MATHS

BOOKS - ML KHANNA

MATRICES

Illustration

1. If $A = \begin{bmatrix} 1 & -2 & 3 \\ -4 & 5 & 5 \end{bmatrix}_{2 \times 3}$

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

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2. $A = \begin{bmatrix} \alpha & \beta \\ \gamma & \delta \end{bmatrix}$ find adj A and show that $adj(adjA) = |A|^{n-2}A.$

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Example

1. Find the rank of the martrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 7 \\ 3 & 6 & 10 \end{bmatrix}$ by reducing into the Echelon form.

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2. Find the rank of the martrix $A = \begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 9 \\ -1 & -3 & -4 & -3 \end{bmatrix}$ by reducing into the Echelon form.

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3. Reduce the martix $A = \begin{bmatrix} 2 & 4 & 3 \\ 1 & 2 & -1 \\ -1 & -2 & 6 \end{bmatrix}$ to Echelon form and hence prove that $\rho(A) = 2$.

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4. Find the rank of the martrix $A = \begin{bmatrix} 1 & -2 & 1 & -1 \\ 1 & 1 & -2 & 3 \\ 4 & 1 & -5 & 8 \\ 5 & -7 & 2 & -1 \end{bmatrix}$ by reducing into the Echelon form.

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Problem Set 1 Multiple Choice Questions

1. If $A = \begin{bmatrix} 0 & 1 & 2 \\ 2 & 3 & 4 \\ 4 & 5 & 6 \end{bmatrix}, B = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 01 \end{bmatrix}$ then

$3A - 4B =$

A. $\begin{bmatrix} -4 & 3 & 6 \\ 6 & 5 & 12 \\ 12 & 15 & 14 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 1 & 2 \\ 2 & 3 & 4 \\ 4 & 5 & 6 \end{bmatrix}$

C. $\begin{bmatrix} -4 & 6 & 3 \\ 6 & 5 & 12 \\ 12 & 15 & 14 \end{bmatrix}$

D. $\begin{bmatrix} -4 & 3 & 6 \\ 6 & 15 & 12 \\ 12 & 5 & 14 \end{bmatrix}$

Answer: A

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2. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$, and $4A - 3B + C = O$, then C=

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

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

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

D. None

Answer: B

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3. If $A = \begin{bmatrix} 1 & 0 \\ 2 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 0 \\ 1 & 12 \end{bmatrix}$ then

A. $AB = O, BA = O$

B. $AB = O, BA \neq 0$

C. $AB \neq O, BA = O$

D. $AB \neq O, BA \neq O$

Answer: B

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4. If the matrix AB is zero then

A. A=O or B=O

B. A=O and B=O

C. It is not necessary that either A=O or B=O

D. All these statements are wrong.

Answer: C

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5. If A and B are two matrices such that A+B and AB are both defined, then

A. A and B are two matrices not necessarily of same order

B. A and B are square matrices of same order

C. Number of colomns of A=number of rows of B.

D. None of these

Answer: B

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6. If A is any $m \times n$ matrix such that AB and BA are both defined, then B is a matrix of type

A. $m \times n$

B. $n \times m$

C. $m \times m$

D. $n \times n$

Answer: B

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7. 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. AB=BA

B. A=B

C. A or B=O

D. A or B=I

Answer: A

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8. If A is 3×4 matrix and B is a matrix such that A'B and BA' are both defined. Then B is of the type

A. 3×4

B. 3×3

C. 4×4

D. 4×3

Answer: A

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9. If $A = \begin{bmatrix} 1 & -2 & 3 \\ -4 & 2 & 5 \end{bmatrix}_{2 \times 3}$

and $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \\ 2 & 1 \end{bmatrix}$ then

A. AB,BA, exist and are equal

B. AB,BA exist but not equal

C. AB exists and BA does not exist

D. AB does not exist and BA exists.

Answer: A

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10. Assuming that the sums and products given below are defined which of the following is not true for matrices.

A. AB=AC does not imply B=C

B. $A + B = B + A$

C. $(AB)' = B'A'$

D. $AB = O \Rightarrow A = O$ or B=O

Answer: D

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11. If a matrix has 13 elements, then the possible dimensions (order) it can have are

A. $1 \times 13, 13 \times 1$

B. $1 \times 26, 26 \times 1$

C. $2 \times 13, 13 \times 2$

D. None of these

Answer: C

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12. The construction of 3×4 matrix a whose element a_{ij} is given by $\frac{(i+j)^2}{2}$ is

