



39. If A = [-110 - 2], then prove that $A^2 + 3A + 2I = O$ Hence, find *BandC*

matrices of order 2 with integer elements, if $A = B^3 + C^3$



40. If
$$A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$$
 then find tr. (A^{2012}) .

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41. If A is a nonsingular matrix satisfying AB - BA = A, then prove that det.

$$(B + I) = \det, (B - I).$$

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42. If det, $(A - B) \neq 0, A^4 = B^4, C^3A = C^3B$ and $B^3A = A^3B$, then find the value of det. $(A^3 + B^3 + C^3)$.



43. Given a matrix A = [abcbcacab], wherea, b, c are real positive numbers

 $abc = 1andA^{T}A = I$, then find the value of $a^{3} + b^{3} + c^{3}$

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44. If M is a 3×3 matrix, where det M = 1 and $MM^T = 1$, where I is an

identity matrix, prove theat det (M - I) = 0.

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45. Consider point P(x, y) in first quadrant. Its reflection about x-axis is $Q(x_1, y_1)$. So, $x_1 = x$ and y(1) = -y.

This may be written as :
$$\begin{cases} x_1 = 1. \, x + 0. \, y \\ y_1 = 0. \, x + (-1) y \end{cases}$$

This system of equations can be put in the matrix as :

 $\begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$ Here, matrix $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ is the matrix of reflection about x-axis. Then find the matrix of

- (i) reflection about y-axis
- (ii) reflection about the line y = x
- (iii) reflection about origin
- (iv) reflection about line $y = (\tan \theta)x$

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46. If
$$A = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$$
 then A is `1) an idempotent matrix 2) nilpotent

matrix 3) involutary 4) orthogonal matrix

47. If
$$A = \begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$$
 then find $A^{14} + 3A - 2I$

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48. The matrix A = [-5 - 8035012 -] is a idempotent matrix b. involutory

matrix c. nilpotent matrix d. none of these

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49. If
$$abc = p$$
 and $A = \begin{bmatrix} a & b & c \\ c & a & b \\ b & c & a \end{bmatrix}$, prove that A is orthogonal if and only if

a, b, c are the roots of the equation $x^3 \pm x^2 - p = 0$.

50. Let A be an orthogonal matrix, and B is a matrix such that AB = BA,

then show that $AB^T = B^T A$.

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51. Find the adjoint of the matrix
$$A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 1 & -3 \\ -1 & 2 & 3 \end{bmatrix}$$
.

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52. If
$$S = \begin{bmatrix} \frac{\sqrt{3} - 1}{2\sqrt{2}} & \frac{\sqrt{3} + 1}{2\sqrt{2}} \\ -\left(\frac{\sqrt{3} + 1}{2\sqrt{2}}\right) & \frac{\sqrt{3} - 1}{2\sqrt{2}} \end{bmatrix}$$
, $A = \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$ and $P = S(\text{adj.A})S^T$, then find

matrix $S^T P^{10} S$.

53. If A is a square matrix such that
$$A(adjA) = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{bmatrix}$$
, then
$$= \frac{|adj(adjA)|}{2|adjA|}$$
 is equal to
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54. Let A be a square matrix of order 3 such that

adj. (adj. (adj. A)) =
$$\begin{bmatrix} 16 & 0 & -24 \\ 0 & 4 & 0 \\ 0 & 12 & 4 \end{bmatrix}$$
. Then find

(i) |*A*| (ii) adj. A

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55. Let
$$A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$$
 and $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$. If B is the inverse of A,

then α is :

56. Matrices a and B satisfy $AB = B^{-1}$, where $B = \begin{bmatrix} 2 & -1 \\ 2 & 0 \end{bmatrix}$. Find

(i) without finding B^{-1} , the value of K for which

 $KA - 2B^{-1} + I = O.$

(ii) without finding A^{-1} , the matrix X satifying $A^{-1}XA = B$.

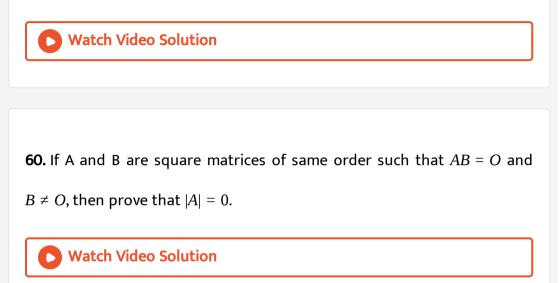
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57. Given the matrices a and B as $A = \begin{bmatrix} 1 & -1 \\ 4 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 \\ 2 & -2 \end{bmatrix}$. The two matrices X and Y are such that XA = B and AY = B, then find the matrix 3(X + Y)

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58. If M is the matrix
$$\begin{bmatrix} 1 & -3 \\ -1 & 1 \end{bmatrix}$$
 then find matrix $\sum_{r=0}^{\infty} \left(\frac{-1}{3}\right)^r M^{r+1}$

59. Let p be a non singular matrix, and $I + P + p^2 + ... + p^n = 0$, then find p^{-1} .



61. If A is a symmetric matrix, B is a skew-symmetric matrix, A + B is nonsingular and $C = (A + B)^{-1}(A - B)$, then prove that (i) $C^{T}(A + B)C = A + B$ (ii) $C^{T}(A - B)C = A - B$ (iii) $C^{T}AC = A$

62. If the matrices, A, B and (A + B) are non-singular, then prove that

$$\left[A(A+B)^{-1}B\right]^{-1} = B^{-1} + A^{-1}.$$

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63. If matrix a satisfies the equation $A^2 = A^{-1}$, then prove that $A^{2^n} = A^{2^{(n-1)}}, n \in N$.

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64. If a and B are non-singular symmetric matrices such that AB = BA, then prove that $A^{-1}B^{-1}$ is symmetric matrix.

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65. If A is a matrix of order n such that $A^{T}A = I$ and X is any matric such

that $X = (A + I)^{-1}(A - I)$, then show that X is skew symmetric matrix.

66. Show that two matrices

$$A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 1 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 3 & 0 & 1 \\ 0 & 3 & 1 \end{bmatrix} \text{ are row equivalent.}$$

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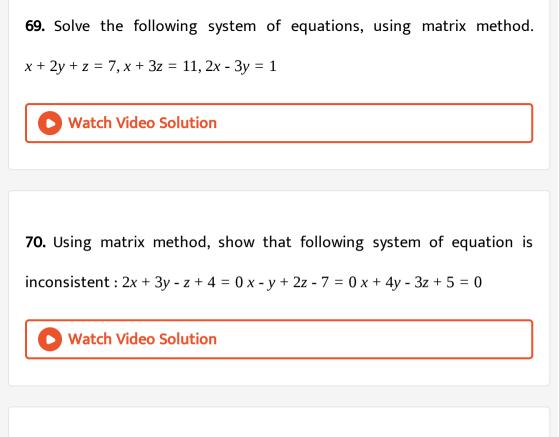
67. Using elementary transformations, find the inverse of the matrix :

(20 - 1510013)

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68. Let a be a 3×3 matric such that

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}, \text{ then find } A^{-1}.$$



71.
$$A = \begin{bmatrix} a & 1 & 0 \\ 1 & b & d \\ 1 & b & c \end{bmatrix}, B = \begin{bmatrix} a & 1 & 1 \\ 0 & d & c \\ f & g & h \end{bmatrix}, U = \begin{bmatrix} f \\ g \\ h \end{bmatrix}, V = \begin{bmatrix} a^2 \\ 0 \\ 0 \end{bmatrix}$$
 If there is a

vector matrix X, such that AX = U has infinitely many solutions, then prove that BX = V cannot have a unique solution. If $afd \neq 0$. Then, prove that BX = V has no solution.

72. Find the characteristic roots of the two-rowed orthogonal matrix

 $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ and verify that they are of unit modulus.

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73. Show that if $\lambda_1, \lambda_2, \dots, lamnda_n$ are *n* eigenvalues of a square matrix a

of order n, then the eigenvalues of the matric A^2 are $\lambda_1^2, \lambda_2^2, ..., \lambda_n^2$.

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74. If A is nonsingular, prove that the eigenvalues of A^{-1} are the reciprocals of the eigenvalue of A.



75. If one of the eigenvalues of a square matrix a order 3×3 is zero, then

prove that $\det A = 0$.



Exercise 13 1

1. Construct a 3 × 4matrix, whose elements are given by:(i) $a_{ij} = \frac{1}{2} |-3i+j|$

(ii) $a_{ij} = 2i - j$



2. Find the value of a if [a - b2a + c2a - b3c + d] = [-15013]

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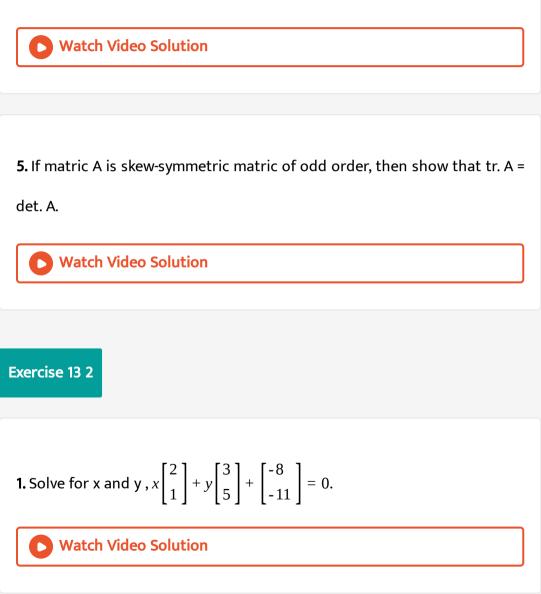
3. Find the number of all possible matrices of order 3×3 with each entry

0 or 1. How many of these are symmetric?



4. Find the value of x for which the matrix $A = \begin{bmatrix} 2/x & -1 & 2\\ 1 & x & 2x^2\\ 1 & 1/x & 2 \end{bmatrix}$ is

singular.



2. If
$$A = \begin{bmatrix} 1 & 5 \\ 7 & 12 \end{bmatrix}$$
 and $B = \begin{bmatrix} 9 & 1 \\ 7 & 8 \end{bmatrix}$ then find a matrix C such that

3A + 5B + 2C is a null matrix.



3. Solve the following equations for X and Y :

$$2X - Y = \begin{bmatrix} 3 & -3 & 0 \\ 3 & 3 & 2 \end{bmatrix}, 2Y + X = \begin{bmatrix} 4 & 1 & 5 \\ -1 & 4 & -4 \end{bmatrix}$$

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4. If
$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 2 & 2 & 3 \end{bmatrix} B = \begin{bmatrix} 1 & 2 & 2 \\ -2 & -1 & -2 \\ 2 & 2 & 3 \end{bmatrix}$$
 and $C = \begin{bmatrix} -1 & -2 & -2 \\ 2 & 1 & 2 \\ 2 & 2 & 3 \end{bmatrix}$ then find the value of tr. $(A + B^T + 3C)$.

5. If $A = \begin{bmatrix} 3 & -2 \\ 4 & -1 \end{bmatrix}$, then find all the possible values of λ such that the

matrix (A - λI) is singular.

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6. If matrix
$$A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix} = B + C$$
, where B is symmetric matrix and C

is skew-symmetric matrix, then find matrices B and C.

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Exercise 13 3

1. Consider the matrices

$$A = \begin{bmatrix} 4 & 6 & -1 \\ 3 & 0 & 2 \\ 1 & -2 & 5 \end{bmatrix}, B = \begin{bmatrix} 2 & 4 \\ 0 & 1 \\ -1 & 2 \end{bmatrix}, C = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$$

Out of the given matrix products, which one is not defined ?

A. $(AB)^T C$

B. $C^T C(AB)^T$

 $\mathsf{C}.\, C^T\!AB$

 $\mathbf{D}. A^T A B B^T C$

Answer: B

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2. Let
$$A = BB^T + CC^T$$
, where $B = \begin{bmatrix} \cos\theta \\ \sin\theta \end{bmatrix}$, $C = \begin{bmatrix} \sin\theta \\ -\cos\theta \end{bmatrix}$, $\theta \in R$. Then prove

that a is unit matrix.

3. The matrix R(t) is defined by $R(t) = \begin{bmatrix} \cos t & \sin t \\ -\sin t & \cos t \end{bmatrix}$. Show that R(s)R(t) = R(s+t).

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4. if
$$A = \begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$$
 where $i = \sqrt{-1}$ and $x \in N$ then A^{4x} equals to:

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5. If
$$A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$$
 prove that $A^k = \begin{bmatrix} 1+2k & -4k \\ k & 1-2k \end{bmatrix}$ where k is any positive

integer.

6. If
$$A = \begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$$
 and $B = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ and X is a matrix such that $A = BX$, then X=



7. for what values of x:

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

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8. Find the matrix X so that *X*[123456] = [-7-8-9246]



9. If
$$A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$$
, then $\lim_{x \to \infty} \frac{1}{n} A^n$ is

10.
$$A = \begin{bmatrix} 3 & a & -1 \\ 2 & 5 & c \\ b & 8 & 2 \end{bmatrix}$$
 is symmetric and $B = \begin{bmatrix} d & 3 & a \\ b - a & e & -2b - c \\ -2 & 6 & -f \end{bmatrix}$ is skew-

symmetric, then find AB.





1. If A and B are matrices of the same order, then $AB^T - B^T A$ is a (a) skew-

symmetric matrix (b) null matrix (c) unit matrix (d) symmetric matrix



2. If A and B are square matrices such that AB = BA then prove that $A^3 - B^3 = (A - B)(A^2 + AB + B^2).$ **3.** If A is a square matrix such that $A^2 = I$, then

 $(A - I)^3 + (A + I)^3 - 7A$ is equal to

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4. If *B*, *C* are square matrices of order nand if A = B + C, BC = CB, $C^2 = O$, then without using mathematical

induction, show that for any positive integer $p, A^{p-1} = B^p[B + (p+1)C]$.

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5. Let A be any 3×2 matrix. Then prove that det. $(AA^T) = 0$.

6. Let A be a matrix of order 3, such that $A^{T}A = I$. Then find the value of

det.
$$(A^2 - I)$$
.

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7. A and B are different matrices of order n satisfying $A^3 = B^3$ and $A^2B = B^2A$. If det. $(A - B) \neq 0$, then find the value of det. $(A^2 + B^2)$.

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8. If
$$D = diag[d_1, d_2, d_n]$$
, then prove that $f(D) = diag[f(d_1), f(d_2), f(d_n)]$, where $f(x)$ is a polynomial with scalar coefficient.

9. Point P(x, y) is rotated by an angle θ in anticlockwise direction. The new

position of point P is
$$Q(x_1, y_1)$$
. If $\begin{bmatrix} x_1 \\ y_1 \end{bmatrix} = A \begin{bmatrix} x \\ y \end{bmatrix}$, then find matrix A.

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10. How many different diagonal matrices of order n can be formed which

are idempotent ?

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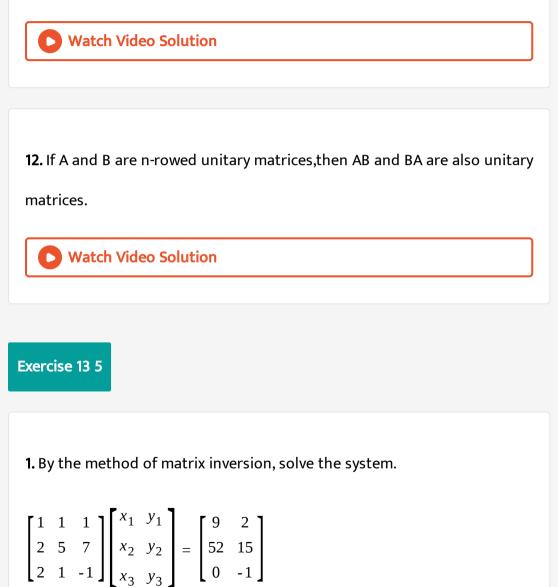
11. How many different diagonal matrices of order n can be formed which are involuntary ?

A. 2^{*n*}

B. 2^{*n*} - 1

C. 2^{*n*-1}

Answer: A



2. Let
$$A = \begin{bmatrix} 2 & 0 & 7 \\ 0 & 1 & 0 \\ 1 & -2 & 1 \end{bmatrix}$$
 and $B = \begin{bmatrix} -x & 14x & 7x \\ 0 & 1 & 0 \\ x & -4x & -2x \end{bmatrix}$ are two matrices such
that $AB = (AB)^{-1}$ and $AB \neq I$ then
 $Tr((AB) + (AB)^2 + (AB)^3 + (AB)^4 + (AB)^5 + (AB)^6) =$

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3. Find
$$A^{-1}$$
 if $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ and show that $A^{-1} = \frac{A^2 - 3I}{2}$

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4. For the matrix A = [3175], find x and y so that $A^2 + xI = yA$



5. If $A^3 = O$, then prove that $(I - A)^{-1} = I + A + A^2$.



6. If
$$A = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$$
, $B = \begin{bmatrix} \cos 2\beta & \sin 2\beta \\ \sin 2\beta & -\cos 2\beta \end{bmatrix}$ where $0 < \beta < \frac{\pi}{2}$ then prove that $BAB = A^{-1}$ Also find the least positive value of α for which $BA^4B = A^{-1}$

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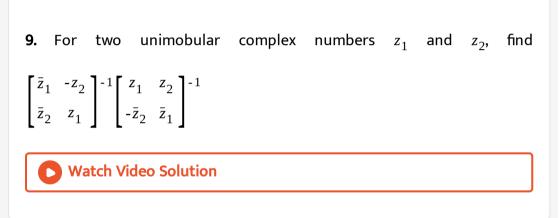
7. If
$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 2 & 3 \\ 1 & -1 & 3 \end{bmatrix}$$
, $C = \begin{bmatrix} 2 & 1 & 1 \\ 2 & 2 & 1 \\ 1 & 1 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 10 \\ 13 \\ 9 \end{bmatrix}$, and $CB = D$. Solve the

equation AX = B.

8. If A is a 2×2 matrix such that $A^2 - 4A + 3I = O$, then prove that

$$(A+3I)^{-1}=\frac{7}{24}I-\frac{1}{24}A.$$

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10. Prove that inverse of a skew-symmetric matrix (if it exists) is skew-

symmetric.



11. If square matrix a is orthogonal, then prove that its inverse is also orthogonal.



12. If A is a skew symmetric matrix, then $B = (I - A)(I + A)^{-1}$ is (where I is

an identity matrix of same order as of A)

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13. Prove that (adj.
$$A$$
)⁻¹ = (adj. A^{-1}).

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14. Using elementary transformation, find the inverse of the matrix

$$A = \begin{bmatrix} a & b \\ c & \left(\frac{1+bc}{a}\right) \end{bmatrix}.$$



15. Show that the two matrices A, $P^{-1}AP$ have the same characteristic

roots.

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16. Show that the characteristics roots of an idempotent matris are either

0 or 1

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17. If α is a characteristic root of a nonsin-gular matrix, then prove that

 $|A|\alpha|$ is a characteristic root of adj A.



