MATHS

JEE (MAIN AND ADVANCED MATHEMATICS) FOR BOARD AND COMPETITIVE EXAMS

MATRICES

Example 1

1. Consider the following information regarding the number of men and women workers in three factories I, II and III.

	Men workers	Women workers
I	100	70
II	120	50
III	180	90

Represent above information in the form of a 3×2 matrix. What does the entry in the 2^{nd} row and 2^{nd} column represent ?

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Example 2

1. If a matrix has 18 elements what are the possible orders it can have ?

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Example 3

1. Construct a 3×3 matrix whose elements are given by
$$a_{ij} = \begin{cases} \frac{1}{2}|2i - 3j|, i \neq j \\ |2i - j|, i = j \end{cases}$$

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Example 4

1. If $\begin{bmatrix} x-2 & y-3 \\ z+1 & t-4 \end{bmatrix} = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ then find x,y,z and t.

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Example 5

1. If $\begin{bmatrix} x-2y & 2x-y \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 4 \\ 3 & 4 \end{bmatrix}$ then find x and y.

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Example 6

1. $A = \begin{bmatrix} 1 & 2 & 3 & -4 \\ -1 & 8 & 3 & 2 \end{bmatrix}, B = [b_{ij}]_{m \times n}$. Find the value of m and n for which A+B can be defined.

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Example 7

1. Let $A = \begin{bmatrix} \sqrt{3} & -1 \\ 2+\sqrt{3} & 1-\sqrt{3} \end{bmatrix}, B = \begin{bmatrix} -\sqrt{3} & 2 \\ 2-\sqrt{3} & 1+\sqrt{3} \end{bmatrix}$ Find A+B.

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Example 8

1. Let $A = \begin{bmatrix} 3 & 2 & 3 \\ -1 & 4 & -2 \\ 1 & 4 & 2 \end{bmatrix}$ Find additive inverse of A.

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Example 9

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

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Example 10

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

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Example 11

1. $A=\begin{bmatrix}1 & 2\\ 3 & 4\\ 5 & 6\end{bmatrix}, B=\begin{bmatrix}0 & 1\\ -1 & 2\\ -2 & 1\end{bmatrix}$, then find matrix X such that 2A +3X=5B.

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Example 12

1. Let $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}, B=\begin{bmatrix}-1 & -2\\ -4 & -3\end{bmatrix}$, find AB and BA.

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Example 13

1. If $A = \begin{bmatrix} 1 & 2 & 0 \\ -1 & 0 & 1 \\ 1 & 2 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 2 & 1 \\ -1 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 1 & 2 & 1 & 2 \end{bmatrix}$ Find A(BC), (AB)C and prove that A(BC)=(AB)C.

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Example 14

1. If $A + I = \begin{bmatrix} 2 & 2 & 3 \\ 3 & -1 & 1 \\ 4 & 2 & 2 \end{bmatrix}$ then show that $A^3 - 23A - 40I = 0$

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Example 15

1. A trust has Rs. 60,000 that must be invested in two different types of bonds. The first type of bond pays 10% interest per year and the second type pays 12%. Using matrix multiplication, determine how to invest Rs. 60,000 into two types of bonds so that the total annual interest received is Rs. 6400.

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Example 16

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

(i) $(A')' = A$

(ii) $(kB)' = kB'$

(iii) $(A+B)' = A' + B'$

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Example 17

1. $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & 1 & 4 \end{bmatrix}, B = \begin{bmatrix} 1 & -1 \\ 2 & 3 \\ -1 & 1 \end{bmatrix}$, verify (AB)'=B'A'

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Example 18

1. If $A = \begin{bmatrix} a & 2 & 3 \\ b & c & 4 \\ d & e & f \end{bmatrix}$ is skew symmetric matrix, then find a,b,c,d,e,f.

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Example 19

1. Express the matrix $A = \begin{bmatrix} 2 & -3 & 4 \\ -1 & 4 & 3 \\ 1 & -2 & 3 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix

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Example 20

1. Statement 1: If A is an orthogonal matrix of order 2, then $|A| = \pm 1$.

Statement 2: Every two-rowed real orthogonal matrix is of any one of the forms $\left(\cos\theta - s\int h\eta s\int h\eta \cos\theta\right)$ or $\left(\cos\theta s\int h\eta s\int h\eta - \cos\theta\right)$.