A. $\begin{bmatrix} 2 & 9/2 & 8 & 25 \\ 9 & 4 & 5 & 18 \\ 8 & 25 & 18 & 49 \end{bmatrix}$

B. $\begin{bmatrix} 2 & 9/2 & 25/2 \\ 9/2 & 5/2 & 5 \\ 25 & 18 & 25 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 9/2 & 8 & 25/2 \\ 9/2 & 8 & 25/2 & 18 \\ 8 & 25/2 & 18 & 49/2 \end{bmatrix}$

D. None of these

Answer: A

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13. $\cos\theta\begin{bmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{bmatrix}+\sin\theta\begin{bmatrix}\sin\theta & -\cos\theta\\ \cos\theta & \sin\theta\end{bmatrix}$ is equal to

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

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

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

D. None of these

Answer: A

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14. If A is a 2×2 matrix such that $\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} A \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then the sum of the elements in A is

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

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

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

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

Answer: A

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15. What is the order of : $[xyz]\begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix}$?

A. 3×1

B. 1×1

C. 1×3

D. 3×3

Answer: B

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16. If $\begin{bmatrix} 1 & x & 1 \end{bmatrix}\begin{bmatrix} 1 & 3 & 2 \\ 0 & 5 & 1 \\ 0 & 3 & 2 \end{bmatrix}\begin{bmatrix} 1 \\ 1 \\ x \end{bmatrix} = O$ then x equals to

A. $-3 \pm \sqrt{3}$

B. $\dfrac{-9 \pm \sqrt{53}}{2}$

C. 1

D. None of these

Answer: B

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17. If $\begin{bmatrix} 1 & \lambda & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 0 & 5 & 1 \\ 0 & 3 & 2 \end{bmatrix} \begin{bmatrix} \lambda \\ 1 \\ -2 \end{bmatrix} = O$ then $\lambda =$

A. -1

B. $-1/2$

C. $1/2$

D. 1

Answer: A

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18. The matrix producet

$$\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix} \begin{bmatrix} 4 & 5 & 2 \end{bmatrix} \begin{bmatrix} 2 \\ -3 \\ 5 \end{bmatrix}$$ equals

A. $\begin{bmatrix} 3 \\ -6 \\ 9 \end{bmatrix}$

B. $\begin{bmatrix} 3 \\ 6 \\ 9 \end{bmatrix}$

C. $\begin{bmatrix} 3 \\ 6 \\ -9 \end{bmatrix}$

D. None of these

Answer: D

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19. The value of λ for which the matrix product $\begin{bmatrix} 2 & 0 & 7 \\ 0 & 1 & 0 \\ 1 & -2 & 1 \end{bmatrix}\begin{bmatrix} -\lambda & 14\lambda & 7\lambda \\ 0 & 1 & 6 \\ \lambda & -4\lambda & -2\lambda \end{bmatrix}$ is an identify matrx.

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

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

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

D. $\frac{1}{5}$

Answer: C

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20. 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

A. $2AB$

B. $2BA$

C. $A + B$

D. AB

Answer: A

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21. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ then $A^4 =$

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

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

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

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

Answer: D

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22. If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$ then value of A^n is

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

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

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

D. None of these

Answer: A

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

A. $\begin{bmatrix} 8 & -5 \\ -5 & 3 \end{bmatrix}$

B. $\begin{bmatrix} 8 & -5 \\ 5 & 3 \end{bmatrix}$

C. $\begin{bmatrix} 8 & -5 \\ -5 & -3 \end{bmatrix}$

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

Answer: D

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24. If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$ then (α, β) is

A. $\left(a^2+b^2, ab\right)$

B. $\left(a^2+b^2, 2ab\right)$

C. $\left(a^2+b^2, a^2-b^2\right)$

D. $\left(2ab, a^2+b^2\right)$

Answer: C

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25. If $A=\begin{bmatrix}\alpha & 2\\ 2 & \alpha\end{bmatrix}$ and $\left|A^3\right|=125$ then α is

A. ± 1

B. $+2$

C. ± 3

D. ± 5

Answer: B

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26. If for a 2×2 matrix $A, A^2 + I = O$, where I is identity matrix then A equals

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

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

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

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

Answer: C

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27. If $A+B=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}$ and $A-2B=\begin{bmatrix}-1 & 1\\ 0 & -1\end{bmatrix}$

then A is equal to

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

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

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

D. None of these

Answer: A

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28. If $A=\begin{bmatrix}1 & 2 & -1 \\ 3 & 4 & 7 \\ 5 & 1 & 6\end{bmatrix}$ then the value of X where A+X is a unit matrix is