1. If A is symmetric as well as skew-symmetric matrix, then A is

A. diagonal matrix

B. null matrix

C. triangular materix

D. none of these

Answer: B

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2. Elements of a matrix A of order 10 x 10 are defined as $a_{ij} = \omega^{i+j}$ (where omega is cube root unity), then tr(A) of matrix is

A. 0

B. 1

C. 3

D. none of these

Answer: D



3. If A_1, A_2, A_{2n-1} area skew-symmetric matrices of same order, then $B = \sum_{r=1}^{n} (2r - 1) \left(A^{2r-1}\right)^{2r-1}$ will be symmetric skew-symmetric neither

symmetric nor skew-symmetric data not adequate

A. symmetric

B. skew-symmetric

C. neither symmetric nor skew-symmetric

D. data not adequate

Answer: B

4. The equation $[1xy] \begin{bmatrix} 1 & 3 & 1 \\ 0 & 2 & -1 \\ 0 & 2 & -1 \end{bmatrix} \begin{bmatrix} 1 \\ x \\ y \end{bmatrix} = [0]$ has

- A. (i) (ii) (ii) (p) (r)B. (i) (ii) (ii) (q) (p)C. (i) (ii) (p) (q) (q)D
- D. (r) (p)

Answer: C

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5. Let *AandB* be two 2×2 matrices. Consider the statements AB = OA + O or B = O $AB = I_2A = B^{-1} (A + B)^2 = A^2 + 2AB + B^2$ (i) and (ii) are false, (iii) is true (ii) and (iii) are false, (i) is true (i) is false (ii) and, (iii) are true (i) and (iii) are false, (ii) is true

A. (i) and (ii) are false, (iii) is true

- B. (ii) and (iii) are false, (i) is true
- C. (i) is false, (ii) and (iii) are true
- D. (i) and (iii) are false, (ii) is true

Answer: D

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6. The number of diagonal matrix, A or ordern which $A^3 = A$ is

A. 1

B. 0

C. 2^{*n*}

D. 3^{*n*}

Answer: D

7. A is a 2 × 2 matrix such that $A[1 - 1] = [-12]andA^2[1 - 1] = [10]$ The

sum of the elements of A is -1 b. 0 c. 2 d. 5

A. - 1

B. 0

C. 2

D. 5

Answer: D

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8. If
$$\begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix} \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix} = O$$
 'then value of '
 $\theta - \phi$ equals,

 $\mathsf{B}.\,n\frac{\pi}{2},n\in Z$

A. $2n\pi$, $\in Z$

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

D. $n\pi$, $n \in Z$

Answer: C

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9. If A = [ab0a] is nth root of I_2 , then choose the correct statements: If n is odd, a = 1, b = 0 If n is odd, a = -1, b = 0 If n is even, a = 1, b = 0 If n is even, a = -1, b = 0 If n is even, a = -1, b = 0 If n is iii, iv b. ii, iii, iv c. i, ii, iii, iv d. i, iii, iv

A. i, ii, iii

B. ii, iii, iv

C. i, ii, iii, iv

D. i, iii, iv

Answer: D

10. If $[\alpha\beta\gamma - \alpha]$ is to be square root of two-rowed unit matrix, then α , β and γ should satisfy the relation. $1 - \alpha^2 + \beta\gamma = 0$ b. $\alpha^2 + \beta\gamma = 0$ c. $1 + \alpha^2 + \beta\gamma = 0$ d. $1 - \alpha^2 - \beta\gamma = 0$ A. $1 - \alpha^2 + \beta\gamma = 0$ B. $\alpha^2 + \beta\gamma - 1 = 0$ C. $1 + \alpha^2 + \beta\gamma = 0$ D. $1 - \alpha^2 - \beta\gamma = 0$

Answer: B

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11. If A = [i - i - ii]andB = [1 - 1 - 11], then A^8 equals 4B b. 128B c. -128B d.

-64B

A. 4B

B. 128B

С. - 128 В

D.-64B

Answer: B

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12. If
$$\begin{bmatrix} 2 & -1 \\ 1 & 0 \\ -3 & 4 \end{bmatrix} A = \begin{bmatrix} -1 & -8 & -10 \\ 1 & -2 & -5 \\ 9 & 22 & 15 \end{bmatrix}$$
, then sum of all the elements of

matrix A is

A. 0

B. 1

C. 2

D. - 3

Answer: B

13. For each real x, -1 < x < 1. Let A(x) be the matrix $(1 - x)^{-1} \begin{bmatrix} 1 & -x \\ -x & 1 \end{bmatrix}$

and
$$z = \frac{x+y}{1+xy}$$
. Then

A. A(z) = A(x)A(y)

$$\mathsf{B}.\,A(z)=A(x)-A(y)$$

$$\mathsf{C}.\,A(z) = A(x) + A(y)$$

D.
$$A(z) = A(x)[A(y)]^{-1}$$

Answer: A

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14. Let $A = [0 - \tan(\alpha/2)\tan(\alpha/2)0]$ and *I* be the identity matrix of order 2.

Show that $I + A = (I - A)[\cos \alpha - \sin \alpha \sin \alpha \cos \alpha]$.

A. -*I* + *A*

В. І - А

C. -*I* - *A*

D. none of these

Answer: B

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15. The number of solutions of the matrix equation $X^2 = [1123]$ is a. more

than2 b. 2 c. 0 d. 1

A. more then 2

B. 2

C. 0

D. 1

Answer: A

16. If A = [abcd] (where $bc \neq 0$) satisfies the equations $x^2 + k = 0$, then

a + d = 0 b. K = -|A| c. k = |A| d. none of these

A. a + d = 0

B. k = -|A|

C. k = |A|

D. none of these

Answer: C

17.
$$A = \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}; B = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix} \qquad \&$$

$$c = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix},$$

$$tr(A) + tr\left[\frac{ABC}{2}\right] + tr\left[\frac{A(BC)^2}{4}\right] + tr\left[\frac{A(BC)^2}{8}\right] + \dots \infty$$
 is:

A. 6

B. 9

C. 12

D. none of these

Answer: A

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18. If
$$\begin{bmatrix} \cos \frac{2\pi}{7} & -\sin \frac{2\pi}{7} \\ \sin \frac{2\pi}{7} & \cos \frac{2\pi}{7} \end{bmatrix}^k = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$
, then the least positive integral value

of *k*, is

A. 3

B. 6

C. 7

D. 14

Answer: C



19. If A and B are square matrices of order *n*, then prove that *AandB* will

commute iff A - $\lambda IandB$ - λI commute for every scalar λ

A.AB = BA

B.AB + BA = O

C.A = -B

D. none of these

Answer: A



20. Matrix A such that $A^2 = 2A - I$, where I is the identity matrix, the for

 $n \ge 2$. A^n is equal to $2^{n-1}A - (n-1)l$ b. $2^{n-1}A - I$ c. nA - (n-1)l d. nA - I

Answer: C

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21. Let
$$A = \begin{bmatrix} 0 & \alpha \\ 0 & 0 \end{bmatrix}$$
 and $(A + I)^{50} - 50A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$. Then the value of $a + b + c + d$ is
A. 2
B. 1
C. 4
D. none of these

Answer: A

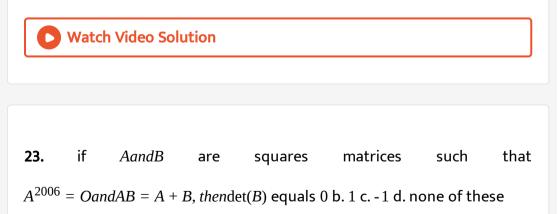
22. If Z is an idempotent matrix, then $(I + Z)^n$

A.
$$I + 2^{n}Z$$

B. $I + (2^{n} - 1)Z$
C. $I - (2^{n} - 1)Z$

D. none of these

Answer: B



A. 0

B. 1

C. - 1

D. none of these

Answer: A

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24. If matrix A is given by
$$A = \begin{bmatrix} 6 & 11 \\ 2 & 4 \end{bmatrix}$$
 then determinant of $A^{2005} - 6A^{2004}$

is

A. 2²⁰⁰⁶

B. (- 11)2²⁰⁰⁵

C. - 2²⁰⁰⁵.7

D. (-9)2²⁰⁰⁴

Answer: B

25. If A is a non-diagonal involutory matrix, then

$$A.A - I = O$$

 $\mathsf{B}.A + I = O$

C. A - I is nonzero singular

D. none of these

Answer: C

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26. If A and B are two nonzero square matrices of the same order such

that the product AB = O, then

A. both A and B must be singular

B. exactly one of them must be singular

C. both of them are nonsingular

D. none of these

Answer: A



27. If *A* and *B* are symmetric matrices of the same order and X = AB + BA and Y = AB - BA, then $(XY)^T$ is equal to : (A) *XY* (B) *YX* (C) -*YX* (D) non of these

A. *XY*

B. *YX*

C. - *YX*

D. none of these

Answer: C

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28. If A, B, A + I, A + B are idempotent matrices, then AB is equal to

В. -*ВА*

C. I

D. *O*

Answer: B

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29. If
$$A = \begin{bmatrix} 0 & x \\ y & 0 \end{bmatrix}$$
 and $A^3 + A = O$ then sum of possible values of xy is
A. 0
B. -1
C. 1
D. 2

Answer: B



30. Which of the following is an orthogonal matrix ?

A.
$$\begin{bmatrix} 6/7 & 2/7 & -3/7 \\ 2/7 & 3/7 & 6/7 \\ 3/7 & -6/7 & 2/7 \end{bmatrix}$$

B.
$$\begin{bmatrix} 6/7 & 2/7 & 3/7 \\ 2/7 & -3/7 & 6/7 \\ 3/7 & 6/7 & -2/7 \end{bmatrix}$$

C.
$$\begin{bmatrix} -6/7 & -2/7 & -3/7 \\ 2/7 & 3/7 & 6/7 \\ -3/7 & 6/7 & 2/7 \end{bmatrix}$$

D.
$$\begin{bmatrix} 6/7 & -2/7 & 3/7 \\ 2/7 & 2/7 & 3/7 \\ -6/7 & 2/7 & 3/7 \end{bmatrix}$$

Answer: A

31. Let A and B be two square matrices of the same size such that $AB^T + BA^T = O$. If A is a skew-symmetric matrix then BA is

A. a symmetric matrix

B. a skew-symmetric matrix

C. an orthogonal matrix

D. an invertible matrix

Answer: B

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32. In which of the following type of matrix inverse does not exist always?

a. idempotent b. orthogonal c. involuntary d. none of these

A. idempotent

B. orthogonal

C. involuntary

D. none of these

Answer: A

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33. Let A be an nth-order square matrix and B be its adjoint, then $|AB + KI_n|$ is (where K is a scalar quantity) $(|A| + K)^{n-2}$ b. $(|A| +)K^n$ c. $(|A| + K)^{n-1}$ d. none of these

A. $(|A| + K)^{n-2}$

B. $(|A| + K)^n$

C. $(|A| + K)^{n-1}$

D. none of these

Answer: B

34. If
$$A = \begin{bmatrix} a & b & c \\ x & y & x \\ p & q & r \end{bmatrix}$$
, $B = \begin{bmatrix} q & -b & y \\ -p & a & -x \\ r & -c & z \end{bmatrix}$ and $B = \begin{bmatrix} c & -b & y \\ -p & a & -x \\ r & -c & z \end{bmatrix}$

and If A is invertible, then which

of the following is not true ?

A. |A| = |B|

B. |A| = -|B|

C. |adj A| = |adj B|

D. A is invertible if and only if B is invertible

Answer: A



35. If
$$A(\alpha, \beta) = \begin{bmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & e^{\beta} \end{bmatrix}$$
, then $A(\alpha, \beta)^{-1}$ is equal to
A. $A(-\alpha, -\beta)$
B. $A(-\alpha, \beta)$

 $C.A(\alpha, -\beta)$

D. $A(\alpha, \beta)$

Answer: A

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36. If
$$A = \begin{bmatrix} a + ib & c + id \\ -c + id & a - ib \end{bmatrix}$$
 and $a^2 + b^2 + c^2 + d^2 = 1$, then A^{-1} is equal to

$$A. \begin{bmatrix} a - ib & -c - id \\ c - id & a + ib \end{bmatrix}$$
$$B. \begin{bmatrix} a + ib & -c + id \\ -c + id & a - ib \end{bmatrix}$$
$$C. \begin{bmatrix} a - ib & -c - id \\ -c - id & a + ib \end{bmatrix}$$

D. none of these

Answer: A

37. Id $[1/250x1/25] = [50 - a5]^{-2}$, then the value of x is a/125 b. 2a/125 c.

2a/25 d. none of these

A. *a*/125

B. 2*a*/125

C. 2*a*/25

D. none of these

Answer: B

38. If
$$A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$$
 and $f(x) = \frac{1+x}{1-x}$, then $f(A)$ is
A. $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$
B. $\begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$
C. $\begin{bmatrix} -1 & -1 \\ -1 & -1 \end{bmatrix}$

D. none of these

Answer: C



39. There are two possible values of A in the solution of the matrix equation

$$\begin{bmatrix} 2A+1 & -5\\ -4 & A \end{bmatrix}^{-1} \begin{bmatrix} A-5 & B\\ 2A-2 & C \end{bmatrix} = \begin{bmatrix} 14 & D\\ E & F \end{bmatrix}$$

where A, B, C, D, E and F are real numbers. The absolute value of the

difference of these two solutions, is

A.
$$\frac{8}{3}$$

B. $\frac{19}{3}$
C. $\frac{1}{3}$
D. $\frac{11}{3}$

Answer: B



40. If A and B are two square matrices such that $B = -A^{-1}BA$, then $(A + B)^2$ is equal to

A. $A^2 + B^2$ B. O C. $A^2 + 2AB + B^2$

D. *A* + *B*

Answer: A

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41. If $A = [1\tan x - \tan x]$, show that $A^T A^{-1} = [\cos 2x - \sin 2x \sin 2x \cos 2x]$

A.
$$\begin{bmatrix} -\cos 2x & \sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$$

B.
$$\begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$$

C. $\begin{bmatrix} \cos 2x & \cos 2x \\ \cos 2x & \sin 2x \end{bmatrix}$

D. none of these

Answer: B

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42. If A is order 3 square matrix such that |A| = 2, then |adj (adj (adj A))| is

A. 512

B. 256

C. 64

D. none of these

Answer: B

43. If
$$A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & a & 1 \end{bmatrix}$$
 and $A^{-1} = \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & c \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$, then the values of a

and c are equal to

A. 1, 1

B. 1, -1

C. 1, 2

D.-1, 1

Answer: B

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44. If nth-order square matrix A is a orthogonal, then |adj (adj A)| is

A. always -1 if n is even

B. always 1 if n is odd

C. always 1

D. none of these

Answer: B

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45. Let *aandb* be two real numbers such that a > 1, b > 1. If A = (a00b),

then ($\lim_{n \in \mathbb{Z}} A^{-n}$ is a. unit matrix b. null matrix c. 2*l* d. none of these

A. unit matrix

B. null matrix

C. 2*I*

D. none of these

Answer: B

46. If $A = \begin{bmatrix} a_{ij} \end{bmatrix}_{4 \times 4}$, such that $a_{ij} = \begin{cases} 2, & \text{when } i = j \\ 0, & \text{when } i \neq j \end{cases}$ then $\left\{ \frac{\det (\text{adj } (\text{adj } A))}{7} \right\}$ is (where $\{ \cdot \}$ represents fractional part function) A. 1/7 B. 2/7

C. 3/7

D. none of these

Answer: A

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47. A is an involuntary matrix given by A = [01 - 14 - 343 - 34], then the

inverse of
$$A/2$$
 will be 2A b. $\frac{A^{-1}}{2}$ c. $\frac{A}{2}$ d. A^2

A. 2*A*

B.
$$\frac{A^{-1}}{2}$$

C.
$$\frac{A}{2}$$

D. A^2

Answer: A

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48. If A is a nonsingular matrix such that $AA^T = A^T A$ and $B = A^{-1}A^T$, then

matrix B is

A. involuntary

B. orthogonal

C. idempotent

D. none of these

Answer: B

49. If *P* is an orthogonal matrix and $Q = PAP^{T}andx = P^{T}A$ b. *I* c. A^{1000} d.

none of these

A.*A*

 $\mathsf{B}.\,I$

 $C.A^{1000}$

D. none of these

Answer: B

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50. If *AandB* are two non-singular matrices of the same order such that $B^r = I$, for some positive integer r > 1, *then* $A^{-1}B^{r-1}A = A^{-1}B^{-1}A = I$ b. 2*I* c. *O* d. -I

A. I

B. 2*I*

C. 0

D. -*I*

Answer: C



51. If
$$adjB = A$$
, $|P| = |Q| = 1$, then $adj(Q^{-1}BP^{-1})$ is `

A. PQ

B. QAP

C. PAQ

D. $PA^{-1}Q$

Answer: C

52. If *A* is non-singular and (A - 2I)(A - 4I) = O, then $\frac{1}{6}A + \frac{4}{3}A^{-1}$ is equal to

OI b. 2*I* c. 6*I* d. *I*

A. 0

 $\mathsf{B}.\,I$

C. 2I

D. 6I

Answer: B

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53. Let $f(x) = \frac{1+x}{1-x}$. If *A* is matrix for which $A^3 = O$, *thenf*(*A*) is $I + A + A^2$ b. $I + 2A + 2A^2$ c. $I - A - A^2$ d. none of these

A. $I + A + A^2$

B. $I + 2A + 2A^2$

C. $I - A - A^2$

D. none of these

Answer: B

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54. if
$$\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$
, then $A = ?$
A. $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$
B. $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$
C. $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$
D. $-\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

Answer: A

55. If $A^2 - A + I = 0$, then the inverse of A is: (A) A + I (B) A (C) A - I (D) I - A

A. A⁻² B. A + I C. I - A

D. A - I

Answer: C

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56. If
$$F(x) = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
 and $G(y) = \begin{bmatrix} \cos y & 0 & \sin y \\ 0 & 1 & 0 \\ -\sin y & 0 & \cos y \end{bmatrix}$, then

 $[F(x)G(y)]^{-1}$ is equal to

A. F(-x)G(-y)

B. G(-y)F(-x)

C.
$$F(x^{-1})G(y^{-1})$$

D. $G(y^{-1})F(x^{-1})$

Answer: B

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57. If *AandB* are square matrices of the same order and *A* is non-singular, then for a positive integer n, $(A^{-1}BA)^n$ is equal to $A^{-n}B^nA^n$ b. $A^nB^nA^{-n}$ c. $A^{-1}B^nA$ d. $n(A^{-1}B^A)$ A. $A^{-n}B^nA^n$ B. $A^nB^nA^{-n}$ C. $A^{-1}B^nA$ D. $n(A^{-1}BA)$

Answer: C

58. If $k \in R_o$ then det $\{adj(kI_n)\}$ is equal to K^{n-1} b. $K^{n(n-1)}$ c. K^n d. k

A. *k*^{*n*-1}

B. $k^{n(n-1)}$

C. *k*^{*n*}

D. *k*

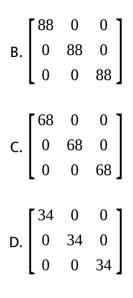
Answer: B

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59. Given that matrix
$$A\begin{bmatrix} x & 3 & 2 \\ 1 & y & 4 \\ 2 & 2 & z \end{bmatrix}$$
. If $xyz = 60$ and $8x + 4y + 3z = 20$, then

A(adj A) is equal to

$$A. \begin{bmatrix} 64 & 0 & 0 \\ 0 & 64 & 0 \\ 0 & 0 & 64 \end{bmatrix}$$



Answer: C

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60. Let
$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 0 & 5 \\ 0 & 2 & 1 \end{bmatrix}$$
 and $B = \begin{bmatrix} 0 \\ -3 \\ 1 \end{bmatrix}$. Which of the following is true ?