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Example 21

1. Prove that the matrix A= $\begin{bmatrix} \frac{1+i}{2} & \frac{-1+i}{2} \\ \frac{1+i}{2} & \frac{1-i}{2} \end{bmatrix}$ is unitary.

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Example 22

1. If A is an idempotent matrix, then show that B=I-A is also idempotent and AB=BA=0

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Example 23

1. Let $A = \begin{bmatrix} 4 & 1 \\ -9 & -2 \end{bmatrix}$, then find A^{100}.

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Try Yourself

1. If a matrix has 20 elements what are possible orders it can have ?

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

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3. Let $A = [a_{ij}]_{3 \times 3}$ be a scalar matrix and $a_{11} + a_{22} + a_{33} = 15$ then write matrix A.

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4. If $\begin{bmatrix} -5 & 8 \\ -3 & 4 \end{bmatrix} = \begin{bmatrix} a & b \\ c & 4 \end{bmatrix}$ then find the value of $a^3 + b^3 + c^3$ a) 0 b) 120 c) 360 d) none of these

A. 0

B. 120

C. 360

D. none of these

Answer:

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5. Find additive inverse of $A = \begin{bmatrix} 1 & 2 & -1 \\ -4 & 3 & -2 \\ 1 & -1 & 4 \end{bmatrix}$.

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6. If $A = \begin{bmatrix} 2 & 1 \\ -3 & 2 \end{bmatrix}, B = \begin{bmatrix} 4 & 1 \\ -3 & 2 \end{bmatrix}$ Find 2A+3B.

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7. $A = \begin{bmatrix} 1 & 2 & 1 \\ 3 & -1 & 2 \\ 1 & 0 & 3 \end{bmatrix}, B = \begin{bmatrix} 1 & 1 & 1 \\ -1 & 1 & 1 \\ 2 & -2 & 2 \end{bmatrix}$ then find matrix X such that 2A+X=2B.

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8. $A+B=\begin{bmatrix}4 & -2 & 2\\ 6 & 8 & 10\\ 2 & -4 & 12\end{bmatrix}, A-B=\begin{bmatrix}2 & -4 & -2\\ 6 & -8 & -8\\ -2 & 4 & -6\end{bmatrix}$. Find A,B.

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9. $A=\begin{bmatrix}1 & 2 & 3\\ 4 & 1 & -1\\ 2 & 3 & 1\end{bmatrix}, B=\begin{bmatrix}1 & -1 & 1\\ 2 & 0 & 1\\ 1 & 1 & 1\end{bmatrix}$, verify (AB)'=B'A'.

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10. If $A=\begin{bmatrix}1 & 2 & 3\\ 3 & 2 & 1\end{bmatrix}, B=\begin{bmatrix}1 & -1 & 4\\ 2 & 3 & 1\end{bmatrix}$, verify that

(i) (B')'=B , (ii) (A-B)'=A'-B'

(iii) (A+B)'=A'+B' , (iv) (kA)'=kA', where k is any constant

(v) (2A+3B)'=2A'+3B'

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11. $A=\begin{bmatrix}1 & 4 & 9\\ -1 & 2 & 0\\ 3 & 1 & 9\end{bmatrix}$. Represent A as sum of symmetric and skew symmetric matrix

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12. Let $A=\begin{bmatrix}1 & a & 4\\ 2 & 3 & c\\ b & -2 & 4\end{bmatrix}$. If A is symmetric matrix, then find a,b,c.

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Assignment Section A Objective Type Questions One Option Is Correct

1. Let A be 5×8 matrix, then each column of A contains

A. 5 elements

B. 8 elements

C. 40 elements

D. 13 elements

Answer: A

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2. If A is matrix of order 10×15, then each row of A contains

A. 25 elements

B. 15 elements

C. 10 elements

D. 150 elements

Answer: B

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3. The number of all possible matrices of order 2×3 with each entry 1 or -1 is (i) 32 (ii)12 (iii)6 (iv)64

A. 32

B. 12

C. 6

D. 64

Answer: D

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4. If A is of order $m \times n$ and B is of oredr $p \times q$, then AB is defined only if

A. m=q

B. m=p

C. n=p

D. n=q

Answer: C

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5. Question 1: If P is of order 2 x 3 and Q is of order 3 x 2, then P Q is of order , 2 x 3 ,2 x 2 , 3 x 2 , 3 x 3,

