MATHS

BOOKS - ARIHANT MATHS (HINGLISH)

MATRICES

Examples

1. IF a matrix has 12 elements, what are the possible orders it can have? What, if it has 7 elements?

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2. Construct $a2 \times 3$ matrix $A = [a_i j]$, whose elements are given by $a_{ij} = \frac{(i+2j)^2}{2}$

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3. Construct a 2×3matrix $A = [a_{ij}]$, whose elements are given by $a_{ij} = \frac{1}{2}|2i - 3j|$.

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4. construct a $2 \times 3\text{matrix}A = [a_{ij}]$, whose elements are give by $a_{ij} = \begin{cases} i - j, \geq j \\ i + j, < j \end{cases}$

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5. Construct a $2 \times 3\text{matrix}A = [a_{ij}]$, whose elements are give by $a_{ij} = \left[\frac{i}{j}\right]$, where [.] denotes the greatest integer function.

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6. Construct a$2 \times 3matrix\ \ A = [a_ij]$, whose elements are given by

$$a_{ij} = \left\{ \frac{2i}{3j} \right\}$$

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7. construct a $2 \times 3matrix A = \left[a_{ij}\right]$, whose elements are give by

$$a_{ij} = \left(\frac{3i + 4j}{2} \right)$$

where (.) denotes the least integer function.

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8. construct a $2 \times 3matrix A = \left[a_{ij}\right]$, whose elements are give by

$$a_{ij} = \left(\frac{3i + 4j}{2} \right)$$

where (.) denotes the least integer function.

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9. If $\begin{bmatrix} x+3 & 2y+x \\ z-1 & 4w-8 \end{bmatrix} = \begin{bmatrix} -x-1 & 0 \\ 3 & 2w \end{bmatrix}$, then find the value of $|x+y|+|z+w|$.

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10. If $\begin{bmatrix} 2\alpha+1 & 3\beta \\ 0 & \beta^2-5\beta \end{bmatrix} = \begin{bmatrix} \beta+3 & \beta^2+2 \\ 0 & -6 \end{bmatrix}$

find the equation whose roots are alpha and beta.

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11. Given, $A = \begin{bmatrix} 1 & 3 & 5 \\ -2 & 0 & 2 \\ 0 & 0 & -3 \end{bmatrix}, B = \begin{bmatrix} 0 & 3 \\ -2 & 0 \\ 0 & -4 \end{bmatrix}$

and $A = \begin{bmatrix} 4 & 1 & -2 \\ 3 & 2 & 1 \\ 2 & -1 & 7 \end{bmatrix}$, find (whichever defined)"

(i)A+B." (ii)A+C.

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12. If a,b,c, and c, are the roots of $x^2 - 4x + 3 = 0$, $x^2 - 8x + 15 = 0$ and $x^2 - 6x + 5 = 0$,

$$\begin{bmatrix} a^2 & +c^2 & a^2+b^2 \\ b^2 & +c^2 & a^2+c^2 \end{bmatrix} + \begin{bmatrix} 2ac & -2ab \\ -2bc & -2ac \end{bmatrix}$$

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13. Determine the matrix A, when

$$A = 4\begin{bmatrix} 1 & 2 & 3 \\ -1 & -2 & -3 \\ 4 & 2 & 6 \end{bmatrix} + 2\begin{bmatrix} 5 & 4 & 1 \\ 3 & 2 & 4 \\ 3 & 8 & 2 \end{bmatrix}$$

A. $\begin{bmatrix} -14 & 16 & 14 \\ -2 & -4 & -4 \\ 22 & 24 & 28 \end{bmatrix}$

B. $\begin{bmatrix} 14 & -16 & 14 \\ 2 & -4 & -4 \\ 22 & 24 & 28 \end{bmatrix}$

C. $\begin{bmatrix} 14 & 16 & 14 \\ 2 & -4 & -4 \\ 22 & 24 & 28 \end{bmatrix}$

D. $\begin{bmatrix} -14 & 16 & 14 \\ 2 & -4 & -4 \\ -22 & 24 & -28 \end{bmatrix}$

Answer: C

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14. If $A = \begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$ and $kA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then find the value of b-a-k.

A. 1

B. 0

C. 10

D. 5

Answer: A

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15. If $A = \begin{bmatrix} 1 & 2 & -3 \\ 5 & 0 & 2 \\ 1 & -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 & 2 \\ 4 & 2 & 5 \\ 2 & 0 & 3 \end{bmatrix}$ then find matrix C such that $A + 2C = B$

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16. 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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17. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 2 & 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -1 & 0 \\ 2 & -1 \end{bmatrix}$ obtain the product AB and explain why BA is not defined?

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18. If $A = \begin{bmatrix} 0 & -\tan(\alpha/2) \\ \tan(\alpha/2) & 0 \end{bmatrix}$ and I is a 2×2 unit matrix, prove that $I + A = (I - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$

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19. If $A = \begin{bmatrix} 1 & 2 \\ -2 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} -3 & 1 \\ 2 & 0 \end{bmatrix}$,verify that (AB)C = A(BC) and A(B+C)=AB+AC.

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20. If A $= \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ p & q & r \end{bmatrix}$, show that ltbargt $A^3 = pI + qA + rA^2$

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21. The value of x so that $\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 0 & 5 & 1 \\ 0 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ x \end{bmatrix} = 0$ is

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22. show that the matrix

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

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23. show that $\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix} = A$ is nipotent matrix of order 3.

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24. show that the matrix

$A = \begin{bmatrix} -5 & -8 & 0 \\ 3 & 5 & 0 \\ 1 & 2 & -1 \end{bmatrix}$ is involutory.

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25. If $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ find the values of θ satisfying the equation $A^T + A = I_2$.

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26. the square matrix $A = [a_{ij}]_m \times m$ given by$a_{ij} = (i - j)^n$, show that A is symmetic and skew-sysmmetic matrices according as n is even or odd, repectively.

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27. Expresss A as the sum of a symmtric and a skew-symmetric matrix, where $A = \begin{bmatrix} 3 & 5 \\ -1 & 2 \end{bmatrix}$

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28. If $\begin{bmatrix} 0 & 2\beta & \gamma \\ \alpha & \beta & -\gamma \\ \alpha & -\beta & \gamma \end{bmatrix}$ is orthogonal, then find the value of $2\alpha^2 + 6\beta^2 + 3\gamma^2$.

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29. if $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & -1 \\ a & 2 & b \end{bmatrix}$ is a matrix satisfying $AA' = 9I_3$, find the value of $|a| + |b|$.

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30. Express A as the sun of a hermitian and skew-hermitian matrix,where $A = \begin{bmatrix} 2+3_i & 7 \\ 1-i & 2_i \end{bmatrix}, i = \sqrt{-1}.$

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31. Verify that the matrix $\frac{1}{\sqrt{3}}\begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$ is unitary, where $i = \sqrt{-1}$

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32. If A,B and C are square matrices of order n and det (A)=2, det(B)=3 and det c=5, then find the value of 10det $\left(A^3B^2C^{-1}\right)$.

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33. If $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}, abc = 1, A^T A = l,$ then find the value of $a^3 + b^3 + c^3.$

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34. If $\omega \neq 1$ is a complex cube root of unity, then prove that $\begin{bmatrix} 1 + 2\omega^{2017} + \omega^{2018} & \omega^{2018} & 1 \\ 1 & 1 + 2\omega^{2018} + \omega^{2017} & \omega^{2017} \\ \omega^{2017} & \omega^{2018} & 2 + 2\omega^{2017} + \omega^{2018} \end{bmatrix}$ is singular

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35. find the real value of x for which the matrix $= \begin{bmatrix} x+1 & 3 & 5 \\ 1 & x+3 & 5 \\ 1 & 3 & x+5 \end{bmatrix}$ is non-singular.

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36. find the cofactor ofa_{23} in $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & -1 \\ 1 & -3 & 5 \end{bmatrix}$

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37. find the adjoint of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 5 & 0 \\ 2 & 4 & 3 \end{bmatrix}$

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38. If A = $= \begin{bmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$ find the values of

(i) |A||adj A| (ii) |adj (adj (adjA))|

(iii) |adj(3A)| (iv) adj adj A

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39. If A $= \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ and B is the adjoint of A, find the value of $|AB + 2I|$,where I is the identity matrix of order 3.

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40. Compute the inverse of the matix $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & 1 & 2 \end{bmatrix}$

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41. If A and B are symmetric non-singular matrices of same order,AB = BA and $A^{-1}B^{-1}$ exist, prove that $A^{-1}B^{-1}$ is symmetric.

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42. Matrices A and B Satisfy $AB = B^{-1}$, where B $= \begin{bmatrix} 2 & -2 \\ -1 & 0 \end{bmatrix}$, find the value of λ for which $\lambda A - 2B^{-1} + 1 = O$, Without finding B^{-1}.

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43. If A,B and C arae three non-singular square matrices of order 3 satisfying the equation $A^2 = A^{-1}$ let $B = A^8$ and $C = A^2$,find the value of det (B-C)

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44. Transform $\begin{bmatrix} 1 & 3 & 3 \\ 2 & 4 & 10 \\ 3 & 8 & 4 \end{bmatrix}$ into a unit matrix.

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45. Given $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 4 & 1 \\ 2 & 3 & 1 \end{bmatrix}, B = \begin{bmatrix} 2 & 3 \\ 3 & 4 \end{bmatrix}$. Find P such that BPA= $\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$

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46. find the invese of the matraix $\begin{bmatrix} 1 & 2 & 5 \\ 2 & 3 & 1 \\ -1 & 1 & 1 \end{bmatrix}$, using elementary row operaations.

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47. If $A = \begin{bmatrix} k & l \\ m & n \end{bmatrix}$ and $kn \neq lm$, show that $A^2 - (k+n)A + (kn - lm)I = O$. Hence, find A^{-1}

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48. If $A = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$ find the value of $|a| + |b|$ such that $A^2 + aA + bI = O$. Hece,find A^{-1}

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49. Let $A = [0100]$show that $(aI + bA)^n = a^n I + na^{n-1}bA$, where I is the identitymatrix of order 2 and $n \in N$.

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50. If A=$\begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ then by the method of mathematical induction prove that $A^n = \begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$

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51. Solve the system of equations $x + 2y + 3z = 1, 2x + 3y + 2z = 2$ and $3x + 3y + 4z = 1$ with the help of matrix inversion.

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52. Solve the system of equations $x+y+z=6$, $x+2y+3z=14$ and $x+4y+7z=30$ with the help of matrix method.

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53. Determine whether the following equations will have non-trivial solutions, if so solve them: $x+3y-2z=0, 2x-y+4z=0, x-11y+14z=0$

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54. Solve the system of equations $2x+3y-3z=0$, $3x-3y+z=0$ and $3x-2y-3z=0$

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55. Find the rank of $\begin{bmatrix} 3 & -1 & 2 \\ -3 & 1 & 2 \\ -6 & 2 & 4 \end{bmatrix}$

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56. . For what values of λ and μ the system of equations $x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ has (i) Unique solution (ii) No solution (iii) Infinite number of solutions

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57. The point $p(3, 4)$ undergoes a reflection in the X-axis followed by a reflection in the y-axis. Show that their combined effect is the same as the single reflection of p(3,4) in the orign.