A. AX = B has a unique solution

B. AX = B has exactly three solutions

C. AX = B has infinitelt many solutions

D.AX = B is inconsistent

Answer: A



61. If A is a square matrix of order less than 4 such that $|A - A^T| \neq 0$ and B = adj. (A), then adj. $(B^2 A^{-1} B^{-1} A)$ is

A.*A*

B. *B*

C. |A|A

D. |B|B

Answer: A

62. Let A be a square matrix of order 3 such that det. (A) = $\frac{1}{3}$, then the value of det. (adj. A^{-1}) is

A. 1/9

B. 1/3

C. 3

D. 9

Answer: D

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63. If A and B are two non-singular matrices of order 3 such that $AA^T = 2I$ and $A^{-1} = A^T - A$. Adj. $(2B^{-1})$, then det. (B) is equal to

A. 4

B. $4\sqrt{2}$

C. 16

D. $16\sqrt{2}$

Answer: D

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64. If A is a square matric of order 5 and $2A^{-1} = A^T$, then the remainder

when |adj. (adj. (adj. A))| is divided by 7 is

A. 2

B. 3

C. 4

D. 5

Answer: A

65. Let
$$P = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$$
. If the product PQ has inverse $R = \begin{bmatrix} -1 & 0 & 1 \\ 1 & 1 & 3 \\ 2 & 0 & 2 \end{bmatrix}$

then Q^{-1} equals

$$A. \begin{bmatrix} 3 & 2 & 9 \\ -1 & 1 & 1 \\ 0 & 1 & 8 \end{bmatrix}$$
$$B. \begin{bmatrix} 5 & 2 & 9 \\ -1 & 1 & 1 \\ 0 & 1 & 7 \end{bmatrix}$$
$$C. \begin{bmatrix} 2 & -1 & 0 \\ 10 & 6 & 3 \\ 8 & 6 & 4 \end{bmatrix}$$

D. none of these

Answer: C



Exercise Multiple

1. If A is unimidular, then which of the following is unimodular?

A. -*A*

B. A⁻¹

C. adj A

D. ωA , where ω is cube root of unity

Answer: B::C

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2. Let $A = a_{ij}$ be a matrix of order 3, where $a_{ij} = \{(x, , \text{ if } i = j, x \in R,), (1, , \text{ if } |i - j| = 1, , , \text{ then which of the following}), (0, , on hold (s) good :$

A. for x = 2, A is a diagonal matrix

B. A is a symmetric matrix

C. for x = 2, det A has the value equal to 6

D. Let $f(x) = \det A$, then the function f(x) has both the maxima and

minima

Answer: B::D

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3. If
$$A = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix}$$
, $B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2 + 2AB$, then
A. $a = -1$
B. $a = 1$
C. $b = 2$
D. $b = -2$

Answer: A::D

4. If AB=A and BA=Bm then which of the following is/are true ?

A. A is idempotent

B. B is idempotent

 $C. A^T$ is idempotent

D. none of these

Answer: A::B::C

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5. If $A(\theta) = \begin{bmatrix} \sin\theta & i\cos\theta\\ i\cos\theta & \sin\theta \end{bmatrix}$, then which of the following is not true ?

$$A. A(\theta)^{-t} = A(\pi - \theta)$$

B. $A(\theta) + A(\pi + \theta)$ is a null matrix

C. $A(\theta)$ is invertible for all $\theta \in R$

 $\mathsf{D}.\,A(\theta)^{-1} = A(-\theta)$



6. Let A and B be two nonsingular square matrices, A^T and B^T are the tranpose matrices of A and B, respectively, then which of the following are coorect ?

A. $B^T A B$ is symmetric matrix if A is symmetric

B. $B^{T}AB$ is symmetric matrix if B is symmetric

C. $B^{T}AB$ is skew-symmetric matrix for every matrix A

D. $B^{T}AB$ is skew-symmetric matrix if A is skew-symmetric

Answer: A::D

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7. If B is an idempotent matrix, and A = I - B, then

$$A. A2 = A$$
$$B. A2 = I$$
$$C. AB = O$$
$$D. BA = O$$

Answer: A::C::D

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8.

 $A_1 = [0001001001001000], A_2 = [000i00 - i00i00 - i000], then A_i A_k + A_k A_i$ is

equal to 2*l* if i = k b. O if $i \neq k$ c. 2*l* if $i \neq k$ d. O always

A. 2*I* if *i* = *k*

B. O if $i \neq k$

C. 2*I* if $i \neq k$

D. O always

lf

Answer: A::B



9. Suppose a_1, a_2, \dots Are real numbers, with $a_1 \neq 0$. If a_1, a_2, a_3, \dots Are in

A.P., then

A.
$$A = \begin{bmatrix} a_1 & a_2 & a_3 \\ a_4 & a_5 & a_6 \\ a_5 & a_6 & a_7 \end{bmatrix}$$
 is singular (where $i = \sqrt{-1}$)

B. the	system	of	equations

$$a_1x + a_2y + a_3z = 0, a_4x + a_5y + a_6z = 0, a_7x + a_8y + a_9z = 0$$
 has

infinite number of solutions

C.
$$B\begin{bmatrix} a_1 & ia_2 \\ ia_2 & a_1 \end{bmatrix}$$
 is nonsingular

D. none of these

Answer: A::B::C



10. If
$$\alpha, \beta, \gamma$$
 are three real numbers and

$$A = \begin{bmatrix} 1 & \cos(\alpha - \beta) & \cos(\alpha - \gamma) \\ \cos(\beta - \alpha) & 1 & \cos(\beta - \gamma) \\ \cos(\gamma - \alpha) & \cos(\gamma - \beta) & 1 \end{bmatrix}$$
then which of following is/are true ?

A. A is singular

B. A is symmetric

C. A is orthogonal

D. A is not invertible

Answer: A::B::D



11. If D_1 and D_2 are two 3×3 diagonal matrices, then which of the

following is/are true ?

A. D_1D_2 is a diagonal matrix

B.
$$D_1 D_2 = D_2 D_1$$

C. $D_1^2 + D_2^2$ is a diagonal matrix

D. none of these

Answer:

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12. Let A be the 2 × 2 matrix given by $A = [a_{ij}]$ where $a_{ij} \in \{0, 1, 2, 3, 4\}$ such theta $a_{11} + a_{12} + a_{21} + a_{22} = 4$ then which of the following statement(s) is/are true ?

A. Number of matrices A such that the trace of A equal to 4, is 5

B. Number of matrices A, such that A is invertible is 18

C. Absolute difference between maximum value and minimum value of

det (A) is 8

D. Number of matrices A such that A is either symmetric (or) skew

symmetric and det (A) is divisible by 2, is 5.

Answer:

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13. If
$$S = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$
 and $A = \begin{bmatrix} b+c & c-a & b-a \\ c-b & c+b & a-b \\ b-c & a-c & a+b \end{bmatrix}$

 $(a, b, c \neq 0)$, then SAS⁻¹ is

A. symmetric matrix

B. diagonal matrix

C. invertible matrix

D. singular matrix

Answer:

14. P is a non-singular matrix and A, B are two matrices such that $B = P^{-1}AP$. The true statements among the following are

A. A is invertible iff B is invertib,e

 $\mathsf{B}.\,B^n = P^{-1}A^nP\,\forall\,n \in N$

C. $\forall \lambda \in R, B - \lambda I = P^{-1}(A - \lambda I)P$

D. A and B are both singular matrices

Answer:

15. Let
$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$$
. Then
A. $A^2 - 4A - 5I_3 = O$
B. $A^{-1} = \frac{1}{5}(A - 4I_3)$

 $C. A^3$ is not invertible

 $D.A^2$ is invertible

Answer:

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$$16. \text{ If } A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}, \text{ then}$$
$$A. A^3 - A^2 = A - I$$
$$B. \text{ det. } (A^{100} - I) = 0$$
$$C. A^{200} = \begin{bmatrix} 1 & 0 & 0 \\ 100 & 1 & 0 \\ 100 & 0 & 1 \end{bmatrix}$$
$$D. A^{100} = \begin{bmatrix} 1 & 1 & 0 \\ 50 & 1 & 0 \\ 50 & 0 & 1 \end{bmatrix}$$

Answer:

17. If Ais symmetric and B is skew-symmetric matrix, then which of the following is/are CORRECT ?

A. *ABA^T* is skew-symmetric matrix

B. $AB^T + BA^T$ is symmetric matrix

C. (A + B)(A - B) is skew-symmetric

D. (A + I)(B - I) is symmetric

Answer:

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18. If $A = \left(\left(a_{ij} \right) \right)_{n \times n}$ and f is a function, we define $f(A) = \left(\left(f\left(a_{ij} \right) \right) \right)_{n \times n'}$ Let $A = (\pi/2 - \theta\theta - \theta\pi/2 - \theta)$. Then sinA is invertible b. sin $A = \cos A$ c. sinA is orthogonal d. sin $(2A) = 2A\sin A\cos A$ A. sinA is invertible

B. sinA = cosA

C. sinA is orthogonal

 $D. \sin(2A) = 2\sin A \cos A$

Answer:

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19. If a is matrix such that $A^2 + A + 2I = O$, then which of the following

is/are true ?

A. A is nonsingular

B. A is symmetric

C. A cannot be skew-symmetric

$$\mathsf{D}.A^{-1} = -\frac{1}{2}(A+I)$$

Answer:

20. If
$$A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$$
, then adj (adj A) is

A. adj(adjA) = A

 $\mathsf{B.} |adj(adjA)| = 1$

 $\mathsf{C}.\left|adjA\right|=1$

D. none of these

Answer: B

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21. If
$$\begin{bmatrix} 1 & -\tan\theta \\ \tan\theta & 1 \end{bmatrix} \begin{bmatrix} 1 & \tan\theta \\ -\tan\theta & 1 \end{bmatrix}^{-1} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$$
, then

A. $a = \cos 2\theta$

B. *a* = 1

 $\mathsf{C.} b = \sin 2\theta$

D.b = -1

Answer:



22. If
$$A^{-1} = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 3 & 1 \\ 0 & 0 & -1/3 \end{bmatrix}$$
, then

A.
$$|A| = -1$$

B. adj
$$A = \begin{bmatrix} -1 & 1 & -2 \\ 0 & -3 & -1 \\ 0 & 0 & 1/3 \end{bmatrix}$$

C. $A = \begin{bmatrix} 1 & 1/3 & 7 \\ 0 & 1/3 & 1 \\ 0 & 0 & -3 \end{bmatrix}$

$$\mathbf{D}.A = \begin{bmatrix} 1 & -1/3 & -7 \\ 0 & -3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Answer:

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23. If *A* is an invertible matrix, tehn
$$\left(adjA\right)^{-1}$$
 is equal to $adjA^{-1}$ b. $\frac{A}{detA}$ c.

A d. (detA)A

A. adj. (A^{-1}) B. $\frac{A}{\det A}$ C. A

D. (det. A) A

Answer:

24. If A and B are two invertible matrices of the same order, then adj (AB)

is equal to

A. adj (B) adj (A)

B. $|B||A|B^{-1}A^{-1}$

C. $|B||A|A^{-1}B^{-1}$

D. |A||B|(AB)⁻¹

Answer:

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 $\ensuremath{\textbf{25.}}$ If A, B, and C are three square matrices of the same order, then

 $AB = AC \Rightarrow B = C$. Then

A. $|A| \neq 0$

B. A is invertible

C. A may be orthogonal

D. A is symmetric

Answer:



26. If *A* and *B* are two non singular matrices and both are symmetric and commute each other, then

A. *A*⁻¹*B*

B. AB⁻¹

 $C.A^{-1}B^{-1}$

D. none of these

Answer:

27. If A and B are square matrices of order 3 such that $A^3 = 8B^3 = 8I$ and det. (*AB* - *A* - 2*B* + 2*I*) \neq 0, then identify the correct statement(s), where *I* is idensity matrix of order 3.

A. $A^2 + 2A + 4I = O$ B. $A^2 + 2A + 4I \neq O$ C. $B^2 + B + I = O$ D. $B^2 + B + I \neq O$

Answer:

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28. Let A, B be two matrices different from identify matrix such that AB = BA and $A^n - B^n$ is invertible for some positive integer n. If $A^n - B^n = A^{n+1} - B^{n+1} = A^{n+1} - B^{n+2}$, then

A. I - A is non-singular

B. I - B is non-singular

- C. I A is singular
- D. I B is singular

Answer:

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29. Let A and B be square matrices of the same order such that $A^2 = I$ and

 $B^2 = I$, then which of the following is CORRECT ?

A. IF A and B are inverse to each other, then A = B.

B. If AB = BA, then there exists matrix $C = \frac{AB + BA}{2}$ such that $C^2 = C$.

C. If AB = BA, then there exists matrix D = AB - BA such that $D^n = O$

for some $n \in N$.

D. If AB = BA then $(A + B)^5 = 16(A + B)$.

Answer:

30. Let B is an invertible square matrix and B is the adjoint of matrix A such that $AB = B^T$. Then

A. A is an identity matrix

B. B is symmetric matrix

C. A is a skew-symmetric matrix

D. B is skew symmetic matrix

Answer: A

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31. First row of a matrix A is [1, 3, 2]. If

adj
$$A = \begin{bmatrix} -2 & 4 & \alpha \\ -1 & 2 & 1 \\ 3\alpha & -5 & -2 \end{bmatrix}$$
, then maximum value of det(A) is



32. Let A be a square matrix of order 3 satisfies the relation $A^3 - 6A^2 + 7A - 8I = O$ and B = A - 2I. Also, det. A = 8, then

A. det.
$$\left(\operatorname{adj.} \left(I - 2A^{-1}\right) = \frac{25}{16}\right)$$

B. adj. $\left(\left(\frac{B}{2}\right)^{-1}\right) = \frac{B}{10}$
C. det. $\left(\operatorname{adj.} \left(I - 2A^{-1}\right)\right) = \frac{75}{32}$
D. adj. $\left(\left(\frac{B}{2}\right)^{-1}\right) = \frac{2B}{5}$

Answer:

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33. Which of the following matericeshave eigen values as 1 and -1?

$$\mathsf{A}. \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

$$B \begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix}$$
$$C \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$$
$$D \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

Answer:

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Exercise Comprehension

1. Let a be a matrix of order 2×2 such that $A^2 = O$.

 A^2 - (a + d)A + (ad - bc)I is equal to

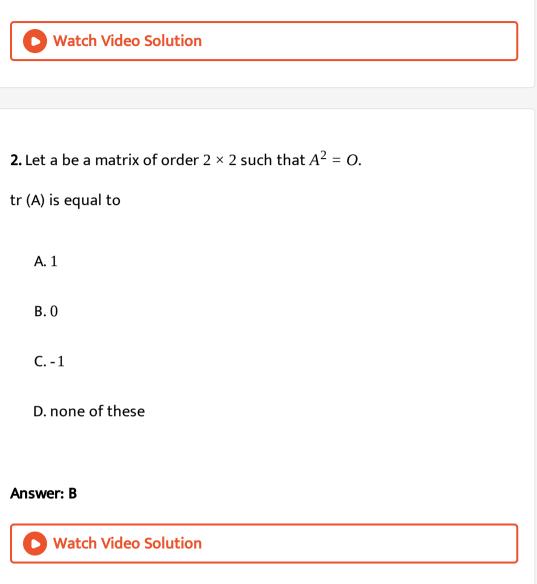
A. I

B. *O*

C. -*I*

D. none of these

Answer: B



3. Let a be a matrix of order 2×2 such that $A^2 = O$.

 $(I + A)^{100} =$

A. 100 A

B. 100(*I* + *A*)

C. 100*I* + *A*

D. *I* + 100*A*

Answer: D



4. If A and B are two square matrices of order 3×3 which satify AB = A

and BA = B, then

Which of the following is true ?

A. If matrix A is singular, then matrix B is nonsingular.

B. If matrix A is nonsingular, then materix B is singular.

C. If matrix A is singular, then matrix B is also singular.

D. Cannot say anything.

Answer: C



5. if *A* and *B* are two matrices of order 3×3 so that AB = A and BA = Bthen $(A + B)^7 =$

A. 7(A + B)

B. 7. *I*_{3×3}

C. 64(A + B)

D. 128*I*

Answer: C



6. If A and B are two square matrices of order 3×3 which satisfy AB = A

and BA = B, then

 $(A + I)^5$ is equal to (where I is identity matric)

A. I + 60I

B. I + 16A

C. I + 31A

D. none of these

Answer: C

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7. Consider an arbitarary 3×3 non-singular matrix $A[a_{ij}]$. A maxtrix $B = [b_{ij}]$ is formed such that b_{ij} is the sum of all the elements except a_{ij} in the ith row of A. Answer the following questions :

If there exists a matrix X with constant elemts such that AX=B`, then X is

A. skew-symmetric

B. null matrix

C. diagonal matrix

D. none of these

Answer: D

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8. Let $A = \begin{bmatrix} a_{ij} \end{bmatrix}$ be 3 × 3 matrix and $B = \begin{bmatrix} b_{ij} \end{bmatrix}$ be 3 × 3 matrix such that b_{ij} is the sum of the elements of i^{th} row of A except a_{ij} . If det, (A) = 19, then the value of det. (B) is _____.

A. |A|

B. |*A*|/2

C. 2|A|

D. none of these

Answer: C

9. Let
$$A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$
 satisfies $A^n = A^{n-1} + A^2 - I$ for $n \ge 3$. And trace of a

square matrix X is equal to the sum of elements in its proncipal diagonal. Further consider a matrix $U_{3\times3}$ with its column as U_1 , U_2 , U_3 such that

$$A^{50} \mathsf{U}_{1} = \begin{bmatrix} 1\\ 25\\ 25 \end{bmatrix}, A^{50} \mathsf{U}_{2} = \begin{bmatrix} 0\\ 1\\ 0 \end{bmatrix}, A^{50} \mathsf{U}_{3} = \begin{bmatrix} 0\\ 0\\ 1 \end{bmatrix}$$

Then answer the following question :

The values of $|A^{50}|$ equals

A. 0

B. 1

D. 25

Answer: B

10. Let
$$A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$
 satisfies $A^n = A^{n-1} + A^2 - I$ for $n \ge 3$. And trace of a

square matrix X is equal to the sum of elements in its proncipal diagonal. Further consider a matrix $U_3 \times 3$ with its column as U_1 , U_2 , U_3 such that

$$A^{50} \cup_{1} = \begin{bmatrix} 1 \\ 25 \\ 25 \end{bmatrix}, A^{50} \cup_{2} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, A^{50} \cup_{3} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

Then answer the following question :

Trace of A^{50} equals

A. 0

B. 1

C. 2

D. 3

Answer: D

11. Let
$$A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$
 satisfies $A^n = A^{n-2} + A^2 - I$ for $n \ge 3$. And trace of a

square matrix X is equal to the sum of elements in its proncipal diagonal. Further consider a matrix $U_{3\times3}$ with its column as U_1 , U_2 , U_3 such that

$$A^{50} \cup_{1} = \begin{bmatrix} 1 \\ 25 \\ 25 \end{bmatrix}, A^{50} \cup_{2} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, A^{50} \cup_{3} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

Then answer the following question :

The value of | U | equals

A. 0

B. 1

C. 2

D. - 1

Answer: B

12. Let for $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$, there be three row matrices R_1, R_2 and R_3 ,

satifying the relations, $R_1A = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$, $R_2A = \begin{bmatrix} 2 & 3 & 0 \end{bmatrix}$ and $R_3A = \begin{bmatrix} 2 & 3 & 1 \end{bmatrix}$. If B is square matrix of order 3 with rows R_1 , R_2 and R_3 in order, then

The value of det. $\left(2A^{100}B^3 - A^{99}B^4\right)$ is

A. - 2

B. - 1

C. 2

D. 3

Answer: D



13. Let for $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$, there be three row matrices R_1, R_2 and R_3 ,

satifying the relations, $R_1A = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$, $R_2A = \begin{bmatrix} 2 & 3 & 0 \end{bmatrix}$ and $R_3A = \begin{bmatrix} 2 & 3 & 1 \end{bmatrix}$. If B is square matrix of order 3 with rows R_1 , R_2 and R_3 in order, then

The value of det. $\left(2A^{100}B^3 - A^{99}B^4\right)$ is

A. -27

B. - 9

C. - 3

D. 9

Answer: A



14. A and B are square matrices such that det. (A) = 1, $BB^T = I$, det (B) > 0

, and A(adj. A + adj. B) = B.