A. 2×3

B. 2×2

C. 3×2

D. 3×3

Answer: B

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

A. $A^2 = 0$

B. $A^2 = A$

C. $A^3 = A$

D. $A^2 = 2A$

Answer: A

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7. If A is a square matrix, then A is symmetric, iff

A. $A^2 = A$

B. $A^2 = l$

C. $A^T = A$

D. $A^T = -A$

Answer: C

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8. If A is a square matrix, then A is skew symmetric if

A. $A^2 = A$

B. $A^2 = l$

C. $A^T = A$

D. $A^T = -A$

Answer: D

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9. If A is any square matrix, then

A. $A + A^T$ is skew symmetric

B. $A - A^T$ is symmetric

C. AA^T is symmetric

D. AA^T is skew symmetric

Answer: C

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10. If A and B are symmetric matrices of the same order then (AB-BA) is always

A. AB is a symmetrix matrix

B. A-B is a skew - symmetric matrix

C. AB+BA is a symmetric matrix

D. AB-BA is a symmetric matrix

Answer: C

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11. Let A be a square matrix. Then which of the following is not a symmetric matrix -

A. $A+A^T$

B. $A-A^T$

C. AA^T

D. A^TA

Answer: B

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12. Each diagonal elemetn of a skew symmetric matrix is (A) zero (B) negative (C) positive (D) non real

A. Zero

B. Positive and equal

C. Negative and equal

D. any real number

Answer: A

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13. If $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$, then A^{2008} is equal to

A. $\begin{bmatrix} 2008 & 0 \\ 1 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 \\ 2008 & 1 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 0 \\ 1 & 2008 \end{bmatrix}$

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

Answer: B

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14. If $A = [xyz]$, $B = \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$, $C = [\alpha\beta\gamma]^T$ then ABC is

A. Not defined

B. Is a 3×3 matrix

C. Is a 1×1 matrix

D. Is a 3×2 matrix

Answer: C

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15. if for a matrix A, $A^2 + I = O$, where I is the 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: B

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16. about to only mathematics

A. 2AB

B. 2BA

C. AB

D. A+B

Answer: D

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

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

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

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

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

Answer: A

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18. $\begin{bmatrix} 7 & 1 & 2 \\ 9 & 2 & 1 \end{bmatrix}\begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix} + 2\begin{bmatrix} 4 \\ 2 \end{bmatrix}$ is equal to

A. $\begin{bmatrix} 45 \\ 44 \end{bmatrix}$

B. $\begin{bmatrix} 43 \\ 45 \end{bmatrix}$

C. $\begin{bmatrix} 44 \\ 43 \end{bmatrix}$

D. $\begin{bmatrix} 43 \\ 44 \end{bmatrix}$

Answer: D

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19. If $f(x) = x^2 + 4x - 5 \text{ and } A = \begin{bmatrix} 1 & 2 \\ 4 & -3 \end{bmatrix}$, then f(A) is equal to

A. $\begin{bmatrix} 0 & -4 \\ 8 & 8 \end{bmatrix}$

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

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

D. $\begin{bmatrix} 8 & 4 \\ 8 & 0 \end{bmatrix}$

Answer: D

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20. Multiplicative inverse of the matrix $\begin{bmatrix} 2 & 1 \\ 7 & 4 \end{bmatrix}$ is (i) $\begin{bmatrix} 4 & -1 \\ -7 & -2 \end{bmatrix}$ (ii) $\begin{bmatrix} -4 & -1 \\ 7 & -2 \end{bmatrix}$ (iii) $\begin{bmatrix} 4 & -1 \\ 7 & 2 \end{bmatrix}$ (iv) $\begin{bmatrix} 4 & -1 \\ -7 & 2 \end{bmatrix}$

A. $\begin{bmatrix} 4 & -1 \\ -7 & -2 \end{bmatrix}$

B. $\begin{bmatrix} -4 & -1 \\ 7 & -2 \end{bmatrix}$

C. $\begin{bmatrix} 4 & -1 \\ 7 & 2 \end{bmatrix}$

D. $\begin{bmatrix} 4 & -1 \\ -7 & 2 \end{bmatrix}$

Answer: D

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21. If the matrix A is such that $\begin{pmatrix} 1 & 3 \\ 0 & 1 \end{pmatrix} A = \begin{pmatrix} 1 & 1 \\ 0 & -1 \end{pmatrix}$, then what is A equal to ?

