MATHS

BOOKS - MCGROW HILL EDUCATION MATHS (HINGLISH)

MATRICES

Solved Examples

1. The number of 2×2 matrices $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ for which $\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \begin{bmatrix} \frac{1}{a} & \frac{1}{b} \\ \frac{1}{c} & \frac{1}{d} \end{bmatrix}, (a, b, c, d \in R)$ is

A. 0

B. 1

C. 2

D. infinite

Answer: A

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2. Let A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}, a, b, c, d \in R$

If $A^5 = A^3 + I$ then A is

A. a symmetric matrix

B. a skew symmetric matrix

C. an invertible matrix

D. none of these

Answer: C

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3. Let A and B be two 3×3 invertible matrices . If A + B = AB then

A. $A^{-1} + B^{-1} = O$

B. $A^{-1} + B^{-1} = B^{-1}A^{-1}$

C. $I - A^{-1}$ is invertible

D. $B^{-1} + I$ is invertible

Answer: c

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4. Let A be a 3×3 matrix and $S = \left\{ \begin{pmatrix} x \\ y \\ z \end{pmatrix} x, y, z, \in R \right\}$

Define $f: S \to S$ by

$f\begin{pmatrix} x \\ y \\ z \end{pmatrix} = A\begin{pmatrix} x \\ y \\ z \end{pmatrix}$

Suppose $f\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \Rightarrow x = y = z = 0$ Then

A. f is one - to - one

B. f cannot be onto

C. A is not invertible

D. A=O

Answer: A

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5. Let A = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ where a,b,c,d $\in$ R .

If $|a|, |b|, |c|, |d| \leq$ where $k > 0$ then

A. det (A) $\geq 2\hat{k}$

B. det (A) $\geq k^2$

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

D. det (A) $\leq k$

Answer: C

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6. Let A $= \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ where a,b,c,d $\in$ R . Then

A. det (A) $\leq \sqrt{a^2 + b^3}\sqrt{c^3 + d^2}$

B. det(A) $\leq (a + b)(c + d)$

C. det(A) $< \quad = ac + bd$

D. det (A) $\leq (|a| - |b|)(|c| - |d|)$

Answer: A

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7. Let A be a $3x3$ matrix such that $|A| = -2,$ then $\det(-2A^{-1}) =$
-4 (b) 4 (c) 8 (d) none of these

A. 4

B. -4

C. 8

D. -2

Answer: A

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8. For $1 \leq i, j \leq 3$ let

$a_{ij} = \int_{-\pi/2}^{\pi/2} \cos(ix)\cos(jx)dx$ and let $A = (a_{ij})_{3 \times 3}$. Then

A. A is a singular matrix

B. AX = B has a unique solution for every 3×3 matrix B

C. A is a skew symmetric matrix

D. $A^2 = I$

Answer: B

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9. The number of values of λ for which there exist a non -zero 3×3 matrix A such that $A = \lambda A$ is

A. 0

B. 1

C. 2

D. infinite

Answer: C

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10. Let A = $\begin{bmatrix} 1 & a \\ 0 & 1 \end{bmatrix}$ where $a > 0$. Sum of the series S = trace (A) + trace $\left(\frac{1}{2}A\right) + trace\left(\frac{1}{2^2}A^2\right) + trace\left(\frac{1}{2^3}A^3\right) + \cdots$ is

A. 3

B. 4

C. 6

D. 8

Answer: B

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Solved Examples Level 1 Single Correct Answer Type Questions

1. If $\begin{bmatrix} 1 & 4 \\ 2 & 0 \end{bmatrix}$ = $\begin{bmatrix} x & y^2 \\ z & 0 \end{bmatrix}$ $y < 0$ then x-y+z is equal to

A. 5

B. 2

C. 1

D. -3

Answer: A

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2. If A = [1,-2,3] B = $\begin{bmatrix} 2 \\ -3 \\ -1 \end{bmatrix}$ then AB is equal to

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

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

C. [2,6-3]

D. none of these

Answer: D

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3. If A = $\begin{bmatrix} -i & 0 \\ 0 & i \end{bmatrix}$ then A ' A is equal to

A. I

B. $-i$A

C. $-I$

D. iA

Answer: C

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4. If $A(\alpha) = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$ then $A(\alpha)A(\beta)$

A. $A_{\alpha+\beta}$

B. $A_{\alpha\beta}$

C. $A_{\alpha-\beta}$

D. none of these

Answer: A

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5. Let $A and B$ be two 2×2 matrices. Consider the statements $AB = OA + O$ or $B = O$ $AB = I_2 A = B^{-1}$ $(A+B)^2 = A^2 + 2AB + B^2$ (i) and (ii) are false, (iii) is true (ii) and (iii) are false, (i) is true (i) is false (ii) and, (iii) are true (i) and (iii) are false, (ii) is true

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

B. (i) and (iii) are fase (ii) is true

C. (i) and (ii) are false (iii) is true

D. (ii) and (iii) are fase (i) is true

Answer: B

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6. If $A-2B=[1537]and2A-3B=[-2507]$ the matrix $B=$ $[-4-5-6-7]$ (b) $[06-37]$ $[2-132]$ (d) none of these

A. $\begin{bmatrix}-4 & -5\\ -6 & -7\end{bmatrix}$

B. $\begin{bmatrix}0 & 6\\ -3 & 7\end{bmatrix}$

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

D. $\begin{bmatrix}6 & -1\\ 0 & 1\end{bmatrix}$

Answer: A

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7. If A and B two are 3×3 matrices then which one of the following is not true:

A. (A+B) = A + B

B. (AB) = A' B'

C. det (AB)= det (A) det (B)

D. A (adj A) = $|A| I_3$

Answer: B

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8. If A = $\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$ then

A. A is an orthogonal matrix

B. A is a symmetric matrix

C. A is a skew -symmetric matrix

D. none of these

Answer: A

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9. If $A = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$ and $\mathrm{B} = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}$ then the product AB is equal to

A. O

B. A

C. B

D. I

Answer: A

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10. If A is an invertible matrix and B is an orthogonal matrix of the order same as that of A then $C = A^{-1}BA$ is

A. an orthogonal matrix

B. symmetric matrix

C. skew symmetric matrix

D. none of these

Answer: D

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11. Prove that the product of the matrices $\begin{bmatrix} \cos^2\alpha & \cos\alpha\sin\alpha \\ \cos\alpha\sin\alpha & \sin^2\alpha \end{bmatrix}$ and $\begin{bmatrix} \cos^2\beta & \cos\beta\sin\beta \\ \cos\beta\sin\beta & \sin^{\beta} \end{bmatrix}$ is the null matrix when α and β differ by an odd multiple of $\frac{\pi}{2}$.

A. null matrix

B. unit matrix

C. diagonal matrix

D. orthogonal matrix

Answer: A

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12. If $\begin{bmatrix} 2 & 1 \\ 7 & 4 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then matrix A equals

A. $\begin{bmatrix} 7 & 5 \\ -11 & -8 \end{bmatrix}$

B. $\begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$

C. $\begin{bmatrix} 7 & 1 \\ 34 & 5 \end{bmatrix}$

D. $\begin{bmatrix} 5 & 3 \\ 13 & 8 \end{bmatrix}$

Answer: A

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13. The matrix A satisfying $A\begin{bmatrix}1 & 5 \\ 0 & 1\end{bmatrix} = \begin{bmatrix}3 & -1 \\ 6 & 0\end{bmatrix}$ is

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

B. $\begin{bmatrix}3 & -16 \\ 6 & -30\end{bmatrix}$

C. $\begin{bmatrix}3 & -16 \\ 6 & 30\end{bmatrix}$

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

Answer: B

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14. If product of matrix A with $\begin{bmatrix}1 & 1 \\ 2 & 0\end{bmatrix} is \begin{bmatrix}3 & 2 \\ 1 & 1\end{bmatrix}$ then A^{-1} is given by

A. $\begin{bmatrix}0 & -1 \\ 2 & -4\end{bmatrix}$

B. $\begin{bmatrix}0 & -1 \\ -2 & -4\end{bmatrix}$

C. $\begin{bmatrix}0 & 1 \\ 2 & -4\end{bmatrix}$

D. none of these

Answer: C

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15. If A and B are two skew symmetric matrices of order n then

A. AB is a skew symmetric matrix

B. AB is a symmetric matrix

C. AB is a symetric matrix if A and B commute

D. none of these

Answer: C

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16. Which of the following statements is false :

A. If |A| =0 then |adj A| =0

B. Adjoint of a diagonal matrix of order 3×3 is a diagonal matrix

C. Product of two upper triangular matrices is a upper triangular matrix

D. adj (AB) = adj (A) adj (B)

Answer: D

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17. If A and B are symmetric matrices then $AB - BA$ is a Symmetric Matrix (b) Skew- symmetric matrix Diagonal matrix (d) Null matrix

A. symmetric matrix

B. skew - symmetric matix

C. diagonal matrix

D. null matrix

Answer: B

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18. Let A and B be two 3×3 matrices such that $A + B = 2B'$ and $3A + 2B = I$ then

A. $A - B = O$

B. $A + B = I$

C. $A - B = I$

D. $A + 2B = O$

Answer: A

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19. If A and B are two nonzero square matrices of the same order such that the product $AB = O$, then

A. Both A and B are non - singular

B. Exactly one of A ,B is singular

C. Both A and B are singular

D. Both A +B and AB are singular

Answer: C

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20. If A is skew-symmetric and $B = (I - A)^{-1}(I + A)$, then B is

A. B is orthogonal

B. B is skew symmetric

C. $B^2 = O$

D. B is a diagonal matrix

Answer: A

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21. Let $a_n = 3^n + 5^n, n \in$ N and let

$$A = \begin{pmatrix} a_n & a_{n+1} & a_{n+2} \\ a_{n+1} & a_{n+2} & a_{n+3} \\ a_{n+2} & a_{n+3} & a_{n+4} \end{pmatrix}$$ Then

A. 0 is a root of the equation det (A-xI) =0

B. det (A) =$a_n a_{n+2} a_{n+4}$

C. det (A) < 0

D. det (A) $= a_n + a_{n+2} + a_{n+4}$

Answer: A

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

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

A. 1

B. 2

C. -1

D. -2

Answer: A

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23. Suppose ABC is a triangle with sides a,b ,c and semiperimeter s. Then matric

$$A\begin{bmatrix} s & s-c \\ s(s-b)^2 & (s-a)^2(s-c) \\ s(s-c) & (s-a)^2 \end{bmatrix}_{3\times 2}\begin{bmatrix} s-a \\ s-b \end{bmatrix}_{2\times 1} - \begin{bmatrix} bc \\ ca(s-a)(s-b) \\ ab(s-a) \end{bmatrix}_{3\times 1}$$

A. $\begin{bmatrix} a \\ b \\ c \end{bmatrix}$

B. $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

C. $\begin{bmatrix} s \\ s \\ s \end{bmatrix}$

D. $\begin{bmatrix} s-a \\ s-b \\ s-c \end{bmatrix}$

Answer: B

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24. The number of matrices

$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ (where a,b,c,d $\in$ R) such that A^{-1} = -A is :

A. 0

B. 1

C. 2

D. infinite

Answer: D

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25. Let A be a 3×3 matrix with entries from the set of numbers, If the system of equations $A^2X = 0$ has a non - trivial solution then

A. AX =0 has a non trivial solution

B. AX= 0 does not have a non - trivial solution.

C. A is a non -singular matrix

D. none of these

Answer: A

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26. $A = \begin{bmatrix} a & b \\ b & -a \end{bmatrix}$ and $MA = A^{2m}$, $m \in N$ for some matrix M, then which one of the following is correct ?