The value of det (A + B) is

A. - 2

B. - 1

C. 0

D. 1

Answer: D

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15. A and B are square matrices such that det. (A) = 1, $BB^T = I$, det (B) > 0 , and A(adj. A + adj. B)=B.

 $AB^{-1} =$

A. *B*⁻¹*A*

B. *AB*⁻¹

 $C.A^TB^{-1}$

D. $B^{T}A^{-1}$

Answer: A

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16. Let A be an $m \times n$ matrix. If there exists a matrix L of type $n \times m$ such that $LA = I_n$, then L is called left inverse of A. Similarly, if there exists a matrix R of type $n \times m$ such that $AR = I_m$, then R is called right inverse of A.

For example, to find right inverse of matrix

$$A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}, \text{ we take } R = \begin{bmatrix} x & y & x \\ u & v & w \end{bmatrix}$$

and solve $AR = I_3$, i.e.,

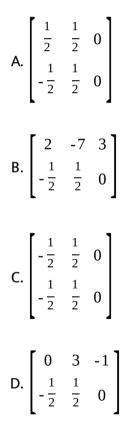
$$\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x & y & z \\ u & v & w \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow x - u = 1 \qquad y - v = 0 \qquad z - w = 0$$
$$x + u = 0 \qquad y + v = 1 \qquad z + w = 0$$
$$2x + 3u = 0 \qquad 2y + 3v = 0 \qquad 2z + 3w = 1$$

As this system of equations is inconsistent, we say there is no right

inverse for matrix A.

Which of the following matrices is NOT left inverse of matrix $\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}$?



Answer: C

17. Let A be an $m \times n$ matrix. If there exists a matrix L of type $n \times m$ such that $LA = I_n$, then L is called left inverse of A. Similarly, if there exists a matrix R of type $n \times m$ such that $AR = I_m$, then R is called right inverse of A.

For example, to find right inverse of matrix

$$A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}, \text{ we take } R = \begin{bmatrix} x & y & x \\ u & v & w \end{bmatrix}$$

and solve $AR = I_3$, i.e.,

$$\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x & y & z \\ u & v & w \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow \quad x - u = 1 \qquad y - v = 0 \qquad z - w = 0$$

$$x + u = 0 \qquad y + v = 1 \qquad z + w = 0$$

$$2x + 3u = 0 \qquad 2v + 3v = 0 \qquad 2z + 3w = 1$$

As this system of equations is inconsistent, we say there is no right inverse for matrix A.

The number of right inverses for the matrix $\begin{bmatrix} 1 & -1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$ is

A. 0

B. 1

C. 2

D. infinite

Answer: D

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18. Let A be an $m \times n$ matrix. If there exists a matrix L of type $n \times m$ such that $LA = I_n$, then L is called left inverse of A. Similarly, if there exists a matrix R of type $n \times m$ such that $AR = I_m$, then R is called right inverse of A.

For example, to find right inverse of matrix

$$A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix}, \text{ we take } R = \begin{bmatrix} x & y & x \\ u & v & w \end{bmatrix}$$

and solve $AR = I_3$, i.e.,

$$\begin{bmatrix} 1 & -1 \\ 1 & 1 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} x & y & z \\ u & v & w \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow \quad x - u = 1 \qquad y - v = 0 \qquad z - w = 0$$

$$x + u = 0 \qquad y + v = 1 \qquad z + w = 0$$

$$2x + 3u = 0 \qquad 2y + 3v = 0 \qquad 2z + 3w = 1$$

As this system of equations is inconsistent, we say there is no right

inverse for matrix A.

For which of the following matrices, the number of left inverses is greater than the number of right inverses ?

A.
$$\begin{bmatrix} 1 & 2 & 4 \\ -3 & 2 & 1 \end{bmatrix}$$

B. $\begin{bmatrix} 3 & 2 & 1 \\ 3 & 2 & 1 \end{bmatrix}$
C. $\begin{bmatrix} 1 & 4 \\ 2 & -3 \\ 2 & -3 \end{bmatrix}$
D. $\begin{bmatrix} 3 & 3 \\ 1 & 1 \\ 4 & 4 \end{bmatrix}$

Answer: C

1. Match the following lists :

List I	List II
a. $(I - A)^n$ is if A is idempotent	p. $2^{n-1}(I-A)$
b. $(I - A)^n$ is if A is involuntary	q. $I - nA$
c. $(I - A)^n$ is if A is nilpotent of index 2	r. A
d. If A is orthogonal, then $(A^T)^{-1}$	s. <i>I</i> – <i>A</i>



2. Match the following lists :

List I	List II
a. If A is an idempotent matrix and I is an identity matrix of the same order, then the value of n, such that $(A + I)^n = I + 127$ is	p. 9
b. If $(I - A)^{-1} = I + A + A^2 + \dots + A^7$, then $A^n = O$, where <i>n</i> is	q. 10
c. If <i>A</i> is matrix such that $a_{ij} = (i + j)(i - j)$, then <i>A</i> is singular if order of matrix is	r. 7
d. If a nonsingular matrix A is symmetric, show that A^{-1} is also symmetric, then order of A can be	s. 8

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3. Match the following lists :

List I (A, B, C are matrices)	List II
a. If $ A = 2$, then $ 2A^{-1} =$ (where A is of order 3)	p. 1
b. If $ A = 1/8$, then $ adj(adj(2A)) = (where A is of order 3)$	q. 4
c. If $(A + B)^2 = A^2 + B^2$, and $ A = 2$, then $ B =$ (where A and B are of odd order)	r. 24
d. $ A_{2 \times 2} = 2$, $ B_{3 \times 3} = 3$ and $ C_{4 \times 4} = 4$, then $ ABC $ is equal to	s. 0
	t. does not exist

4. Consider a matrix $A = [a_{ij}]$ of order 3×3 such that $a_{ij} = (k)^{i+j}$ where $k \in I$.

Match List I with List II and select the correct answer using the codes given below the lists.

List I	List II
a. A is singular if	p. $k \in \{0\}$
b. A is null matrix if	q. $k \in \phi$
c. A is skew-symmetric which is not null matrix if	r. <i>k</i> ∈ <i>I</i>
d. $A^2 = 3A$ if	s. $k \in \{-1, 0, 1\}$

Answer: C

5. Match the following lists :

List IList IIa. If
$$M_r = \begin{bmatrix} r-1 & \frac{1}{r} \\ 1 & \frac{1}{(r-1)^2} \end{bmatrix}$$
 and $|M_r|$ p. 0is the corresponding determinant, then $\lim_{n \to \infty} (|M_2| + |M_3| + ..., |M_n|) =$ b. If $(A + B)^2 = A^2 + B^2$ and $|A| = 2$ then $|B| = q$. 1(where A and B are matrices of odd order)c. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 1 \end{bmatrix}$ and a matrix C is defined as $C = (BAB^{-1}) (B^{-1}A^TB)$, where $|C| = K^2 (K \in N)$ then $K =$ d. If $A = \begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix}$ and $A^4 = -\lambda I$ then $\lambda - 2$ is equalto



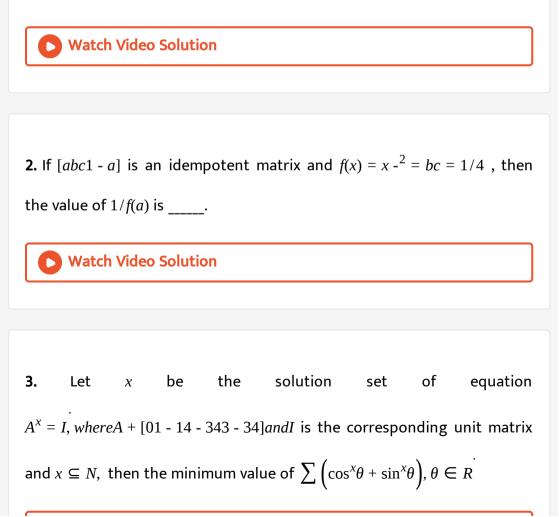
Answer: C

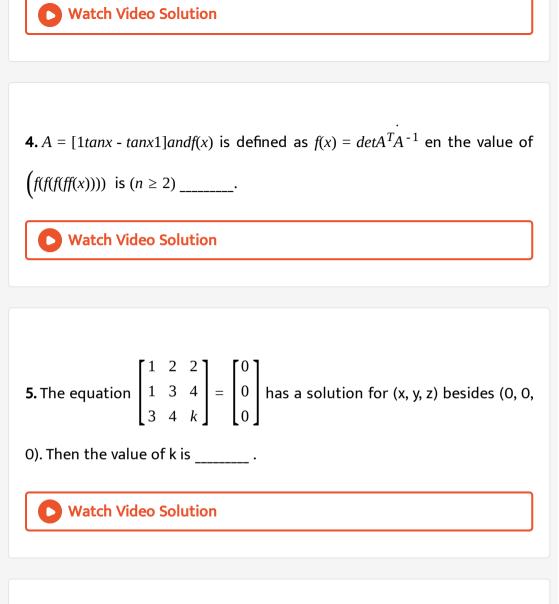


Exercise Numerical

1.
$$A = [0130]andA^8 + A^6 + A^2 + IV = [011](where I is the 2 \times 2 identity)$$

matrix), then the product of all elements of matrix V is _____.





6. If A is an idempotent matrix satisfying, $(I - 0.4A)^{-1} = I - \alpha A$, where I is the unit matrix of the name order as that of A, then the value of $|9\alpha|$ is equal to _____.

$$A = \left[3x^{2}16x\right], B = [abc], and C = \left[(x+2)^{2}5x^{2}2x5x^{2}2x(x+2)^{2}2x(x+2)^{2}5x^{2}\right]$$

be three given matrices, where $a, b, candx \in R$ Given that $f(x) = ax^2 + bx + c$, then the value of f(I) is _____.

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8. Let A be the set of all 3×3 skew-symmetri matrices whose entries are either -1, 0, or 1. If there are exactly three 0s three 1s, and there (-1)'s, then the number of such matrices is _____.

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9. Let $A = [a_{ij}]_{3\times 3}$ be a matrix such that $AA^T = 4I$ and $a_{ij} + 2c_{ij} = 0$, where C_{ij} is the cofactor of a_{ij} and I is the unit matrix of order 3.

$$\begin{vmatrix} a_{11} + 4 & a_{12} & a_{13} \\ a_{21} & a_{22} + 4 & a_{23} \\ a_{31} & a_{32} & a_{33} + 4 \end{vmatrix} + 5\lambda \begin{vmatrix} a_{11} + 1 & a_{12} & a_{13} \\ a_{21} & a_{22} + 1 & a_{23} \\ a_{31} & a_{32} & a_{33} + 1 \end{vmatrix} = 0$$

then the value of λ is

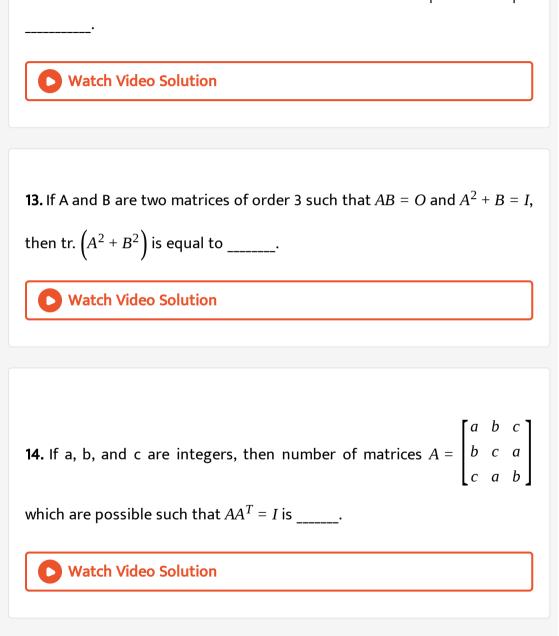


10. Let *S* be the set which contains all possible vaues fo *I*, *m*, *n*, *p*, *q*, *r* for which $A = [I^2 - 3p00m^2 - 8qr0n^2 - 15]$ be non-singular idempotent matrix. Then the sum of all the elements of the set *S* is _____.

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11. If A is a diagonal matrix of order 3×3 is commutative with every square matrix of order 3×3 under multiplication and trace (A)=12, then

12. If A is a square matrix of order 3 such that |A| = 2, then $\left| \left(adjA^{-1} \right)^{-1} \right|$ is



15. Let $A = \begin{bmatrix} a_{ij} \end{bmatrix}$ be 3 × 3 matrix and $B = \begin{bmatrix} b_{ij} \end{bmatrix}$ be 3 × 3 matrix such that b_{ij} is the sum of the elements of i^{th} row of A except a_{ij} . If det, (A) = 19, then the value of det. (B) is _____.

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16. A square matrix M of order 3 satisfies $M^2 = I - M$, where I is an identity

matrix of order 3. If $M^n = 5I - 8M$, then *n* is equal to _____.

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17. Let
$$A = [a_{ij}]_{3\times 3}$$
, $B = [b_{ij}]_{3\times 3}$ and $C = [c_{ij}]_{3\times 3}$ be any three matrices,
where $b_{ij} = 3^{i-j}a_{ij}$ and $c_{ij} = 4^{i-j}b_{ij}$. If det. $A = 2$, then det. (*BC*) is equal to

18. If A is a square matrix of order 2×2 such that |A| = 27, then sum of

the infinite series
$$|A| + \left|\frac{1}{2}A\right| + \left|\frac{1}{4}A\right| + \left|\frac{1}{8}A\right| + \dots$$
 is equal to _____

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19. If A is a aquare matrix of order 2 and det. A = 10, then $((tr. A)^2 - tr. (A^2))$ is equal to _____.

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20. Let A and B are two square matrices of order 3 such that det. (A) = 3

and det. (B) = 2, then the value of det. $\left(\left(\text{adj. } \left(B^{-1}A^{-1} \right) \right)^{-1} \right)$ is equal to

21. Let P, Q and R be invertible matrices of order 3 such $A = PQ^{-1}$, $B = QR^{-1}$ and $C = RP^{-1}$. Then the value of det. (*ABC* + *BCA* + *CAB*) is equal to _____.

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22. If
$$A = \begin{bmatrix} 1 & x & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$$
 is the adjoint of a 3 × 3 matrix B and det. (B) = 4,

then the value of x is _____.

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23. A, B and C are three square matrices of order 3 such that A= diag. (x, y, x), det. (B) = 4 and det. (C) = 2, where x, y, $z \in I^+$. If det. (adj. (adj. (ABC))) = $2^{16} \times 3^8 \times 7^4$, then the number of distinct possible matrices A is

24. Let $A = \begin{bmatrix} a_{ij} \end{bmatrix}$ be a matrix of order 2 where $a_{ij} \in \{-1, 0, 1\}$ and adj. A = -A. If det. (A) = -1, then the number of such matrices is

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Jee Main Previous Year

1. Let A be 2 x 2 matrix. Statement I adj(adjA) = A Statement II |adjA| = A

A. Statement 1 is true, statement 2 is true, statement 2 is a correct

explanation for statement 1.

B. Statement 1 is true, statement 2 is true, statement 2 is a correct

explanation for statement 1.

- C. Statement 1 is true, statement 2 is false.
- D. Statement 1 is false, statement 2 is true.

Answer: B Watch Video Solution 2. 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 A. at least 7 B. less than 4 C. 5 D. 6 Answer: A Watch Video Solution

3. Let A be a 2×2 matrix with non-zero entries and let A²=I, where i is a

 2×2 identity matrix, Tr(A) i= sum of diagonal elements of A and |A| =

determinant of matrix A. Statement 1:Tr(A)=0 Statement 2:|A|=1

A. Statement 1 is false, statement 2 is true.

B. Statement 1 is true, statement 2 is true, statement 2 is a correct

explanation for statement 1.

C. Statement 1 is true, statement 2 is true, statement 2 is a correct

explanation for statement 1.

D. Statement 1 is true, statement 2 is false.

Answer: D

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4. Let A and B two symmetric matrices of order 3.

Statement 1: A(BA) and (AB)A are symmetric matrices.

Statement 2 : AB is symmetric matrix if matrix multiplication of A with B is

commutative.

A. Statement 1 is false, statement 2 is true.

B. Statement 1 is true, statement 2 is true, statement 2 is a correct

explanation for statement 1.

C. Statement 1 is true, statement 2 is true, statement 2 is not a correct

explanation for statement 1.