A. $\begin{bmatrix}0 & -2 & 1 \\ -3 & -3 & -7 \\ -5 & -1 & -6\end{bmatrix}$

B. $\begin{bmatrix}0 & -3 & 5 \\ -2 & -3 & 1 \\ -1 & -7 & 6\end{bmatrix}$

C. $\begin{bmatrix}0 & -1 & -2 \\ 3 & 3 & 7 \\ 5 & 1 & 6\end{bmatrix}$

D. None of these

Answer: B

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29. If the matrix $\begin{bmatrix} 1 & 3 & \lambda+2 \\ 2 & 4 & 8 \\ 3 & 5 & 10 \end{bmatrix}$ is singular then $\lambda =$

A. -2

B. 4

C. 2

D. -4

Answer: D

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30. If $A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix}, B = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix}$

then AB=

A. A

B. B

C. It is not necessary that either A=O or B=O

D. O

Answer: B

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31. If $A = \begin{bmatrix} i & 0 \\ 0 & i \end{bmatrix}$ then A^2=

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

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

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

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

Answer: D

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32. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$ whenever $A^2 = B$

then the value of α is

A. 1

B. -1

C. 4

D. no real value of α

Answer: C

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33. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ where $a, b, \in N$ If AB=BA then three exists

A. only one B

B. infinitely many B's

C. more than one but infinite B's

D. not N exists

Answer: D

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34. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ a & b & -1 \end{bmatrix}$ then A^2 is eqal to

A. A

B. $-A$

C. Null matrix

D. I

Answer: B

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35. If $A = \begin{bmatrix} 1 & 3 \\ 3 & 4 \end{bmatrix}$ and $A^2 - \lambda A - 5I = O$ then λ is equal to

A. 3

B. 0.05

C. 0.07

D. -7

Answer: B

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36. For any 2×2 matrix A if A (Adj. A) $= \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$

then |A| equals

A. 0

B. 10

C. 20

D. 100

Answer: B

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37. Assuming that the sums and products given below are defined which of the following is not true for matrices.

A. $\begin{bmatrix} 10 & 1 \\ 1 & 10 \end{bmatrix}$

B. $\begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$

C. $\begin{bmatrix} 0 & 10 \\ 10 & 0 \end{bmatrix}$

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

Answer: C

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38. If $A = \begin{bmatrix} \alpha & 0 & 0 \\ 0 & \alpha & 0 \\ 0 & 0 & \alpha \end{bmatrix}$ then the valueof

(i) $|A||Adj.\ A|$ and

(ii) $|Adj.\ A|$ is equal to

A. α^3

B. α^6

C. α^9

D. α^{27}

Answer: B

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39. For a 3×3 matrix A if det A=4, then det (Adj. A) equals

A. -4

B. 4

C. 16

D. 64

Answer: C

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40. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ and $A(adjA) = \lambda I$ then λ is equal to

A. 1

B. 2

C. 3

D. $\sin\theta\cos\theta$

Answer: A

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41. If A is a singular matrix then Adj is

A. non singular

B. singular

C. symmetric

D. skew symmetric

Answer: B

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42. Let A be a 2×2 matrix.

Statement 1: $adj(adjA) = A$

Statement 2: $|adjA| = |A|$.

Which statement is true

A. Statement 1 is right

B. Statement 2 is right

C. Both statement are right and statement 2 explain statement 1

D. Both statement are right and statement 2 does not explain statement 1

Answer: D

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43. The inverse of the matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is equal to

A. A

B. A'

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

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

Answer: A

44. Let A $\begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$. Then the only correct statement A is

A. $A = O$

B. $A = (-1)I$

C. A^{-1} does not exist

D. $A^2 = I$

Answer: D

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45. The number of 3×3 non singular matrices, with four entries is 1 and all other entries as 0, is

A. 5

B. 6

C. at least 7

D. less than 4

Answer: C

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46. If I_3 is the identity matrix of order 3 order $(I_3)^{-1}$ is equal to

A. 0

B. $3I_3$

C. I_3

D. does not exist

Answer: C

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47. If $\begin{pmatrix} 1 & 2 & 3 \end{pmatrix} A = \begin{pmatrix} 4 & 5 \end{pmatrix}$, what is the order of matrix A?

A. 3×2

B. 3×1

C. 2×3

D. 2×1

Answer: A

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48. Let A be an invertible matrix, then which of the following is not true?