A. $(a^2 + b^2)^m I$

B. $(a^2 + b^2)^{m-1} A$

C. $-(a^2 + b^2)^{m-1} A$

D. $\left(a^2+b^2\right)^m$ A

Answer: B

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27. Let $A=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a 2×2 matrix, where a, b, c, d take value 0 to 1 only. The number of such matrices which have inverses is

A. 5

B. 6

C. 7

D. 8

Answer: B

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28. Find the inverse of each of the matrices given below :

Let $D = \text{diag}[d_1, d_2, d_3]$ where none of d_1, d_2, d_3 is), prove that

$D^{-1} = \text{diag}\left[d_1^{-1}, d_2^{-1}, d_3^{-1}\right]$.

A. D

B. 2D

C. diag $\left(d_1^{-1}, d_2^{-1}, \dots. d_n^{-1}\right)$

D. Adj D

Answer: C

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29. The inverse of a symmetric matrix (if it exists) is

A. a symmetric matrix

B. a skew -symmetric matrix

C. a diagonal matrix

D. none of these

Answer: A

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

A. a symmetric matrix

B. a skew -symmetric matrix

C. a diagonal matrix

D. none of these

Answer: B

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31. The inverse of a skew symmetric matrix of odd order is a symmetric matrix a skew symmetric matrix a diagonal matrix does not exist

A. a symmetric matrix

B. a skew symmetric matrix

C. diagonal matrix

D. does not exist

Answer: D

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32. If A is an orthogonal matrix, then

A. 1

B. -1

C. ± 1

D. 0

Answer: C

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33. If A = $\begin{bmatrix} 1 & 0 & 2 \\ 5 & 1 & x \\ 1 & 1 & 1 \end{bmatrix}$ is a singular matrix then x is equal to

A. 3

B. 5

C. 9

D. 11

Answer: C

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

A. ± 1

B. ± 2

C. ± 3

D. none of these

Answer: A

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35. If a matrix A is such that $3A^3 + 2A^2 + 5A + I = 0$, then A^{-1} is equal to

A. $3A^2 + 2A + 5I$

B. $-(3A^2 + 2A + 5I)$

C. $3A^2 - 2A - 5I$

D. none of these

Answer: B

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

Answer: C

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37. If A, B, and C are three square matrices of the same order, then $AB=AC\Rightarrow B=C$. Then

A. singular

B. non -singular

C. symmetric

D. skew symmetric

Answer: B

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38. If the product of the matrix $B = \begin{bmatrix} 2 & 6 & 4 \\ 1 & 0 & 1 \\ -1 & 1 & -1 \end{bmatrix}$ with a matrix A has inverse $C = \begin{bmatrix} -1 & 0 & 1 \\ 1 & 1 & 3 \\ 2 & 0 & 2 \end{bmatrix}$ then $A^{-1} =$

A. $\begin{bmatrix} -3 & -5 & 5 \\ 0 & 9 & 14 \\ 2 & 2 & 16 \end{bmatrix}$

B. $\begin{bmatrix} -3 & 5 & 5 \\ 0 & 0 & 9 \\ 2 & 14 & 16 \end{bmatrix}$

C. $\begin{bmatrix} -3 & -5 & -5 \\ 0 & 0 & 2 \\ 2 & 14 & 6 \end{bmatrix}$

D. $\begin{bmatrix} -3 & -3 & -5 \\ 0 & 9 & 2 \\ 2 & 14 & 6 \end{bmatrix}$

Answer: C

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39. If ω is a complex cube root of unity then the matrix $A = \begin{bmatrix} 1 & \omega^2 & \omega \\ \omega^2 & \omega & 1 \\ \omega & 1 & \omega^2 \end{bmatrix}$ is a

A. singular matrix

B. non -singular matrix

C. skew symmetric matrix

D. none of these

Answer: A

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40. $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & a & 1 \end{bmatrix}, = A^{-1} = \begin{bmatrix} 1/2 & -1/2 & 1/2 \\ -4 & 3 & c \\ 5/2 & -3/2 & 1/2 \end{bmatrix}$ then find vales of a&c.

A. x=1 ,y=-1

B. x=-1 , y=1

C. x=2,y=-1/2

D. $x = 1/2, y = 1/2$

Answer: A

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41. Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a 2×2 real matrix. If $A - \alpha I$ is invertible for every real number α , then

A. $bc > 0$

B. bc =0

C. $bc > \min\left(0, \frac{1}{2}ad\right)$

D. a=0

Answer: C

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42. If A $= \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ then $A^2 - 5A$ equals

A. O

B. I

C. 2I

D. none of these

Answer: C

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43. Solve system of linear equations, using matrix method,

$xy \quad + \quad 2z \quad = \quad 7 \qquad\qquad 3x \quad + \quad 4y \qquad 5z \quad = \quad 5$

$2xy \quad + \quad 3 \quad z = \quad 12$

A. $-4, 2$

B. $-3, 3$

C. $-4, 1$

D. $-3, 1$

Answer: C

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

A. I-A

B. A-I

C. A+I

D. A

Answer: B

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45. Let $A = [1 - 1121 - 3111] and 10B = [- 422 - 50\alpha 123]$. If B is the inverse of matrix A, then $\alpha =$ 2 (b) -2 (c) 5 (d) -2

A. 2

B. -1

C. -2

D. 5

Answer: D

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46. If $A = [(a, b), (b, a0]$ and $A^2 = [(\alpha, \beta 0, (\beta, \alpha)]$ then (A) $\alpha = a^2 + b^2, \beta = ab$ (B) $\alpha = a^2 + b^2, \beta = 2ab$ (C) $\alpha = a^2 + b^2, \beta = a^2 - b^2$ (D) $\alpha = 2ab, \beta = a^2 + b^2$

A. $\alpha = a^2 + b^2 \beta = 2ab$

B. $\alpha = a^2 + b^2, \beta = a^{2 - b^2}$

C. $\alpha = 2ab, \beta = a^2 + b^2$

D. $\alpha = a^2 + b^2, \beta = -2ab$

Answer: A

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47. 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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48. If a matrix A is both symmetric and skew-symmetric, then A is a diagonal matrix (b) A is a zero matrix (c) A is a scalar matrix (d) A is a square matrix

A. A is a diagonal matrix

B. A is a scalar matrix

C. A is zero matix

D. none of these

Answer: C

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49. Let A = $\begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 5 & 2 \\ 7 & 4 \end{bmatrix}, C = \begin{bmatrix} 2 & 5 \\ 3 & 8 \end{bmatrix}$.

Let D be a matrix such that CD = AB then D equals

A. I

B. O

C. $-A$

D. none of these

Answer: D

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50. If $A^2 = A$, then $(I + A)^4$ is equal to

A. I+15 A

B. I + 7A

C. I +8A

D. I +11A

Answer: A

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51. The matrix A = $\begin{bmatrix} 0 & 0 & -7 \\ 0 & -7 & 0 \\ -7 & 0 & 0 \end{bmatrix}$ is a

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52. If $A = [35], B = [73],$ then find a non-zero matrix C such that AC=BC.

A. 0

B. 1

C. infinitely many

D. none of these

Answer: C

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53. Find the values of x, y, z if the matrix $A = [02yzxy - zx - yz]$ satisfy the equation $A'A = I$.

A. $x = \pm 1/\sqrt{6}, y = \pm 1/\sqrt{6}, z = \pm 1/\sqrt{3}$

B. $x = \pm 1/\sqrt{2}, y = \pm 1/\sqrt{6}, z = \pm 1/\sqrt{3}$

C. $x = \pm 1/\sqrt{2}, y = \pm 1/\sqrt{6}, z = \pm 1/\sqrt{3}$

D. $x = \pm 1/\sqrt{2}, y = \pm 1/3, z = \pm 1/\sqrt{2}$

Answer: B

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54. Suppose A is square matrix such that $A^3 = I$ then $(A + I)^3 + (A - I)^3 - 6A$ equals

A. I

B. 2I

C. A

D. 3A

Answer: B

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55. The number of 3×3 matrices A whose entries are either 0 or 1 and for which the system of equations $A\begin{bmatrix}x\\y\\z\end{bmatrix}=\begin{bmatrix}2\\0\\3\end{bmatrix}$ has exactly five distinct solution is

A. 0

B. 511

C. 1024

D. 5

Answer: A

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56. 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. 6

B. at least 7

C. less than 4

D. 5

Answer: B

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57. Consider the system of linear equations:

$x_1 + 2x_2 + x_3 = 3$

$2x_1 + 3x_2 + x_3 = 3$

$3x_1 + 5x_2 + 2x_3 = 1$

The system has

A. a unique solution

B. non solution

C. infinite number of solutions

D. exactly 3 solutions

Answer: B

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58. 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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59. Let P and Q be 3×3 matrices with $P \neq Q$. If $P^3 = Q^3 and P^2 Q = Q^2 P$, then determinant of $(P^2 + Q^2)$ is equal to