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58. Find the image of the $(-2, -7)$ under the transformations (x,y) to $(x - 2y, -3x + y)$.

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59. the image of the point $A(2, 3)$ by the line mirror y=x is the point B and the image of B by the line mirror y=0 is the point (α, β), find α and β

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60. Find the image of the point $(-\sqrt{2}, \sqrt{2})$ by the line mirror $y = x\tan\left(\frac{\pi}{8}\right)$.

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61. Find the matrices of transformation T_1T_2 and T_2T_1 when T_1 is rotation through an angle 60° and T_2 is the reflection in the Y-asix Also, verify that $T_1T_2 \neq T_2T_1$.

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62. Write down 2×2 matrix A which corresponds to a counterclockwise rotation of 60° about tha origin. In the diagram OB of $2\sqrt{2}$ units in lenth. The square is rotated counterclockwise about O through 60° find the coordiates of the vertices of the square after rotating.

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63. Let matrix $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$, Find the non-zero column vector X such that $AX = \lambda X$ for some scalar λ.

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64. If A and P are the square matrices of the same order and if P be invertible, show that the matrices A and P^{-1} have the same characteristic roots.

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65. show that the characterstic roots of an idempotent matrix are either zero or unity.

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66. If $3, -2$ are the eigen values of a non-singular matrix A and $|A| = 4$, find the eigen values of $adj(A)$

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67. Find the characteristic equation of the matrix$A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$ and hence find its inverse using Cayley-hamilton theorem.

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68. If A is a square matrix of order 2 such that $A\begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} -1 \\ 2 \end{bmatrix}$ and $A^2\begin{bmatrix} 1 \\ -1 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ the sum of elements and product of elements of A are S and P, S + P is

A. -1

B. 2

C. 4

D. 5

Answer:

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69. If P is an orthogonal matrix and $Q = PAP^T and x = P^T \ A$ b. I c. A^{1000} d. none of these

A. A

B. A^{1000}

C. 1

D. None of these

Answer:

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70. 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

A. $|A| = 64$

B. $|A| = 16$

C. $|A| = 12$

D. $|A| = 4$

Answer:

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71. let $A = \{a_{ij}\}_{3 \times 3}$ such that $a_{ij} = \{3, i = j$ and $0, i \neq j.$ then $\left\{\frac{\det(adj(adjA))}{5}\right\}$ equals: (where {.} represents fractional part)

A. $\frac{1}{7}$

B. $\frac{2}{7}$

C. $\frac{3}{7}$

D. $\frac{4}{7}$

Answer:

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72. If $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ and det $(A^n - 1) = 1 - \lambda^n, n \in N,$ then the value of λ is

A. 1

B. 2

C. 3

D. 4

Answer: B

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73. 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

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74. 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

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75. For a matrix $A = \begin{bmatrix} 1 & 2r-1 \\ 0 & 1 \end{bmatrix}$ then $\prod_{r=1}^{60} \begin{bmatrix} 1 & 2r-1 \\ 0 & 1 \end{bmatrix} =$

A. $\begin{bmatrix} 1 & 100 \\ 0 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 4950 \\ 0 & 1 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 5050 \\ 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 2500 \\ 0 & 1 \end{bmatrix}$

Answer: D

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76. If $A_1, A_2, , A_{2n-1} aren$ 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

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77. 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

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78. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ (where bc $\neq 0$) satisfies the equations $x^2 + k = 0$, then

A. a + d = 0

B. $k = -|A|$

C. $k = |A|$

D. None of these

Answer: A::C

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79. If $A = \left[a_{ij}\right]_{n \times n}$ and f is a function, we define $f(A) = \left[f\left(a_{ij}\right)\right]_{n \times n}$. Let $A = \begin{bmatrix} \frac{\pi}{2} - \theta & \theta \\ -\theta & \frac{\pi}{2} - \theta \end{bmatrix}$ then

A. sin A is invertible

B. sin A = cos A

C. sin A is orthogonal

D. sin 2 A=2 sin A cos A

Answer: A::C

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80. Let A and b are two square idempotent matrices such that $AB \pm BA$ is a null matrix, the value of det (A - B)

cann vbe equal

A. -1

B. 0

C. 1

D. 2

Answer: A::B::C

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81. if AB = A and BA = B, then

A. $A^2B = A^2$

B. $B^2A = B^2$

C. $ABA = A$

D. $BAB = B$

Answer: A::B::C::D

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82. If A is a square matrix of order 3 and I is an Identity matrix of order 3 such that $A^3 - 2A^2 - A + 2l = 0$, then A is equal to

A. I

B. 2I

C. $\begin{bmatrix} 2 & -1 & 2 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$

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

Answer: A::B::D

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83. If $A_0 = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ and $B_0 \begin{bmatrix} -4 & -4 & -4 \\ 1 & 0 & 1 \\ 4 & 4 & 3 \end{bmatrix}$ and

$B_n = adj(B_{n-1}), n \in N$ and I is an dientity matrix of order 3.

det $\left(A_0 + A_0^2 B_0^2 + A_0^2 + A_0^4 B_0^4 + \dots\right.$ upto 12 terms) is

equal to

A. 1200

B. -960

C. 0

D. -9600

Answer: C

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84. If $A_0 = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ and $B_0 = \begin{bmatrix} -4 & -4 & -4 \\ 1 & 0 & 1 \\ 4 & 4 & 3 \end{bmatrix}$ and $B_n = adj(B_{n-1}), n \in N$ and I is an dientity matrix of order 3. $B_2 + B_3 + B_4 + \dots + B_{50}$ is equal to

A. B_0

B. $7B_0$

C. $49B_0$

D. 49I

Answer: C

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85. If $A_0 = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ and $B_0 = \begin{bmatrix} -4 & -4 & -4 \\ 1 & 0 & 1 \\ 4 & 4 & 3 \end{bmatrix}$ and $B_n = adj(B_{n-1}), n \in N$ and I is an dientity matrix of order 3. For a variable matrix X, the equation $A_0X = B_0$ will heve

A. unique solution

B. infinite solution

C. finitrly many solution

D. no solution

Answer: D

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86. 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 $n \geq 3$ and consider matrix $\underset{3 \times 3}{U}$ with its columns as $U_1, U_2, U_3,$ such that

$$A^{50}U_1 = \begin{bmatrix} 1 \\ 25 \\ 25 \end{bmatrix}, A^{50}U_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \text{ and } A^{50}U_3 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

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

A. -1

B. 0

C. 1

D. 25

Answer: C

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87. 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 $n \geq 3$ and consider matrix $\underset{3 \times 3}{U}$ with its columns as $U_1, U_2, U_3,$ such that

$$A^{50}U_1 = \begin{bmatrix} 1 \\ 25 \\ 25 \end{bmatrix}, A^{50}U_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \text{ and } A^{50}U_3 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

Trace of A^{50} equals

A. 0

B. 1

C. 2

D. 3

Answer: D

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88. 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 $n \geq 3$ and consider matrix $\underset{3 \times 3}{U}$ with its columns as $U_1, U_2, U_3,$ such that

$$A^{50}U_1 = \begin{bmatrix} 1 \\ 25 \\ 25 \end{bmatrix}, A^{50}U_2 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \text{ and } A^{50}U_3 \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

The value of $|U|$ equals

A. -1

B. 0

C. 1

D. 2

Answer: C

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89. Let A be $a3 \times 3$ diagonal matrix which commutes with ever 3×3 matrix. If det (A) = 8 , then tr A is

A.

B.

C.

D.

Answer:

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90. 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.

B.

C.

D.

Answer:

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91. Match the following Column I and Column II

	Column I		Column II
(A)	If A is a square matrix of order 3 and $\det(A) = 3$, then $\det(6A^{-1})$ is divisible by	(p)	3
(B)	If A is a square matrix of order 3 and $\det(A) = \frac{1}{4}$, then det [adj (adj (2A))] is divisible by	(q)	4
(C)	If A and B are square matrices of odd order and $(A+B)^2 = A^2 + B^2$, if $\det(A) = 2$, then $\det(B)$ is divisible by	(r)	5
		(s)	6

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	Column I		Column II
(A)	If $\begin{bmatrix} 1 & 2 & a \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{bmatrix}^n = \begin{bmatrix} 1 & 18 & 2007 \\ 0 & 1 & 36 \\ 0 & 0 & 1 \end{bmatrix}$, then $(n + a)$ is divisible by	(p)	4
(B)	If A is a square matrix of order 3 such that $\|A\| = a$, $B = \text{adj}(A)$ and $\|B\| = b$, then $(ab^2 + a^2b + 1)\lambda$ is divisible by, where $\frac{1}{2}\lambda = \frac{a}{b} + \frac{a^2}{b^3} + \frac{a^3}{b^5} + \dots$ upto ∞ and $a = 3$	(q)	6
(C)	Let $A = \begin{bmatrix} a & b & c \\ p & q & r \\ 1 & 1 & 1 \end{bmatrix}$ and $B = A^2$. If $(a - b)^2 + (p - q)^2 = 25$, $(b - c)^2 + (q - r)^2 = 36$ and $(c - a)^2 + (r - p)^2 = 49$, then det $\left(\frac{B}{2}\right)$ is divisible by	(r)	10
		(s)	12
		(t)	15

92.

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93. Statement -1 (Assertion) and Statement - 2 (Reason)

Each of these examples also has four alternative choices,

ONLY ONE of which is the correct answer. You have to

select the correct choice as given below

Statement-1 A is singular matrox pf order $n \times n$,

then adj A is singular.

Statement -2 $|adj A| = |A|^{n-1}$

A. Statement - 1 is true, Statement - 2 is true , Statement - 2 is correct explanaction for Statement -1

B. Statement -1 is true, Statement - 2 is true, Statement - 2 is not a correct explanation for Statement-1

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

D. Statement-1 is false, Statement-2 is ttrue

Answer: D

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94. Statement -1 (Assertion) and Statement - 2 (Reason)

Each of these examples also has four alternative choices,

ONLY ONE of which is the correct answer. You have to select the correct choice as given below

Statement-1 If A and B are two matrices such

that AB = B, BA = A, then $A^2 + B^2 = A + B$.

Statement-2 A and B are idempotent motrices, then

$A^2 = A, B^2 = B$.

A. Statement - 1 is true, Statement - 2 is true , Statement - 2

is correct explanaction for Statement -2

B. Statement -1 is true, Statement - 2 is true, Statement - 2

is not a correct explanation for Statement-2

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

D. Statement-1 is false, Statement-2 is ttrue

Answer: B

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95. If $A^n = 0$, then evaluate

(i) $I + A + A^2 + A^3 + \ldots + A^{n-1}$

(ii)$I - A + A^2 - A^3 + \ldots + (-1)^{n-1}$ for odd 'n' where I is the identity matrix having the same

order of A.