D. Statement 1 is true, statement 2 is false.

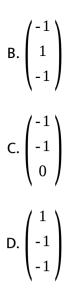
Answer: C



5. 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 :

 $A. \begin{pmatrix} -1\\1\\0 \end{pmatrix}$



Answer: D



6. Let P and Q be 3×3 matrices with $P \neq Q$. If $P^3 = Q^3 and P^2 Q = Q^2 P$,

then determinant of $(P^2 + Q^2)$ is equal to (1) 2 (2) 1 (3) 0 (4) 1

A. - 2

B. 1

C. 0

D. - 1

Answer: C



7. If
$$P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$$
 is the adjoint of a 3 x 3 matrix A and $|A| = 4$, then α is
equal to
A. 4
B. 11
C. 5
D. 0
Answer: B

8. If A is an 3 × 3 non-singular matrix such that $\forall' = A'A$ and $B = A^{-1}A'$, then BB equals (1) I + B (2) I (3) B^{-1} (4) $(B^{-1})'$

A. I + B

В.*I*

C. *B*⁻¹

 $\mathsf{D}.\left(B^{-1}\right)'$

Answer: B

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9. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ a & 2 & b \end{bmatrix}$ is a matrix satisfying the equation $\forall^T = 9I$, where I

is 3×3 identity matrix, then the ordered pair (a, b) is equal to :

A. (2, -1)

B. (-2, 1)

C. (2, 1)

D. (-2, -1)

Answer: D



10. If
$$A = \begin{bmatrix} 5a & -b \\ 3 & 2 \end{bmatrix}$$
 and $AadjA=AA^{T}$, then $5a + b$ is equal to:
A. 5
B. 4
C. 13
D. -1

Answer: A

11. if
$$A = \begin{bmatrix} 2 & -3 \\ -4 & 1 \end{bmatrix}$$
 then $(3A^2 + 12A) = ?$
A. $\begin{bmatrix} 72 & -63 \\ -84 & 51 \end{bmatrix}$
B. $\begin{bmatrix} 72 & -84 \\ -63 & 51 \end{bmatrix}$
C. $\begin{bmatrix} 51 & 63 \\ 84 & 72 \end{bmatrix}$
D. $\begin{bmatrix} 51 & 84 \\ 63 & 72 \end{bmatrix}$

Answer: C

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Jee Advanced Previous Year

1. The number of 3×3 matrices A whose entries are either 0 or 1 and for which the system A[xyz] = [100] has exactly two distinct solution is a. 0 b. $2^9 - 1$ c. 168 d. 2

A. 0

B. 2⁹ - 1

C. 168

D. 2

Answer: A

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2. Let $\omega \neq 1$ be cube root of unity and *S* be the set of all non-singular matrices of the form $[1ab\omega 1c\omega^2\theta 1]$, where each of *a*, *b*, and *c* is either ω or ω^2 . Then the number of distinct matrices in the set *S* is a. 2 b. 6 c. 4 d. 8

A. 2 B. 6 C. 4

D. 8

Answer: A



3. Let $P = \begin{bmatrix} a_{ij} \end{bmatrix}$ be a 3 × 3 matrix and let $Q = \begin{bmatrix} b_{ij} \end{bmatrix}$, where $b_{ij} = 2^{i+j}a_{ij}$ for $1 \le i, j \le 3$. If the determinant of P is 2, then the determinant of the matrix Q is

- **A**. 2¹⁰
- **B**. 2¹¹
- **C**. 2¹²

D. 2¹³

Answer: D

4. Let $P = \begin{bmatrix} 1 & 0 & 0 \\ 4 & 1 & 0 \\ 16 & 4 & 1 \end{bmatrix}$ and *I* be the identity matrix of order 3. If $Q = \begin{bmatrix} qij \end{bmatrix}$

is a matrix, such that P^{50} - Q = I, then $\frac{q_{31} + q_{32}}{q_{21}}$ equals

A. 52

B. 103

C. 201

D. 205

Answer: B

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5. How many 3×3 matrices M with entries from $\{0, 1, 2\}$ are there, for which the sum of the diagonal entries of $M^T Mis5$? 126 (b) 198 (c) 162 (d) 135

A. 198

B. 126

C. 135

D. 162

Answer: A

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6. Let *MandN* be two 3×3 non singular skew-symmetric matrices such that MN = NM if P^T denote the transpose of *P*, then $M^2N^2(M^TN^{-1})^T$ is equal to M^2 b. $-N^2$ c. $-M^2$ d. MN

A. M^2

B. - *N*²

C. -*M*²

D. *MN*

Answer: C

7. Let ω be a complex cube root of unity with $\omega \neq 1$ and $P = \begin{bmatrix} p_{ij} \end{bmatrix}$ be a $n \times n$

matrix with $p_{ij} = \omega^{i+j}$ Then $p^2 \neq O$, whe $\cap = a.57$ b. 55 c. 58 d. 56

- A. 57
- B. 55
- C. 58
- D. 56

Answer: B::C::D

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8. For 3×3 matrices *MandN*, which of the following statement (s) is (are) NOT correct ? N^TMN is symmetricor skew-symmetric, according as *m* is symmetric or skew-symmetric. *MN* - *NM* is skew-symmetric for all symmetric matrices *MandN MN* is symmetric for all symmetric matrices *MandN* (adjM)(adjN) = adj(MN) for all invertible matrices *MandN*

A. $N^T M N$ is symmetric or skew-symmetric, according as M is symmetric

or skew-symmetric

B. MN - NM is skewOsymmetric for all symmetric matrices M and N

C. MN is symmetric for all symmetric matrices M and N

D. (adj M) (adj N) = adj (MN) for all inveriblr matrices M and N.

Answer: C::D

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9. Let M be a 2×2 symmetric matrix with integer entries. Then M is invertible if The first column of M is the transpose of the second row of M. The second row of M is the transpose of the first column of M M is a diagonal matrix with non-zero entries in the main diagonal. The product of entries in the main diagonal of M is not the square of an integer.

A. the first column of M is the transpose of the second row of M

B. the second row of M is the transpose of the column of M

C. M is a diagonal matrix with non-zero entries in the main diagonal

D. the product of entries in the main diagonal of M is not the square

of an integer

Answer: C::D

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10. Let m and N be two 3x3 matrices such that MN=NM. Further if $M \neq N^2$ and $M^2 = N^4$ then which of the following are correct.

A. determinant of $(M^2 + Mn^2)$ is 0

B. there is a 3×3 non-zero matrix U such that $(M^2 + MN^2)U$ is the

zero matrix

C. determinant of
$$\left(M^2 + MN^2\right) \ge 1$$

D. for a 3×3 matrix U, is the zero matrix

Answer: A::B



11. Let *XandY* be two arbitrary, 3×3 , non-zero, skew-symmetric matrices and *Z* be an arbitrary 3×3 , non-zero, symmetric matrix. Then which of the following matrices is (are) skew symmetric? a. $Y^3Z^4Z^4Y^3$ b. $x^{44} + Y^{44}$ c. $X^4Z^3 - Z^3X^4$ d. $X^{23} + Y^{23}$

A. $Y^3Z^4 - Z^4Y^3$

B. $X^{44} + Y^{44}$

C. $X^4 Z^3 - Z^3 X^4$

D. $X^{23} + Y^{23}$

Answer: C::D

12. Let
$$p = \begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{bmatrix}$$
, where $\alpha \in \mathbb{R}$. Suppose $Q = \begin{bmatrix} q_{ij} \end{bmatrix}$ is a matrix

such that PQ = kl, where $k \in \mathbb{R}, k \neq 0$ and l is the identity matrix of

order 3. If $q_{23} = -\frac{k}{8}$ and $det(Q) = \frac{k^2}{2}$, then

A. $\alpha = 0, k = 8$

B. $4\alpha - k + 8 = 0$

C. det (P adj (Q)) = 2^9

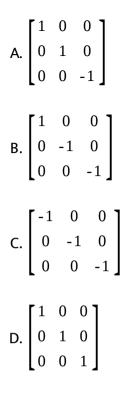
D. det (Q adj (P)) = 2^{13}

Answer: B::C

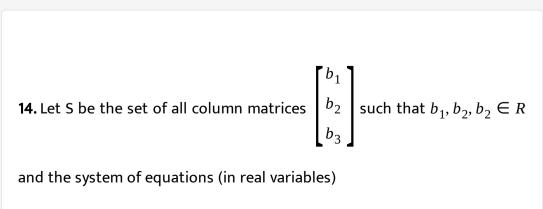
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13. Which of the following is (are) NOT the square of a 3×3 matrix with

real entries ?



Answer: A::C



$$-x + 2y + 5z = b_1$$

 $2x - 4y + 3z = b_2$

$$x - 2y + 2z = b_3$$

has at least one solution. The, which of the following system (s) (in real

variables) has (have) at least one solution for each $\begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix} \in S$?

A. $x + 2y + 3z = b_1$, $4y + 5z = b_2$ and $x + 2y + 6z = b_3$

B.
$$x + y + 3z = b_1$$
, $5x + 2y + 6z = b_2$ and $-2x - y - 3z = b_3$

C.
$$x + 2y - 5z = b_1, 2x - 4y + 10z = b_2$$
 and $x - 2y + 5z = b_3$

D.
$$x + 2y + 5z = b_1$$
, $2x + 3z = b_2$ and $x + 4y - 5z = b_3$

Answer: A::D

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15. Let A be the set of all 3×3 symmetric matrices all of whose entries are either 0 or 1. Five of these entries are 1 and four of them are 0. The number of matrices in A is

A. 12	
B. 6	
C. 9	
D. 3	

Answer: A



16. Let A be the set of all 3×3 symmetric matrices all of whose either 0 or

1. Five of these entries are 1 and four of them are 0.

The number of matrices A in A for which the system of linear equations

$$A\begin{bmatrix} x\\ y\\ z\end{bmatrix} = \begin{bmatrix} 1\\ 0\\ 0\end{bmatrix}$$

has a unique solution is

A. less than 4

B. at least 4 but less than 7

C. at least 7 but less than 10

D. at leat 10

Answer: B

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17. Let A be the set of all 3×3 symmetric matrices all of whose either 0 or

1. Five of these entries are 1 and four of them are 0.

The number of matrices A in A for which the system of linear equations

$$A\begin{bmatrix} x\\ y\\ z\end{bmatrix} = \begin{bmatrix} 1\\ 0\\ 0\end{bmatrix}$$

is inconsistent is

A. 0

B. more than 2

C. 2

D. 1

Answer: B



18. Let p be an odd prime number and T_p , be the following set of 2×2

matrices
$$T_p = \left\{ A = \begin{bmatrix} a & b \\ c & a \end{bmatrix} : a, b, c \in \{0, 1, 2, \dots, p-1\} \right\}$$
 The number of A in T_p , such that A is either symmetric or skew-symmetric or both, and

det (A) divisible by p is

A. $(p - 1)^2$ B. 2(p - 1)C. $(p - 1)^2 + 1$ D. 2p - 1

Answer: D

19. Let P be an odd prime number and T_p be the following set of 2×2 matrices :

The number of A in T_p such that the trace of a is not divisible by p but det (A) divisible by p is [Note : The trace of matrix is the sum of its diaginal entries].

A.
$$(p - 1)(p^2 - p + 1)$$

B. $p^3 - (p - 1)^2$
C. $(p - 1)^2$
D. $(p - 1)(p^2 - 2)$

Answer: C

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20. Let p be an odd prime number and T_p , be the following set of 2×2

matrices
$$T_p = \left\{ A = \begin{bmatrix} a & b \\ c & a \end{bmatrix} : a, b, c \in \{0, 1, 2, \dots, p-1\} \right\}$$
 The number of

A in T_p , such that A is either symmetric or skew-symmetric or both, and det (A) divisible by p is

A. $2p^2$ B. $p^3 - 5p$ C. $p^3 - 3p$ D. $p^3 - p^2$

Answer: D

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21. Let a,b, and c be three real numbers satistying

 $[a, b, c] \begin{bmatrix} 1 & 9 & 7 \\ 8 & 2 & 7 \\ 7 & 3 & 7 \end{bmatrix} = [0, 0, 0]$ If the point P(a, b, c) with reference to (E),

lies on the plane 2x + y + z = 1, the the value of 7a + b + c is

B. 12

C. 7

D. 6

Answer: D

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22. Let a,b, and c be three real numbers satisfying

$$\begin{bmatrix} a, b, c \end{bmatrix} \begin{bmatrix} 1 & 9 & 7 \\ 8 & 2 & 7 \\ 7 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 0, 0, 0 \end{bmatrix}$$
 Let ω be a solution of $x^3 - 1 = 0$ with
 $Im(\omega) > 0.$ If $a = 2$ with b nd c satisfying (E) then the value of
 $\frac{3}{\omega^a} + \frac{1}{\omega^b} + \frac{3}{\omega^c}$ is equa to (A) -2 (B) 2 (C) 3 (D) -3
A. -2
B. 2

C. 3

D. - 3

Answer: A



23. Let
$$a$$
, b and c be three real numbers satisfying

$$\begin{bmatrix} 1 & 9 & 7 \\ 8 & 2 & 7 \\ 7 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 0, 0, 0 \end{bmatrix}$$
Let b=6, with a and c satisfying (E). If alpha

and beta are the roots of the quadratic equation $ax^2 + bx + c = 0$ then $\sum_{n=0}^{\infty} \left(\frac{1}{\alpha} + \frac{1}{\beta}\right)^n$ is

A. 6

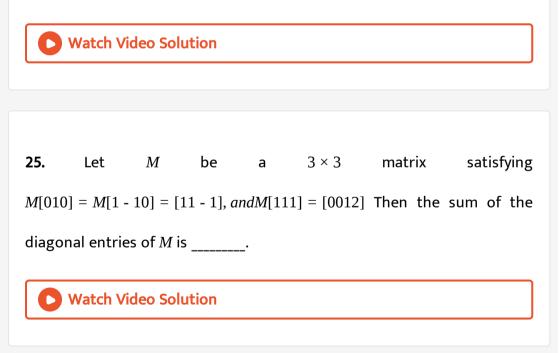
B. 7

 $C. \frac{6}{7}$

D. ∞

Answer: B

24. Let *K* be a positive real number and $A = [2k - 12\sqrt{k}2\sqrt{k}1 - 2k - 2\sqrt{k}2k - 1]andB = [02k - 1\sqrt{k}1 - 2k02 - \sqrt{k} - 2\sqrt{k}]$. If det $(adjA) + det(adjB) = 10^6$, then[k] is equal to. [Note: adjM denotes the adjoint of a square matix *M* and [k] denotes the largest integer less than or equal to *K*].



26. let
$$z = \frac{-1 + \sqrt{3i}}{2}$$
, where $i = \sqrt{-1}$ and $r, s \in P1, 2, 3$. Let $P = \begin{bmatrix} (-z)^r & z^{2s} \\ z^{2s} & z^r \end{bmatrix}$

and I be the idenfity matrix or order 2. Then the total number of ordered pairs (r,s) or which $P^2 = -I$ is

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Single Correct Answer

1. If
$$A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$$
 and $B = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$, then $(A + B)^2 =$

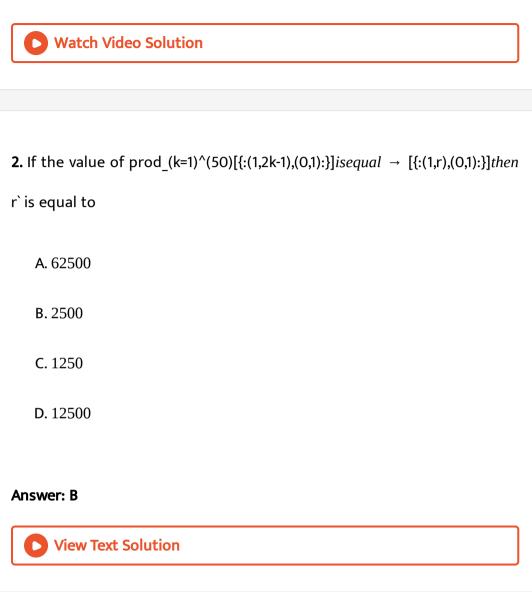
A.*A*

B. *B*

C. I

D. $A^2 + B^2$

Answer: D



3. A square matrix P satisfies $P^2 = I - P$ where I is identity matrix. If

 $P^n = 5I - 8P$, then *n* is

4. A and B are two square matrices such that $A^2B = BA$ and if $(AB)^{10} = A^k B^{10}$, then k is

A. 1001

B. 1023

C. 1042

D. none of these

Answer: B

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5. If matrix $A = \begin{bmatrix} a_{ij} \end{bmatrix}_{3 \times 3}$, matrix $B = \begin{bmatrix} b_{ij} \end{bmatrix}_{3 \times 3}$, where $a_{ij} + a_{ji} = 0$ and $b_{ij} - b_{ji} = 0 \forall i, j$, then $A^4 \cdot B^3$ is

A. Singular

B. Zero matrix

C. Symmetric

D. Skew-Symmetric matrix

Answer: A

$$\mathsf{D}. \begin{pmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & -2 \end{pmatrix}$$

Answer: D

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7. Let
$$A = \begin{bmatrix} -5 & -8 & -7 \\ 3 & 5 & 4 \\ 2 & 3 & 3 \end{bmatrix}$$
 and $B = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$. If *AB* is a scalar multiple of *B*, then

the value of x + y is

A. - 1

B. - 2

C. 1

D. 2

Answer: B

8. $A = \begin{bmatrix} a & b \\ b & -a \end{bmatrix}$ and $MA = A^{2m}$, $m \in N$ for some matrix M, then which one

of the following is correct?

$$A. M = \begin{bmatrix} a^{2m} & b^{2m} \\ b^{2m} & -a^{2m} \end{bmatrix}$$
$$B. M = \begin{pmatrix} a^2 + b^2 \end{pmatrix}^m \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$
$$C. M = \begin{pmatrix} a^m + b^m \end{pmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$
$$D. M = \begin{pmatrix} a^2 + b^2 \end{pmatrix}^{m-1} \begin{bmatrix} a & b \\ b & -a \end{bmatrix}$$

Answer: D

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9. If $A = [a_{ij}]_{m \times n}$ and $a_{ij} = (i^2 + j^2 - ij)(j - i)$, *n* odd, then which of the following is not the value of Tr(A)

 $\mathbf{B}.|A|$

C. 2|A|

D. none of these

Answer: D

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10.
$$|A - B| \neq 0, A^4 = B^4, C^3A = C^3B, B^3A = A^3B$$
, then $|A^3 + B^3 + C^3| =$

A. 0

B. 1

C. 3|A|³

D. 6

Answer: A

11. If AB + BA = 0, then which of the following is equivalent to $A^3 - B^3$

A.
$$(A - B)(A^2 + AB + B^2)$$

B. $(A - B)(A^2 - AB - B^2)$
C. $(A + B)(A^2 - AB - B^2)$
D. $(A + B)(A^2 + AB - B^2)$

Answer: C

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12. *A*, *B*, *C* are three matrices of the same order such that any two are symmetric and the 3^{rd} one is skew symmetric. If X = ABC + CBA and Y = ABC - CBA, then $(XY)^T$ is

A. symmetric

B. skew symmetric

C. I - XY

D. - *YX*

Answer: D



13. If A and P are different matrices of order n satisfying $A^3 = P^3$ and $A^2P = P^2A$ (where $|A - P| \neq 0$) then $|A^2 + P^2|$ is equal to

A. n

B. 0

 $\mathsf{C}.\left|A\right||P|$

D. |A + P|

Answer: B

14. Let *A*, *B* are square matrices of same order satisfying
$$AB = A$$
 and
 $BA = B$ then $(A^{2010} + B^{2010})^{2011}$ equals.
A. *A* + *B*
B. 2010(*A* + *B*)
C. 2011(*A* + *B*)
D. 2²⁰¹¹(*A* + *B*)

Answer: D

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15. The number of 2 × 2 matrices A, that are there with the elements as real numbers satisfying $A + A^T = I$ and $AA^T = I$ is

A. zero

B. one

C. two

D. infinite

Answer: C



16. If the orthogonal square matrices A and B of same size satisfy detA + detB = 0 then the value of det(A + B)

A. - 1

B. 1

C. 0

D. none of these

Answer: C

17. If
$$A = \begin{bmatrix} \cos\theta & \sin\theta \\ \sin\theta & -\cos\theta \end{bmatrix}$$
, $B = \begin{bmatrix} 1 & 0 \\ -1 & 1 \end{bmatrix}$, $C = ABA^T$, then A^TC^nA equals to
 $(n \in I^+)$
A. $\begin{bmatrix} -n & 1 \\ 1 & 0 \end{bmatrix}$
B. $\begin{bmatrix} 1 & -n \\ 0 & 1 \end{bmatrix}$
C. $\begin{bmatrix} 0 & 1 \\ 1 & -n \end{bmatrix}$
D. $\begin{bmatrix} 1 & 0 \\ -n & 1 \end{bmatrix}$