(1) 2 (2) 1 (3) 0 (4) 1

A. 1

B. 0

C. -1

D. -2

Answer: D

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

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

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

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

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

Answer: C

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61. 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 =O

B. PX=X

C. PX=2X

D. PX=-X

Answer: D

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62. $A = \begin{bmatrix} 4 & 3 \\ 2 & 5 \end{bmatrix}$ find x and y such that $A^2 - xA + yI = 0$

A. (-9,-14)

B. (9,-14)

C. (-9,14)

D. (9,14)

Answer: C

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63. The system of equations

$$\begin{pmatrix} 3 & -2 & 1 \\ 5 & -8 & 9 \\ 2 & 1 & a \end{pmatrix}\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} b \\ 3 \\ -1 \end{pmatrix}$$

has no solution if a and b are

A. a= -3 , b $\neq$ 1/3

B. a= 2/3 , b $\neq$ 1/3

C. a $\neq$ 1/4, b = 1/3

D. $a \neq -3, b \neq 1/3$

Answer: A

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64. Suppose $l + A$ is non-singular. Let $B = (I + A)^{-1}$ and $C = I - A$, then ....(where I, A, O are identity square and null matrices of order n respectively)

A. BC =CB

B. BC=O

C. BC=I

D. none of these

Answer: A

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65. Let A = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ be such that $A^3 = O$ but $A \neq O$ then

A. $A^2 = O$

B. $A^2 = A$

C. $A^2 = I - A$

D. none of these

Answer: A

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Solved Examples Level 2 Straight Objective Type Questions

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

A. Then there exists infinitely many B' s such that AB =BA

B. there cannot exist B such that AB=BA

C. there exist more than one but finite number of B's such that AB= BA

D. there exists exactly one B such that AB=BA

Answer: A

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2. Let $A = \begin{bmatrix} 5 & 5\alpha & \alpha \\ 0 & \alpha & 5\alpha \\ 0 & 0 & 5 \end{bmatrix}$. If $\left|A^2\right| = 25$, then $|\alpha|$ is equal to :

A. 5^2

B. 1

C. $1/5$

D. 5

Answer: C

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

A. $2n\pi \pm \frac{2\pi}{2}, n\pi I$

B. $2n\pi \pm \frac{\pi}{3}, n \in I$

C. $2n\pi \pm \frac{2\pi}{3}, n \in I$

D. $2n\pi \pm \frac{4\pi}{3}, n \in I$

Answer: B

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

$$l + A(l - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$$

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

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

C. $\begin{bmatrix} \tan\alpha & 0 \\ 0 & \tan\alpha \end{bmatrix}$

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

Answer: A

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5. If

$$P = \left[\left(\frac{\sqrt{3}}{2}, \frac{1}{20}, \left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)\right]\right], A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \text{ and } Q = PAP^T, thenP^T$$

is: (A) $\begin{bmatrix} 1 & 2005 \\ 0 & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 2005 \\ 2005 & 1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & 0 \\ 2005 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

A. $\begin{bmatrix} 1 & -2015 \\ 0 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 2015 & 1 \\ 0 & 2015 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 2015 \\ 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 2015 & 2015 \\ 0 & 2015 \end{bmatrix}$

Answer: C

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6. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}, 6A^{-1} = A^2 + cA + dI,$ then $(c, d) =$

A. (-6,11)

B. (-11,6)

C. (11,6)

D. (6,11)

Answer: A

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7. If a,b,c are non -zero then number of solutions of solutions of

$$\frac{2x^2}{a^2} - \frac{y^2}{b^2} - \frac{z^2}{c^2} = 0$$

$$-\frac{x^2}{a^2} + \frac{2y^2}{b^2} - \frac{z^2}{c^2} = 0$$

$$-\frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{2z^2}{c^2} = 0$$ is

A. 6

B. 8

C. 9

D. infinite

Answer: D

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8. If A and B are two matrices such that AB=B and BA=A , then $A^2 + B^2 =$

A. 2AB

B. 2BA

C. A+B

D. AB

Answer: C

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9. If $A = \begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ -1 & -1 & 0 \end{bmatrix}$ and $f(x) = x^2 - 5x + 6$ is any polynomial , then f(A) =

A. $\begin{bmatrix} 1 & -1 & -3 \\ -1 & -1 & -10 \\ -5 & 4 & 4 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 1 & -5 \\ -1 & -1 & 4 \\ -3 & -10 & 4 \end{bmatrix}$

C. O

D. I

Answer: A

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10. The inverse of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ a & 1 & 0 \\ b & c & 1 \end{bmatrix}$ is (A) $\begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ b & c & 1 \end{bmatrix}$ (B) $\begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ ac & b & 1 \end{bmatrix}$ (C) $\begin{bmatrix} 1 & -a & ac-b \\ -0 & 1 & -c \\ 0 & 0 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ ac-b & -c & 1 \end{bmatrix}$

A. $\begin{bmatrix} 1 & 0 & 0 \\ -a & 1 & 0 \\ ac-b & -c & 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 & 0 \\ -a & 0 & 0 \\ b & -c & 1 \end{bmatrix}$

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

D. none of these

Answer: A

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

A. A

B. A^2

C. A^3

D. A^4

Answer: C

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Solved Examples Level 2 Numercial Answer Type Questions

1. Let A = $\begin{bmatrix} 7 & 5 \\ 4 & 8 \end{bmatrix}, B = \begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$ and $C = \begin{bmatrix} 5 & -3 \\ -3 & 2 \end{bmatrix}$ then $\sum_{k=0}^{\infty} \frac{1}{3^k} tr\left\{A(BC)^k\right\}$= _____

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2. If x =α, $y = \beta$, $z = \gamma$ is a solution of the system of equations

x+y+z=4

2x-y+3z=9

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3. Suppose p,q,r $\in$ R and and pqr = 2.5 . Let

A = $\begin{bmatrix} p & q & r \\ r & p & q \\ q & r & p \end{bmatrix}$

If $\mathrm{AA} = I_3$ then maximum possible value of $p^3 + q^3 + r^3$ is

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4. Suppose A and B are two 3×3 non singular matrices such that tr (AB) = 7.57 then tr $(BA + I_3)$= _____

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5. Suppose k is a root of $x^2 - 6.1x + 5.1 = 0$ such that A $= \begin{bmatrix} 1 & 2 & 1 \\ 3 & 2 & 3 \\ 1 & 1 & k \end{bmatrix}$ is non -singular then tr (adj (A))=

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6. Let A = $\begin{pmatrix} 2.1 & 2.7 & 1.3 \\ 3.1 & 3.2 & 1.7 \\ 2.1 & 2.5 & 2.9 \end{pmatrix}$. The sum of values of x for which A - xI_3 is singular is ______

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7. If the system of linear equations

ax+(a+1)y+(a-1)z=0

(a-1)x+(a+2)y+az=0

(a+1)x+ay+(a+2)z=0

has a nontrivial solution then sum of possible values of |a| is ________

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8. Let A = $\begin{bmatrix} 3 & -1 \\ 0 & 2 \end{bmatrix}$. Suppose A satisfies the equation $x^2 + ax + b = 0$ for some real numbers a and b . Let α, β be the roots of $t^2 + at$ +b=0 then

$$\frac{1}{\alpha^2 - 3\alpha + 4} + \frac{1}{\beta^2 - 3\alpha + 4} = \_\_\_\_\_\_\_$$

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9. Let A = $\begin{bmatrix} 5.1 & -3.1 & 0 \\ -3.1 & 5.1 & 0 \\ 0 & 0 & 2.2 \end{bmatrix}$ X be a non zero 3×1 matrix and λ is a real number . If $A^2X = \lambda AX$ then sum of possible values of λ is ________

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10. A solution set of the equations $x + 2y + z = 1,\ x + 3y + 4z = k,$

$x + 5y + 10z = k^2$ is

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11. Let $\alpha = \dfrac{2k\pi}{2025}, \beta = \dfrac{2m\pi}{2026}$ and $\gamma = \dfrac{2k\pi}{2027}$ where k,m,n $\in$ Z.

$$A = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix},$$

$$B = \begin{pmatrix} \cos\beta & -\sin\beta \\ \sin\beta & \cos\gamma \end{pmatrix}$$

$$C = \begin{pmatrix} \sin\gamma & -\sin\gamma \\ \sin\gamma & \cos\gamma \end{pmatrix}$$

then det $\left(A^{2025} + B^{2026} + C^{2027}\right)$ is equal to ______

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12. Let A = $\begin{pmatrix} 1 & 2 & 3 \\ 0 & 0 & 0 \\ 3 & 2 & 1 \end{pmatrix}$ and $A^n = \begin{pmatrix} a_n & b_n & c_n \\ 0 & 0 & 0 \\ c_n & b_n & a_n \end{pmatrix} \forall n \in N,$

If $a = \lim_{n \to \infty} \frac{1}{2^{n-2}}(a_n + b_n + c_n)$ then |a+3i|= ________

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13. Let A and B be two 3×3 real matrices such that

$AB \neq BA$

$AB - B^2A^2 = I_3$

$A^3 + B^3 = O_3$.

then det $\left(BA - A^2B^2\right)$. Then |12a +5i|= _______

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14. Let A and B be two 3×3 matrices with integer entries . If 6AB +2A+3B=

O_3 then |det (3B+I_3) | is equal to ____ .

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15. Let A = $\begin{pmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{pmatrix}$ and let n be the smallest value of n $\in$ N such that $A^n = O_3$ then det $\left(I_3 + A + A^2 + \cdots + A^{n-1}\right)$ is equal to

_____ .

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16. Suppose a,b,c $\in R - \{0\}$ and a+b+c =0 Let $\alpha = \frac{1}{5}\left(a^5 + b^5 + c^5\right), \beta = \frac{1}{3}\left(a^3 + b^3 + c^3\right)$ and $\gamma = \frac{1}{2}\left(a^2 + b^2 + c^2\right)$.

Suppose $A = \begin{bmatrix} \alpha & \beta \\ \gamma & 1 \end{bmatrix}$ and a = det (A)

If $|a + ib| = 4.1$ then b^2 = ______ .

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17. Let m = the number of values of a for which the system of equations

x+2y+z=a

3x+4y+2z=a -3

4x+2y+z=4

has a solution . Let $\omega \neq 1$ be cube root of unity then |m+ω| = ____ .