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96. If A is idempotent matrix, then show that

$(A + I)^n = I + (2^n - 1)A, \ \forall n \in N,$ where I is the identity

matrix having the same order of A.

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97. If the matrices $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}(a, b, cd$ not all simultaneously zero) commute, find the value of $\dfrac{d-b}{a+b-c}$. Also show that the matrix which commutes with A is of the form $\begin{bmatrix} \alpha - \beta & \frac{2\beta}{3} \\ \beta & \alpha \end{bmatrix}$

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98. Fiven the matrix $A = \begin{bmatrix} -1 & 3 & 5 \\ 1 & -3 & -5 \\ -1 & 3 & 5 \end{bmatrix}$ and X be the solution set of the equation $A^x = A$, where $x \in N - \{1\}$. Evaluate $\prod\left(\frac{x^3+1}{x^3-1}\right)$ where the contincued extends for all $x \in X$.

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99. If P is a non-singular matrix, with (P^{-1}) in terms of $'P'$, then show that $adj(Q^{-1}BP^{-1}) = PAQ$. Given that $adjB = A$ and $|P| = |Q| = 1$.

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100. Let A and B be matrices of order n. Provce that if

(I - AB) is invertible, (I - BA) is also invertible and

$(I - BA)^{-1} = I + B(I - AB)^{-1}A,$ where I be the dientity matrix of order n.

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101. Prove that the inverse of $\begin{bmatrix} A & O \\ B & C \end{bmatrix}$ is $\begin{bmatrix} A^{-1} & O \\ -C^{-1}BA^{-1} & C^{-1} \end{bmatrix}$, where A, Care non-singular matrices and O is null matrix and find the inverse. $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$

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102. Let $A = \begin{bmatrix} 3 & a & -1 \\ 2 & 5 & c \\ b & 8 & 2 \end{bmatrix}$ is symmetric and $B = \begin{bmatrix} d & 3 & a \\ b-a & e & -2b-c \\ -2 & 6 & -f \end{bmatrix}$ is skew- symmetric, find AB. If AB is symmetric or skew symmetric or neither of them. Justify your answer.

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103. 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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104. If there are three square matrix A, B, C of same order satisfying the equation $A^2 = A^{-1}$ and $B = A^{2^n}$ and $C = A^{2^{(n-2)}}$, then prove that $\det.(B - C) = 0, n \in N$.

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105. Construct an orthogonal matrix using the skew- symmetric matrix $A = \begin{bmatrix} 0 & 2 \\ -2 & 0 \end{bmatrix}$.

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106. If $A = \begin{bmatrix} 3 & 2 & 2 \\ 2 & 4 & 1 \\ -2 & -4 & -1 \end{bmatrix}$ and X,Y are two non-zero column vectors such that $AX = \lambda X, AY = \mu Y, \lambda \neq \mu,$ find angle between X and Y.

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Exercise For Session 1

1. if $A = \begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix}$ and $|A^3| = 125$ then the value of $\alpha$is

A. $\pm = 2$

B. $\pm = 3$

C. $\pm = 5$

D. 0

Answer: B

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2. If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}, B = \begin{bmatrix} a & -1 \\ b & -1 \end{bmatrix}$ and $(A+B)^2 = (A^2 + B^2)$ then find the values of a and b.

A. 4

B. 5

C. 6

D. 7

Answer: B

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3. if $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ and $A^2 - \lambda A - l_2 = O$, then λ is equal to

A. -4

B. -2

C. 2

D. 4

Answer: D

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4. Let $A=\begin{bmatrix}0 & \alpha\\ 0 & 0\end{bmatrix}$ and $(A+I)^{50}A=\begin{bmatrix}a & b\\ c & d\end{bmatrix}$. Then the value of $a+b+c+d$ is

A. 1

B. 2

C. 4

D. None of these

Answer: B

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5. if $A = \begin{bmatrix} \cos 0 & \sin 0 \\ -\sin 0 & \cos 0 \end{bmatrix}, then A^2 = l$is true for

A. $\theta = 0$

B. $\theta = \frac{\pi}{4}$

C. $\theta = \frac{\pi}{2}$

D. None of these

Answer: A

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6. If $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is to be the square root of two-rowed unit matrix, then $\alpha, \beta \text{ and } \gamma$ should satisfy the relation

A. $1 - \alpha^2 + \beta\lambda = 0$

B. $\alpha^2 + \beta\lambda - 1 = 0$

C. 1+alpha^(2)+beta=0`

D. 1-alpha-betalambda=0`

Answer: B

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7. If $A=\begin{bmatrix}1 & 0\\ \frac{1}{2} & 1\end{bmatrix}$, then A^{100} is equal to

A. $\begin{bmatrix}1 & 0\\ 25 & 0\end{bmatrix}$

B. $\begin{bmatrix}1 & 0\\ 50 & 1\end{bmatrix}$

C. $\begin{bmatrix}1 & 0\\ 1/2^{100} & 1\end{bmatrix}$

D. none of these

Answer: B

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8. if the product of n matrices $\begin{bmatrix}1 & 1\\0 & 1\end{bmatrix}\begin{bmatrix}1 & 2\\0 & 1\end{bmatrix}\begin{bmatrix}1 & 3\\0 & 1\end{bmatrix}\cdots\begin{bmatrix}1 & n\\0 & 1\end{bmatrix} is equal \to the matrix \begin{bmatrix}1 & 378\\0 & 1\end{bmatrix}$ the value of n is equal to

A. 26

B. 27

C. 377

D. 378

Answer: B

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9. If A and B are two matrices such that AB=B and BA=A, then $A^2 + B^2$ is equal to

A. 2AB

B. 2BA

C. A+B

D. AB

Answer: C

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Exercise For Session 2

1. If $A = \begin{bmatrix} 4 & x+2 \\ 2x-3 & x+1 \end{bmatrix}$ is symmetric, then x =

A. 2

B. 3

C. 4

D. 5

Answer: D

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2. If A and B are symmetric matrices, then ABA is

A. symmetric matrix

B. skew-symmetric matrix

C. diagonal matrix

D. scalar matrix

Answer: A

Watch Video Solution

3. if A and B are symmetric matrices of the same order and $P = AB + BA$ and $Q = AB - BA$, then $(PQ)'$ is equal to

A. PQ

B. QP

C. $-QP$

D. none of these

Answer: C

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4. 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

A. a skew-symmetric matrix

B. a symmetric matrix

C. a diagonal matrix

D. nono of these

Answer: A

Watch Video Solution

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

A. diagonal matrix

B. null matrix

C. triangular matrix

D. nono of these

Answer: B

Watch Video Solution

6. If A is square matrix order 3, then $\left|(A - A')^{2015}\right|$ is

A. $|A|$

B. $|A'|$

C. 0

D. none of these

Answer: C

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7. the maximum number of different elements requried to from a symmetric matrx of order 6 is

A. 15

B. 17

C. 19

D. 21

Answer: D

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8. A and B are square matrices of order 3×3 , A is an orthogonal matrix and B is a skew symmetric matrix. Which of the following statement is not true

A. $|AB| = 1$

B. $|AB| = 0$

C. $|AB| = -1$

D. none of these

Answer: B

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9. the matrix $A = \begin{bmatrix} i & 1-2i \\ -1-2i & 0 \end{bmatrix}, where I = \sqrt{-1},$ is

A. symmetric matrix

B. skew-symmetric matric

C. hermitain

D. skew-hermitain

Answer: D

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10. if A and B are square matrices of same order such that A = and B = B, where A denotes the conjugate transpose of A, then `(AB-BA)* is equal to

A. null matrix

B. $AB - BA$

C. BA-AB

D. none of these

Answer: C

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11. if matrix $A = \frac{1}{\sqrt{2}}\begin{bmatrix} 1 & i \\ -i & a \end{bmatrix}, i = \sqrt{-1}$ is unitary matrix, a is equal to

A. 2

B. -1

C. 0

D. 1

Answer: B

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12. If A is a $3x3$ matrix and $\det(3A) = k\{\det(A)\}$, k is equal to

A. 9

B. 6

C. 1

D. 27

Answer: D

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13. If A and B are square matrices of order 3 such that $|A| = -1, |B| = 3, \text{ then } |3AB|$ equals

A. -9

B. 81

C. -27

D. 81

Answer: B

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14. if A is a square matrix such that $A^2 = A,$ then det (A) is equal to

A. 0 or 1

B. $-2 \text{ or } 2$

C. $-3 \text{ or } 3$

D. none of these

Answer: A

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15. If I is a unit matrix of order 10, then the determinant of I is equal to

A. 10

B. 1

C. $\frac{1}{10}$

D. 9

Answer: B

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16. If $A_i = \begin{bmatrix} 2^{-i} & 3^{-i} \\ 3^{-i} & 2^{-i} \end{bmatrix}, then \sum_{i=1}^{\infty} \det(A_i)$ is equal to

A. $\frac{3}{4}$

B. $\frac{5}{24}$

C. $\frac{5}{4}$

D. $\frac{7}{144}$

Answer: B

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17. The number of values of x for which the matrix $A=\begin{bmatrix}3-x & 2 & 2 \\ 2 & 4-x & 1 \\ -2 & -4 & -1-x\end{bmatrix}$ is singular, is

A. 0

B. 1

C. 2

D. 3

Answer: C

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18. For how many values of 'x' in the closed interval $[-4, -1]$ is the matrix $\begin{bmatrix} 3 & -1+x & 2 \\ 3 & -1 & x+2 \\ x+3 & -1 & 2 \end{bmatrix}$ singular ? (A) 2 (B) 0 (C) 3 (D) 1

A. 0

B. 1

C. 2

D. 3

Answer: B

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19. The value of x for which the matrix $\begin{vmatrix} -x & x & 2 \\ 2 & x & -x \\ x & -2 & -x \end{vmatrix}$ will be non-singular, are

A. $-2 \leq x \leq 2$

B. for all x other than 2 and -2

C. $x \geq 2$

D. $x \leq \ -20$

Answer: B

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Exercise For Session 3

1. Find the adjoint of the given matrix and verify in each case that $A.\,(adjA) = (adjA).\,A = |A|.\,I.$

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

A. A

B. A^T

C. 3A

D. $3A^T$

Answer: D

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2. If A is a 3x3 matrix and B is its adjoint matrix the determinant of B is 64 then determinant of A is

A. 64

B. ± 64

C. ± 8

D. 18

Answer: C

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3. For any 2×2 matrix, if $A\ (adj\ A) = [100010]$, then $|A|$ is equal to (a) 20 (b) 100 (c) 10 (d) 0

A. 0

B. 10

C. 20

D. 100

Answer: B

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

A. singular

B. non-singular

C. symmetic

D. not defined

Answer: D

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5. If $A = \begin{bmatrix} 1 & 2 & -1 \\ -1 & 1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$, then det (adj (adjA)) is

A. 14^4

B. 14^3

C. 14^2

D. 14

Answer: A

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6. If K $\in R_0$, then det (KI_0) is equal to

A. k^{n-1}

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

C. $k^n)$

D. k

Answer: B

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7. With $1, \omega, \omega^2$ as cube roots of unity, inverse of which of the following matrices exists?