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

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

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

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

Answer: B

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22. If A is a square matrix such that $A^2 = I$, then A^{-1} is equal to $A + I$

(b) A (c) 0 (d) $2A$

A. I

B. 0

C. A

D. I+A

Answer: A

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23. If $X+\begin{bmatrix}2 & 1\\ 6 & 1\end{bmatrix}=\begin{bmatrix}1 & 1\\ 0 & 1\end{bmatrix}$ then 'X' is equal to

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

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

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

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

Answer: C

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24. If $A = \begin{bmatrix} 1 & 2 & 3 \\ -2 & 5 & 7 \end{bmatrix}$ and $2A - 3B = \begin{bmatrix} 4 & 5 & -9 \\ 1 & 2 & 3 \end{bmatrix}$ then B is equal to

A. $\frac{1}{3}\begin{bmatrix} -2 & -1 & 15 \\ 5 & 8 & -11 \end{bmatrix}$

B. $\frac{1}{3}\begin{bmatrix} 2 & 1 & -15 \\ 5 & -8 & -11 \end{bmatrix}$

C. $\frac{1}{3}\begin{bmatrix} 2 & -1 & 15 \\ 5 & 8 & 11 \end{bmatrix}$

D. $\frac{1}{3}\begin{bmatrix} -2 & -1 & 15 \\ -5 & 8 & 11 \end{bmatrix}$

Answer: D

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25. If $\begin{bmatrix} x & 1 \\ -1 & -y \end{bmatrix} + \begin{bmatrix} y & 1 \\ 3 & x \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, then

A. x=-1, y=0

B. x=1, y=0

C. x=0, y=1

D. x=1, y=1

Answer: B

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26. Let $A = \begin{bmatrix} 2 & 3 & 5 \\ 1 & 0 & 2 \\ 3 & 4 & 5 \end{bmatrix}$ and $A + B - 4I = 0$, then B is equal to

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

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

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

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

Answer: A

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27. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 8 \\ 4 & 9 \end{bmatrix}$ and $X + A = 0$, then X is equal to

A. $\begin{bmatrix} 1 & 2 \\ 1 & 8 \\ 4 & 9 \end{bmatrix}$

B. $\begin{bmatrix} -1 & -2 \\ 1 & 8 \\ 4 & 9 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 2 \\ 1 & -8 \\ 4 & 9 \end{bmatrix}$

D. $\begin{bmatrix} -1 & -2 \\ 1 & -8 \\ -4 & -9 \end{bmatrix}$

Answer: D

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28. Show that $\cos\theta.\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} + \sin\theta.\begin{bmatrix} \sin\theta & -\cos\theta \\ \cos\theta & \sin\theta \end{bmatrix} = I.$

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

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

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

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

Answer: B

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29. If $\begin{bmatrix} x+y & y-z \\ z-2x & y-x \end{bmatrix} = \begin{bmatrix} 3 & -1 \\ 1 & 1 \end{bmatrix}$, then

A. x=2,y=1,z=3

B. x=3,y=1,z=2

C. x=1,y=2,z=3

D. x=1,y=3,z=2

Answer: C

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30. If $A = [1 - 32202]$ and, $B = [2 - 1 - 110 - 1]$, find the matrix C such that $A + B + C$ is zero matrix.

A. $\begin{bmatrix} -3 & 4 & -1 \\ -3 & 0 & -1 \end{bmatrix}$

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

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

D. $\begin{bmatrix} 3 & 4 & 1 \\ 3 & 0 & 1 \end{bmatrix}$

Answer: A

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Assignment Section B Objective Type Questions One Option Is Correct

1. If A is a matrix of order $[x - 1] \times 3$ and B is matrix of order $3 \times [y - 2]$,where [ ] represent greatest integer function, such that AB is a matrix of order 4×5 then

A. $x \in [5, 6)$

B. $x \in [5, 6]$

C. $y \in [7, 8]$

D. $y \in [8, 9]$

Answer: A

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

A. A diagonal matrix with atleast two diagonal elements different

B. A scalar matrix

C. A unit matrix

D. A diagonal matrix with exactly two diagonal elements different

Answer: B

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

A. A is an idempotent matrix but B is not

B. B is an idempotent matrix but A is not

C. A and B are both idempotent matrices

D. Neither A nor B are idempotent matrices

Answer: C

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4. Which of the following about the trace of a matrix is false? (1) $tr(ABC) = tr(BCA) \neq tr(ACB) = tr(BAC) = tr(CBA)$ (2) $tr(AB) = tr(BA)$ (3) $tr(A - B) = trA - trB$ (4) $tr\left(A^2\right) = (trA)^2$