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18. If A = $\begin{bmatrix} 2 & 52 & 152 \\ 4 & 106 & 358 \\ 6 & 162 & 620 \end{bmatrix}$ then det $\left(adj\left(\frac{1}{2}A\right)\right)$ is equal to ______ .

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Exercise Concept Based Single Correct Answer Type Questions

1. Let A be a 2×2 invertible matrix . For which of the following functions det (f(A)) = f (det (A)) is not true ?

A. f(x) $= x^3$

B. f(x) $= x^{-1}, x \neq 0$

C. f(x) = 1 +x

D. f(x) $= x^{-3}, x \neq 0$

Answer: C

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2. Suppose a,b,c,d $\in C$ and let A $= \begin{bmatrix} a & b \\ c & d \end{bmatrix}$. Then which one of the following is not true ?

A. $|\det(A)| \leq \ + |a| + |b| + |c| + |d|$

B. $|\det(A)| \leq (|a| + |b|)(|c| + |d|)$

C. $|\det(A)| \leq (|a| + |c|)(|b| + |d|)$

D. $|\det(A)| \leq \sqrt{|a|^2 + |b|^2}\sqrt{|c|^2 + |d|^2}$

Answer: A

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3. Let A, B be two 3×3 matrices with entries from real number . Which one of the follwing is true ?

A. $(A+B)^3 = A^3 + 3A^2B + 3AB^2 + B^3$

B. $(AB)^2 = O \Rightarrow AB = O$

C. $(A+B)(A-B) = A^2 - B^2$

D. $(A+B)A = BA + A^2$

Answer: D

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4. Suppose A and B are two 3×3 matrices with entries from complex numbers such that ABA = I. Which one the following is not true ?

A. B is invertible

B. $B^{-1} = A^2$

C. A is not invertible

D. $A^4B^2 = I$

Answer: C

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5. Let A be a 3×3 matrix with entries from the set of real numbers. Suppose the equation AX =B has a solution for every 3×1 matrix B with entries from the set of real numbers. Then

A. A'Y = B has no soluton

B. A'Y = O $\Rightarrow$ Y =O

C. AX = O has a non - trivial solution

D. A is a singular matrix

Answer: B

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6. Suppose A $= \begin{bmatrix} \cos\theta & I\sin\theta \\ I\sin\theta & \cos\theta \end{bmatrix}$ for some $\theta \in$ R. Let B,C , D be three 2×2 matrices such that AB= BC -AD then

A. C' = B' -D'

B. C+D=B

C. C'=B+D

D. none of these

Answer: C

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7. Suppose A ,B are two 3×3 matrices such that A^{-1} exists . Then $(A-B)A^{-1}(A+B)$ is equal to

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

B. $A^{-1}B+B^2$

C. $\left(I-BAB^{-1}\right)(A-B)$

D. $(I + BAB^{-1})(A + B)$

Answer: A

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8. Let A be 3×3 matrix such that A is orthogonal idempotent then

A. A must be symmetric

B. det(A) =-I

C. A +$A^{-1} = 1$

D. none of these

Answer: A

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9. If A and B are two orthogonal matrices of order n and $\det(A) + \det(B) = 0;$ then which of the following must be correct ?

A. A+B =-I

B. A+B=I

C. det (A+B) =0

D. A+B=O

Answer: C

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10. Let A = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$ where a,b,c,d $\in$ R . Ad $\neq$ 0 If (a+d) $A - A^2 = A$ then

A. a=d

B. a=d=1

C. a+d=0

D. a+d=1

Answer: B

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Exercise Level 1 Single Correct Answer Type Questions

1. $Let \quad S_k = \begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}, k \in N. Then (S_2)^n (S_x)^{-1}$(where n in N) isequal to: $(S_k)^{-1}$ denotes the inverse of matrix S_k

A. S_{2n+k}

B. S_{2n-k}

C. S_{2^n+k-1}

D. S_{2^n-k}

Answer: B

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2. Let S be the set of all 2×2 real matrices A $= \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ such that a+d=3 and A=$A^2 - 3A$. Then

A. S contains infinite number of elements

B. S=Q

C. S contains exactly two elements

D. S contains exactly 2^4 elements

Answer: B

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3. Let A = $\left(a_{ij} \_ (3 \times 2)\right)$ be a 3×2 matrix with real entries and B = AA. Then

A. B^{-1} is a 3×3 matrix

B. B^{-1} is a 2×2 matrix

C. B^{-1} does not exist

D. B^{-1} exists if and only if exactly one row of A consists of zeros

Answer: C

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4. Let A = $\left(a_{ij} \_ (3 \times 3)\right)$ be a matrix with $a_{ij} \in C$. Let B be a matrix obtained by inerchanging two columns of A . Then det (A+B) is equal to

A. det (A) +det (B)

B. 0

C. 2 det (A)

D. det(A) - det(B)

Answer: B

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5. If $I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, J = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix}$ then B equals

A. $(\cos\theta)I + (\sin\theta)J$

B. $(\sin\theta)I + (\cos\theta)J$

C. $(\cos\theta)I - (\sin\theta)J$

D. $-(\cos\theta)I + (\sin\theta)J$

Answer: A

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6. If A is both diagonal and skew - symmetric then

A. A is a symmetric matrix

B. A is a null matrix

C. A is a unit matrix

D. none of these matrix

Answer: B

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7. If $A^2 - 3A + 2I = 0$ then A^{-1} equals

A. $\frac{1}{2}(A - 3I)$

B. $\frac{1}{2}(3I - A)$

C. $(A + 3I)$

D. none of these

Answer: B

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8. If A is a square matrix of order 3 such that A^2 = 2A then $|A|^2$ is equal to

A. $2|A|$

B. $8|A|$

C. $16|A|$

D. 0

Answer: B

View Text Solution

9. If A is a squyare matrix then which one of the following is not a symmetric matrix

A. A +A'

B. AA'

C. A'A

D. A-A'

Answer: D

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10. If A = $\left(a_{ij}\right)_{3 \times 3}$ where a_{ij} = cos (i+j) then

A. A is symmetric

B. A is skew symmetric

C. A is a triangular matrix

D. A is a singular matrix

Answer: A

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11. If A $= \left(a_{ij}\right)_{3 \times}$ is a matrix satrisfying the equation $x^3 - 3x + 1 = 0$ then

A. A is a unit matrix

B. A is singular matrix

C. A is non -singular matrix

D. none of these

Answer: C

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12. Let A and B be square matrices of the same order. Does $(A+B)^2 = A^2 + 2AB + B^2$ hold? If not, why?

A. AB=BA

B. AB+BA =O

C. $|AB| \neq 0$

D. $|AB| = 0$

Answer: A

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13. If $\begin{bmatrix} I & 0 \\ 3 & -i \end{bmatrix} + X = \begin{bmatrix} I & 2 \\ 3 & 4+i \end{bmatrix}$ -X then X is equal to

A. $\begin{bmatrix} 0 & -1 \\ 3 & i \end{bmatrix}$

B. $\begin{bmatrix} 0 & 1 \\ 0 & 2+i \end{bmatrix}$

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

D. $\begin{bmatrix} I & 2 \\ 0 & 2+i \end{bmatrix}$

Answer: B

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14. If A = $\begin{bmatrix} 0 & -i \\ i & 0 \end{bmatrix} B = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ then A B+ BA is

A. null matrix

B. unit matrix

C. invertible matrix

D. none of these

Answer: A

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15. A = $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ -1 & -2 & -3 \end{bmatrix}$ then A is a nilpotent matrix of index

A. 2

B. 3

C. 4

D. 5

Answer: A

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16. If A is a 2×2 unitary matrix then |A| is equal to

A. 1

B. -1

C. ± 1

D. none of these

Answer: C

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17. If $A = \frac{1}{2}\begin{pmatrix} -1 & -\sqrt{3} \\ \sqrt{3} & -1 \end{pmatrix}$ then $A^{-1} - A^2$ is equal to a

A. null matrix

B. invertible matrix

C. unit matrix

D. none of these

Answer: A

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18. If C is a 3×3 matrix satisfying the relation $C^2 + C = I$ then C^{-2} is given by

A. 2 C

B. 3 C -I

C. C

D. 2I + C

Answer: D

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19. If A , B and C are three square matrices of the same size such that B = CAC^{-1} then CA^3C^{-1} is equal to

A. B

B. B^2

C. B^3

D. B^9

Answer: C

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20. If X is a 2×3 matrix such that $|X'X| \neq 0$ and $A = I_2 - X(X'X)^{-1}X'$, then A^2 is equal to

A. A

B. I

C. A^{-1}

D. none of these

Answer: A

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21. The matrix A $= \begin{pmatrix} p & -q \\ q & p \end{pmatrix}$ is orthogonal if and only if

A. $p^2 + q^2 = 1$

B. $p^2 = q^2$

C. $p^2 = q^2 + 1$

D. none of these

Answer: A

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22. The values of λ for which the matrix A = $\begin{pmatrix} \lambda & 0 & \lambda \\ \lambda & 0 & -\lambda \\ 0 & 1 & 0 \end{pmatrix}$ is orthogonal is

A. ± 1

B. $\pm 1/\sqrt{2}$

C. $\pm 1/2$

D. $\pm 1/\sqrt{2}$

Answer: D

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23. The values of a for which the matrix

$$A=\begin{pmatrix} a & a^2-1 & -3 \\ a+1 & 2 & a^2+4 \\ -3 & 4a & -1 \end{pmatrix}$$ is symmetric are

A. -1

B. -2

C. 3

D. 2

Answer: D

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24. Let $A_t = \begin{pmatrix} 1 & 3 & 2 \\ 2 & 5 & t \\ 4 & 7-t & -6 \end{pmatrix}$ then the values (s) of t for which inverse of A_t does not exist.