A. $\begin{bmatrix} 1 & \omega \\ \omega & \omega \end{bmatrix}$

B. $\begin{bmatrix} \omega^2 & 1 \\ 1 & \omega \end{bmatrix}$

C. $\begin{bmatrix} \omega & \omega^2 \\ \omega^2 & 1 \end{bmatrix}$

D. None of these

Answer: D

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8. If the matrix A is such that $A\begin{bmatrix} -1 & 2 \\ 3 & 1 \end{bmatrix} = \begin{bmatrix} -4 & 1 \\ 7 & 7 \end{bmatrix}$,then A is equal to

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

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

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

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

Answer: C

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9. If $A = \begin{bmatrix} \cos x & \sin x & 0 \\ -\sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$ =f(x), then A^{-1} is equal to

A. $f(-x)$

B. $f(x)$

C. $-f(x)$

D. $-f(-x)$

Answer: A

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10. The element in the first row and third column of the inverse of the matrix $\begin{bmatrix} 1 & 2 & -3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$ is

A. -2

B. 0

C. 1

D. None of these

Answer: D

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11. If $A = \begin{bmatrix} 0 & 1 & -1 \\ 2 & 1 & 3 \\ 3 & 2 & 1 \end{bmatrix}$ then $\left(A(adjA)A^{-1}\right)A =$

A. $\begin{bmatrix} -6 & 0 & 0 \\ 0 & -6 & 0 \\ 0 & 0 & -6 \end{bmatrix}$

B. $\begin{bmatrix} 0 & \frac{1}{6} & -\frac{1}{6} \\ \frac{1}{3} & \frac{1}{6} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{3} & \frac{1}{6} \end{bmatrix}$

C. $\begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Answer: C

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12. 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. 2A

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

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

D. A^2

Answer: A

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13. If A satisfies the equation $x^3 - 5x^2 + 4x + \lambda = 0$, then A^{-1} exists if $\lambda \neq 1$ (b) $\lambda \neq 2$ (c) $\lambda \neq -1$ (d) $\lambda \neq 0$

A. $\lambda \neq 1$

B. $\lambda \neq 2$

C. $\lambda \neq -1$

D. $\lambda \neq 0$

Answer: D

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14. A square non-singular matrix A satisfies $A^2 - A + 2I = 0, \text{ then } A^{-1}$=

A. I-A

B. (I-A)I2

C. I+A

D. (I+)I2

Answer: B

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15. Matrix A such that $A^2 = 2A - I, where I$ is the identity matrix, the for $n \geq 2. A^n$ is equal to $2^{n-1}A - (n-1)l$ b. $2^{n-1}A - I$ c. $nA - (n-1)l$ d. $nA - I$

A. $n^A - n(n-1)$

B. nA-I

C. $2^{n-1}A - (n-1)I$

D. $2^{n-1}A - I$

Answer: A

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16. If $X = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, the value of X^n is equal to

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

B. $\begin{bmatrix} 2n+n & 5-n \\ n & -n \end{bmatrix}$

C. $\begin{bmatrix} 3^n & (-4)^n \\ 1^n & (-1)^n \end{bmatrix}$

D. None of these

Answer: D

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Exercise For Session 4

1. If the system of equations $ax + y = 1, x + 2y = 3, 2x + 3y = 5$ are consistent, then a is given by

A. 0

B. 1

C. 2

D. None of these

Answer: A

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2. The system of linear equations $x+y+z=2, 2x=y-z=3, 3x+2y+kz=4$ has a unique solution if (A) $k\neq 0$ (B) $-1<k<1$ (C) $-2<k<2$ (D) $k=0$

A. $\lambda \neq 0$

B. $-1<\lambda<1$

C. $\lambda=0$

D. $-2<\lambda<2$

Answer: A

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3. The value of a for which system of equation , $a^3x+(a+1)^3y+(a+2)^3z=0, ax+(a+1)y+(a+2)z=0, x+y+$

has a non-zero solution is:

A. 2

B. 1

C. 0

D. -1

Answer: D

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4. The number of solution of the set of equations $\frac{2x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2} = 0, \frac{x^2}{a^2} + \frac{2y^2}{b^2} - \frac{z^2}{c^2} = 0, \frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{2z^2}{c^2} = 0$ is

A. 6

B. 7

C. 8

D. 9

Answer: D

View Text Solution

5. the matrix $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is the matrix reflection in the line

A. x=1

B. x+y=1

C. y=1

D. x=y

Answer: D

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6. the matrix S is rotation through an angle 45° and G is th reflection about the line $y = 2x$, then $(SG)^2$ is equal to

A. 7I

B. 5I

C. 3I

D. I

Answer: D

View Text Solution

7. If $A = \begin{bmatrix} -2 & 3 \\ -1 & 1 \end{bmatrix}$ then A^3 is equal to

A. 2A

B. A

C. 2I.

D. I

Answer: D

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8. If $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ and the sum of eigen values of A is m anda product of eigen values of A is n, then m+n is equal to

A. 10

B. 12

C. 14

D. 16

Answer: B

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9. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 4 \end{bmatrix}$ and θ be the angle between the two non-zero column vectors X such that $AX = \lambda X$ for some scalar λ, then $9 \sec^2 \theta$ is equal to

A. 13

B. 12

C. 11

D. 10

Answer: D

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Exercise Single Option Correct Type Questions

1. If $A^5 = O$ such that $A^n \neq I$ for $1 \leq n \leq 4$, then $(I - A)^{-1}$ is equal to

A. A^4

B. A^3

C. $I + A$

D. None of these

Answer: D

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2. Let $A = \begin{bmatrix} a & b & c \\ p & q & r \\ x & y & z \end{bmatrix}$ and suppose then det (A) = 2, then det (B) equals, where $B = \begin{bmatrix} 4x & 2a & -p \\ 4y & 2b & -q \\ 4z & 2c & -r \end{bmatrix}$

A. -2

B. -8

C. -16

D. 8

Answer: C

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3. If A is any square matrix such that $A + \frac{I}{2}$ and $A - \frac{I}{2}$ are orthogonal matrices, 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

Answer: B

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4. Let $a = \lim_{x \to 1} \left(\frac{x}{\ln x} - \frac{1}{x \ln x} \right)$, $b = \lim_{x \to 0} \left(\frac{x^3 - 16x}{4x + x^2} \right)$,
$c = \lim_{x \to 1} \left(\frac{\ln(1 + \sin x)}{x} \right)$ and
$c = \lim_{x \to -1} \frac{(x+1)^3}{[\sin(x+1) - (x+1)]}$ then $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is

A. idempotent

B. involutory

C. non-singular

D. nilpotent

Answer: D

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5. Let $A = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$ If θ is the angle between the two non- zero column vectors X such that $AX = \lambda X$ for some scalar λ then $\tan \theta$ is equal to

A. 3

B. 5

C. 7

D. 9

Answer: C

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6. If a square matrix A is involutory, then A^{2n+1} is equal to

A. I

B. A

C. A^2

D. $(2n+1)A$

Answer: B

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7. If $\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then $\lim_{n \to \infty} \frac{A^n}{n}$ is (where $\theta \in R$)

A. a zero matrix

B. an identity matrix

C. $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 0 & 1 \\ 0 & -1 \end{bmatrix}$

Answer: A

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8. The rank of the matrix $\begin{bmatrix} -1 & 2 & 5 \\ 2 & -4 & a-4 \\ 1 & -2 & a+1 \end{bmatrix}$ is (where a = - 6)

A. 1

B. 2

C. 3

D. 4

Answer: A

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9. 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. $2A$

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

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

D. A^2

Answer: A

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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

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

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

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

D. $(|A|+k)^{n+1}$

Answer: B

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

A. O

B. $A^2 + B^2$

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

D. $A + B$

Answer: B

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12. If matrix $A = [a_{ij}]_{3 \times 3}$, matrix $B = [b_{ij}]_{3 \times 3}$ where $a_{ij} + a_{ij} = 0$ and $b_{ij} - b_{ij} = 0$ then $A^4 \cdot B^3$ is

A. skew- symmetric matrix

B. singular

C. symmetric

D. Both B & C

Answer: D

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13. Let A be a $n \times n$ matrix such that $A^n = \alpha A,$ where α is a real number different from 1 and - 1. The matrix $A + I_n$ is

A. singular

B. invertible

C. scalar matrix

D. None of these

Answer: B

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14. If $A = \begin{bmatrix} \frac{-1+i\sqrt{3}}{2i} & \frac{-1-i\sqrt{3}}{2i} \\ \frac{1+i\sqrt{3}}{2i} & \frac{1-i\sqrt{3}}{2i} \end{bmatrix}$, $I = \sqrt{-1}$ and $f(x) = x^2 + 2$,

then $f(A)$ equals to

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

B. $\left(\frac{3 - i\sqrt{3}}{2}\right)\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

C. $\left(\frac{5 - i\sqrt{3}}{2}\right)\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

D. $(2 + i\sqrt{3})\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Answer: D

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15. The number of $2x2$ matrices X satisfying the matrix equation $X^2 = I(Iis2x2unitmatrix)$ is 1 (b) 2 (c) 3 (d) infinite

A. 0

B. 1

C. 2

D. more then 3

Answer: D

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16. if A and B are squares matrices such that $A^{2006} = O$ and $AB = A + B$, then $\det(B)$ equals

A. -1

B. 0

C. 1

D. None of these

Answer: B

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17. If $P = \begin{bmatrix} \cos\frac{\pi}{6} & \sin\frac{\pi}{6} \\ -\sin\frac{\pi}{6} & \cos\frac{\pi}{6} \end{bmatrix}$, $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$ then

$P^T Q^{2007} P$ is equal to

A. $\begin{bmatrix} 1 & \sqrt{3}/2 \\ 0 & 2007 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 2007 \\ 0 & 1 \end{bmatrix}$

C. $\begin{bmatrix} \sqrt{3}/2 & 2007 \\ 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} \sqrt{3}/2 & -1/2 \\ 1 & 2007 \end{bmatrix}$

Answer: B

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18. 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, F are real numbers. The absolute value of the difference of these two solutions, is

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

B. $\frac{11}{3}$

C. $\frac{1}{3}$

D. $\frac{19}{3}$

Answer: D

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19. If $f(\theta) = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta & -\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta & \cos\theta \\ \sin\theta & -\cos\theta & 0 \end{bmatrix}$ "then " f (pi/7) ` is