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

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

C. $(A')^{-1} = (A^{-1})$

D. None of these

Answer: C

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

A. Idempotent

B. Involutary

C. Nilpotent

D. Scalar

Answer: A

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

A. Diagonal matrix

B. Scalar matrix

C. Nilpotent matrix

D. Idempotent matrix

Answer: A

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51. Let $A = \begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ then A is

A. Nilpotent

B. Idempotent

C. Scalar

D. None of these

Answer: B

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52. The matrix $\begin{bmatrix} 0 & 5 & -7 \\ -5 & 0 & 11 \\ 7 & -11 & 0 \end{bmatrix}$ is

A. symmetric

B. skew symmetric

C. diagonal

D. upper diagonal

Answer: D

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53. If A and B symmetric matrices of the same order then AB-BA is a matrix which is

A. null

B. unit

C. symmetric

D. skew symmetric

Answer: D

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54. If $A = \begin{bmatrix} 0 & -1 & -4 \\ 1 & 0 & -7 \\ 4 & 7 & 0 \end{bmatrix}$ then $A^T =$

A. O

B. I

C. A

D. $-A$

Answer: A

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55. If $A = \begin{bmatrix} a & p \\ b & q \\ c & r \end{bmatrix}_{3 \times 2}$ then Det $\left(\mathrm{AA}^T\right)$ is equal to

A. 0

B. $a^2 + b^2 + c^2$

C. $p^2 + q^2 + r^2$

D. Σap

Answer: B

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56. If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then what is $A\mathrm{A}^T$ equal to (where A^T is the transpose of A) ?

A. only one B

B. I

C. A

D. $-A$

Answer: D

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

A. A

B. A^T

C. $3A$

D. $3A^T$

Answer: D

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58. If I_3 is identity matrix of order 3, then $I_3^{-1} =$

A. O

B. $3I_3$

C. I_3

D. Not necessarily exists

Answer: B

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59. From the matrix equation AB=AC we can conclude B=C provided the matrix A is

A. singular

B. non singular

C. symmetric

D. None of these

Answer: C

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60. If A and B are square matrices of order 3 such that $|A| = -1, |B| = 3$, the the determinant of 3 AB is equal to

A. -9

B. -27

C. -81

D. 81

Answer: C

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61. If reach element of a 3×3 matrix is multiplied by 3, then the determine of the newly formed matrix is

A. $3|A|$

B. $9|A|$

C. $27|A|$

D. $|A|^3$

Answer: C

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62. If B is a non singular matrix and A is a square matrix, the $\det\left(B^{-1}AB\right) =$

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

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

C. $\det(A)$

D. $\det(B)$

Answer: C

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63. Matrix $A_{\lambda}=\begin{bmatrix}\lambda & \lambda-1\\ \lambda-1 & \lambda\end{bmatrix}, \lambda\in N$

The value of $|A_1|+|A_2|+\ldots\ldots\ldots+|A_{300}|$ is

A. $(299)^2$

B. $(300)^2$

C. $(301)^2$

D. None of these

Answer: B

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64. If A is a square matrix such that $|A| = 2$, then $|A'|$, where A' is transpose of A, is equal to

A. 0

B. -2

C. $1/2$

D. 2

Answer: C

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65. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ such that $ad - bc \neq 0$, then A^{-1} is equal to

A. $\dfrac{1}{ad - bc}\begin{bmatrix} d & b \\ -c & a \end{bmatrix}$

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

C. $1(ad - bc)\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

D. None of these

Answer: C

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66. Which of the following matrices is not invertible

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

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

C. $\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix}$

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

Answer: D

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67. The system of linear equations $ax + by = 0, cx + dy = 0$, has a non trivial solution if

A. $ad - bc < 0$

B. $ad - bc > 0$

C. $ac + bd = 0$

D. $ad - bc = 0$

Answer: B

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68. If $A = \begin{bmatrix} 1 & -6 & 2 \\ 0 & -1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix}$ then AB equals

A. $\begin{bmatrix} -8 & 3 \end{bmatrix}$

B. $\begin{bmatrix} -8 \\ 3 \end{bmatrix}$

C. $\begin{bmatrix} 2 & -12 & 2 \\ 0 & -2 & 5 \end{bmatrix}$

D. $\begin{bmatrix} 2 & -12 & 4 \\ 0 & -2 & -10 \end{bmatrix}$

Answer: C

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69. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ then $A^2 + 2A$ equals

A. A

B. 2A

C. 3A

D. 4A

Answer: B

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70. If $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ then $A^2 =$

A. A

B. 2A

C. 3A

D. I

Answer: B

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

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

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

C. $1 - \alpha^2 + \beta\gamma = 0$

D. $1 + \alpha^2 - \beta\gamma = 0$

Answer: B

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72. If $A = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$ and $A^2 = \begin{bmatrix} \alpha & \beta \\ \beta & \alpha \end{bmatrix}$ then (α, β) is

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

Answer: D

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73. If $A = (a_{ij})$ is a 4×4 matrix and C_{ij}, is the co-factor of the element a_{ij}, in $Det(A)$, then the expression $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13} + a_{14}C_{14}$ equals-