A. $-2, 1$

B. 3,2

C. 2,-3

D. 3,-1

Answer: C

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

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

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

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

D. none of these

Answer: C

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26. If $A = \begin{bmatrix} \frac{1}{2}\left(e^{ix}+e^{-ix}\right) & \frac{1}{2}\left(e^{ix}-e^{-ix}\right) \\ \frac{1}{2}\left(e^{ix}-e^{-ix}\right) & \frac{1}{2}\left(e^{ix}+e^{-ix}\right) \end{bmatrix}$ then A^{-1} exists

A. for all real x

B. for positive real x only

C. for negative real x only

D. none of these

Answer: A

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27. If A= $\begin{bmatrix} ab & b^2 \\ -a^2 & -ab \end{bmatrix}$ then A^2 is equal

A. O

B. I

C. $-I$

D. none of these

Answer: A

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28. If A is 2×2 matrix such that A^2 =O then tr (A) is

A. 1

B. -1

C. 0

D. none of these

Answer: C

View Text Solution

29. If A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ such that A satisfies the relation $A^2 - (a+d)A = O$ then inverse of A is

A. I

B. A

C. (a+d)A

D. none of these

Answer: D

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30. If A = $\begin{bmatrix} 3 & 2 \\ 0 & 1 \end{bmatrix}$ then A^{-3} is

A. $\frac{1}{27}\begin{bmatrix}1 & -26 \\ 0 & -27\end{bmatrix}$

B. $\frac{1}{27}\begin{bmatrix}-1 & -26 \\ 0 & -27\end{bmatrix}$

C. $\frac{1}{27}\begin{bmatrix}1 & -26 \\ 0 & 27\end{bmatrix}$

D. $\frac{1}{27}\begin{bmatrix}-1 & 26 \\ 0 & -27\end{bmatrix}$

Answer: C

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31. If A is a skew Hermitian matrix then the main diagonal elements of A are all

A. purely real

B. positive

C. negative

D. purely imaginary

Answer: D

View Text Solution

32. If A $= \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ and AA' =I , then x+y is equal to

A. O

B. I

C. A

D. A^2

Answer: A

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33. If 3A = $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ x & 2 & y \end{bmatrix}$ and A'A =I then x+y is equal to

A. -3

B. -2

C. -1

D. 0

Answer: A

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34. If the system of equations ax +y=3,x+2y=3 , 3x+4y=7 is consistent then value of a is given by

A. 2

B. 1

C. -1

D. 0

Answer: A

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35. If the system of equations $x+2y-3z=1, (P+2)z=3, (2P+1)y+z=2$ is inconsistent then the value of P is

A. -2

B. $-1/2$

C. 0

D. 2

Answer: A

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36. 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

Answer: A

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

A. -1

B. 2

C. 3

D. none of these

Answer: D

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38. If A and B are two square matrices of the same order then which of the following is true.

A. (AB)'= A'B'

B. (AB)'=B'A'

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

D. none of these

Answer: B

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39. Value of $'\alpha'$ for which system of equations $x+y+z=1, x+2y+4z=\alpha$ and $x+4y+10z=\alpha^2$ is consistent, are 1 (b) 3 (c) 2 (d) 0

A. 1,-2

B. $-1, 2$

C. 1,2

D. none of these

Answer: C

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40. The system of homogenous equations

$tx + (t+1)y + (t-1)z = 0,$ $(t+1)x + ty + (t+2)z = 0,$

$(t-1)x + (t+2)y + tz = 0$ has a non trivial solution for

A. three values of t

B. two values of t

C. one value of t

D. infinite number of values of t

Answer: C

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41. 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| $\neq 0 \Rightarrow |B| \neq 0$

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

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

Answer: D

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42. If $A = \begin{pmatrix} i & -i \\ -i & i \end{pmatrix}$ and $B = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ then A^8 equals

A. 128 B

B. 32 B

C. 16 B

D. 64 B

Answer: A

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43. If A = $\begin{pmatrix} 2 & 3-i & -i \\ 3+i & \pi & 7+i \\ i & 7-i & e \end{pmatrix}$ then A is

A. symmetric

B. Hermitian

C. skew Hermitian

D. none of these

Answer: B

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Exercise Level 2 Single Correct Answer Type Questions

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

A. a=b=1

B. $a = \cos 2\theta, b = \sin 2\theta$

C. $a = \sin 2\theta, b = \cos 2\theta$

D. $a = 1, b = \sin 2\theta$

Answer: B

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2. If a,b,c $\neq$ 0 and a+b+c=0 then the matrix

$$\begin{bmatrix} 1+\frac{1}{a} & 1 & 1 \\ 1 & 1+\frac{1}{b} & 1 \\ 1 & 1 & 1+\frac{1}{c} \end{bmatrix}$$ is

A. singular

B. non -singular

C. skew -symmetric

D. orthogonal

Answer: B

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3. Suppose matrix A satisfies the equation $A^2 - 5A + 7I = O$. If $A^8 = aA + bI$ then value of a is

A. 1265

B. 2599

C. -2599

D. 0

Answer: A

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4. If α, β, γ are three real numbers and

$$A = \begin{bmatrix} 1 & \cos(\alpha - \beta) & \cos(\alpha - \gamma) \\ \cos(\beta - \alpha) & 1 & \cos(\beta - \gamma) \\ \cos(\gamma - \alpha) & \cos(\gamma - \beta) & 1 \end{bmatrix}$$

then whichof following is/are true ?

A. A is singular

B. A is non -singular

C. A is orthogonal

D. noone of these

Answer: A

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5. Let A$(\theta) = \begin{pmatrix} \sin\theta & i\cos\theta \\ i\cos\theta & \sin\theta \end{pmatrix}$, then

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

B. $A(\theta)^{-1} = A(\pi - \theta)$

C. $A(\theta)^{-1}$ does not exist

D. $A(\theta)^2 = A(2\theta)$

Answer: B

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6. 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. $A^n B = B^n A$

D. $A^n B^n = B^n A^n$

Answer: C

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7. Let $A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$. Find the sum of all the value of λ for which there exists a column vertor $X \neq 0$ such that $AX = \lambda X$.

A. 0

B. 1

C. 2

D. 3

Answer: D

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8. Let a,b,c $\in$ R be such that a+b+c $>$ 0 and abc = 2 . Let

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

If $A^2 = I$ then value of $a^3 + b^3 + c^3$ is

A. 7

B. 2

C. 0

D. -1

Answer: A

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9. If A is a 3×3 skew -symmetric matrix with real entries and trace of A^2 equals zero then

A. A=O

B. 2A=I

C. A is orthogonal

D. none of these

Answer: A

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10. Suppose A and B are two 3×3 non -singular matrices such that

$(AB)^k = A^k B^k$

for k = 2015,2016, 2017 then

A. AB = O

B. BA=O

C. AB=BA

D. AB+BA =O

Answer: C

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11. Let A be a square matrix of order 3 such that $|AdjA| = 100$ then |A| equals

A. ± 10

B. -100

C. 100

D. 25

Answer: A

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12. Let M be a 3×3 matrix satisfying $M\begin{bmatrix}0\\1\\0\end{bmatrix} = \begin{bmatrix}-1\\2\\3\end{bmatrix}, M\begin{bmatrix}1\\-1\\0\end{bmatrix} = \begin{bmatrix}1\\1\\1\end{bmatrix} = \begin{bmatrix}0\\0\\12\end{bmatrix}$ then the sum of the diagonal entries of M is

A. 0

B. -3

C. 6

D. 9

Answer: D

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13. If A , B and A+B are non -singular matrices then

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

A. O

B. I

C. A

D. B

Answer: B

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14. If A+B is a non -singular matrix then

A-B -$A(A+B)^{-1}A+B(A+B)^{-1}B$ equals

A. O

B. I

C. A

D. B

Answer: A

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15. If A and B are two matrices such that A+B =AB , then

A. A=I

B. B=I

C. AB=BA

D. AB=I

Answer: C

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16. Let $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ such that $A^3 = 0,$ then $a + d$ equals

A. ad

B. bc

C. 1

D. 0

Answer: D

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17. Let A $= \begin{pmatrix} 0 & x & 0 \\ y & 0 & -x \\ 0 & y & 0 \end{pmatrix}$ then A^3 equals

A. O

B. $x^2 I$

C. $(x^2 + y^2) I$

D. none of these

Answer: A

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Exercise Numerical Answer Type Questions

1.

$$A = \begin{pmatrix} 2.1 & 2.5 & 3.7 \\ -2.1 & 5.9 & 3.8 \\ 0 & -2.9 & -3 \end{pmatrix}, B = \begin{pmatrix} \cos\alpha & \sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & -1 \end{pmatrix}, C = \begin{pmatrix} \cos\alpha \\ -\sin\alpha \\ 0 \end{pmatrix}$$

then $\sum_{k=0}^{\infty} \frac{1}{3^k} tr\left(A(BC)^k\right) =$ _______

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2. Sum of the values of t $\in$ C for which the matrix $\begin{pmatrix} 1+t & 3 & 2 \\ 2 & 5 & t \\ 4 & 7-t & -6 \end{pmatrix}$ has no inverse is ______ .

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3. If the system of linear equations given by

x+y+z=3

2x+y-z=3

x+y-z=1

is consistent and if (α, β, γ) is a solution then $2\alpha + 2\beta + \gamma$ = _____

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4. Suppose A and B are two 3×3 matrices then det [(A-A) + (B-B)] = ______

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5. If the system of linear equations

x+2ky+3z=0

3x+2ky-2z=0

2x+4y -3z=0 has a non -zero solution (x,y,z) then $\left|\frac{yz}{2x^2}\right| =$ ____

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6. Suppose (α, β, γ) lie on the plane 2x+y+z=1 and $[\alpha, \beta, \gamma]\begin{bmatrix}1 & 9 & 1\\ 7 & 2 & 1\\ 8 & 3 & 1\end{bmatrix} = [0, 0, 0]$ then $\alpha + \beta^2 + \gamma^2$ = ____

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7. Let A = $\begin{bmatrix}-1 & 2 & 0\\ 3 & 1 & 5\\ -1 & 2 & -1\end{bmatrix}$ then det $\left(\frac{1}{10}adj(adjA)\right) =$ _____

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8. Suppose p , q,r $\in$ R pqr $\neq$ 0. Let A= $\begin{pmatrix}0 & 2q & r\\ p & q & -r\\ p & -q & r\end{pmatrix}$

If AA = $4.41I_3$ then r^2 =_______

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9. Suppose a $\in$ R and $a \neq 0$. Let

$$P = \begin{bmatrix} 1 & 0 & 0 \\ a & 1 & 0 \\ a^2 & a & 1 \end{bmatrix} \text{ and } Q = (a_{ij})$$

be 3×3 matrices such that $Q - P^5 = I_3$. If $\frac{q_{21} + q_{31}}{q_{32}} = 12.1$ then a = _____

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10. Suppose

$$\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} \cdots \begin{bmatrix} 1 & n \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 91 \\ 0 & 1 \end{bmatrix}$$ then n= ______

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11. Let A be a 2×2 matrix such that

$\det\left(A^2 + 4I_2\right) = 0$ then

det(A) + tr(A)= _____

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12. Suppose a ,b,c ≥ 0 and

$$\frac{(a+1)(b+1)}{(a+2)(b+2)}+\frac{(b+1)(c+1)}{(b+2)(c+2)}+\frac{(c+1)(a+1)}{(c+2)(a+2)}=\frac{3}{4}$$ then det $\left[\begin{pmatrix} a & b \\ c & a \end{pmatrix}\begin{pmatrix} b & c \\ a & b \end{pmatrix}\begin{pmatrix} c & a \\ b & c \end{pmatrix}\right]=$ ____

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13. Let A = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$,a,b,c,d $\in$ R , a+d $\neq$ 4 . If A satisfies $A^2-4A+3I_2=O_2$ then bc is equal to _____ .