A. symmetric

B. skew-symmetric

C. singular

D. non-singular

Answer: D

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20. In a square matrix A of order 3 the elements a_{ij} 's are the sum of the roots of the equation $x^2 - (a+b)x + ab = 0$, $a_{I,i+1}$'s are the prodeuct of the roots, $a_{I,i-1}$'s are all unity and the rest of the elements are all zero. The value of the det (A) is equal to

A. 0

B. $(a+b)^3$

C. a^(3) - b^(3)`

D. (a^(2)+ b^(2)) (a+b)`

Answer: D

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21. If $A and B$ 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

A. I

B. $2I$

C. 0

D. $-I$

Answer: C

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22. 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 $A^T C^n A, n \in I^+$ equals to

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

A. 1

B. 2

C. 4

D. 8

Answer: C

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24. If A and B are different matrices satisfying $A^3 = B^3$ and $A^2B = B^2A$, then

A. $\det\left(A^2+B^2\right)$ must be zero

B. det $(A-B)$ must be zero

C. $\det\left(A^2+B^2\right)$ as well as $\det(A-B)$ must be zero

D. alteast one of $\det\left(A^2+B^2\right)$ or $\det(A-B)$ must be zero

Answer: D

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25. If A is a skew-symmetric matrix of order 2 and B, C are matrices $\begin{bmatrix}1 & 4\\ 2 & 9\end{bmatrix}, \begin{bmatrix}9 & -4\\ -2 & 1\end{bmatrix}$ respectively, then $A^3(BC)+A^5\left(B^2C^2\right)+A^7\left(B^3C^3\right)+\ldots+A^{2n+1}(B^nC^n)$, is

A. a symmetric matrix

B. a skew-symmetric matrix

C. an identity matrix

D. None of these

Answer: B

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26. If $A = \begin{bmatrix} a & b & c \\ x & y & z \\ p & q & r \end{bmatrix}, B = \begin{bmatrix} q & -b & y \\ -p & a & -x \\ r & -c & z \end{bmatrix}$ and if A is invertible, then which of the following is not true?

A. $|A| = |B|$

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

C. $|adjA| = |adjB|$

D. A is invertible $\Leftrightarrow$ B is invertble

Answer: A

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27. Let 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 tr

$$(A) + tr\left(\frac{ABC}{2}\right) + tr\left(\frac{A(BC)^2}{4}\right) + tr\left(\frac{A(BC)^3}{8}\right) + \dots + \infty$$

equals to

A. 4

B. 9

C. 12

D. 6

Answer: D

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

A. O

B. I

C. $2I$

D. $6I$

Answer: B

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29. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & a & 1 \end{bmatrix}$ and $A^{-1} \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & b \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$ then

A. $a = 1, b = -1$

B. $a = 2, b = -\frac{1}{2}$

C. $a = -1, b = 1$

D. $a = \frac{1}{2}, b = \frac{1}{2}$

Answer: A

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

A. $64I$

B. $88I$

C. $68I$

D. $34I$

Answer: C

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Exercise More Than One Correct Option Type Questions

1. If $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ then

A. $A^3 = 9A$

B. $A^3 = 27A$

C. $A + A = A^2$

D. A^{-1} does not exist

Answer: A::D

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2. A square matrix A with elements form the set of real numbers is said to be orthogonal if $A' = A^{-1}$. If A is an orthogonal matris, then

A. A' is orthogonal

B. A^{-1} is orthogonl

C. $adjA = A'$

D. $|A^{-1}| = 1$

Answer: A::B::D

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3. 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: A::B::D

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4. D is a 3×3 diagonal matrix. Which of the following

statements are not true?

A. $D^T = D$

B. $AD = DA$ for every matrix A of order 3×3

C. D^{-1} if exists is a scalar matrix

D. None of the above

Answer: B::C

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5. If the rank of the matrix $\begin{bmatrix} -1 & 2 & 5 \\ 2 & -4 & a-4 \\ 1 & -2 & a+1 \end{bmatrix}$ is 1 then the value of a is

(A) -1 (B) 2 (C) -6 (D) 4

A. $2, \quad \text{if} \quad a = -6$

B. $2, \quad \text{if} \quad a = 1$

C. $1, \quad \text{if} \quad a = 2$

D. $1, \quad \text{if} \quad a = -6$

Answer: B::D

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6. If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then

A. $adj(adjA) = A$

B. $|adj(adj(A))| = 1$

C. $|adj(A)| = 1$

D. None of these

Answer: A::B::C

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

c. $AB = O$ d. $BA = O$

A. $A^2 = A$

B. $A^2 = I$

C. $AB = O$

D. $BA = O$

Answer: A::C::D

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8. If A is a non-singular matrix, then

A. A^{-1} is a non-singular matrix, then

B. $A^{-1}$is skew-symmetric if A is symmetric

C. $\left|A^{-1}\right| = |A|$

D. $\left|A^{-1}\right| = |A|^{-1}$

Answer: A::D

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9. Let A and B are two matrices such that $AB = BA,$ then

for every $n \in N$

A. $A^n B = BA^n$

B. $(AB)^n = A^n B^n$

C. $(A + B)^n = {}^nC_0 A^n + {}^nC_1 A^{n-1} B + \dots + {}^nC_n B^n$

D. $A^{2n} - B^{2n} = (A^n - B^n)(A^n + B^n)$

Answer: A::C::D

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10. If A and B are 3×3 matrices and $|A| \neq 0,$ which of the

following are true?

A. $|AB| = 0 \Rightarrow |B| = 0$

B. $|AB| = 0 \Rightarrow B = 0$

C. $\left|A^{-1}\right| = |A|^{-1}$

D. $|A + A| = 2|A|$

Answer: A::C

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11. If A is a matrix of order $m \times m$ such that

$A^2 + A + 2I = O$, then

A. A is non-singular

B. A is symmetric

C. $|A| \neq 0$

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

Answer: A::C::D

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12. If $A^2 - 3A + 2I = 0,$ then A is equal to

A. I

B. $2I$

C. $\begin{bmatrix} 3 & -2 \\ 1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 3 & 1 \\ -2 & 0 \end{bmatrix}$

Answer: A::B::C::D

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13. If A and B are two matrices such that their product AB is a null matrix, then

A. det $A \neq 0 \Rightarrow B$ must be a null matrix

B. det $B \neq 0 \Rightarrow A$ must be a null matrix

C. alteast one of the two matrices must be singular

D. if neither det A nor det B is zero, then the given statement is not possible

Answer: C::D

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14. If $D_1 \text{ and } D_2$ are two $3x3$ diagnal matrices where none of the diagonal elements is zero, then

A. D_1D_2 is a diagonal matrix

B. $D_1D_2 = D_2D_1$

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

D. None of the above

Answer: A::B::C

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15. Let, $C_k = {}^{n}C_k \ \text{for} 0 \le k \le n \ \text{and} \ A_k = \begin{bmatrix} C_{k-1}^2 & 0 \\ 0 & C_k^2 \end{bmatrix}$ for

$k \ge l \ \text{and}$

$A_1 + A_2 + A_3 + \ldots + A_n = \begin{bmatrix} k_1 & 0 \\ 0 & k_2 \end{bmatrix}$, then

A. $k_1 = K_2$

B. $k_1 + k_2 = 2$

C. $k_1 = {}^{2n}C_n - 1$

D. $k_2 = {}^{2n}C_{n+1}$

Answer: A::C

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Exercise Passage Based Questions

1. Suppose A and B be two ono-singular matrices such that

$AB = BA^m, B^n = I \ \text{and} \ A^p = I$, where I is an identity matrix.

If $m = 2 \ \text{and} \ n = 5$ then p equals to

A. 30

B. 31

C. 33

D. 81

Answer: B

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2. Suppose A and B be two ono-singular matrices such that

$AB = BA^m, B^n = I \text{ and } A^p = I$, where I is an identity matrix.

The relation between m, n and p, is

A. $p = mn^2$

B. $p = m^n - 1$

C. $p = n^m - 1$

D. $p = m^{n-1}$

Answer: B

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3. Suppose A and B be two ono-singular matrices such that

$AB = BA^m, B^n = I$ and $A^p = I$, where I is an identity matrix.

Which of the following orderd triplet (m, n, p) is false?

A. $(3, 2, 80)$

B. $(6, 3, 215)$

C. $(8, 3, 510)$

D. $(2, 8, 255)$

Answer: C

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4. Let $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$ is an orthogonal matrix and $abc = \lambda(< 0)$.

The value $a^2b^2 + b^2c^2 + c^2a^2$, is

A. 2λ

B. -2λ

C. λ^2

D. $-\lambda$

Answer: B

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5. Let $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$ is an orthogonal matrix and $abc = \lambda(< 0)$.

The value of $a^3 + b^3 + c^3$ is

A. λ

B. 2λ

C. 3λ

D. None of these

Answer: D

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6. Let $A = \begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$ is an orthogonal matrix and $abc = \lambda(<0)$.

The equation whose roots are $a, b, c,$ is

A. $x^3 - 2x^2 + \lambda = 0$

B. $x^3 - \lambda x^2 + \lambda x + \lambda = 0$

C. $x^3 - 2x^2 + 2\lambda x + \lambda = 0$

D. $x^3 \pm x^2 - \lambda = 0$

Answer: D

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7. Lat $A = [a_{ij}]_{3 \times 3}$. If tr is arithmetic mean of elements of rth row and $a_{ij} + a_{jk} + a_{ki} = 0$ holde for all $1 \leq i, j, k \leq 3$. $\sum_{1 \leq i} \sum_{j \leq 3} a_{ij}$ is not equal to

A. $t_1 + t_2 + t_3$

B. zero

C. $(\det(A))^2$

D. $t_1 t_2 t_3$

Answer: D

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8. Lat $A = [a_{ij}]_{3 \times 3}$. If tr is arithmetic mean of elements of rth row and $a_{ij} + a_{jk} + a_{ki} = 0$ holde for all $1 \leq i, j, k \leq 3$.

Matrix A is

A. non- singular

B. symmetric

C. skew-symmetric

D. nether symmetric nor skew-symmetric

Answer: C

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9. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$ be a square matrix and C_1, C_2, C_3 be three comumn matrices satisgying $AC_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, AC_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}$ and $AC_3 = \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}$ of matrix B. If the matrix $C = \frac{1}{3}(A \cdot B)$.

The value of $\det(B^{-1})$, is

A. 2

B. $\frac{1}{2}$

C. 3

D. $\frac{1}{3}$

Answer: D

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10. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$ be a square matrix and C_1, C_2, C_3 be three comumn matrices satisgying $AC_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, AC_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}$ and $AC_3 = \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}$ of matrix B. If the matrix $C = \frac{1}{3}(A \cdot B)$.