A. 0

B. -1

C. 1

D. $|A|$

Answer: A

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74. If A is a square matrix such that $A^2 = A$, then |A| equals

A. 0 or 1

B. 1 or 1

C. -2 or 2

D. -3 or 3

Answer: C

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75. If $A^2 + A = I$ then A^{-1} is

A. $A - I$

B. $I - A$

C. $A+I$

D. None of these

Answer: B

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76. If $A^2-A+I=O$ then inverse of A is

A. $A-I$

B. $I-A$

C. $A+I$

D. A

Answer: B

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77. The multiplicative inverse of $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$

is equal to

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

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

C. $\begin{bmatrix} -\cos\theta & -\sin\theta \\ \sin\theta & -\cos\theta \end{bmatrix}$

D. $\begin{bmatrix} \cos\theta & \sin\theta \\ \sin\theta & -\cos\theta \end{bmatrix}$

Answer: C

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78. The matrix A satisfying the equation $\begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix} A = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix}$ is

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

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

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

D. None

Answer: C

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79. If $A = BX$ and $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$ and B is $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ then X=

A. $\begin{bmatrix} 2 & 4 \\ 3 & -5 \end{bmatrix}$

B. $\frac{1}{2}\begin{bmatrix} -2 & 4 \\ 3 & 5 \end{bmatrix}$

C. $\frac{1}{2}\begin{bmatrix} 2 & 4 \\ 3 & -5 \end{bmatrix}$

D. None of these

Answer: A

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80. If a,b,c are non-zero real numbers, then the inverse of the matrix $A = \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$ is equal to :

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

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

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

D. $\dfrac{1}{abc}\begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$

Answer: a

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81. If $D = diag[d_1, d_2, \ldots\ldots\ldots\ldots\ldots, d_n]$ where $d_i \neq 0 \forall i = 1, 2, 3, \ldots\ldots\ldots\ldots n$ then D^{-1} is equal to

A. Diagonal matrix

B. I_n

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

D. None

Answer: D

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82. If $A = \begin{bmatrix} 3 & 4 \\ 2 & 4 \end{bmatrix}, B = \begin{bmatrix} -2 & -2 \\ 0 & -2 \end{bmatrix}$ then $(A+B)^{-1} =$

A. does not exist

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

C. skew symmetric

D. None of these

Answer: D

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83. If $A = diag[d_1, d_2, d_3]$ then A^n is equal to

A. $diag\left[d_1^{n-1}, d_2^{n-1}, d_3^{n-1}\right]$

B. A

C. $diag\left[d_1^{n}, d_2^{n}, d_3^{n}\right]$

D. None of these

Answer: C

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84. Inverse of the matrix $\begin{bmatrix} 3 & -2 & -1 \\ -4 & 1 & -1 \\ 2 & 0 & 1 \end{bmatrix}$ is

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85. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ 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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86. The inverse of a symmetric matrix is a matrix which is

A. diagonal

B. symmetric

C. skew symmetric

D. None of these

Answer: B

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87. $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & -2 & 4 \end{bmatrix}, I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$A^{-1} = \frac{1}{6}\left(A^2 + CA + DI\right)$ then C and D equal to

A. $-11, 6$

B. $-6, 11$

C. $6, 11$

D. $-6, \ -11$

Answer: A

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88. If $A=\begin{bmatrix}0 & 0 & 1\\ 0 & -1 & 0\\ 1 & 0 & 0\end{bmatrix}$ then $A^{-1}=$

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

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

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

D. None of these

Answer: C

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89. Let $F(\alpha)=\begin{bmatrix}\cos\alpha & -\sin\alpha & 0\\ \sin\alpha & \cos\alpha & 0\\ 0 & 0 & 1\end{bmatrix}$ then $F(\alpha).F(\beta)$ is equal to

A. $F(\alpha\beta)$

B. $F\left(\frac{\alpha}{\beta}\right)$

C. $F(\alpha+\beta)$

D. $F(\alpha-\beta)$

Answer: C

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90. If $E(\theta) = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then $E(\alpha).E(\beta)$ is equal to

A. $E(0)$

B. $E(\alpha\beta)$

C. $E(\alpha + \beta)$

D. $E(\alpha - \beta)$

Answer: A

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91. If $E(\theta)=\begin{bmatrix}\cos^2\theta & \cos\theta\sin\theta\\ \cos\theta\sin\theta & \sin^2\theta\end{bmatrix}$, and θ and ϕ differ by an odd multiple of $\pi/2$, then $E(\theta)E(\phi)$ is a