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14. Suppose $\sum_{n=1}^{\infty}\frac{1}{(n+2)\sqrt{n}+n\sqrt{n+2}}=\frac{\sqrt{b}+\sqrt{c}}{\sqrt{a}}$ where a,b,c $\in$ N and A = $\begin{pmatrix} \sqrt{a} & b \\ c & \sqrt{a} \end{pmatrix}$ then $\frac{\det(A)}{bc}$ is equal to ___

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15. Suppose A = $\left(a_{ij}\right)_{3\times3}$ be a symmetric matrix . If $S=\left\{a_{ij}1\leq I,j\leq3\right\}$ then S can contain at most ________ distinct number of elements .

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16. Let A =$\begin{pmatrix}a & b\\ c & d\end{pmatrix}$,a,b,c,d ∈ R . Suppose there exists $x_1,x_2\in Cx_1,x_2\neq0$ such that $(A-3.1il_2)\begin{pmatrix}x_1\\ x_2\end{pmatrix}=O_2$ then det (A) is equal to ______ .

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17. Let A be an upper triangular 3×3 real matrices such that det (A) =0 det (A+2.1I_3) =0 and det $(A-3.2I_3)$ =0 then tr (A) is equal to __________ .

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18. Let A and B be two 3×3 real matrices such that AB = BA and det $(A^2 + AB + B^2) = 0$. If $\omega \neq 1$ is a cube root of unity then det $(A - \omega^2 B)$ is equal to ______ .

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19. Let A = $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$,a,b,c,d $\in$ R , a+d $\neq$ 7.

If n is the number of matrices A satisfying the equation $A^2 - 7A + 12I_2 = O_2$ then 6.31 +n is equal to _____ .

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20. Let A be a 3×3 matrix such that $(A - 2.2I_3)(A - 3.8I_3) = O_{3 \times 3}$ then trace of A+ $8.36A^{-1}$ is _______

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Questions From Previous Years Aieee Jee Main Papers

1. If $A = [(a, b), (b, a0]$ and $A^2 = [(\alpha, \beta 0, (\beta, \alpha)]$ then (A) $\alpha = a^2 + b^2, \beta = ab$ (B) $\alpha = a^2 + b^2, \beta = 2ab$ (C) $\alpha = a^2 + b^2, \beta = a^2 - b^2$ (D) $\alpha = 2ab, \beta = a^2 + b^2$

A. $\alpha = a^2 + b^2 \beta = 2ab$

B. $\alpha = a^2 + b^2, \beta = a^{2 - b^2}$

C. $\alpha = 2ab, \beta = a^2 + b^2$

D. $\alpha = a^2 + b^2, \beta = -2ab$

Answer: A

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2. Let $A = \begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$. The only correct statement aboul the matrix A is

A. A^{-1} does not exist

B. A =(-1) I where I is a unit matrix

C. A is a zero matrix

D. $A^2 = I$

Answer: D

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

A. 2

B. -1

C. -2

D. 5

Answer: D

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4. Let A be a square matrix such that $A^2 - A + I = O$, then write A^{-1} in terms of A.

A. A-I

B. I-A

C. A+I

D. A

Answer: B

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5. 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. $A^n = nA - (n-I)I$

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

D. $A^n = (2n-1)A - (n-1)I$

Answer: C

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6. 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. either A or B is an identity matrix

B. A=B

C. AB=BA

D. either A or B is a zero matrix

Answer: C

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

A. there exist infinitely many B' s such that AB=BA

B. there cannot exist B such that AB=BA

C. there exist more than one but finite number of B's such that AB= BA

D. there exists exactly one B such that AB=BA

Answer: A

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8. Let $A=\begin{bmatrix}5 & 5\alpha & \alpha\\ 0 & \alpha & 5\alpha\\ 0 & 0 & 5\end{bmatrix}$. If $\left|A^2\right|=25$, then $|\alpha|$ is equal to :

A. 5^2

B. 1

C. $1/5$

D. 5

Answer: C

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9. 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.

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10. Let A be a 2×2 matrix

Statement -1 adj $(adjA) = A$

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

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11. Let A be a 2×2 matrix with non-zero entries and let $A^2 = I$, where I is 2×2 identity matrix. Define Tr(A) = sum of diagonal elements of A and |A| = determinant of matrix A. Statement-1: $Tr(A) = 0$ Statement-2: $|A| = 1$ (1) Statement-1 is true, Statement-2 is true; Statement-2 is not the correct explanation for Statement-1 (2) Statement-1 is true, Statement-2 is false (3) Statement-1 is false, Statement-2 is true (4) Statement-1 is true, Statement-2 is true; Statement-2 is the correct explanation for Statement-1

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12. 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. 6

B. at least 7

C. less than 4

D. 5

Answer: B

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13. Consider the system of linear equations:

$x_1 + 2x_2 + x_3 = 3$

$2x_1 + 3x_2 + x_3 = 3$

$3x_1 + 5x_2 + 2x_3 = 1$

The system has

A. a unique solution

B. no solution

C. infinite number of solutions

D. exactly 3 solutions

Answer: B

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14. The number of values of k for which the linear equations $4x + ky + 2z = 0$ $kx + 4y + z = 0$ $2x + 2y + z = 0$ posses a non-zero solution is : (1) 3 (2) 2 (3) 1 (4) zero

A. 0

B. 3

C. 2

D. 1

Answer: C

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15. If $\omega = 1$ is the complex cube root of unity and matrix $H = \begin{vmatrix} \omega & 0 \\ 0 & \omega \end{vmatrix}$,

then H^{70} is equal to:

A. O

B. $-H$

C. H^2

D. H

Answer: D

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16. If the trivial solution is the only solution of the system of equations $x - ky + z = 0, kx + 3y - kz = 0, 3x + y - z = 0$ Then the set of all values of k is:

A. R-{2,-3)

B. R-{2}

C. R-{-3}

D. {2,-3}

Answer: A

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

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

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

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18. Let P and Q be 3×3 matrices with $P \neq Q$. If $P^3 = Q^3 and P^2 Q = Q^2 P$, then determinant of $(P^2 + Q^2)$ is equal to

(1) 2 (2) 1 (3) 0 (4) 1

A. 1

B. 0

C. -1

D. -2

Answer: B

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

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

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

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

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

Answer: C

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

A. 11

B. 5

C. 0

D. 4

Answer: A

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21. The number of values of k, for which the system of equations $(k+1)x+8y=4k\ kx+(k+3)y=3k-1$ has no solution, is (1) 1 (2) 2 (3) 3 (4) infinite

A. 1

B. 2

C. 3

D. infinite

Answer: A

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22. If the system of linear equations $x_1+2x_2+3x_3=6, x_1+3x_2+5x_3=9, 2x_1+5x_2+ax_3=b$, is consistent and has infinite number of solutions, then :-

A. a = 8 ,b can be any real number

B. b= 15 a can be any real number

C. a = $\in$ R - {8} and b $\in$ R - {15}

D. a=8 ,b=15

Answer: D

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23. If p, q, r are 3 real number satisfying the matrix equation, $[pqr]\begin{bmatrix}3 & 4 & 1 \\ 3 & 2 & 3 \\ 2 & 0 & 2\end{bmatrix} = [3, 0, 1]$ then $2p + q - r$ equals

A. -3

B. -1

C. 4

D. 2

Answer: A

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24. Consider the system of equations : $x+ay=0, y+az=0$ and $z+ax=0$. Then the set of all real values of 'a' for which the system has a unique solution is :

A. R-{1}

B. R-{-1}

C. {1,-1}

D. {1,0,-1}

Answer: B

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25. let A $=\left\{\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} : a_{ij}\{0, 1, 2\} \text{ and } a_{11} = a_{22}\right\}$

then the number of singular matrices in set A is

A. 27

B. 24

C. 10

D. 20

Answer: D

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26. The matrix $A^2 + 4A - 5I$, where I is identity matrix and $A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$ equals : (A) $32\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$ (B) $4\begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$ (C) $4\begin{bmatrix} 0 & -1 \\ 2 & 2 \end{bmatrix}$ (D) $32\begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$

A. $4\begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$

B. $4\begin{bmatrix} 0 & -1 \\ 2 & 2 \end{bmatrix}$

C. $32\begin{bmatrix} 2 & 1 \\ 2 & 0 \end{bmatrix}$

D. $32\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$

Answer: A

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27. Let A be a 2×2 matrix with non-zero entries and let $A^2 = I$, where I is 2×2 identity matrix. Define Tr(A) = sum of diagonal elements of A and |A| = determinant of matrix A. Statement-1: $Tr(A) = 0$ Statement-2: $|A| = 1$ (1) Statement-1 is true, Statement-2 is true; Statement-2 is not the correct explanation for Statement-1 (2) Statement-1 is true, Statement-2 is false (3) Statement-1 is false, Statement-2 is true (4) Statement-1 is true, Statement-2 is true; Statement-2 is the correct explanation for Statement-1

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28. 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. I

B. B^{-1}

C. (B^{-1})

D. I+B

Answer: A

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29. If B is a 3×3 matrics such that $B^2 = 0$ then $\det\left[(1+B)^{50} - 50B\right] = 0$

A. 1

B. 2

C. 3

D. 50

Answer: A

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30. Let a be a 3×3 matric such that

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

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

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

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

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

Answer: A

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31. If $A = \begin{bmatrix} 1 & 2 & x \\ 3 & -1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} y \\ x \\ 1 \end{bmatrix}$ be such that $AB = \begin{bmatrix} 6 \\ 8 \end{bmatrix}$, then

A. y=2 x

B. y=-2x

C. y=x

D. y=-x

Answer: A

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32. Let A and B be any two 3×3 matrices . If A is symmetric and B is skew -symmetric then the matrix AB-BA is :

A. skew -symmetric

B. symmetric

C. neither symmetric nor skew -symmetric

D. I or -I where -I is an identity matrix .

Answer: B

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33. 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: D

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34. If A is a 3×3 such that $|5.\, adj(A)| = 5$ then $|A|$ is equal to

A. $\pm\frac{1}{5}$

B. ± 5

C. ± 1

D. $\pm\frac{1}{25}$

Answer: A

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35. If A = $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ then which one of the following statement is not correct ?