A. tr(ABC)-tr(BCA)=tr(ACB)=tr(BAC)=tr(CBA)

B. tr(AB)=tr(BA)

C. tr(A-B)trA-trB

D. $tr\left(A^2\right) = (trA)^2$

Answer: D

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

A. AB=BA

B. AB+BA=O

C. AB-BA=I

D. AB+BA=I

Answer: B

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6. If $A = \begin{bmatrix} a & b \end{bmatrix}, b = \begin{bmatrix} -b & -a \end{bmatrix}$ and $C = \begin{bmatrix} a \\ -a \end{bmatrix}$, then correct statement is

A. A=-B

B. A+B=A-B

C. AC=BC

D. CA=CB

Answer: C

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7. Let $A = \begin{bmatrix} 1 & \frac{x}{n} \\ -\frac{x}{n} & 1 \end{bmatrix}$, then $\lim_{n \to \infty} A^n$ is:

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

B. (b) $\begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$

C. (c) $\begin{bmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{bmatrix}$

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

Answer: B

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8. Let A be a square matrix of order n.

l= maximum number of different entries if A is a upper triangular matrix.

m= minimum number of zeros if A is a triangular matrix.

p = minimum number of zeros if A is a diagonal matrix.

If $l + 2m = 2p + 1$, then n is :

A. (a) 1

B. (b) 2

C. (c) 3

D. (d) 4

Answer: C

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9. Let $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $P = \begin{bmatrix} \cos\left(\frac{\pi}{6}\right) & \sin\left(\frac{\pi}{6}\right) \\ -\sin\left(\frac{\pi}{6}\right) & \cos\left(\frac{\pi}{6}\right) \end{bmatrix}$ and $Q = PAP^T$ then $P^T Q^{2013} P$ is:

A. (a) $\begin{bmatrix} 1 & 2013 \\ 0 & 1 \end{bmatrix}$

B. (b) $\begin{bmatrix} 0 & 2013 \\ 0 & 1 \end{bmatrix}$

C. (c) $\begin{bmatrix} 2013 & 0 \\ 0 & 2013 \end{bmatrix}$

D. (d) $\begin{bmatrix} 0 & 2013 \\ 2013 & 0 \end{bmatrix}$

Answer: A

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10. Let t be the trace of matrix A $\left[\left(\frac{|x+y|}{|x|+|y|}, \alpha_1, \beta_1\right), \left(\alpha_2, \frac{|y+z|}{|y|+|z|}, \beta_2\right), \left(\alpha_3, \beta_3, \left(\frac{|z+x|}{|z|+|x|}\right)\right]$ then

A. A) $0 \leq t < 3$

B. B) $1 \leq t \leq 2$

C. C) $1 \leq t \leq 3$

D. D) $-1 \leq t \leq 1$

Answer: C

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11. 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 in A is

A. 6

B. 12

C. 9

D. 18

Answer: B

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12. The number of matrices of A of order 2×2 such that AB-BA=I, where B is a given matrix,

A. 0

B. 1

C. 2

D. Infinite

Answer: A

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13. Let X be the solution set of the equation

$A^{x} = I$, where A $= \begin{vmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{vmatrix}$ and I is the unit matrix and $X \subset N$

then the minimum value of $\sum_{x} \left(\cos^{x}\theta + \sin^{2}\theta\right), \theta \in R$ is

A. 2

B. 4

C. 0

D. -2

Answer: A

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Assignment Section C Objective Type Questions More Than One Options Are Correct

1. The product of matrices $A = \begin{bmatrix} \cos^2\theta & \sin\theta\cos\theta \\ \sin\theta\cos\theta & \sin^2\theta \end{bmatrix}$ and $B = \begin{bmatrix} \cos^2\phi & \sin\phi\cos\phi \\ \sin\phi\cos\phi & \sin^2\phi \end{bmatrix}$ is a null matrix if $\theta - \phi =$ (A) $2n\pi, n \in Z$ (B) $\frac{n\pi}{2}, n \in Z$ (C) $(2n+1)\frac{\pi}{2}, n \in Z$ (D) $n\pi, n \in Z$

A. $C\left(\frac{2\pi}{5}, \ -\frac{11\pi}{10}\right)$

B. $C\left(\frac{11\pi}{10}, \ -\frac{2\pi}{5}\right)$

C. $C\left(\frac{3\pi}{7}, \ -\frac{41\pi}{14}\right)$

D. $C\left(\frac{7\pi}{3}, \ -\frac{29\pi}{6}\right)$

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

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2. If A and B are commuting square matrices of the same order, then which of the following is/are correct ?