A. Null matrix

B. Unit matrix

C. Diagonal matrix

D. None of these

Answer: C

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92. If $A = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$

and $B = \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$ are the two matrices such that the product AB is the null matrix then $\theta - \phi$ is equal to

A. 0

B. multiple of π

C. on odd multiple of $\pi/2$

D. None of these

Answer: C

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93. If A and B are matrices given below:

$$A = \begin{bmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{bmatrix} \text{ and } B = \begin{bmatrix} a^2 & ab & ac \\ ab & b^2 & bc \\ ac & bc & c^2 \end{bmatrix} \text{ then}$$

AB is a

A. A

B. O

C. on odd multiple of $\pi/2$

D. I

Answer: A

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94. Let $F(\alpha) = \begin{bmatrix} \cos\alpha & -\sin\alpha & 0 \\ \sin\alpha & \cos\alpha & 0 \\ 0 & 0 & 1 \end{bmatrix}$ where alpha in R.

Then $[F(\alpha)]^{-1}$ is equal to

A. $F(-\alpha)$

B. $F(\alpha^{-1})$

C. $F(2\alpha)$

D. None of these

Answer: C

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95. If $F(\alpha)=\begin{bmatrix}\cos\alpha & -\sin\alpha & 0\\ \sin\alpha & \cos\alpha & 0\\ 0 & 0 & 1\end{bmatrix}$ and $G(\beta)=\begin{bmatrix}\cos\beta & 0 & \sin\beta\\ 0 & 1 & 0\\ -\sin\beta & 0 & \cos\beta\end{bmatrix}$, then $[F(\alpha)G(\beta)]^{-1}$ is equal to

A. $F(-\alpha)G(-\beta)$

B. $F(\alpha^{-1})G(\beta^{-1})$

C. $G(-\beta)F(-\alpha)$

D. $G(\beta^{-1})F(\alpha^{-1})$

Answer: B

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96. 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. None of these

Answer: C

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97. Which of the following the following is correct?

A. skew symmetric matrix of even order is always singular

B. skew symmetric matrix of odd order is non singular

C. skew symmetric matrix of odd order is singular

D. None of these

Answer: A

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98. If A be a skew symmetric matrix of odd order, then $|A|$ is equal to

A. 0

B. 1

C. -1

D. None

Answer: A

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99. If A be a skew symmetric matrix of even order then $|A|$ is equal to

A. perfect square

B. 0

C. not a perfect square

D. None of these

Answer: D

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100. If $A = \begin{bmatrix} 1 & 0 \\ 1/2 & 1 \end{bmatrix}$ then A^{50} is

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

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

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

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

Answer: D

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101. If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$ then $A^n =$

A. $\begin{bmatrix} a^n & 0 & 0 \\ 0 & a^n & 0 \\ 0 & 0 & 0 \end{bmatrix}$

B. $\begin{bmatrix} a^n & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$

C. $\begin{bmatrix} a^n & 0 & 0 \\ 0 & a^n & 0 \\ 0 & 0 & a^n \end{bmatrix}$

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

Answer: A

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102. 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. $\begin{bmatrix} 1 & 2005 \\ 0 & 10 \end{bmatrix}$

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

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

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

Answer: C

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103. If $A = \begin{bmatrix} 1 & 2 & -1 \\ -1 & 1 & 2 \\ 2 & -1 & 1 \end{bmatrix}$ then det $[adj(adjA)] =$

A. 12^4

B. 13^4

C. 14^4

D. None of these

Answer: A

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104. The equations $x + 2y + 3z = 1, 2x + y + 3z = 2, 5x + 5y + 9z = 4$ have

A. unique solutions

B. infinite many solutions

C. inconsistent

D. None of these

Answer: A

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105. The equations $2x - 3y + 6z = 4, 5x + 7y - 14z = 13x + 2y - 4z = 0,$ have

A. unique solutions

B. no solution

C. infinite many

D. None of these

Answer: B

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106. $x + y + z = 6$

$x - y + z = 2$

$2x + y - z = 1$

then x,y,z are respectively

A. 3,2,1

B. 1,2,3

C. 2,1,3

D. None of these

Answer: C

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107. The value of a fro which the system of equations

$ax + by + z = 0, x + ay + z = 0, x + y + z = 0$

posses non zero solutions are given by

A. $1, 2$

B. $1, \ -1$

C. 1

D. None of these

Answer: D

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108. There are two column vectors $X = \begin{pmatrix} x \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 1 & 4 \\ 5 & 2 \end{pmatrix}$ X is parallel to X. If θ is the angle between them, the $\tan\theta$ is

A. 3

B. 5

C. 7

D. 9

Answer: A

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109. 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 of 0.