A. $A^4 - I = A^2 + I$

B. $A^3 - I = A(A - I)$

C. $A^2 + I = A(A^2 - I)$

D. $A^3 + I = A(A^3 - I)$

Answer: C

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36. 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. -1

B. 5

C. 4

D. 13

Answer: B

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37. 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 $Q = PAP^T$, then $P^T Q^{2015} P$ is

A. $\begin{bmatrix} 0 & 2015 \\ 0 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 2015 & 0 \\ 1 & 2015 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 2015 \\ 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 2015 & 1 \\ 0 & 2015 \end{bmatrix}$

Answer: C

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38. If $A = \begin{bmatrix} -4 & -1 \\ 3 & 1 \end{bmatrix}$, then the determint of the matrix $(A^{2016} - 2A^{2015} - A^{2014})$,is

A. -175

B. 2014

C. 2016

D. -25

Answer: D

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39. Let A be a 3×3 matrix such that $A^2 - 5A + 7I = 0$ then which of the statements is true

A. Both the statements are true

B. Both the statements are false

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

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

Answer: A

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40. If S is the set of distinct values of $'b$ for which the following system of linear equations $x+y+z=1$ $x+ay+z=1$ $ax+by+z=0$ has no solution, then S is : a finite set containing two or more elements (2) a singleton an empty set (4) an infinite set

A. a singleton set

B. an empty set

C. an infinite set

D. a finite set containing two or more elements

Answer: A

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41. If $A = \begin{vmatrix} 2 & -3 \\ -4 & 1 \end{vmatrix}$ then adj $\left(3A^2 + 12A\right)$ is equal to

A. $\begin{pmatrix} 72 & -63 \\ -84 & 51 \end{pmatrix}$

B. $\begin{pmatrix} 72 & -84 \\ -63 & 51 \end{pmatrix}$

C. $\begin{pmatrix} 51 & 63 \\ 84 & 72 \end{pmatrix}$

D. $\begin{pmatrix} 51 & 84 \\ 63 & 72 \end{pmatrix}$

Answer: C

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42. The number of real values of λ for which the system of linear equations $2x + 4y - \lambda z = 0, 4x + \lambda y + 2z = 0, \lambda x + 2y + 2z = 0$ has infinitely many solutions, is: (A) 0 (B) 1 (C) 2 (D) 3

A. 0

B. 1

C. 2

D. 3

Answer: B

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43. Let A be any 3×3 invertible matrix. Thenwhich one of the following is not always true?

A. adj (A) = (det (A)) A^{-1}

B. adj (adj (A)) = (det (A)) A

C. adj (adj (A) =$(\det(A))^2 (adj(A))^{-1}$

D. adj (adj (A)) = det (A) (adj $(A))^{-1}$

Answer: D

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44. For two 3×3 matrices A and B, let $A + B = 2B'$ and $3A + 2B = I_3$ where B' is the transpose of B and I_3 is 3×3 identity matrix, Then:

A. 5A 10 B =$2I_3$

B. $10A + 5B = 3I_3$

C. $B + 2A = I_3$

D. $3A + 6B = 2I_3$

Answer: B

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45. If $x = a, y = b, z = c$ is a solution of the system of linear equations $x + 8y + 7z = 0, 9x + 2y + 3z = 0, x + y + z = 0$ such that point (a, b, c) lies on the plane $x + 2y + z = 6,$ then $2a + b + c$ equals

A. -1

B. 0

C. 1

D. 2

Answer: C

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46. If the system of linear equations x+ky+3z=0 3x+ky-2z=0 2x+4y-3z=0 has a non-zero solution (x,y,z) then $\frac{xz}{y^2}$ is equal to

A. 10

B. -30

C. 30

D. -10

Answer: A

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47. Let A be a matrix such that A* $\begin{bmatrix} 1 & 2 \\ 0 & 3 \end{bmatrix}$ is a scalar matrix and |3A|=108 .Then A^2 equals

A. $\begin{pmatrix} 36 & -32 \\ 0 & 4 \end{pmatrix}$

B. $\begin{pmatrix} 4 & 0 \\ -32 & 0 \end{pmatrix}$

C. $\begin{pmatrix} 4 & -32 \\ 0 & 36 \end{pmatrix}$

D. $\begin{pmatrix} 36 & 0 \\ -32 & 4 \end{pmatrix}$

Answer: A

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48. If the system of linear equations $x + ay + z = 3$ and $x + 2y + 2z = 6$ and $x + 5y + 3z = b$ has no solution, then (a) $a = -1, b = 9 (2) a = -1, b \neq 9$ (3) $a \neq -1, b = 9$ (4) $a = 1, b \neq 9$

A. a =-1 , b = 9

B. a $\neq -1, b = 9$

C. $a = 1, b \neq 9$

D. $a = -1, b \neq 9$

Answer: D

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49. The number of values of k for which the system of linear equations,

$(k+2)x+10y=k; kx+(k+3)y=k-1$ has no solution, is

A. infinitely many

B. 1

C. 2

D. 3

Answer: B

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50. The system of linear equations

x+y+z =2,

2x+3y+2z = 5

2x +3y+$\left(a^2-1\right)z=a+1$

A. has infinitely many solution for a =4

B. is inconsisten when |a| = $\sqrt{3}$

C. is inconsistent when a= 4

D. has unique solution for |a| =$\sqrt{3}$

Answer: B

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51. If $A=\begin{bmatrix}\cos\theta & -\sin\theta \\ \sin\theta & \cos\theta\end{bmatrix}$, then the matrix A^{-50} when $\theta=\frac{\pi}{12}$, is equal to :

A. $\begin{pmatrix}\frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2}\end{pmatrix}$

B. $\begin{pmatrix}\frac{1}{2} & \frac{\sqrt{3}}{2} \\ -\frac{\sqrt{3}}{2} & \frac{1}{2}\end{pmatrix}$

C. $\begin{pmatrix}\frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2}\end{pmatrix}$

D. $\begin{pmatrix}\frac{\sqrt{3}}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2}\end{pmatrix}$

Answer: A

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52. $A = \begin{bmatrix} e^t & e^{-t}\cos t & e^{-t}\sin t \\ e^t & -e^{-t}\cos t - e^{-t}\sin t & -e^{-t}\sin t + e^{-t}\cos t \\ e^t & 2e^{-t}\sin t & -2e^{-t}\cos t \end{bmatrix}$ then A is

A. invertible only if t = $\pi/2$

B. not invertible for any t $\in$ R

C. invertible for all t $\in R$

D. invertible only if t = π

Answer: C

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53. If the system of linear equations $x - 4y + 7z = g$, $3y - 5z = h$, $-2x + 5y - 9z = k$ is consistent, then (a) $g + 2h + k = 0$ (b)

$g + h + 2k = 0$ (c) $2g + h + k = 0$ (d) $g + h + k = 0$

A. g + h + k =0

B. 2g +h +k =0

C. g +h +2k =0

D. g +2h+k =0

Answer: B

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54. If the system fo equations

x+y+z = 5

x + 2y + 3z = 9

$x + 3y + \alpha z = \beta$

has infinitely many solution, then $\beta - \alpha$ equals

A. 5

B. 18

C. 21

D. 8

Answer: D

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55. The number of possible value of θ lies in $(0, \pi)$, such that system of equation $x + 3y + 7z = 0,$ $-x + 4y + 7z = 0,$ $x \sin 3\theta + y \cos 2\theta + 2z = 0$ has non trivial solution is/are equal to (a) 2 (b) 3 (c) 5 (d) 4

A. One

B. Three

C. Four

D. Two

Answer: D

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56. Let $A = \begin{vmatrix} 0 & 21 & r \\ p & q & -r \\ p & -q & r \end{vmatrix} = AA^T = I_3$ then |p| is

A. $\frac{1}{\sqrt{2}}$

B. $\frac{1}{\sqrt{5}}$

C. $\frac{1}{\sqrt{6}}$

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

Answer: A

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57. If the system of linear equations

2x + 2y +3z =a

3x - y +5z =b

x- 3y +2z =c

where a, b, c are non-zero real numbers, has more than one solution, then

A. b-c-a =0

B. a+b+c=0

C. b+c-a=0

D. b-c+a=0

Answer: A

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58. Let A and B be two invertible matrices of order 3×3. If $\det(ABA^T) = 8$ and $\det(AB^{-1}) = 8$, then $\det(BA^{-1}B^T)$ is equal to

A. 16

B. $\frac{1}{16}$

C. $\frac{1}{4}$

D. 1

Answer: B

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59. An ordered pair (α, β) for which the system of linear equations

$(1+\alpha)x + \beta y + z = 2$

$\alpha x + (1+\beta)y + z = 3$

$\alpha x + \beta y + 2z = 2$

has a unique solution, is

A. (1,-3)

B. (-3,1)

C. (2,4)

D. (-4,2)

Answer: C

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60. Let $P = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 1 & 0 \\ 9 & 3 & 1 \end{bmatrix} Q = [q_{ij}]$ and $Q = P^5 + I_3$ then $\dfrac{q_{21} + q_{31}}{q_{32}}$ is equal to (A) 12 (B) 8 (C) 10 (D) 20

A. 15

B. 9

C. 135

D. 10

Answer: D

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61. The set of all values of λ for which the system of linear equations

$x - 2y - 2z = \lambda x$

$x + 2y + z = \lambda y$

$-x - y = \lambda z$

has a non-trivial solution

A. contains more than two elements

B. is a singleton

C. is an empty set

D. contains exactly two elements

Answer: B

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62. The greatest value of $c \in R$ for which the system of linear equations x-cy-cz = 0, cx -y + cz =0, cx + cy-z =0 has a non-trivial solution, is

A. -1

B. $1/2$

C. 2

D. 0

Answer: B

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63. Let $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}, (\alpha \in R)$ such that $A^{32} = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$.