Answer: D

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18. Let A be a 3×3 matrix given by $A = (a_{ij})_{3 \times 3}$. If for every column vector X satisfies X'AX = 0 and $a_{12} = 2008$, $a_{13} = 1010$ and $a_{23} = -2012$. Then the value of $a_{21} + a_{31} + a_{32} =$

A. - 6

B. 2006

C. - 2006

D. 0

Answer: C

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19. Suppose A and B are two non singular matrices such that $B \neq I$, $A^6 = I$

and $AB^2 = BA$. Find the least value of k for $B^k = 1$

A. 31

B. 32

C. 64

D. 63

Answer: D

20. Let *A* be a 2×3 matrix, whereas *B* be a 3×2 amtrix. If det. (*AB*) = 4, then the value of det. (*BA*) is

A. - 4

B.2

C. - 2

D. 0

Answer: D

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21. Let A be a square matrix of order 3 so that sum of elements of each row is 1. Then the sum elements of matrix A^2 is

A. 1

B.3

C. 0

D. 6

Answer: B



22. A and B be 3×3 matrices such that AB + A = 0, then

A. $(A + B)^2 = A^2 + 2AB + B^2$

$$B. |A| = |B|$$

 $C. A^2 = B^2$

D. none of these

Answer: A

23. If $(A + B)^2 = A^2 + B^2$ and $|A| \neq 0$, then |B| = (where A and B are

matrices of odd order)

A. 2

B. - 2

C. 1

D. 0

Answer: D

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24. If A is a square matrix of order 3 such that |A| = 5, then |Adj(4A)| =

A. $5^3 \times 4^2$

B. $5^2 \times 4^3$

 $\mathbf{C.}\,\mathbf{5}^2\times\mathbf{16}^3$

D. $5^3 \times 16^2$

Answer: C



25. If *A* and *B* are two non singular matrices and both are symmetric and commute each other, then

A. Both $A^{-1}B$ and $A^{-1}B^{-1}$ are symmetric.

B. $A^{-1}B$ is symmetric but $A^{-1}B^{-1}$ is not symmetric.

C. $A^{-1}B^{-1}$ is symmetric but $A^{-1}B$ is not symmetric.

D. Neither $A^{-1}B$ nor $A^{-1}B^{-1}$ are symmetric

Answer: A



26. If *A* is a square matrix of order 3 such that |A| = 2, then $\left| \left(a d j A^{-1} \right)^{-1} \right|$

A. 1	
B. 2	
C. 4	
D. 8	

Answer: C

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27. Let matrix
$$A = \begin{bmatrix} x & y & -z \\ 1 & 2 & 3 \\ 1 & 1 & 2 \end{bmatrix}$$
, where $x, y, z \in N$. If

 $|adj(adj(adj(adjA)))| = 4^8 \cdot 5^{16}$, then the number of such (x, y, z) are

A. 28

B. 36

C. 45

D. 55

Answer: B



28. A be a square matrix of order 2 with $|A| \neq 0$ such that |A + |A|adj(A)| = 0, where adj(A) is a adjoint of matrix A, then the value of |A - |A|adj(A)| is

A. 1

B. 2

C. 3

D. 4

Answer: D

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29. If A is a skew symmetric matrix, then $B = (I - A)(I + A)^{-1}$ is (where I is

an identity matrix of same order as of A)

A. idempotent matrix

B. symmetric matrix

C. orthogonal matrix

D. none of these

Answer: C

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30. If
$$A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$$
, then the trace of the matrix $Adj(AdjA)$ is

A. 1

B.2

C. 3

D. 4

Answer: A

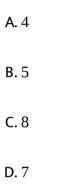
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31. If
$$A = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -3 \\ 2 & 1 & 0 \end{bmatrix}$$
 and $B = (adjA)$ and $C = 5A$, then find the value of
 $\frac{|adjB|}{|C|}$
A. 25
B. 2
C. 1
D. 5

Answer: C

32. Let A and B be two non-singular square matrices such that $B \neq I$ and

 $AB^2 = BA$. If $A^3 - B^{-1}A^3B^n$, then value of *n* is



Answer: C

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33. If *A* is an idempotent matrix satisfying $(I - 0.4A)^{-1} = I - \alpha A$ where *I* is the unit matrix of the same order as that of *A* then the value of α is

A. - 1/3

B. 1/3

C. - 2/3

D. 2/3

Answer: C

34. If A and B are two non-singular matrices which commute, then $(A(A + B)^{-1}B)^{-1}(AB) =$ A. A + BB. $A^{-1} + B^{-1}$ C. $A^{-1} + B$

D. none of these

Answer: A

1. If
$$A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$
, then
A. $A^3 - A^2 = A - I$
B. $Det(A^{2010} - I) = 0$
C. $A^{50} = \begin{bmatrix} 1 & 0 & 0 \\ 25 & 1 & 0 \\ 25 & 0 & 1 \end{bmatrix}$
D. $A^{50} = \begin{bmatrix} 1 & 1 & 0 \\ 25 & 1 & 0 \\ 25 & 0 & 1 \end{bmatrix}$

Answer: A::B::C

2. If the elements of a matrix A are real positive and distinct such that

$$\det(A + A^T)^T = 0$$
 then

A. detA > 0

B. det $A \ge 0$

C. det
$$\left(A - A^{T}\right) > 0$$

D. det $\left(A, A^{T}\right) > 0$

Answer: A::C::D

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3. If
$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$
 and X is a non zero column matrix such that

 $AX = \lambda X$, where λ is a scalar, then values of λ can be

A. 3

B.6

C. 12

D. 15

Answer: A::D

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4. If A, B are two square matrices of same order such that A + B = AB and

I is identity matrix of order same as that of A,B, then

A. AB = BAB. |A - I| = 0C. $|B - I| \neq 0$

D. |A - B| = 0

Answer: A::C

5. If A is a non-singular matrix of order $n \times n$ such that $3ABA^{-1} + A = 2A^{-1}BA$, then

A. A and B both are identity matrices

$$||A + B|| = 0$$

$$\mathsf{C.} \left| ABA^{-1} - A^{-1}BA \right| = 0$$

D.A + B is not a singular matrix

Answer: B::C

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6. If the matrix A and B are of 3×3 and (I - AB) is invertible, then which of

the following statement is/are correct ?

A. I - BA is not invertible

B. I - BA is invertible

C. *I* - *BA* has for its inverse $I + B(I - AB)^{-1}A$

D. *I* - *BA* has for its inverse $I + A(I - BA)^{-1}B$

Answer: B::C



7. If A is a square matrix such that
$$A \cdot (AdjA) = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{bmatrix}$$
, then

A. |A| = 4

B. |adjA| = 16|adi(adjA)|

$$C. \frac{|adj(ddjA)|}{|adjA|} = 16$$

D. |*adj*2*A*| = 128

Answer: A::B::C

1. In which of the following type of matrix inverse does not exist always? a.

idempotent b. orthogonal c. involuntary d. none of

these

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2. If both $A - \frac{1}{2}IandA + \frac{1}{2}$ are orthogonal matices, then (a)A is orthogonal (b)A is skew-symmetric matrix of even order (c) $A^2 = \frac{3}{4}I$ (d)none of these

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3. If nth-order square matrix *A* is a orthogonal, then |adj(adjA)| is (a)always -1 if n is even (b) always 1 if n is odd (c) always 1 (d) none of these

4. If P is an orthogonal matrix and $Q = PAP^{T}andx = P^{T}Q^{1000}P$ then x^{-1} is,

where A is involutary matrix. A b. I c. A^{1000} d. none of these



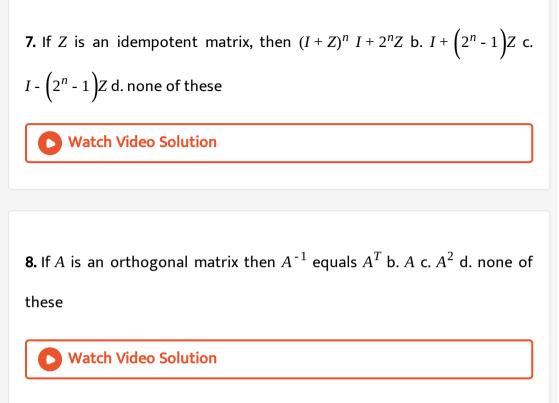
5. If A is a nilpotent matrix of index 2, then for any positive integer $n, A(I + A)^n$ is equal to A^{-1} b. $A c. A^n d. I_n$

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6. If AandB are two matrices such that AB = BandBA = A, then

$$(A^5 - B^5)^3 = A - B$$
 b. $(A^5 - B^5)^3 = A^3 - B^3$ c. $A - B$ is idempotent d. none

of these



9. If $A^2 = 1$, then the value of det(A - I) is (where A has order 3) 1 b. -1 c. 0

d. cannot say anything

10. Let A be an nth-order square matrix and B be its adjoint, then $|AB + KI_n|$ is (where K is a scalar quantity) $(|A| + K)^{n-2}$ b. $(|A| +)K^n$ c.

$(|A| + K)^{n-1}$ d. none of these



11.
$$A = \begin{bmatrix} a & 1 & 0 \\ 1 & b & d \\ 1 & b & c \end{bmatrix}, B = \begin{bmatrix} a & 1 & 1 \\ 0 & d & c \\ f & g & h \end{bmatrix}, U = \begin{bmatrix} f \\ g \\ h \end{bmatrix}, V = \begin{bmatrix} a^2 \\ 0 \\ 0 \end{bmatrix}$$
 If there is a

vector matrix X, such that AX = U has infinitely many solutions, then prove that BX = V cannot have a unique solution. If $afd \neq 0$. Then, prove that BX = V has no solution.

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12. If *M* is a 3×3 matrix, where det M = 1 and $MM^T = 1$, where *I* is an identity matrix, prove theat det (M - I) = 0.

13. If *A* is a diagonal matrix of order 3×3 is commutative with every square matrix or order 3×3 under multiplication and tr(A) = 12, then the value of $|A|^{1/2}$ is _____.

14. Let *S* be the set which contains all possible vaues fo *I*, *m*, *n*, *p*, *q*, *r* for which $A = [I^2 - 3p00m^2 - 8qr0n^2 - 15]$ be non-singular idempotent matrix. Then the sum of all the elements of the set *S* is _____.

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15. Given a matrix A = [abcbcacab], wherea, b, c are real positive numbers

 $abc = 1andA^{T}A = I$, then find the value of $a^{3} + b^{3} + c^{3}$

16. If A is a square matrix of order 3 such that |A| = 2, then $\left| \left(adjA^{-1} \right)^{-1} \right|$ is

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17. Let
$$A = \begin{bmatrix} 3x^2 \\ 1 \\ 6x \end{bmatrix}$$
, $B = [a, b, c]$ and $C = \begin{bmatrix} (x+2)^2 & 5x^2 & 2x \\ 5x^2 & 2x & (x+2)^2 \\ 2x & (x+2)^2 & 5x^2 \end{bmatrix}$ be

three given matrices, where $a, b, candx \in R$ Given that tr(AB)=tr(C). If $f(x) = ax^2 + bx + c$, then the value of f(1) is _____.

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18. If A is an idempotent matrix satisfying, $(I - 0.4A)^{-1} = I - \alpha A$, where I is the unit matrix of the name order as that of A, then the value of $|9\alpha|$ is equal to _____.

19. Let $A = \left(\begin{bmatrix} a_{ij} \end{bmatrix}\right)_{3 \times 3}$ be a matrix such that $\forall^T = 4Ianda_{ij} + 2c_{ij} = 0$, where c_{ij} is the cofactor of $a_{ij}andI$ is the unit matrix of order 3. $\begin{vmatrix} a_{11} + 4a_{12}a_{13}a_{21}a_{22} + 4a_{23}a_{31}a_{32}a_{33} + 4 \end{vmatrix} + 5\lambda \begin{vmatrix} a_{11} + 1a_{12}a_{13}a_{21}a_{22} + 1a_{23}a_{31}a_{31}a_{33}a_{33} \end{vmatrix}$ then the value of 10λ is _____.

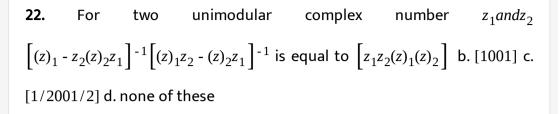
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20. Let *A* be the set of all 3×3 skew-symmetri matrices whose entries are either -1, 0, or 1. If there are exactly three 0s three 1s, and there (-1)'s, then the number of such matrices is _____.

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21. If $A = [0121233a1]andA_1 = [1/212/12/ - 43c5/2 - 3/21/2]$, then the

values of a anti c are equal to 1, 1 b. 1, - 1 c. 1, 2 d. - 1, 1



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23. If AandB are two non-singular matrices of the same order such that

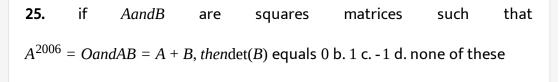
 $B^r = I$, for some positive integer r > 1, then $A^{-1}B^{r-1}A = A^{-1}B^{-1}A = I$ b. 2I

c. O d. -I

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24. If A is non-diagonal involuntary matrix, then A = I = O b. A + I = O c.

A = I is nonzero singular d. none of these





26. If matrix A is given by A = [61124], then the determinant of $A^{2005} - 6A^{2004}$ is 2^{2006} b. $(-11)2^{2005}$ c. -2^{2005} d. $(-9)2^{2004}$

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27. If A = [abcxyzpqr], B[q - by - pa - xr - cz] and if A is invertible, then which of the following is not true? |A| = |B| |A| = -|B| |adjA| = |adjB| A is invertible if and only if B is invertible

28. If AandB are two non-singular matrices such that AB = C, then |B| is

equal to
$$\frac{|C|}{|A|}$$
 b. $\frac{|A|}{|C|}$ c. $|C|$ d. none of these

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29. If
$$A(\alpha, \beta) = \begin{bmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & e^{\beta} \end{bmatrix}$$
, then $A(\alpha, \beta)^{-1}$ is equal to

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30. If
$$A = \begin{bmatrix} a+ib & c+id \\ -c+id & a-ib \end{bmatrix}$$
 and $a^2 + b^2 + c^2 + d^2 = 1$, then A^{-1} is equal to a.
$$\begin{bmatrix} a+ib & -c+id \\ -c+id & a-ib \end{bmatrix}$$
 b.
$$\begin{bmatrix} a-ib & -c-id \\ -c-id & a+ib \end{bmatrix}$$
 c.
$$\begin{bmatrix} a+ib & -c-id \\ -c+id & a-ib \end{bmatrix}$$
 d. none of

these

31. Statement 1: $A = [404222121]B^{-1} = [133143134]$. Then $(AB)^{-1}$ does not exist. Statement 2: Since |A| = 0, $(AB)^{-1} = B^{-1}A^{-1}$ is meaning-less.

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32. Statement 1: If
$$f(\alpha) = \begin{bmatrix} \cos \alpha & -\sin \alpha & 0 \\ \sin \alpha & \cos \alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
, then $[F(\alpha)]^{-1} = F(-\alpha)$
Statement 2: For matrix $G(\beta) = \begin{bmatrix} \cos \beta & 0 & \sin \beta \\ 0 & 1 & 0 \\ -\sin \beta & 0 & \cos \beta \end{bmatrix}$ we have $[G(\beta)]^{-1} = G(-\beta)$
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33. Statement 1: if a, b, c, d are real numbers and $A = [abcd]andA^3 = O, thenA^2 = O$ Statement 2: For matrix A = [abcd] we have $A^2 = (a + d)A + (ad - bc)I = O$

34. Statement 1: Matrix 3×3 , $a_{ij} = \frac{i-j}{i+2j}$ cannot be expressed as a sum of symmetric and skew-symmetric matrix. Statement 2: Matrix 3×3 , $a_{ij} = \frac{i-j}{i+2j}$ is neither symmetric nor skew-symmetric

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35. Statement 1: If A, B, C are matrices such that $|A_{3\times3}| = 3$, $|B_{3\times3}| = -1$, and $|C_{2\times2}| = -1$, then |2ABC| = -12. Statement 2:

For matrices A, B, C of the same order, |ABC| = A = |A||B||C|

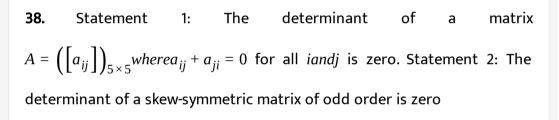
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36. Statement 1: For a singular square matrix A, AB = ACB = C Statement

2; |A| = 0, *then* A^{-1} does not exist.

37. Statement 1: The inverse of singular matrix $A = \left(\begin{bmatrix} a_{ij} \end{bmatrix} \right)_{n \times n}, where a_{ij} = 0, i \ge jisB = \left([aij - 1] \right)_{n \times n}$ Statement 2: The inverse of singular square matrix does not exist.







39. If $A = [1221]andf(x) = \frac{1+x}{1-x}$, then f(A) is [1111] b. [2222] c. 1 - 1 - 1 d.

none of these

40. Id $[1/250x1/25] = [50 - a5]^{-2}$, then the value of x is a/125 b. 2a/125 c.

2a/25 d. none of these



41. If $A = [1\tan x - \tan x]$, show that $A^T A^{-1} = [\cos 2x - \sin 2x \sin 2x \cos 2x]$.

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42. If *A* is a square matrix of order *n* such that $|adj(adjA)| = |A|^9$, then the

value of *n* can be 4 b. 2 c. either 4 or 2 d. none of these

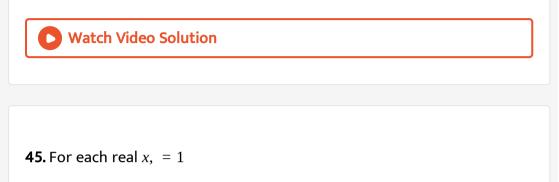
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43. If A is order 2 square matrix such that |A| = 2, then |(adj(adj(adjA)))| is

512 b. 256 c. 64 d. none of these

44. If
$$A^3 = O$$
, then $I + A + A^2$ equals a $I - A$ b. $(I + A^1)^{-1}$ c. $(I - A)^{-1}$ d. none

of these





46. $(-A)^{-1}$ is always equal to (where A is nth-order square matrix) $(-A)^{-1}$

b. $-A^{-1}$ c. $(-1)^n A^{-1}$ d. none of these

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47. The matrix X for which [1 - 43 - 2]X = [-16 - 672] is [-24 - 31] b.

$$-\frac{1}{5}\frac{2}{5}-\frac{3}{10}\frac{1}{5}\right] \text{c.} \left[-161672\right] \text{d.} \left[62\frac{11}{2}2\right]$$

48. If
$$A = \begin{bmatrix} 0 & -\tan\alpha \\ 2 & \tan\alpha \\ 2 & 0 \end{bmatrix}$$
 and I is 2×2 unit matrix, then $(I - A) \begin{bmatrix} \cos\alpha & \sin\alpha \\ \sin\alpha & \sin\alpha \end{bmatrix}$

is (a) -I + A (b) I - A (c) -I - A (d) non of these

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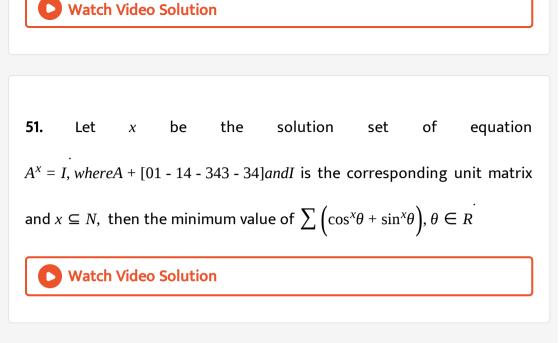
49. Let AdnB be 3×3 matrices of ral numbers, where A is symmetric, B is

skew-symmetric , and (A + B)(A - B) = (A - B)(A + B) If $(AB)^{t} = (-1)^{k}AB$, where $(AB)^{t}$ is the transpose of the mattix AB, then find

the possible values of k

50. If
$$\begin{bmatrix} a & b \\ c & 1 - a \end{bmatrix}$$
 is an idempotent matrix and $f(x) = x - x^2$, $bc = \frac{1}{4}$, then the value of $1/f(a)$ is _____.