The ratio of the trace of the matrix B to the matrix C, is

A. $-\frac{9}{5}$

B. $-\frac{5}{9}$

C. $-\frac{2}{3}$

D. $-\frac{3}{2}$

Answer: A

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11. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$ be a square matrix and C_1, C_2, C_3 be three comumn matrices satisgying $AC_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, AC_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}$ and $AC_3 = \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}$ of matrix B. If the matrix $C = \frac{1}{3}(A \cdot B)$. find $\sin^{-1}(\det A) + \tan^{-1}(9 \det C)$

A. $\frac{\pi}{4}$

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{4}$

D. π

Answer: C

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12. If A is symmetric and B skew- symmetric matrix and $A+B$ is non-singular and $C=(A+B)^{-1}(A-B)$, $C^T(A+B)C$ equals to

A. $A+B$

B. $A-B$

C. A

D. B

Answer: A

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13. If A is a symmetric and B skew symmetric matrix and $(A+B)$ is non-singular and $C=(A+B)^{-1}(A-B)$, then prove that

A. $A+B$

B. $A-B$

C. A

D. B

Answer:

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14. If A is symmetric and B skew- symmetric matrix and $A+B$ is non-singular and $C=(A+B)^{-1}(A-B)$

$C^T AC$ equals to

A. $A+B$

B. $A-B$

C. A

D. B

Answer: C

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15. Let A be a squarre matrix of order of order 3 satisfies the matrix equation

$A^3 - 6A^2 + 7A - 8I = O$ and $B = A - 2I$. Also, $\det A = 8$.

The value of $\det\left(adj\left(I - 2A^{-1}\right)\right)$ is equal to

A. $\frac{25}{16}$

B. $\frac{125}{64}$

C. $\frac{64}{125}$

D. $\frac{16}{25}$

Answer: A

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16. Let A be a squarre matrix of order of order 3 satisfies the matrix equation $A^3 - 6A^2 + 7A - 8I = O$ and $B = A - 2I$. Also, $\det A = 8$. If $adj\left(\left(\frac{B}{2}\right)^{-1}\right) = \left(\frac{p}{q}\right)B$, where $p, q \in N$, the least valuse of $(p+q)$ is equal to

A. 7

B. 9

C. 29

D. 41

Answer: A

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Exercise Single Integer Answer Type Questions

1. Let A, B, C, D be (not necessarily) real matrices such that $A^T = BCD, B^T = CDA, C^T = DAB$ and $D^T = ABC$ for the matrix $S = ABCD$ the least value of k such that $S^k = S$ is

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2. $A = [1 tan x - tan x 1] and f(x)$ is defined as $f(x) = det A^T \dot{A}^{-1}$ en the value of $(f(f(f(ff(x))))$ is $(n \geq 2)$ ________.

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3. If the matrix $A = \begin{bmatrix} \lambda_1^2 & \lambda_1\lambda_2 & \lambda_1\lambda_3 \\ \lambda_2\lambda_1 & \lambda_2^2 & \lambda_2\lambda_3 \\ \lambda_3\lambda_1 & \lambda_3\lambda_2 & \lambda_3^2 \end{bmatrix}$ is idempotent, the value of $\lambda_1^2 + \lambda_2^2 + \lambda_3^2$ is

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4. Let A be a 3×3 matrix given by $A = [a_{ij}]$. If for every column vector X, $X^T AX = O$ and $a_{23} = -1008$, the sum of the digits of a_{32} is

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5. Let X be the soultion set of the equation $A^x = -I$, where

$A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ and I is the corresponding unit matrix

and $x \subseteq N$, the minimum value of $\sum (\cos^x \theta + \sin^x \theta)$

$\theta \in R - \left\{ \frac{n\pi}{2}, n \in I \right\}$ is

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6. If A is an idempotent matrix and I is an identify matrix of the Same order, then the value of n, such that $(A+I)^n = I + 127A$ is

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7. Sluppose $a, b, c, \in R$ and $abc = 1$, if $A = \begin{bmatrix} 3a & b & c \\ b & 3c & a \\ c & a & 3b \end{bmatrix}$ is such that $A^T A = 4^{1/3} I$ and $|A| > 0$, the value of $a^3 + b^3 + c^3$ is

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8. If $A=\begin{bmatrix}0 & 1\\ 3 & 0\end{bmatrix}$ and $\left(A^8+A^6+A^4+A^2+I\right)V=\begin{bmatrix}0\\ 11\end{bmatrix}$,

where V is a vertical vector and I is the 2×2 identity

matrix and if λ is sum of all elements of vertical vector

V, the value of 11λ is

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9. Let the matrix A and B defined as $A=\begin{vmatrix}3 & 2\\ 2 & 1\end{vmatrix}$ and $B=\begin{vmatrix}3 & 1\\ 7 & 3\end{vmatrix}$ Then

the value of $\left|\det\left(2A^9B^{-1}\right|\right.=$

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10. Let $A=\begin{bmatrix}0 & \alpha\\ 0 & 0\end{bmatrix}$ and $(A+I)^{70}-70A=\begin{bmatrix}a-1 & b-1\\ c-1 & d-1\end{bmatrix}$, the

value of $a+b+c+d$ is

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Matrices Exercise 5 Matching Type Questions

1. Suppose a, b, c are three distinct real numbers and $f(x)$ is a real quadratic polynomial such that lt brgt

$$\begin{bmatrix} 4a^2 & 4a & 1 \\ 4b^2 & 4b & 1 \\ 4c^2 & 4c & 1 \end{bmatrix} \begin{bmatrix} f(-1) \\ f(1) \\ f(2) \end{bmatrix} = \begin{bmatrix} 3a^2 & +3a \\ 3b^2 & +3b \\ 3c^2 & +3c \end{bmatrix}.$$

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2. If A is non-singular matrix of order, $n \times n$,

	Column I		Column II
(A)	adj (A^{-1}) is	(p)	$A\,(\det A)^{n-2}$
(B)	det (adj (A^{-1})) is	(q)	$(\det A)^{n-1}$ (adj A)
(C)	adj (adj A) is	(r)	$\dfrac{\text{adj (adj } A)}{(\det A)^{n-1}}$
(D)	adj (A det (A)) is	(s)	$(\det A)^{1-n}$
		(t)	$\dfrac{A}{(\det A)}$

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Column I		Column II	
(A)	If A is a diagonal matrix of order 3×3 is commutative with every square matrix of order 3×3 under multiplication and tr $(A) = 12$, then $\|A\|$ is divisible by	(p)	3
		(q)	4
(B)	Let $a, b, c \in R^+$ and the system of equations $(1-a)x + y + z = 0$, $x + (1-b)y + z = 0$, $x + y + (1-c)z = 0$ has infinitely many solutions. If λ be the minimum value of $a\,b\,c$, then λ is divisible by	(r)	6
(C)	Let $A = [a_{ij}]_{3\times 3}$ be a matrix whose elements are distinct integers from 1, 2, 3, ..., 9. The matrix is formed so that the sum of the numbers is every row, column and each diagonal is a multiple of 9. If number of all such possible matrices is λ, then λ is divisible by	(s)	8

3.

Column I		Column II	
(D)	If the equations $x + y = 1$, $(c+2)x + (c+4)y = 6$, $(c+2)^2 x + (c+4)^2 y = 36$ are consistent and c_1, c_2 $(c_1 > c_2)$ are two values of c, then $c_1\,c_2$ is divisible by	(t)	9

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	Column I		Column II
(A)	If C is skew-symmetric matrix of order n and X is $n \times 1$ column matrix, then $X^T CX$ is	(p)	invertible
(B)	If A is skew - symmetric, then $I - A$ is, where I is an identity matrix of order A.	(q)	singular
(C)	If $S = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ and $A = \begin{bmatrix} b+c & c-a & b-a \\ c-b & c+a & a-b \\ b-c & a-c & a+b \end{bmatrix}$ $(a, b, c \neq 0)$, then SAS^{-1} is	(r)	symmetric
(D)	If A, B, C are the angles of a triangle, then the matrix $A = \begin{bmatrix} \sin 2A & \sin C & \sin B \\ \sin C & \sin 2B & \sin A \\ \sin B & \sin A & \sin 2C \end{bmatrix}$ is	(s)	non-singular
		(t)	non-invertible

4.

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Exercise Statement I And Ii Type Questions

1. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative

choices, only one of which is the correct answer. You

have to select the correct choice as given below.

Statement - 1 If mateix $A = [a_{ij}]_{3 \times 3}, B = [b_{ij}]_{3 \times 3},$ where

$a_{ij} + a_{ji} = 0 \text{ and } b_{ij} - b_{ji} = 0$ then $A^4 B^5$ is non-singular

matrix.

Statement-2 If A is non-singular matrix, then $|A| \neq 0.$

A. Statement- is true, Statement -2 is true, Statement-2

is a correct explanation for Statement-1

B. Statement-1 is true, Statement-2 is true, Sttatement - 2

is not a correct explanation for Stamtement-1

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

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

Answer: D

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2. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative

choices, only one of which is the correct answer. You

have to select the correct choice as given below.

Statement-1 if A and B are two square matrices of order

$n \times n$ which satisfy $AB = A$ and $BA = B,$ then

$(A + B)^7 = 2^6(A + B)$

Statement- 2 A and B are unit matrices.

A. Statement- is true, Statement -2 is true, Statement-2

is a correct explanation for Statement-2

B. Statement-1 is true, Statement-2 is true, Sttatement - 2

is not a correct explanation for Stamtement-2

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

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

Answer: C

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3. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative

choices, only one of which is the correct answer. You

have to select the correct choice as given below.

Statement-1 For a singular matrix A, $\quad \text{if} \quad AB = AC \Rightarrow B = C$

Statement-2 If $|A| = 0, \text{ thhen} A^{-1}$ does not exist.

A. Statement- is true, Statement -2 is true, Statement-2

is a correct explanation for Statement-3

B. Statement-1 is true, Statement-2 is true, Sttatement - 2

is not a correct explanation for Stamtement-3

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

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

Answer: D

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4. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice as given below.

Statement - 1 If A is skew-symnmetric matrix of order 3, then its determinant should be zero.

Statement - 2 If A is square matrix,

$\det(A) = \det(A') = \det(-A')$

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, Sttatement - 2 is not a correct explanation for Stamtement-1

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

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

Answer: C

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5. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative

choices, only one of which is the correct answer. You

have to select the correct choice as given below.

Let A be a skew-symmetric matrix, $B=(I-A)(I+A)^{-1}$

and X and Y be column vectors conformable for

multiplication with B.

Statement-1 (BX)^(T) (BY) = X^(T) Y

Statement- 2 If A is skew-symmetric, then (I+A) is

non-singular.

A. Statement- is true, Statement -2 is true, Statement-2

is a correct explanation for Statement-5

B. Statement-1 is true, Statement-2 is true, Sttatement - 2

is not a correct explanation for Stamtement-5

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

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

Answer: A

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6. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative

choices, only one of which is the correct answer. You

have to select the correct choice as given below.

Statement-1 Let A 2×2 matrix A has determinant 2. If

$B = 9A^2$, the determinant of B^T is equal to 36.

Statement- 2 If A, B and C are three square matrices

Such that $C = AB$ then $|C| = |A||B|$.