Then, a value of α is

A. $\frac{\pi}{32}$

B. 0

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

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

Answer: C

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64. If the system of linear equations

x-2y + kz = 1, 2x + y+ z = 2, 3x-y-kz = 3 has a solution (x, y, z), $z \neq 0$, then (x, y) lies on the straight line whose equation is

A. 3x-4y-1=0

B. 4x-3y-4=0

C. 4x-3y-1=0

D. 3x-4y-4=0

Answer: B

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65. If $\begin{bmatrix}1 & 1\\0 & 1\end{bmatrix}\cdot\begin{bmatrix}1 & 2\\0 & 1\end{bmatrix}\cdot\begin{bmatrix}1 & 3\\0 & 1\end{bmatrix}\cdots\begin{bmatrix}1 & n-1\\0 & 1\end{bmatrix}=\begin{bmatrix}1 & 78\\0 & 1\end{bmatrix}$, then the inverse of $\begin{bmatrix}1 & n\\0 & 1\end{bmatrix}$ is

A. $\begin{bmatrix}1 & 0\\12 & 1\end{bmatrix}$

B. $\begin{bmatrix}1 & -13\\0 & 1\end{bmatrix}$

C. $\begin{bmatrix}1 & -12\\0 & 1\end{bmatrix}$

D. $\begin{bmatrix}1 & 0\\13 & 1\end{bmatrix}$

Answer: C

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66. The total number of matrices $A = \begin{bmatrix} 0 & 2y & 1 \\ 2x & y & -1 \\ 2x & -y & \end{bmatrix} (x, y \in R, x \neq y)$ f or $which A^T A = 3I_3$ is

A. 2

B. 3

C. 6

D. 4

Answer: D

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67. If the system of equations, $2x + 3y - z = 0, x + ky - 2z = 0$ and $2x - y + z = 0$ has a non-

trivial solution (x, y, z), then $\frac{x}{y}+\frac{y}{z}+\frac{z}{x}+k$ is equal to

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

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

C. $-\frac{1}{4}$

D. -4

Answer: B

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68. If the system of linear equations

$x+y+z=5$

$x+2y+2z=6$

$x+3y+\lambda z=\mu, (\lambda, \mu \in R)$ has infinitely many solutions, then the value of $\lambda+\mu$ is :

A. 12

B. 9

C. 7

D. 10

Answer: D

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69. Let λ be a real number for which the system of linear equations

x + y +z =6, 4x + $\lambda y - \lambda z = \lambda - 2$ and 3x + 2y-4z =-5

has infinitely many solutions. Then λ is a root of the quadratic equation

A. $\lambda^2 + 3\lambda - 4 = 0$

B. $\lambda^2 - 3\lambda - 4 = 0$

C. $\lambda^2 + \lambda - 6 = 0$

D. $\lambda^2 - \lambda - 6 = 0$

Answer: D

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70. If A is a symmetric matrix and B is a skew-symmetric matrix such that $A + B = \begin{bmatrix} 2 & 3 \\ 5 & -1 \end{bmatrix}$, then AB is equal to

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

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

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

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

Answer: B

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71. If $B = \begin{bmatrix} 5 & 2\alpha & 1 \\ 0 & 2 & 1 \\ \alpha & 3 & -1 \end{bmatrix}$ is the inverse of a 3×3 matrix A, then the sum of all values of α for which det $(A) + 1 = 0$ is:

A. 0

B. -1

C. 1

D. 2

Answer: C

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Questions From Previous Years B Architecture Entrance Examination Papers

1. If A and B are square matrics of the same order then which one of the following is always true ?

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

B. adj (AB) = (adj B) (adj A)

C. A and B are non -zero and $|AB|=0 \Leftrightarrow |A|=0$ and |B| =0

D. $(AB)^{-1}=A^{-1}=A^{-1}B^{-1}$

Answer: B

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2. Let A = $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and let I denote the 3×3 identity matrix . Then $2A^2 - A^3$ =

A. A+I

B. A-I

C. I-A

D. A

Answer: D

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3. Let A and B be 2×2 matrices with real entries . Let I be the 2×2 indentity matrix. Denote by tr (A) the sum of diagonal entries of A .

Statement -1 : AB -BA $\neq$ I

Statement -2 : tr (A+B) = tr (A) +tr (B) and tr (AB) =tr (BA)

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4. Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a 2×2 real matrix. If $A - \alpha I$ is invertible for every real number α , then

A. $bc > 0$

B. $bc = 0$

C. $bc < \min\left(0, \frac{1}{2}ad\right)$

D. a=0

Answer: C

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5. Let A be a 2×2 matrix

Statement -1 adj $(adjA) = A$

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

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6. Let $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ be a 2×2 matrix, where a, b, c, d take value 0 to 1 only. The number of such matrices which have inverses is

A. 8

B. 7

C. 6

D. 5

Answer: C

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7. Let S be the set of all real matrices A = $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ such that a+d =2 and A' =$A^2 - 2A$. Then S:

A. is an empty set

B. has exactly one element

C. has exactly two elements

D. has exactly four elements

Answer: A

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8. If S(n) denotes the sum of first n natural numbers.the [S_(1)+S_(2)x+S_(3)x^(2)+........+S_(n)*x^(n-1)+..],[" ,then n is

A. $S_{2^n - k}$

B. $S_{2^n + k - 1}$

C. $S_{2^n - k}$

D. S_{2n-k}

Answer: D

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9. Let A = $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and B = $\begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix}$. If $10A^{10} + Adj(A^{10})$ = B then $b_1 + b_2 + b_3 + b_4$ is equal to :

A. 91

B. 92

C. 111

D. 112

Answer: D

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10. If for a matrix A, $|A| = 6$ and $adjA =$ {:[(1,-2,4),(4,1,1),(-1,k,0)]:}`, then k is equal to

A. 0

B. 1

C. 2

D. -1

Answer: C

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11. Let S be the set of all real values of a for which the following system of linear equations :

ax+2y+5z=1

2x+y+3z=1

3y +7z=1

is consistent . Then the set S is

A. an empty set

B. equal to R

C. equal to R - {1}

D. equal to {1}

Answer: B

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12. If A = $\begin{pmatrix} 2 & 52 & 152 \\ 4 & 1-6 & 358 \\ 6 & 162 & 620 \end{pmatrix}$ then the determinant of adj (2A) is equal to

A. 64

B. 256

C. 2048

D. 4096

Answer: D

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13. Let S be the set of all real values of λ for which the system of liner equations

$\lambda x + y + z = 60$

$2\lambda x + 2y - z = 1$

3y +z=9

has infinitely many solutions . Then S :

A. equals R

B. is a singleton

C. contains exactly two elements

D. an empty set

Answer: D

View Text Solution

14. Ifthe equations $a(y+z)=x, b(z+x)=y, c(x+y)=z$ have nontrivial solutions, then $\frac{1}{1+a}+\frac{1}{1+b}+\frac{1}{1+c}=$

A. $\frac{3}{2}$

B. 3

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

D. 2

Answer: D

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15. If B = $\begin{bmatrix}-2 & -2\\ -1 & 0\end{bmatrix}$ and A is a matrix such that $A^{-1}B=B^{-1}$ and $kA^{-1}=2B^{-1}+I_2$ where k is some scalar then value of k is

A. -1

B. -2

C. 1

D. 2

Answer: D

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16. Let $\begin{bmatrix} 3a & b & c \\ b & 3c & a \\ c & a & 3b \end{bmatrix}$ be a 3×3 matrix where a,b,c $\in$ R . If abc =1 AA' = $4I_3$ and det (A) $>$ 0 then $\left(a^3 + b^3 + c^3\right)$ is :

A. 21

B. 11

C. 9

D. 7

Answer: D

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17. The value of a for which the system linear of equations

x+ay+z=1

ax+y+z=1

x+y+az=3

has no solution is :

A. 1

B. -1

C. 2

D. -2

Answer: D

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18. Suppose A is a 2×2 matrix for which $A^2 + A + I_2 = O_2$ then det (adj $(I_2 - A)^6\big)$ is equal to :

A. 3^3

B. 3^4

C. 3^6

D. 3^9

Answer: C

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19. If the system of linear equations :

x+4y-3z=2

2x+7y+4z=α

-x-5y+5z=β

has infinitely many solutoins than the ordered pair (α, β) cannot take value :

A. (4,-2)

B. (2,-4)

C. (3,-3)

D. (-3,3)

Answer: D

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20. Let (a,b) be the solution of the system

$$\begin{bmatrix} x & y \end{bmatrix}\begin{bmatrix} 1 & 3 \\ 5 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 1 \end{bmatrix}$$

If α and β are roots of $ax^2 + 2bx - (a+b) = 0$ then the equation whose are $\alpha\beta$ and $\frac{1}{\alpha} + \frac{1}{\beta}$ is :

A. $12x^2 + 17x - 40 = 0$

B. $12x^2 - 53x + 56 = 0$

C. $12x^2 - 53x + 56 = 0$

D. $9x^2 + 54x + 80 = 0$

Answer: A

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21. If $A^{20} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ where A $= \begin{bmatrix} 1 & 1 \\ 0 & 2 \end{bmatrix}$ then a+b+c+d is equal to

A. 2^{19}

B. 2^{20}

C. 2^{21}

D. 2^{22}

Answer: C

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22. The number of solutions of the equations

3x-y-z=0

-3x+2y+z=0

-3x+z=0

such that x ,y,z are non -negative integers and $x^2 + y^2 + z^2 \leq 81$ is :

A. 3

B. 7

C. 1

D. 2

Answer: A

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