The number of matrices in A is

A. 12

B. 6

C. 9

D. 3

Answer: B

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

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

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

has a unique solution is

A. less than 4

B. at least 4 but less than 7

C. at least 7 but less than 10

D. at least 0

Answer: B

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

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

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

is inconsistent is

A. 0

B. more than 2

C. 2

D. 1

Answer: C

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112.

$A = \begin{bmatrix} 2 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}, AU_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}_{3 \times 1} 'AU_2 = \begin{bmatrix} 2 \\ 3 \\ 0 \end{bmatrix}_{3 \times 1}$

and $AU_3 = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}_{3 \times 1}$

If U_1, U_2, U_3 are columns of matrix U, then

Determinant of U is

A. 13

B. 15

C. 3

D. 2

Answer: D

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113.

$A=\begin{bmatrix}2&0&1\\1&1&0\\1&0&1\end{bmatrix}$, $AU_1=\begin{bmatrix}1\\0\\0\end{bmatrix}_{3\times1}$,$AU_2=\begin{bmatrix}2\\3\\0\end{bmatrix}_{3\times1}$

and $AU_3=\begin{bmatrix}3\\2\\1\end{bmatrix}_{3\times1}$

If U_1, U_2, U_3 are columns of matrix U, then

Sum of elements of U^{-1} is

A. $-\frac{1}{3}$

B. $\frac{1}{12}$

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

D. 0

Answer: C

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114. 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 areU_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. 12

B. 21

C. 19

D. 24

Answer: D

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Problem Set 1 Assertion Reason

1. Let A be a 2×2 matrix with real entries. Let I be the 2×2 identity matrix. Denoted by tr(A), the sum of diagonal entries of A. Assume that $A^2 = I$

Statement 1: If $A \ne I$ and $A = -I$, then det A=-1

Statement 2: If $A \ne I$ and A=-I, then tr $A \ne 0$.

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2. Let A be a square matrix all of whose entries are integers. If det $A = \pm 1$ then Prove A^{-1} exists and all its entries.

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3. 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 elemets 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:

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Problem Set 1 True And False

1. If $A+B=\begin{bmatrix}1&0&2\\2&2&2\\1&1&2\end{bmatrix}$ and $A-B=\begin{bmatrix}1&4&4\\4&2&0\\-1&1&2\end{bmatrix}$ then $A=\begin{bmatrix}1&2&3\\3&2&1\\0&0&2\end{bmatrix}$ and $B=\begin{bmatrix}0&-2&-1\\-1&0&1\\1&1&0\end{bmatrix}$

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2. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ and $4A - 3B + C = O$, then $C = \begin{bmatrix} 2 & 1 \\ 3 & -1 \end{bmatrix}$.

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3. Is the equation given below valid?

$$\begin{bmatrix} 2 & 3 \\ 7 & 8 \\ 9 & 1 \end{bmatrix} - \begin{bmatrix} 2 & 3 \\ 7 & 9 \\ 9 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix} - \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$$

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4. The matrices A and B commute

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 0 \\ -1 & -1 & -1 \end{bmatrix}, B = \begin{bmatrix} -2 & -1 & -6 \\ 3 & 2 & 9 \\ -1 & -1 & -4 \end{bmatrix}$$

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5. Is it possible to define the matrix AB and BA when

a. A has 3 rows, B has 2 rows.

b. B has 3 columns and B has 4 columns

c. A has 4 rows and B has 4 columns.

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

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

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8. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, find A^2 and show that $A^2 = A^{-1}$.

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9. If

$x + 2y + 3z = 6$

$3x - 2y + z = 2$

$4x + 2y + z = 7$ then $x - 1, y = 1, z = 1.$

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Problem Set 1 Fill In The Blanks

1. Is it possible to define the matrix A + B when

a. A has 3 rows and B has 2 rows...............

b. A has 2 columns and B has 4 columns...................

c. A has 3 rows and B has 2 columns................

d Both A and B are square matrices of the same order

....

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

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3. If $\begin{bmatrix} 4 \\ 1 \\ 3 \end{bmatrix} A = \begin{bmatrix} -4 & 8 & 4 \\ -1 & 2 & 1 \\ -3 & 6 & 3 \end{bmatrix}$ then A=..........

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4. If A be any $m \times n$ matrix and both AB and BA are defined then B should be ....matrix.

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5. If $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then $7A^3 + 4A^2 - 11A =$ ....

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6. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ then $A^2 =$ ....

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7. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then $A^2 - 4A - 5I = $ ....

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8. If $A = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ then AB=............

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9. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 3 & 1 & 5 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$ then $2A - 3B = $ ....