A. (a)A and B^n commute, $n \in N$

B. (b)A^n and B commute, $n \in N$

C. (c)$A-\lambda$ and $B+\mu$ commute, $\lambda, \mu \in R$

D. (d)$A+\lambda$ and $B-\mu$ commute,$\lambda, \mu \in R$

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

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3. A matrix $A=\left[a_{ij}\right]_{m \times n}$ is

A. (a)Horizontal matrix if $m>n$

B. (b)Horizontal matrix if $m<n$

C. (c)Vertical matrix if $m>n$

D. (d)Vertical matrix if $m<n$

Answer: B::C

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4. If $A = [a_{ij}]$ is a square matrix of even order such that $a_{ij} = i^2 - j^2$, then (a) A is a skew-symmetric matrix and $|A| = 0$ (b) A is symmetric matrix and $|A|$ is a square (c) A is symmetric matrix and $|A| = 0$ (d) none of these

A. A is skew - symmetric

B. $|A|$ is perfect square

C. A is symmetric and $|A| = 0$

D. A is neither symmetric nor skew - symmetric

Answer: A::B

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5. If A and B are two square matrices such that they commute, then which of the following is true?

A. $AB^{2013} = B^{2013}A$

B. $(AB)^{2013} = A^{2013}B^{2013}$

C.

$$(A+B)^n = .^n C_0 A^n + .^n C_1 A^{n-1} B + .^n C_2 A^{n-2} B^2 + \ldots . + .^n C_n$$

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

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

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6. If A is a nilpotent matrix of odd order r, then which of the following is true?

A. (a)$l = (l - A)\left(l^{r-2}A + l^{r-3}A^2 + \ldots + A^{r-1}\right)$

B. (b)$l = (l + A)\left(l^{r-1} + l^{r-2}A + l^{r-3}A^2 + \ldots . + A^{r-1}\right)$

C. (c)$l = (l + A)\left(l^{r-1} - l^{r-2}A + l^{r-3}A^2 - \ldots . + A^{r-1}\right)$

D. (d)$l = (l - A)\left(l^{r-1} - l^{r-2}A + l^{r-3}A^2 - \ldots + A^{r-1}\right)$

Answer: A::C

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

A. A is symmetric

B. A is skew-symmetric

C. $A^2=\frac{3l}{4}$

D. $A^2=\frac{-3l}{4}$

Answer: B::D

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Assignment Section D Linked Comprehension Type Questions

1. Let ψ_A be defined as trace of a matrix A which is sum of diagonal elements of a square matrix. $\psi_{\lambda A+\mu B}=$

A. (a) $\lambda\psi_A + \mu\psi_B$

B. (b) $\lambda\psi_B + \mu\psi_A$

C. (c) $\lambda\psi_{AB} + \mu\psi_{BA}$

D. (d) none of these

Answer: A

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2. Let ψ_A be defined as trace of a matrix A which is sum of diagonal elements of a square matrix. Which of the following is true?

A. (a) $\psi_{A+B} = \psi_{A-B}$

B. (b) $\psi_{A+B} = \psi_{AB}$

C. (c) $\psi_{AB} = \psi_{BA}$

D. (d) $\psi_{A-B} = \psi_{BA}$

Answer: C

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3. Let ψ_A be defined as trace of a matrix A which is sum of diagonal elements of a square matrix. $\psi_{\lambda A + \mu B} =$

A. $\Psi_{ABC} = \Psi_{BAC}$

B. $\Psi_{ABC} = \Psi_{CBA}$

C. $\Psi_{ABC} = \Psi_{BCA}$

D. none of these

Answer: C

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Assignment Section E Assertion Reason Type Questions

1. Let A and B be n-rowed square matrices

STATEMENT - 1 The identity $(x+y)^2 = x^2 + 2xy + y^2$ doesn't hold when x and y are substituted by A and B.

and

STATEMENT- 2 : Matrix multiplication is not commutative

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

B. Statement-1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement-1

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is False , Statement -2 is True

Answer: A

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

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

B. Statement-1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement-2

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is False , Statement -2 is True

Answer: A

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3. STATEMENT -1 : $A = \frac{1}{3}\begin{bmatrix} 1 & -2 & 2 \\ -2 & 1 & 2 \\ -2 & -2 & -1 \end{bmatrix}$ is an orthogonal matrix

and

STATEMENT-2 : If A and B are otthogonal, then AB is also orthogonal.