52. If $A = [\alpha 011]$ and B = [1051], find the values of α for which $A^2 = B$

53. Let a and b be two real numbers such that a > 1, b > 1. If

$$A = \begin{pmatrix} a & 0 \\ 0 & b \end{pmatrix}$$
, then $(\lim_{n \to \infty} A^{-n} \text{ is (a) unit matrix (b) null matrix (c) } 2I$

(d) non of these

54. Let $f(x) = \frac{1+x}{1-x}$. If A is matrix for which $A^3 = O$, then f(A) is (a) $I + A + A^2$ (b) $I + 2A + 2A^2$ (c) $I - A - A^2$ (d) none of these

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55. A and B are square matrices and A is non-singular matrix, then $(A^{-1}BA)^n$, $n \in I'$, is equal to (A) $A^{-n}B^nA^n$ (B) $A^nB^nA^{-n}$ (C) $A^{-1}B^nA$ (D) $A^{-n}BA^n$

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56. If A is a singular matrix, then adj A is a singular b. non singular c. symmetric d. not defined



57. The inverse of a diagonal matrix is a. a diagonal matrix
 b. a

 skew symmetric matrix c. a symmetric matrix
 d. none of these

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 58. If P is non-singular matrix, then value of
$$adj(P^{-1})$$
 in terms of P is (A)

 $\frac{P}{|P|}$ (B) $P|P|$ (C) P (D) none of these

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59. If
$$adjB = A$$
, $|P| = |Q| = 1$, then $adj(Q^{-1}BP^{-1})$ is PQ b. QAP c. PAQ d. $PA^{1}Q$

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60. If *A* is non-singular and (A - 2I)(A - 4I) = O, then $\frac{1}{6}A + \frac{4}{3}A^{-1}$ is equal to

OI b. 2*I* c. 6*I* d. *I*

61. If
$$A(\alpha, \beta) = \begin{bmatrix} \cos\alpha & \sin\alpha & 0 \\ -\sin\alpha & \cos\alpha & 0 \\ 0 & 0 & e^{\beta} \end{bmatrix}$$
, then $A(\alpha, \beta)^{-1}$ is equal to $aA(-\alpha, -\beta)$ b.

 $A(-\alpha, \beta)$ c. $A(\alpha, -\beta)$ d. $A(\alpha, \beta)$

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62. If *AandB* are two square matrices such that $B = -A^{-1}BA$, then $(A + B)^2$ is equal to $A^2 + B^2$ b. O c. $A^2 + 2AB + B^2$ d. A + B

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63. A = [1tanx - tanx1]andf(x) is defined as $f(x) = detA^TA^{-1}$ en the value of

 $(f(f(f(f(f(x))))) \text{ is } (n \ge 2) _____.$

64. The equation [12213424k][xyz] = [000] has a solution for (x, y, z)

besides (0, 0, 0) Then the value of k is _____.



65. If D_1andD_2 are two 3×3 diagonal matrices, then which of the following is/are true? D_1andD_2 is a diagonal matrix b. $D_1D_2 = D_2D_1$ c. D12 + D22 is a diagonal matrix d. none of these

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66. If *AandB* are symmetric and commute, then which of the following is/are symmetric? $A^{-1}B$ b. AB^{-1} c. $A^{-1}B^{-1}$ d. none of these

67. If *C* is skew-symmetric matrix of order $nand \pm sn \times 1$ column matrix, then X^TCX is a singular b. non-singular c. invertible d. non invertible



68.

lf

 $S = [011101110]andA = [b + + ab - - bc + ba - - ca - ca + b](a, b, c \neq 0), then SA$

is a. symmetric matrix b. diagonal matrix c. invertible matrix d. singular matrix

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69. Let A = [122212221]. Then $A^2 - 4A - 5I_3 = O$ b. $A^{-1} = \frac{1}{5}(A - 4I_3)$ c. A^3

is not invertible d. A^2 is invertible

70. Let $A = a_0$ be a matrix of order 3, where $a_{ij}\{x; \text{ if } i = j, x \in R1; \text{ if } |i - j| = 1; 0; otherwise then when of the following Hold (s) good: for <math>x = 2$, A is a diagonal matrix A is a symmetric matrix for x = 2, det A has the value equal to 6 Let f(x) =, det A, then the function f(x) has both the maxima and minima.



71. A skew-symmetric matrix A satisfies the relation $A^2 + I = O$, where I is a unit matrix then A is a. idempotent b. orthogonal c. of even order d. odd order

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72. If AB = AandBA = B, then a. $A^2B = A^2$ b. $B^2A = B^2$ c. ABA = A d.

BAB = B

73. Each question has four choices a, b, c and d, out of which only one is correct. Each question contains STATEMENT 1 and STATEMENT 2. Both the statements are TRUE and STATEMENT 2 is the correct explanation of STATEMENT1. Both the statements are TRUE but STATEMENT 2 is NOT the correct explanation of STATEMENT 1. STATEMENT 1 is TRUE and STATEMENT 2 is FALSE. STATEMENT 1 is FALSE and STATEMENT 2 is TRUE. Statement 1: $|adj(adj(adjA))| - |A|^{n-1} \wedge 3$, where *n* is order of matrix *A* Statement 2: $|adjA| = |A|^n$

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74. Statement 1: if $D = \text{diag} [d_1, d_2, d_n]$, then $D^{-1} = \text{diag} [d_1^{-1}, d_2^{-1}, ..., d_n^{-1}]$ Statement 2: if $D = \text{diag} [d_1, d_2, d_n]$, then $D^n = \text{diag} [d_1^n, d_2^n, ..., d_n^n]$

75. If A is a skew-symmetric matrix and n is odd positive integer, then A^n is a skew-symmetric matrix a symmetric matrix a diagonal matrix none of these

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76. If $f(x) = [\cos x - \sin x - \sin x \cos c1]$ and $g(y) = [\cos y \sin y \sin y \cos y]$, then $[f(x)g(y)]^{-1}$ is equal to (a) f(-x)g(-y) (b) g(-y)f(-x) (c) $f(x^{-1})g(y^{-1})$ (d) $g(y^{-1})f(x^{-1})$

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77. Let $F(\alpha) = [\cos \alpha - s \in \alpha 0s \in \alpha \cos \alpha 0001]$, where $\alpha \in R$ Then $(F(\alpha))^{-1}$ is

equal to
$$F(\alpha^{-1})$$
 b. $F(-\alpha^{\Box})$ c. $F(2\alpha)$ d. -[1110]

78. Elements of a matrix A or orddr 10×10 are defined as $a_{ij} = w^{i+j}$ (where w is cube root of unity), then trace (A) of the matrix is 0 b. 1 c. 3 d. none of these

) Watch	Video	Solution

79. If A is a 3×3 skew-symmetric matrix, then trace of A is equal to -1 b. 1

c. |A| d. none of these

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80. If *AandB* are symmetric matrices of the same order and

X = AB + BAandY = AB - BA, then $(XY)^T$ is equal to XY b. YX c. - YX d. none

of these

81. The number of solutions of the matrix equation $X^2 = \begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix}$ is (A)

more than 2 (B) 2 (C) 0 (D) 1

82. If $A^2 - A + I = 0$, then the invers of A is A^{-2} b. A + I c. I - A d. A - I

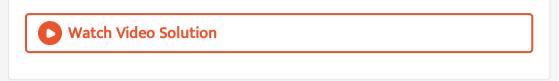
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83. If
$$\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$
, then $A = (A) \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ (D) $- \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

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84. If *AandB* are two nonzero square matrices of the same ordr such that the product AB = O, then (a) both A and B must be singular (b) exactly

one of them must be singular (c) both of them are non singular (d) none of these



85. Let K be a positive real number and $A = \left[2k - 12\sqrt{k}2\sqrt{k}2\sqrt{k}1 - 2k - 2\sqrt{k}2k - 1\right]andB = \left[02k - 1\sqrt{k}1 - 2k02 - \sqrt{k} - 2\sqrt{k}4\right]$. If det $(adjA) + det(adjB) = 10^6$, then[k] is equal to. [Note: adjM denotes the adjoint of a square matix M and [k] denotes the largest integer less than or equal to K].

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86. Let *XandY* be two arbitrary, 3×3 , non-zero, skew-symmetric matrices and *Z* be an arbitrary 3×3 , non-zero, symmetric matrix. Then which of the following matrices is (are) skew symmetric? a. $Y^3Z^4Z^4Y^3$ b. $x^{44} + Y^{44}$ c. $X^4Z^3 - Z^3X^4$ d. $X^{23} + Y^{23}$ **87.** Let *MandN* be two 3×3 matrices such that MN = NM Further, if $M \neq N^2 andM^2 = N^4$, then Determinant of $(M^2 + MN^2)$ is 0 There is a 3×3 non-zeero matrix U such tht $(M^2 + MN^2)U$ is the zero matrix Determinant of $(M^2 + MN^2) \geq 1$ For a 3×3 matrix U, if $(M^2 + MN^2)U$ equal the zero matrix then U is the zero matrix

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88. Let M be a 2×2 symmetric matrix with integer entries. Then M is invertible if The first column of M is the transpose of the second row of M. The second row of M is the transpose of the first column of M M is a diagonal matrix with non-zero entries in the main diagonal. The product of entries in the main diagonal of M is not the square of an integer.

89. For 3×3 matrices *MandN*, which of the following statement (s) is (are) NOT correct ? N^TMN is symmetricor skew-symmetric, according as *m* is symmetric or skew-symmetric. *MN* - *NM* is skew-symmetric for all symmetric matrices *MandN MN* is symmetric for all symmetric matrices *MandN* (*adiM*)(*adiN*) = *adi*(*MN*) for all invertible matrices *MandN*

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90. If B is an idempotent matrix, and A = I - B, then a. $A^2 = A$ b. $A^2 = I$ c.

AB = O d. BA = O

91. If
$$A^{-1} = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 3 & 1 \\ 0 & 0 & -\frac{1}{3} \end{bmatrix}$$
, then $|A| = -1$ b. $adjA = \begin{bmatrix} -1 & 1 & 2 \\ 0 & -3 & -1 \\ 0 & 0 & \frac{1}{3} \end{bmatrix}$ c.
$$A = \begin{bmatrix} 1 & \frac{1}{3} & 7 \\ 0 & \frac{1}{3} & 1 \\ 0 & 0 & -3 \end{bmatrix} d. A = \begin{bmatrix} 1 & -\frac{1}{3} & -7 \\ 0 & -3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

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92.

 $A_1 = [0001001001001000], A_2 = [000i00 - i00i00 - i000], then A_i A_k + A_k A_i$ is

If

equal to 2*l* if i = k b. O if $i \neq k$ c. 2*l* if $i \neq k$ d. O always

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93. Which of the following statements is/are true about square matrix A or order n? $(-A)^{-1}$ is equal to $A^{-1}whe \cap$ is odd only If

 A^{n} - O, then $I + A + A^{2} + A^{n-1} = (I - A)^{-1}$ If A is skew-symmetric matrix of odd order, then its inverse does not exist. $(A^{T})^{-1} = (A^{-1})^{T}$ holds always.

94. If A is an invertible matrix, tehn
$$\begin{pmatrix} A \\ adjA \end{pmatrix}^{-1}$$
 is equal to $adjA^{-1}$ b. $\frac{A}{detA}$ c. $\frac{A}{detA}$

A d. (detA)A

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95. If $A = \left(\left(a_{ij} \right) \right)_{n \times n}$ and f is a function, we define $f(A) = \left(\left(f\left(a_{ij} \right) \right) \right)_{n \times n'}$ Let $A = (\pi/2 - \theta\theta - \theta\pi/2 - \theta)$. Then sinA is invertible b. sin $A = \cos A$ c. sinA

is orthogonal d. sin(2A) = 2AsinAcosA

96. Suppose a_1, a_2 are real numbers, with $a_1 \neq 0$. If a_1, a_2, a_3 , are in A.P., then $A = \left[a_1a_2a_3a_4a_5a_6a_5a_6a_7\right]$ is singular (where $i = \sqrt{-1}$) The system of equations $a_1x + a_2y + a_3z = 0$, $a_4x + a_5y + a_6z = 0$, $a_7x + a_8y + a_9 = 0$ has infinite number of solutions. $B = \left[a_1ia_2ia_2a_1\right]$ is non-singular none of these

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97. If A, B, C are three square matrices of the same order, then $AB = AC \Rightarrow B = C$ Then $|A| \neq 0$ b. A is invertible c. A may be orthogonal d. is symmetric

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98. Let A = [1011]. Then which of following is not true? $(\lim_{n \to \infty} \frac{1}{n^2} A^{-n} = [00 - 10]$ b. $(\lim_{n \to \infty} \frac{1}{n} A^{-n} = [00 - 10]$ c. $A^{-n} = [10 - n1] \forall n \neq N$ d. none of these

99. If α, β, γ are three real numbers and $A = [1\cos(\alpha - \beta)\cos(\alpha - \gamma)\cos(\beta - \alpha)1\cos(\beta - \gamma)\cos(\gamma - \alpha)\cos(\gamma - \beta)1]$, then which of following is/are true? A is singular b. A is symmetric c. A is orthogonal d. A is not invertible

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100. The matrix
$$A = \begin{bmatrix} -5 & -8 & 0 \\ 3 & 5 & 0 \\ 1 & 2 & -1 \end{bmatrix}$$
 is (A) idempotent matrix (B) involutory

matrix (C) nilpotent matrix (D) none of these

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101. If *AandB* are square matrices of the same order and *A* is non-singular, then for a positive integer *n*, $(A^{-1}BA)^n$ is equal to $A^{-n}B^nA^n$ b. $A^nB^nA^{-n}$ c.

$$A^{-1}B^n A \operatorname{d.} n\left(A^{-1}B^A\right)$$



102. If A = [abcd] (where $bc \neq 0$) satisfies the equations $x^2 + k = 0$, then

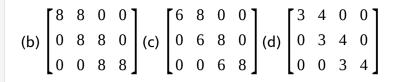
a + d = 0 b. K = -|A| c. k = |A| d. none of these

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103. If *A*, *B*, *A* + *I*, *A* + *B* are idempotent matrices, then *AB* is equal to *BA* b. -*BA* c, *I* d, *O*

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104. Given the matrix A = [(x, 3, 2), (1, y, 4), (2, 2z)]. If xyz = 60 and 8x + 4y + 3z = 20, then A(adjA) is equal to (a) $\begin{bmatrix} 6 & 4 & 0 & 0 \\ 0 & 6 & 4 & 0 \\ 0 & 0 & 6 & 4 \end{bmatrix}$



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105. Let Ad + 2B = [1206 - 33 - 531]and2A - B = [2 - 150 - 16012]. Then

Tr(B) has the value equal to 0 b. 1 c. 2 d. none

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106.	Which	of	the	following	in	an	orthogonal	matrix
[6/72/7 - 3/72/73/76/73/7 - 6/72/7] b						b.		
[6/72	/73/72/7	- 3/70	6/73/7	6/7 - 2/7]				c.
[-6/7	7 - 2/7 - 3	/72/7	3/76/7	7 - 3/76/72/7	']			d.
[6/7 -	2/73/72/	73/7	- 3/7 -	6/72/73/7]				

107. If $k \in R_o$ then det $\{adj(kI_n)\}$ is equal to (A) K^{n-1} (B) $K^{(n-1)n}$ (C) K^n

(D) k



108. If A_1, A_2, A_{2n-1} are n skew-symmetric matrices of same order, then

 $B = \sum_{r=1}^{\infty} (2r - 1) \left(A^{2r-1} \right)^{2r-1}$ will be (a) symmetric (b) skew-symmetric (c)

neither symmetric nor skew-symmetric (d)data not adequate



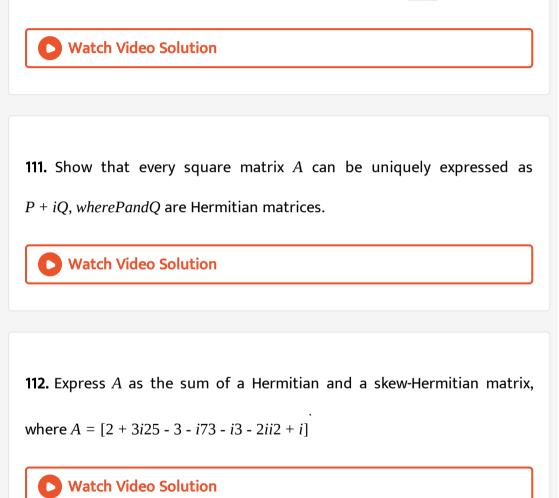
109. Let
$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 0 & 5 \\ 0 & 2 & 1 \end{bmatrix}$$
 and $B = [0, -3, 1]$. Which of the following is true?

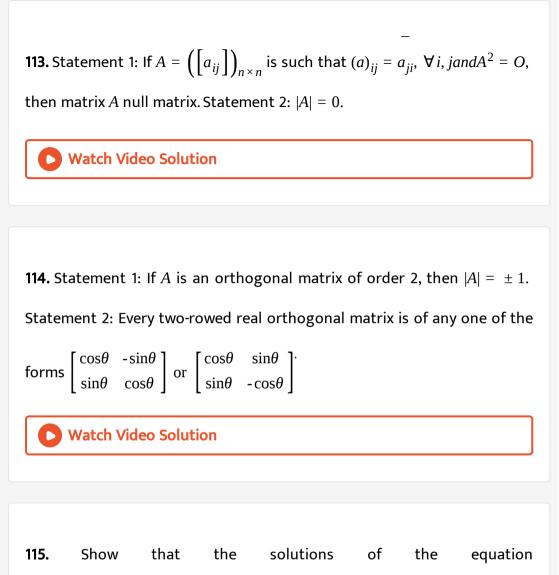
AX = B has a unique solution AX = B has exactly three solutions AC = B

has infinitely many solutions AX = B is inconsistent

110.
$$A = \begin{bmatrix} 0 & 1 \\ 3 & 0 \end{bmatrix} andA^8 + A^6 + A^2 + IV = \begin{bmatrix} 0 \\ 11 \end{bmatrix}$$
 (where *I* is the 2 × 2 identity

matrix), then the product of all elements of matrix V is _____.





$$[xyzt]^2 = Oare[xyzt] = \left[\pm \sqrt{\alpha\beta} - \beta\alpha \pm \sqrt{\alpha\beta} \right]$$
, where α , β are libit rary.