A. Statement- is true, Statement -2 is true, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is true, Statement-2 is true, Sttatement - 2 is not a correct explanation for Stamtement-1

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

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

Answer: D

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7. Statement-1 (Assertion and Statement- 2 (Reason) Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice as given below. Statement -1 If $A = \begin{bmatrix} 1 & -1 & -1 \\ 1 & -1 & 0 \\ 1 & 0 & -1 \end{bmatrix}$ then $A^3 + A^2 + A = I$ Statement - 2 If $\det(A - \lambda I) = C_0\lambda^3 + C_1\lambda^2 + C_2\lambda + C_3 = 0.$ then $C_0A^3 + C_1A^2 + C_2A + C_3I = O.$

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, Sttatement - 2

is not a correct explanation for Stamtement-1

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

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

Answer: D

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8. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative

choices, only one of which is the correct answer. You

have to select the correct choice as given below.

Statement - 1 $A = [a_{ij}]$ be a matrix of order 3×3 where

$a_{ij} = \dfrac{i - j}{i + 2j}$ cannot be expressed as a sum of symmetric

and skew-symmetric matrix.

Statement-2 Matrix $A = [a_{ij}]_{n \times n}$, $a_{ij} = \dfrac{i-j}{i+2j}$ is neither symmetric nor skew-symmetric.

A. Statement- is true, Statement -2 is true, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is true, Statement-2 is true, Sttatement - 2 is not a correct explanation for Stamtement-1

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

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

Answer: D

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9. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice as given below.

Statement- 1 If A, B, C are matrices such that

$|A_{3\times 3}| = 3, |B_{3\times 3}| = -1 \text{ and } |C_{2\times 2}| = 2, |2ABC| = -12.$

Statement - 2 For matrices A, B, C of the same order

$|ABC| = |A||B||C|.$

A. Statement- is true, Statement -2 is true, Statement-2 is a correct explanation for Statement-1

B. Statement-1 is true, Statement-2 is true, Sttatement - 2 is not a correct explanation for Stamtement-1

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

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

Answer: D

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10. Statement-1 (Assertion and Statement- 2 (Reason)

Each of these questions also has four alternative choices, only one of which is the correct answer. You

have to select the correct choice as given below.

Statement-1 The determinant fo a matrix $A = [a_{ij}]_{n \times n}$,

where $a_{ij} + a_{ji} = 0$ for all i and j is zero.

Statement- 2 The determinant of a skew-symmetric

matrix of odd order is zero.

A. Statement- is true, Statement -2 is true, Statement-2 is a correct explanation for Statement-10

B. Statement-1 is true, Statement-2 is true, Sttatement - 2 is not a correct explanation for Stamtement-10

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

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

Answer: A

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Exercise Subjective Type Questions

1. If s is a real skew-symmetric matrix, the show that $I - S$

is non-singular and matrix

$A = (I + S)(I - S)^{-1} = (I - S)^{-1}(I + S)$ is orthogonal.

A.

B.

C.

D.

Answer:

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2. If M is a 3×3 matrix, where $\det M = I$ and $MM^T = I$,

where I is an identity matrix, prove that $\det(M - I) = 0$

A.

B.

C.

D.

Answer:

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3. 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 $BA^4B = A^{-1}$

A.

B.

C.

D.

Answer: $\alpha = \frac{2\pi}{3}$

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4. Flind the product of two matrices

$$A=\begin{bmatrix}\cos^2\theta & \cos\theta\sin\theta\\ \cos\theta\sin\theta & \sin^2\theta\end{bmatrix}B=\begin{bmatrix}\cos^2\phi & \cos\phi\sin\phi\\ \cos\phi\sin\phi & \sin^2\phi\end{bmatrix}$$

Show that, AB is the zero matrix if θ and ϕ differ by an odd multipl of $\frac{\pi}{2}$.

A.

B.

C.

D.

Answer: $\begin{bmatrix}\cos\theta\cos\phi\cos(\theta \sim \phi) & \cos\theta\sin\phi\cos(\theta \sim \phi)\\ \sin\theta\cos\phi\cos(\theta \sim \phi) & \sin\theta\sin\phi\cos(\theta \sim \phi)\end{bmatrix}$

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5. Show that the matris $\begin{bmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{bmatrix}$ is orthogonal,

if $l_1^2 + m_1^2 + n_1^2 = \Sigma l_1^2 = 1 = \Sigma l_2^2 = \Sigma_3^2$ and

$l_1 l_2 + m_1 m_2 + n_1 n_2 = \Sigma l_1 l_2 = 0 = \Sigma l_2 l_3 = \Sigma l_3 l_1.$

A.

B.

C.

D.

Answer:

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6. A finance company has offices located in ewery division,

every didtrict and every taluka in a certain state in India.

Assume that there are five divisions, thirty districts and

200 talukas in the state. Each office has one head clerk,

one cashier, one clerk and one peon. A divisional office

has, in addition, one office superntendent, two clerks,

one typist and one poen. A district office, has in

addition, one clerk and one peon. The basic monthly

salaries are as follows :

Office superintendernt Rs 500, Head clerk Rs 200, cashier Rs 175, clerks and typist

Rs 150 and peon Rs 100. Using matrix motation find

the total unmber of posts of each kind in all the offices

taken together,

A.

B.

C.

D.

Answer: Number of posts in all the offices taken together are 5 office superintendents; 235 had clerks; 235 cashiers; 275 clerks; 5 typisit and 270

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7. A finance company has offices located in ewery division,

every didtrict and every taluka in a certain state in India.

Assume that there are five divisions, thirty districts and

200 talukas in the state. Each office has one head clerk,

one cashier, one clerk and one peon. A divisional office

has, in addition, one office superntendent, two clerks,

one typist and one poen. A district office, has in

addition, one clerk and one peon. The basic monthly

salaries are as follows :

Office superintendernt Rs 500, Head clerk Rs 200, cashier Rs 175, clerks

and typist

Rs 150 and peon Rs 100. Using matrix motation find

the total basic monthly salary bill of each kind of office

A.

B.

C.

D.

Answer: Total basic monthly salary bill of each division of district and taluka offices an Rs 1675, Rs 675 and Rs 625, respectively.

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8. A finance company has offices located in ewery division,

every didtrict and every taluka in a certain state in India.

Assume that there are five divisions, thirty districts and

200 talukas in the state. Each office has one head clerk,

one cashier, one clerk and one peon. A divisional office

has, in addition, one office superntendent, two clerks,

one typist and one poen. A district office, has in

addition, one clerk and one peon. The basic monthly

salaries are as follows :

Office superintendernt Rs 500, Head clerk Rs 200, cashier Rs 175, clerks and typist

Rs 150 and peon Rs 100. Using matrix motation find the total basic monthly salary bill of all the offices taken

together.

A.

B.

C.

D.

Answer: Total basic monthly salary bill of all the offices taken together is Rs 159625.

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9. In a development plan of a city, a contractor has taken a contract to construct certain houses for which he needs building materials like stones, sand etc. There are three firms A, B, C that can supply him these materials. At one time these firms A, B, C supplied him 40, 35 and 25 truck loads of stones and 10, 5 and 8 truck load of stone and sand are Rs 1200 and 500 respectively, find the total amount paid by the contractor to each of these firms A, B, C separately.

A.

B.

C.

D.

Answer: Rs 53000; Rs 44500; Rs 34000 , respectively

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10. Show that the matrix $A = \begin{bmatrix} 1 & a & \alpha & a\alpha \\ 1 & b & \beta & b\beta \\ 1 & c & \gamma & c\gamma \end{bmatrix}$ is of renk 3 provided no two of a, b, c are equal and no two of α, β, γ are equal.

A.

B.

C.

D.

Answer:

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11. By the method of matrix inversion, solve the system.

$$\begin{bmatrix} 1 & 1 & 1 \\ 2 & 5 & 7 \\ 2 & 1 & -1 \end{bmatrix} \begin{bmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{bmatrix} = \begin{bmatrix} 9 & 2 \\ 52 & 15 \\ 0 & -1 \end{bmatrix}$$

A.

B.

C.

D.

Answer: $x - 1, u = -1, y = 3, v = 2, z = 5, w = 1$

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12. If $x_1 = 3y_1 + 2y_2 - y_3, \quad y_1 = z_1 - z_2 + z_3$

$x_2 = -y_1 + 4y_2 + 5y_3, y_2 = z_2 + 3z_3$

$x_3 = y_1 - y_2 + 3y_3, \quad y_3 = 2z_1 + z_2$

espress x_1, x_2, x_3 in terms of z_1, z_2, z_3.

A.

B.

C.

D.

Answer:

$x_1 = z_1 - 2z_2 + 9z_3, x_2 = 9z_1 + 10z_2 + 11z_3, x_3 = 7z_1 + z_2 - 2z_3$

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13. For what values of k the set of equations

$2x - 3y + 6z - 5t = 3, y - 4z + t = 1,$

$4x - 5y + 8z - 9t = k$ has

A.

B.

C.

D.

Answer: $(i)k \neq 7(ii)k = 7$

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

A.

B.

C.

D.

Answer:

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Exercise Questions Asked In Previous 13 Years Exam

1. $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 2 & 4 \end{bmatrix}; I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, A^{-1} = \frac{1}{6}\left[A^2 + cA + dI\right],$ where $c, d \in R,$ then pair of values (c,d)

A. $(6, 11)$

B. $(6, -11)$

C. $(-6, 11)$

D. $(-6, -11)$

Answer: C

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2. If $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}, A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$, the ltbr. $P^T(Q^{2005})P$ equal to

A. $\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$

B. $\begin{bmatrix} \sqrt{3}/1 & 2005 \\ 1 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 2005 \\ \sqrt{3}/2 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 1 & \sqrt{3}/2 \\ 0 & 2005 \end{bmatrix}$

Answer: A

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3. If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then which one of the following holds for all $n \geq 1$ by the principle of mathematica induction? (A) $A^n = 2^{n-1}A + (n-1)I$ (B) $A^n = nA + (n-1)I$ (C) $A^n = 2^{n-1}A - (n-1)I$ (D) $A^n = nA - (n-1)AI$

A. $A^n = nA + (n-1)I$

B. $A^n = 2^{n-1}A + (n-1)I$

C. $A^n = nA - (n-1)I$

D.