A. Statement -1 is True, Statement -2 is True , Statement -2 is a correct explanation for Statement-3

B. Statement-1 is True, Statement -2 is True , Statement -2 is NOT a correct explanation for Statement-3

C. Statement -1 is True, Statement -2 is False

D. Statement -1 is False , Statement -2 is True

Answer: B

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Assignment Section F Matrix Match Type Question

1. Match the following

	Column-I
(A)	If A and B are otthogonal, then AB is
(B)	If A and B are nilpotent matrices of order r and s and A and B comm
(C)	If A is a hermitian matrix such that $A^2 = 0$, then A is
(D)	If A and B are unitary matrices, then AB is

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Assignment Section G Integer Answer Type Questions

1. Let $A=\begin{bmatrix}0 & 2\\ 0 & 0\end{bmatrix}$ and $(A+1)^{100}-100A=\begin{bmatrix}\alpha & \beta\\ \gamma & \delta\end{bmatrix}$, then $\alpha+\beta+\gamma+\delta=\ldots$

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2. Let $A=\begin{bmatrix}\omega & -\omega\\ -\omega & \omega\end{bmatrix}$ where w is a complex cube root of unity, $B=\left[(1,\ -1),(\ -1,1)\right.$ and $A^9=2^kB$, where $k=\ldots.$

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3. If A is a 3×3 skew-symmetric matrix, then trace of A is equal to -1 b. 1 c. $|A|$ d. none of these

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4. Let A be a square matrix of $2x2$ satisfyinga. $a_{ij} = 1$ or -1 and $a_{11} \cdot a_{21} + a_{12} \cdot a_{22} = 0$ then the no. of matrix

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Assignment Section H Multiple True False Type Questions

1. STATEMENT -1 All positive odd integral powers of a skew - symmetric matrix are symmetric.

STATEMENT-2 : All positive even integral powers of a skew - symmetric matrix are symmetric.

STATEMENT-3 If A is a skew - symmetric matrix of even order then $|A|$ is perfect square

A. F T T

B. T T T

C. T F T

D. T T F

Answer: A

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2. If A and B are symmetric matrices of same order, then

STATEMENT-1: A+B is skew - symmetric matrix.

STATEMENT -2 : AB-BA is skew - symmetric matrix.

STATEMENT-3 A-B is skew - symmetric matrix .

A. T T T

B. F T F

C. F T T

D. F F F

Answer: B

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Assignment Section I Subjective Type Questions

1. If A and B are two square matrices of the order 3, then the value of 998 $tr(I) - 999tr(AB) + 999tr$ (BA) is

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2. The matrix $A = \begin{bmatrix} \lambda_1^2 & \lambda_1\lambda_2 & \lambda_1\lambda_3 \\ \lambda_2\lambda_1 & \lambda_2^2 & \lambda_2\lambda_3 \\ \lambda_3\lambda_1 & \lambda_3\lambda_2 & \lambda_3^2 \end{bmatrix}$ is idempotent if $\lambda_1^2 + \lambda_2^2 + \lambda_3^2 = k$ where $\lambda_1, \lambda_2, \lambda_3$ are non-zero real numbers. Then the value of $(10 + k)^2$ is $\dots$

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3. Find all solutions of the matrix equation $X^2 = 1,$ where 1 is the 2*2 unit matrix, and X is a real matrix,i.e. a matrix all of whose elements are real.

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Assignment Section J Aakash Challengers Questions

1. The matrix $A = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{-1}{\sqrt{2}} & \frac{-1}{\sqrt{2}} \end{bmatrix}$ is

A. Unitary

B. Orthogonal

C. Nilpotent

D. Involutary

Answer: C

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2. Let A be an idemopotent matrix and $(l + A)^{100} = l + \left(2^{20k} - 1\right)A$, then k = ...

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3. Let $A = \begin{bmatrix} \alpha & \beta \\ \gamma & \delta \end{bmatrix}$ such that $A^3 = 0$, then sum of all the elements of A^2 is

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