116. If
$$A = \begin{bmatrix} -1 & 1 \\ 0 & -2 \end{bmatrix}$$
, then prove that $A^2 + 3A + 2I = O$ Hence, find *BandC*

matrices of order 2 with integer elements, if $A = B^3 + C^3$

117. If *B*, *C* are square matrices of order *n* and if A = B + C, $BC = CB, C^2 = O$, then without using mathematical induction, show that for any positive integer $p, A^{p+1} = B^p[B + (p+1)C]$.

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118. If
$$D = diag[d_1, d_2, d_n]$$
, then prove that $f(D) = diag[f(d_1), f(d_2), f(d_n)]$, where $f(x)$ is a polynomial with scalar

coefficient.



119. If *S* is a real skew-symmetric matrix, then prove that I - S is nonsingular and the matrix $A = (I + S)(I - S)^{-1}$ is orthogonal.



120. If BandC are non-singular matrices and O is null matrix, then show

that
$$[ABCO]^{-1} = \left[OC^{-1}B^{-1} - B^{1}AC^{-1} \right]^{\cdot}$$

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121. Find the possible square roots of the two rowed unit matrix I. Let

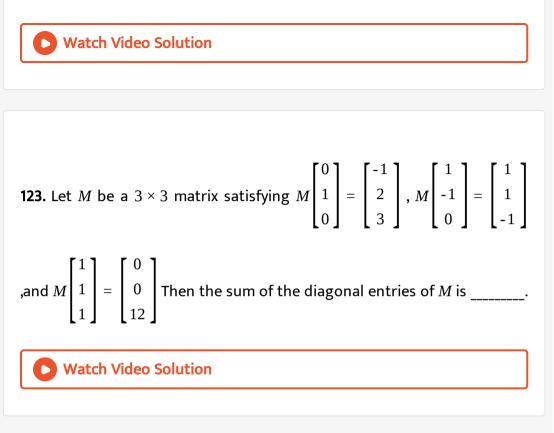
$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$
 be squar root of the matrix $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. Then $A^2 = I$.

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122. If A = [122212221], then show that $A^2 - 4A - 5I = O$, where *I* and *O* are

the unit matrix and the null matrix of order 3, respectively. Use this result





124. If A is unimodular, then which of the following is unimodular? -A b.

 A^{-1} c. *adjA* d. ωA , where ω is cube root of unity



125. Consider three matrices $A = \begin{bmatrix} 2 & 1 \\ 4 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$. Then ghe value of the sum $tr(A) + tr\left(\frac{ABC}{2}\right) + tr\left(\frac{A(BC)^2}{4}\right) + tr\left(\frac{A(BC)^3}{8}\right) + \dots + \infty$ is (A) 6 (B) 9 (C) 12 (D) none of these

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126. If AB = AandBA = B, then which of the following is/are true? A is idempotent b. B is idempotent c. A^T is idempotent d. none of these

127. If
$$A = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix}$$
, $B = \begin{bmatrix} a & 1 \\ b & -1 \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2 + 2AB$, then **a**.

128. Let *AandB* be two nonsinular square matrices, $A^T and B^T$ are the transpose matrices of *AandB*, respectively, then which of the following are correct? $B^T AB$ is symmetric matrix if *A* is symmetric $B^T AB$ is symmetric matrix if *B* is symmetric $B^T AB$ is symmetric matrix for every matrix $A B^T AB$ is skew-symmetric matrix if *A* is skew-symmetric

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129. If
$$A = \frac{1}{3}[12221 - 2a2b]$$
 is an orthogonal matrix, then $a = -2$ b.
 $a = 2, b = 1$ c. $b = -1$ d. $b = 1$

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130. If A is a matrix such that $A^2 + A + 2I = O$, the which of the following

is/are true? A is non-singular A is symmetric A cannot be skew-symmetric

$$A^{-1} = -\frac{1}{2}(A+I)$$

131. If $A(\theta) = \left[s \int h\eta i \cos\theta i \cos\theta s \int h\eta\right]$, then which of the following is not true? $A(\theta)^{-1} = A(\pi - \theta) A(\theta) + A(\pi + \theta)$ is a null matrix $A(\theta)^{-1}$ is invertible for all $\theta \in R A(\theta)^{-1} = A(-\theta)$

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132. If $(1 - tan\theta tan\theta 1)(1tan\theta - tan\theta 1) = [a - a]$, then $a = \cos 2\theta$ b. a = 1 c.

 $b = s \in 2\theta d. b = -1$

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133. If A = [3 - 342 - 340 - 11], then adj(adjA) = A b. |adj(adjA)| = 1 c.

|adjA = I d. none of these

134. If $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is to be square root of two-rowed unit matrix, then α, β

and γ should satisfy the relation.

a. $1 - \alpha^2 + \beta \gamma = 0$ b. $\alpha^2 + \beta \gamma = 0$ c. $1 + \alpha^2 + \beta \gamma = 0$ d. $1 - \alpha^2 - \beta \gamma = 0$

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135. If
$$A = \begin{bmatrix} a_{ij} \end{bmatrix}_{4 \times 4}$$
, such that $a_{ij} = \begin{cases} 2, & \text{when } i = j \\ 0, & \text{when } i \neq j \end{cases}$ then $\left\{ \frac{\det (\operatorname{adj} (\operatorname{adj} A))}{7} \right\}$ is (where $\{ \cdot \}$ represents fractional part function)
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136. Statement 1: Let A, B be two square matrices of the same order such that AB = BA, $A^m = O$, $ndB^n = O$ for some positive integers m, n, then

there exists a positive integer r such that $(A + B)^r = O$ Statement 2: If $AB = BAthen(A + B)^r$ can be expanded as binomial expansion.



137. Statement 1 : If the matrices, A, B, (A + B) are non-singular, then

 $\begin{bmatrix} A(A+B)^{-1}B \end{bmatrix}^{-1} = B^{-1} + A^{-1} & \text{Statement} \\ \begin{bmatrix} A(A+B)^{-1}B \end{bmatrix}^{-1} = \begin{bmatrix} A(A^{-1}+B^{-1})B \end{bmatrix}^{-1} & = \begin{bmatrix} (I+^{A}B^{-1})B \end{bmatrix}^{-1} \\ = \begin{bmatrix} (B^{+}AB^{-1})B \end{bmatrix}^{-1} = \begin{bmatrix} (B^{+}AI) \end{bmatrix}^{-1} = \begin{bmatrix} (B^{+}A) \end{bmatrix}^{-1} = B^{-1} \wedge + A^{-1} & \text{Statement} \\ \end{bmatrix}$

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138. Let *AandB* be two 2×2 matrices. Consider the statements (i) $AB = O \Rightarrow A = O$ or B = O (ii) $AB = I_2 \Rightarrow A = B^{-1}$ (iii) $(A + B)^2 = A^2 + 2AB + B^2$ (i) and (ii) are false, (iii) is true (ii) and (iii) are false, (i) is true (i) is false (ii) and, (iii) are true (i) and (iii) are false, (ii) is true 139. The inverse of a skew-symmetric matrix of odd order a. is a symmetric

matrix b. is a skew-symmetric c. is a diagonal matrix d. does not exist

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140. The number of diagonal matrix, A or ordern which $A^3 = A$ is a. is a a. 1

b. 0 c. 2^{*n*} d. 3^{*n*}

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141. The equation [1xy][13402 - 1001] = [0] has for y = 0 b. rational roots

for y = -1 d. integral roots Then (ii) a. (p) (r) b. (q) (p) c. (p) (q) d. (r) (p)

142. A is a 2×2 matrix such that $A[1 - 1] = [-12]andA^2[1 - 1] = [10]$ The

sum of the elements of A is -1 b. 0 c. 2 d. 5



143. If A = [ab0a] is nth root of I_2 , then choose the correct statements: If n is odd, a = 1, b = 0 If n is odd, a = -1, b = 0 If n is even, a = 1, b = 0 If n is even, a = -1, b = 0 If n is even, a = -1, b = 0 If n

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144. Let *A*, *B* be two matrices such that they commute, then for any positive integer *n*, $AB^n = B^n A (AB)^n A^n B^n$ only (i) and (ii) correct both (i) and (ii) correct only (ii) is correct none of (i) and (ii) is correct

145. The product of matrices
$$A = \begin{bmatrix} \cos^2\theta & \cos\theta \\ \sin\theta\cos\theta & \sin\theta\sin^2\theta \end{bmatrix}$$
 and
 $B = \begin{bmatrix} \cos^2\phi\cos\phi & \sin\phi\cos\phi \\ \sin\phi & \sin^2\phi \end{bmatrix}$ is a null matrix if $\theta - \phi = (A) 2n\pi, n \in Z$ (B)
 $\frac{n\pi}{2}, n \in Z$ (C) $(2n + 1)\frac{\pi}{2}, n \in Z$ (D) $n\pi, n \in Z$

146. If A is an upper triangular matrix of order $n \times nandB$ is a lower triangular matrix of order $n \times nandB$ is a lower triangular matrix of order $n \times n$, then prove that $(A' + B) \times (A + B')$ will be a diagonal matrix of order $n \times n$ [assume all elements of A and dB to e non-negative and a element of $(A' + B) \times (A + B') asC_{ij}$].

147. If $X = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, then prove that $(pI + qX)^m = p^mI + mp^{m-1}qX, \ \forall p, q \in R$, where I is a two rowed unit matrix and $m \in N$.

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148. Let $\omega \neq 1$ be cube root of unity and S be the set of all non-singular

matrices of the form
$$\begin{bmatrix} 1 & a & b \\ \omega & 1 & c \\ \omega^2 & \theta & 1 \end{bmatrix}$$
, where each of *a*, *b*, and *c* is either ω

or ω^2 . Then the number of distinct matrices in the set *S* is (a) 2 (b) 6 (c) 4 (d) 8

149. Let
$$P = \begin{bmatrix} a_{ij} \end{bmatrix}$$
 be a 3×3 matrix and let $Q = \begin{bmatrix} b_{ij} \end{bmatrix}$, where $b_{ij} = 2^{i+j}a_{ij}f$ or $1 \le i, j \le 3$. If the determinant of P is 2, then the determinant of the matrix Q is 2^{10} b. 2^{11} c. 2^{12} d. 2^{13}



150. If
$$P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$$
, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$ and $X = P^TQ^{2005}P$, then

X equal to:

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151. The number of 3×3 matrices A whose entries are either 0 or 1 and

for which the system $A\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ has exactly two distinct solutions, is

a. 0

b. 2⁹ - 1

c. 168

d. 2

152. If $A = [\alpha 22\alpha] and |A^3| = 125$, then the value of α is a.±1 b. ±2 c. ±3 d. ±5

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153. Let
$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}, I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
 and $A^{-1} = \begin{bmatrix} \frac{1}{6} (A^2 + cA + dI) \end{bmatrix}$

Then value of c and d are (a) (= 6, -11) (b) (6, 11) (c) (-6, 11) (d) (6, -11)

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154. A is an involuntary matrix given by A = [01 - 14 - 343 - 34], then the

inverse of
$$A/2$$
 will be $2A$ b. $\frac{A^{-1}}{2}$ c. $\frac{A}{2}$ d. A^2

155. If A is a non-singular matrix such that $\forall^T = A^T A$ and $B = A^{-1}A^T$, the

matrix B is a. involuntary b. orthogonal c. idempotent d. none of these

156. Let *MandN* be two 3 × 3 non singular skew-symmetric matrices such that MN = NM if P^T denote the transpose of P, then $M^2N^2(M^TN)^{-1}(MN^{-1})^T$ is equal to M^2 b. $-N^2$ c. $-M^2$ d. MN

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157. Let ω be a complex cube root of unity with $\omega \neq 1$ and $P = \begin{bmatrix} p_{ij} \end{bmatrix}$ be a

 $n \times n$ matrix with $p_{ij} = \omega^{i+j}$ Then $p^2 \neq O$, whe $\cap = a.57$ b. 55 c. 58 d. 56

158. If A = [i - i - ii] and B = [1 - 1 - 11], then A^8 equals 4B b. 128B c. - 128B d.

-64B



159. If [2 - 110 - 34]A = [-1 - 8 - 101 - 2 - 592215], then sum of all the

elements of matrix A is 0 b. 1 c. 2 d. - 3

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160. If
$$A = \frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1+i \\ 1-i & 1 \end{bmatrix}$$
 then $A(\bar{A}^T)$ equals : a. O b. I c. -I d. 2I

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161. Identity the incorrect statement in respect of two square matrices AandB conformable for sum and product : $a.t_r(A + B) = t_r(A) + t_r(B)$ b. $t_r(\alpha A) = \alpha t_r(A), \in R \text{ c. } t_r(A^T) = t_r(A) \text{ d. none of these}$ **162.** If A is a square matrix such that $A^2 = A$, then write the value of $7A - (I + A)^3$, where I is the identity matrix.

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163. If A and B are square matrices of order *n*, then prove that *AandB* will

commute iff A - $\lambda IandB$ - λI commute for every scalar λ

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164. Matrix A such that $A^2 = 2A - I$, where I is the identity matrix, Then for

 $n \ge 2$. A^n is equal to

a. $2^{n-1}A - (n-1)l$

b. 2^{*n*-1}A - I

c. *nA* - (*n* - 1)*l*

d. *nA* - *I*



165. Let
$$A = \begin{bmatrix} 0 & \alpha \\ 0 & 0 \end{bmatrix}$$
 and $(A+1)^{50} = 50A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ Then the value of

a + b + c + d is (A) 2 (B) 1 (C) 4 (D) none of these



Question Bank

1. If matrix
$$A = \left[\left[\frac{1}{\sqrt{2}}, \right] \left[\frac{1}{\sqrt{2}} \right], \left[-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right] \right]$$
 and B, is a matrix such that $B^{T}A = A^{T}$ and $KB^{T} = 2A^{T} - \sqrt{2}I$. (where I is unit matrix of order 2 and $K \in \mathbb{R}^{l}$) then the value of K^{4} is

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2. If X is a non-zero column matrix, such that $AX = \lambda X$ where λ is a scalar

and the matrix A is
$$\begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$$
 then sum of distinct values of λ is

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3. Let
$$A = \begin{bmatrix} \sqrt{3} & 1 & 0 \\ 1 & -\sqrt{3} & 0 \\ 0 & 0 & 2 \end{bmatrix}$$
 and $d = \det(2A^T \div AA^T + adjA)$ then \sqrt{d} is

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4. If Δ denotes the 'value of the determinant of the inverse of the matrix

 $\begin{bmatrix} -4 & -5 \\ 2 & 2 \end{bmatrix}$ then 2 Δ is equal to

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5. Let A = [[1, 0, 2], [2, 0, 1][1, 1, 2]], then det $((A - I)^3 - 4A)$ is



6.
$$\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix}^{-1} \wedge -1 \dots \begin{bmatrix} 1 & 100 \\ 0 & 1 \end{bmatrix}^{-1} = \begin{bmatrix} 1 & a \\ b & 1 \end{bmatrix}$$
 then absolute

value of a+b is.

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7. Let A be a square matrix of order 2 such that $A^2 - 4A + 4I = O$ where I is an identity matrix of order 2. If $B = A^5 + 4A^4 + 6A^3 + 4A^2 + A$, then det(B) is equal to

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8. If
$$P = \begin{bmatrix} 1 & c & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$$
 is the adjoint of a 3 × 3 matrix Q and det. (Q)⁼4, then

c is equal to

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9. If A is a 3×3 matrix with real entries such that det. adj A=16, then det.

adj(adj A)) is equal to

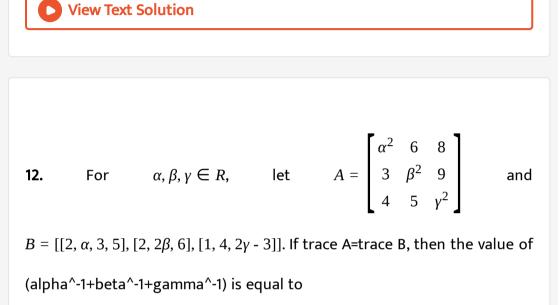
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10. If $A = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$, then the number of values of α in $(0, \pi)$ satisfying $A + A^T = I$, is [Note: *I* is an identity matrix of order 2 and P^T denotes transpose of matrix *P*.]

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11. For $\lambda \in R$, $f(\lambda) = \det(A - \lambda I)$ where $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ and I is an identity

matrix of order 2 . The minimum value of $f(\lambda)$ is equal to



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13. Let the matrix A and B be defined as $A = \begin{bmatrix} 3 & 2 \\ 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 1 \\ 7 & 3 \end{bmatrix}$ then the absolute value of det. $(2A^9B^{-1})$ is

A. 1

B. 2

C. -2

D. 4

Answer: C

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14. Let D_k be the $k \times k$ matrix with O's in the main diagonal, unity as the element of 1^{st} row and $(f(k))^{th}$ column and k for all other entries. If f(x) = x - x where x denotes the tional part function then the value of det. (D_2) + det. (D_3) equals

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15. Let
$$A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$$
 and $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$. If B is the inverse of

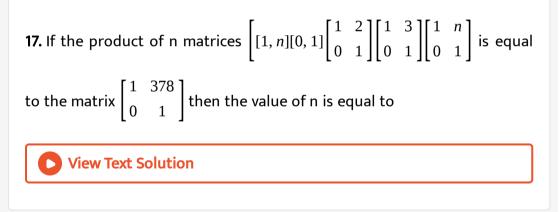
matrix A, then alpha is

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16. Let
$$A + 2B = \begin{bmatrix} 1 & 2 & 0 \\ 6 & -3 & 3 \\ -5 & 3 & 1 \end{bmatrix}$$
 and $2A - B = \begin{bmatrix} 2 & -1 & 5 \\ 2 & -1 & 6 \\ 0 & 1 & 2 \end{bmatrix}$ then Tr(A)-Tr(B) has

the value equal to

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18. If A and B are non-singular matrices of order three such that adj(A B) =

 $[[1, 1, 1], [1, p, 1], [1, 1, p]] \text{ and } |B^2 adj(A)|=p^(2)-3`, then$



19. Let
$$A_r = \begin{bmatrix} r & 3r - 1 \\ 0 & \frac{1}{2^r} \end{bmatrix}$$
, then the value of lim _n rarr oo underset (r
=1) overset (n) sum det (A_r) ` is equal to
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20. Let A=[[1, 2], [3 , 4]] and B = [[a, b],[c, d]] betwomatricessuchttheyarecomptative and c ne 3 bthenthevalueof[(a-d)/(2 bc)]`is

21. Let
$$A = \begin{bmatrix} 2 & 1 & 3 \\ 5 & 6 & 1 \\ 7 & 2 & 9 \end{bmatrix}$$
 if $A^3 + pA^2 + qA + rI = O$ (where O is null matrix),

then value of |p| is

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22. Let
$$A = \begin{bmatrix} -1 & -2 & -2 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$$
 If adj. $A = kA^T$ theri the value of 'K' is

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23. If
$$A = \begin{bmatrix} 0 & -1 & -2 \\ 2 & 4 & 3 \\ 1 & 1 & 1 \end{bmatrix}$$
 then trace (adj A) is equal to.

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