Answer: C

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4. If $A^2 - A + I = 0$ then A^{-1} is equal to

A. a^{-2}

B. $A + I$

C. $I - A$

D. $A - I$

Answer: C

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5. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$ and U_1, U_2, U_3 be column matrices satisfying $AU_1 \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, AU_2 \begin{bmatrix} 2 \\ 3 \\ 6 \end{bmatrix}, AU_3 \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}$ .If U is 3×3 matrix whose columns are $U_1, U_2, U_3, \quad \text{then} \quad |U| =$

A. 3

B. -3

C. $3/2$

D. 2

Answer: A

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6. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix}$, and U_1, U_2 and U_3 are columns of a 3×3 matrix U. If column matrices U_1, U_2 and U_3 satisfy

$AU_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, AU_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}, AU_3 = \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix}$ then the sum of the elements of the matrix U^{-1} is

A. -1

B. 0

C. 1

D. 3

Answer: B

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7. If $A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{pmatrix}, U_1, U_2,$ and U_3 are column matrices satisfying $AU_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, AU_2 = \begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix}$ and $AU_3 = \begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix}$ and U is 3×3 matrix when columns are U_1, U_2, U_3 then answer the following questions

The value of (3 2 0) $U\begin{pmatrix}3\\2\\0\end{pmatrix}$ is

A. 5

B. $5/2$

C. 4

D. $3/2$

Answer: A

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8. Let $A=\begin{bmatrix}1&2\\3&4\end{bmatrix}$ and $B=\begin{bmatrix}a&0\\0&b\end{bmatrix}$ where a, b are natural numbers, then which one of the following is correct ?

A. there cannot exist any B such that $AB=BA$

B. There exist more than one but finite number of B' s such that

$AB=BA$

C. there exists exactly one B such that $AB = BA$

D. there exist infinitely among B' s such that $AB = BA$

Answer: B

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

A. A = B

B. AB = BA

C. Either of A or B is a zero matrix

D. Either of A or B is dientity matrix

Answer: B

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

A. 5^2

B. 1

C. $1/5$

D. 5

Answer: C

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11. Let $AdnB$ be 3×3 matrtices 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.

A. 0

B. 1

C. 2

D. 3

Answer: B::D

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12. Let A be a square matrix all of whose entries are integers. Then which one of the following is true? (1) If $detA = \pm 1, thenA^1$ exists but all its entries are not necessarily integers (2) If $detA \neq \pm 1, thenA^1$ exists and all its entries are non-integers (3) If $detA = \pm 1, thenA^1$ exists and all its entries are integers (4) If $detA = \pm 1, thenA^1$ need not exist

A. If $\det A \neq 1$, then A^{-1} exists and all its entries are non-integers

B. If $\det A = \pm 1$. then A^1 then A^{-1} exist and all its entries are integers

C. If $\det A = \pm 1$, then A^{-1} need not exist

D. If $\det A = \pm 1$, then A^{-1} exists but all its entries are not necessarily integers

Answer: D

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13. Let A be a 2×2 matrix with real entries. Let I be the 2×2 identity matrix. Denote by tr (A), the sum of diagonal entries of A. Assume that $A^2 = I$. Statement 1: If $A \neq I$ and $A \neq -I$, then det $A = -1$. Statement 2: If $A \neq I$ and $A \neq -I$, then $tr(A) \neq 0$. (1) Statement 1 is false, Statement $(2)(3)-2(4)$ is true (6) Statement 1 is true, Statement $(7)(8)-2(9)$ (10) is true, Statement $(11)(12)-2(13)$ is a correct explanation for Statement 1 (15) Statement 1 is true, Statement $(16)(17)-2(18)$ (19) is true; Statement $(20)(21)-2(22)$ is not a correct explanation for Statement 1. (24) Statement 1 is true, Statement $(25)(26)-2(27)$ is false.

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 not 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: C

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14. 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

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15. 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 then 4

B. atleast 4 but les then 7

C. atleast 7 but less then 10

D. atleast 10

Answer: B

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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

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

is inconsistent is

A. 0

B. more then 2

C. 2

D. 1

Answer: B

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17. Let A be a 2×2 matrix

Statement -1 adj $(adjA) = A$

Statement-2 $|adjA| = |A|$

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 not 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

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18. 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. o

B. $2^9 - 1$

C. 168

D. 2

Answer: A

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19. Let p be an odd prime number and T_p be the following set of 2 x 2 matrices

$$T_p = \left\{ A = \begin{bmatrix} a & b \\ c & a \end{bmatrix} \right\}, a, b, c \in \{0,1,2,..., p-1\}$$

The number of A in T_p such that A is either symmetric or skew-symmetric or both and det(A) is divisible by p is: [Note: the trace of a matrix is the sum of its diagonal entries.]

A. $(p-1)^2$

B. $2(p-1)$

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

D. $2p-1$

Answer: D

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20. Let p be an odd prime number and T_p, be the following set of 2×2 matrices $T_p = \left\{A = \begin{bmatrix} a & b \\ c & a \end{bmatrix} : a, b, c \in \{0, 1, 2, \ldots\ldots\ldots p-1\}\right\}$ 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. $(p-1)(p^2-p+1)$

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

C. $(p-1)^2$

D. $(p-1)(p^2-2)$

Answer: A

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21. Let p be an odd prime number and T_p be the following set of 2 x 2 matrices

$T_p = \left\{ A = \begin{bmatrix} a & b \\ c & a \end{bmatrix} \right\}, a, b, c \in$ {0,1,2,..., p -1}

The number of A in T_p such that A is either symmetric or skew-symmetric or both and det(A) is divisible by p is: [Note: the trace of a matrix is the sum of its diagonal entries.]

A. $2P^2$

B. $p^3 - 5p$

C. $p^3 3p$

D. $P^3 = p^2$

Answer: B

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22. Let K be a positive real number and $A = \left[2k - 12\sqrt{k}2\sqrt{k}2\sqrt{k}1 - 2k - 2\sqrt{k}2k - 1\right] and B = \left[02k - 1\sqrt{k}1 - 2k$. 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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23. 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. 5

B. 6

C. atleast 7

D. less then 4

Answer: C

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24. Let A be a 2×2 matrix with non-zero entries and let A^2=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 true, Statement - 2 is true, Statement -2 is not a correct explanation for Statement-1

B. Statement-1 is true, Statement-2 is false

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

D. Statement -1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1

Answer: B

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25. Let $M and N$ be two 3×3 non singular skew-symmetric matrices such that $MN = NM$. If P^T denote the transpose of P, then $M^2 N^2 (M^T N^{-1})^T$ 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

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26. 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 (A) 0 (B) 12 (C) 7 (D) 6

A. 0

B. 12

C. 7

D. 6

Answer: D

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27. Let a,b, and c be three real numbers satistying $[a, b, c]\begin{bmatrix}1 & 9 & 7\\ 8 & 2 & 7\\ 7 & 3 & 7\end{bmatrix} = [0, 0, 0]$ 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 vlaue 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

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28. Let a,b, and c be three real numbers satistying $[a, b, c]\begin{bmatrix}1 & 9 & 7\\8 & 2 & 7\\7 & 3 & 7\end{bmatrix} = [0, 0, 0]$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) oo

A. 6

B. 3

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

D. ∞

Answer: B

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29. 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 $a, b, andc$ 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

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30. Let M be a 3×3 matrix satisfying $M[010] = M[1-10] = [11-1], andM[111] = [0012]$ Then the sum of the diagonal entries of M is ________.

A.

B.

C.

D.

Answer:

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31. Let A and B are 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 true, Statement - 2 is true, Statement -2 is not a correct explanation for Statement-1

B. Statement-1 is true, Statement-2 is false

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

D. Statement -1 is true, Statement-2 is true, Statement-2 is a correct explanation for Statement-1

Answer: A

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

A. 2^{11}

B. 2^{12}

C. 2^{13}

D. 2^{10}

Answer: C

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33. If P is a 3×3 matrix such that $P^T = 2P + I$, where P^T is the transpose of P and I is the 3×3 identity matrix, then there exists a column matrix, $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \neq \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ such that

A. $PX = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

B. $PX = X$

C. $PX = 2X$

D. $PX = -X$

Answer: D

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34. If the adjoint of a 3 3 matrix P is 1 4 4 2 1 7 1 1 3 , then the possible value(s) of the determinant of P is (are) (A) 2 (B) 1 (C) 1 (D) 2

A. -2

B. -1

C. 1

D. 2

Answer: A::D

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

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

B. $\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$

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

D. $\begin{pmatrix} -1 \\ 1 \\ -1 \end{pmatrix}$

Answer: B

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36. Let P and Q be 3×3 matrices with $P \ne Q$. 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. 0

B. -1

C. -2

D. 1

Answer: A

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37. 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. 11

B. 5

C. 0

D. 4

Answer: A

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38. For 3×3 matrices $MandN$, which of the following statement (s) is (are) NOT correct ? $N^T MN$ 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. $N^T MN$ is symmetric or skew-symmetric, according as M is symmetric of skew-symmetric

B. $MN - NM$ is skew-symmetric 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 invertible matrices M and N

Answer: C::D

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39. Let ω be a complex cube root of unity with $\omega \neq 1andP = [p_{ij}]$ be a $n \times n$ matrix withe $p_{ij} = \omega^{i+j}$. Then $p^2 \neq O, whe \cap =$ a.57 b. 55 c. 58 d. 56

A. 55

B. 56

C. 57

D. 58

Answer: A::B::D

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

A. B^{-1}

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

C. $I + B$

D. I

Answer: D

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41. Let M be a 2×2 symmetric matrix with integer entries.

Then , M is invertible, if

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 first 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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42. 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 $(m^2 + MN^2) \geq 1$

D. for a 3×3 matrix U if $(M^2 + MN^2)U$ equals the zero matrix, then U is the zero matrix

Answer: A::B

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43. If $A = [12221 - 2a2b]$ 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 :

(1) $(2, \ -1)$ (2) $(-2, 1)$ (3) (2, 1) (4) $(-2, \ -1)$

A. (2, 1)

B. (-2, -1)

C. $(2, \ -1)$

D. $(-2, 1)$

Answer: B

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44. 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.$Y^3 Z^4 Z^4 Y^3$ b. $x^{44} + Y^{44}$ c. $X^4 Z^3 - Z^3 X^4$ d. $X^{23} + Y^{23}$

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

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

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

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

Answer: C::D

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45. If $A = [5a - b32]$ and A adj $A = \forall^T$, then $5a + b$ is equal to: (1) -1

(2) 5 (3) 4 (4) 13

A. 5

B. 13

C. 4

D. -1

Answer: A

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46. Let $p = \begin{bmatrix} 3 & -1 & -2 \\ 2 & 0 & \alpha \\ 3 & -5 & 0 \end{bmatrix}$, where $\alpha \in \mathbb{R}$. Suppose $Q = [q_{ij}]$ is a matrix 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. $\det(padj(Q)) = 2^9$

D. $\det(Qadj(P)) = 2^{13}$

Answer: B::C

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47. let

$z = \frac{-1 + \sqrt{3i}}{2}$, $where i = \sqrt{-1}$ and $r, s \varepsilon P1, 2, 3 \}$. $Let P = \Big[\begin{matrix} (-z)^r \\ z^{2s} \end{matrix}$ $\begin{matrix} z \\ z \end{matrix}$

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

A. $\frac{1}{2}|a-b|$

B. $\frac{1}{2}|a+b|$

C. $|a-b|$

D. $|a+b|$

Answer: A

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48. 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 $Q=[qij]$ 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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49. if $A = \begin{bmatrix} 2 & -3 \\ -4 & 1 \end{bmatrix}$ then $\left(3A^2 + 12A\right) = ?$

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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