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10. If $A=\begin{bmatrix}9 & 1\\4 & 3\end{bmatrix}, B=\begin{bmatrix}1 & 5\\6 & 11\end{bmatrix}$ and $3A+5B+2C=0$ then C=............

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11. If $A=\begin{bmatrix}2 & -2 & -4\\-1 & 3 & 4\\1 & -2 & x\end{bmatrix}$ is an idempotent matrix, then x=............

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12. If $A=\begin{bmatrix}2 & 1\\1 & 3\end{bmatrix}, B=\begin{bmatrix}3 & 2 & 0\\1 & 0 & 4\end{bmatrix}$, then AB=.............

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

AB=...............

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

AB+BA=.............

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

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16. The inverset of $A = \begin{bmatrix} -4 & -3 & -3 \\ 1 & 0 & 1 \\ 4 & 4 & 3 \end{bmatrix}$ is ....

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17. If $A = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$ then A^{-1}=...........

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

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19. The inverse of $\begin{bmatrix}3 & 5 & 7\\ 2 & -3 & 1\\ 1 & 1 & 2\end{bmatrix}$ is ....

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Self Assessment Test

1. The number of 3×3 matrices A whose entries are either 0 or 1 and for which the system

$A[xyz] = [100]$ has exactly two distinct solution is a. 0 b. $2^9 - 1$ c. 168 d. 2

A. 0

B. $2^9 - 1$

C. 168

D. 2

Answer: A

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2. If P is a 3×3 matrix such that $P^T = 2P + I$ whre P^T is the transpose of P and I is the 3×3 identify matrix, then thre 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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3. Let $A=\begin{pmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 3 & 2 & 1\end{pmatrix}$. If u_1 and u_2 are column matrices such that $Au_1=\begin{pmatrix}1\\0\\0\end{pmatrix}$ and $Au_2=\begin{pmatrix}0\\1\\0\end{pmatrix}$, then u_1+u_2 is equal to :

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

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: D

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4. 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^{10}

B. 2^{11}

C. 2^{12}

D. 2^{13}

Answer: D

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

A. -2

B. 0.01

C. 0

D. -1

Answer: C

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6. Let M and N be two even order non singular skew symmetric matrices than MN=NM. If P^T denotes the transpose of P, then $M^2N^2(M^TN)^{-1}(MN^{-1})^T$ is equal to

A. M^2

B. $-N^2$

C. $-M^2$

D. MN

Answer: C

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7. 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. 0.02

B. 0.03

C. 4

D. 0.08

Answer: A

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8. 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

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9. 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. < 4

B. 5

C. 6

D. at least 7

Answer: D

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10. Let ω be the complex number $\cos\frac{2\pi}{3} + I\sin\frac{2\pi}{3}$.

Then the number of distinct complex numbers z satisfying

$$\begin{vmatrix} z+1 & \omega & \omega^2 \\ \omega & z+\omega^2 & 1 \\ \omega^2 & 1 & z+\omega \end{vmatrix} = 0$$ is equal to

A. 1

B. 2

C. 0

D. 4

Answer: A

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11. Let k be a positive real number and let

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

$$b = \begin{bmatrix} 0 & 2k-1 & \sqrt{k} \\ 1-2k & 0 & 0\sqrt{k} \\ -\sqrt{k} & -2\sqrt{k} & 0 \end{bmatrix}$$

If det(Adj(A))+det(Adj(B)) $= 10^6$ then [k] is equal to

A. 4

B. 6

C. 0

D. 1

Answer: A

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12. Let M be a 3×3 matrix satisfying

$$M\begin{bmatrix}0\\1\\0\end{bmatrix}=\begin{bmatrix}-1\\2\\3\end{bmatrix},\ M\begin{bmatrix}1\\-1\\0\end{bmatrix}=\begin{bmatrix}1\\1\\-1\end{bmatrix}$$ and

$$M\begin{bmatrix}1\\1\\1\end{bmatrix}=\begin{bmatrix}0\\0\\12\end{bmatrix}$$ then

The sum of the diagonal entries of M is

A. 9

B. 4

C. 1

D. 10

Answer: A

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13. If $P=\begin{bmatrix}1 & \alpha & 3\\ 1 & 3 & 3\\ 2 & 4 & 4\end{bmatrix}$ is the adjoing of a 3×3 matrix A and $|A|=4$ then α is equal to

A. 4

B. 11

C. 5

D. 0

Answer: B

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Comprehension

1. 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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2. 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 the trace of A is not divisible by p but det(A) is 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: C

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3. 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 det(A) is not divisible by p, is :

A. $2p^2$

B. $p^3 - 5p$

C. $p^3 - 3p$

D. $p^3 - p^2$

Answer: D

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