



India's Number 1 Education App

MATHS

BOOKS - DISHA PUBLICATION MATHS (HINGLISH)

MATRICES

Jee Main 5 Years At A Glance

1. Let $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ and $B = A^{20}$. Then the sum of the elements of the first column of B is

A. 211

B. 210

C. 231

D. 251

Answer: C



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2. 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. $5A + 10B = 2I_3$

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

C. $B + 2A = I_3$

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

Answer: B



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3.

If

$$P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}, A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \text{ and } Q = PAP^T, \text{ then } P^T Q^{2015} P$$

, is

- A. $\begin{bmatrix} 1 & 2015 \\ 0 & 1 \end{bmatrix}$
- B. $\begin{bmatrix} \sqrt{3}/2 & 2015 \\ 1 & 0 \end{bmatrix}$
- C. $\begin{bmatrix} 1 & 2015 \\ \sqrt{3}/2 & 1 \end{bmatrix}$
- D. $\begin{bmatrix} 1 & \sqrt{3}/2 \\ 0 & 2015 \end{bmatrix}$

Answer: C



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4. If $A = [1 \ 2 \ 2 \ 1 - 2a \ 2b]$ is a matrix satisfying the equation $\forall^T = 9I$, where I is 3×3 identity matrix, then the ordered pair (a, b) is equal to : (1) (2, -1) (2) (-2, 1) (3) (2, 1) (4) (-2, -1)

A. (2,1)

B. (-2,-1)

C. (2,-1)

D. (-2,1)

Answer: B



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

A. $A^2 + I = A(A^2 - 1)$

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

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

D. $A^3 - I = A(A - 1)$

Answer: A



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6. 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. $y = 2x$

B. $y = -2x$

C. $y=x$

D. $y = -x$

Answer: A



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Exercise 1 Concept Builder Topic 1

1. Square matrix $[a_{ij}]_{n \times m}$ will be an upper triangular matrix, if

A. $a_{ij} \neq 0$ for $i > j$

B. $a_{ij} = 0$ for $i > j$

C. $a_{ij} = 0$ for $i < j$

D. None of these

Answer: B



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2. The number of all possible matrices of order 3×3 with each entry 0 or 1 is (a) 27 (b) 18 (c) 81 (d) 512

A. 18

B. 512

C. 81

D. None of these

Answer: B



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

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

A. 2,3

B. 3,4

C. 2,2

D. 3,3

Answer: C



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4. Construct a 2×2 matrix $A = [a_{ij}]$ whose elements a_{ij} are

given by: (i) $\frac{(i+j)^2}{2}$ (ii) $a_{ij} = \frac{(i-j)^2}{2}$ (iii) $a_{ij} = \frac{(i-2j)^2}{2}$

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

B.
$$\begin{bmatrix} 2 & 9/2 & 25/2 & 9 \\ 9/2 & 5/2 & 5 & 45/2 \\ 25 & 18 & 25 & 9/2 \end{bmatrix}$$

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

D. None of these

Answer: C



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5. Choose the incorrect statement

A. A matrix $A = [3]$ is a scalar matrix of order 1

B. A matrix $B = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ is a scalar matrix of order 2

C. A matrix $C = \begin{bmatrix} \sqrt{3} & 0 & 0 \\ 0 & \sqrt{3} & 0 \\ 0 & 0 & \sqrt{3} \end{bmatrix}$ of order 3 is not a scalar matrix

D. None of these

Answer: C



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6. If $A = [a_{ij}]$ is a scalar matrix of order $n \times n$ such that $a_{ii} = k$ for all i , then trace of A is equal to nk (b) $n + k$ (c) $\frac{n}{k}$ (d) none of these

A. k^n

B. $\frac{n}{k}$

C. nk

D. None of these

Answer: C



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7. If $\begin{bmatrix} x+3 & z+4 & 2y-7 \\ -6 & a-1 & 0 \\ b-3 & -21 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 6 & 3y-2 \\ -6 & -3 & 2c+2 \\ 2b+4 & -21 & 0 \end{bmatrix}$ Find

the values of a, b, c, x, y and z

A. -2,-7,-1,-3,-5,2

B. 2,7,1,3,5,-2

C. 1,3,4,2,8,9

D. -1,3,-2,-7,4,5

Answer: A



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8. Find matrix A, if $\begin{bmatrix} 1 & 2 & -1 \\ 0 & 4 & 9 \end{bmatrix} + A = \begin{bmatrix} 9 & -1 & 4 \\ -2 & 1 & 3 \end{bmatrix}$

A. $\begin{bmatrix} 8 & -3 & -5 \\ -2 & -3 & -6 \end{bmatrix}$

B. $\begin{bmatrix} 8 & -3 & 5 \\ -2 & -3 & -6 \end{bmatrix}$

C. $\begin{bmatrix} 8 & -3 & 5 \\ 2 & -3 & 6 \end{bmatrix}$

D. None of these

Answer: B



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9. In a upper triangular matrix $n \times n$, minimum number of zeros is

A. $n \frac{n-l}{2}$

B. $n \frac{n+l}{2}$

C. $2n(n-1)/2$

D. None of these

Answer: A



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10. If A is a 3×2 matrix, B is a 3×3 matrix and C is a 2×3 matrix,
then the elements in A, B and C are respectively

A. 6,9,8

B. 6,9,6

C. 9,6,6

D. 6,6,9

Answer: B



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

A. $\begin{bmatrix} -1 & 0 \\ 4 & -1 \\ 9 & 9 \end{bmatrix}$

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

C. $\begin{bmatrix} -1 & 0 \\ -4 & 1 \\ -9 & -9 \end{bmatrix}$

D. $\begin{bmatrix} -2 & 0 \\ 4 & -1 \\ 9 & 9 \end{bmatrix}$

Answer: D



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12. If number of elements is 20 then how many different types of matrices can be formed if number of rows is always even?

A. 3

B. 4

C. 5

D. 6

Answer: B



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13. If a matrix has 8 elements, then which of the following will not be a possible order of the matrix?

A. 1×8

B. 2×4

C. 4×2

D. 4×4

Answer: D



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14. The number of all possible matrices of order 3×3 with each entry 0 or 1 is (a) 27 (b) 18 (c) 81 (d) 512

A. 18

B. 512

C. 81

D. None of these

Answer: B



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Exercise 1 Concept Builder Topic 2

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

Answer: C



2. If A is any matrix, then the product AA is defined only when A is a matrix of order $m \times n$ where :

- A. $m \neq n$
- B. $m \neq n$
- C. $M = N$
- D. $m \leq n$

Answer: C



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

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

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

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

Answer: D



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4. If A and B are 2×2 matrices, then which of the following is true ?

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

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

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

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

Answer: C



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5. If p, q, r are 3 real number satisfying the matrix equation,

$$[pqr] \begin{bmatrix} 3 & 4 & 1 \\ 3 & 2 & 3 \\ 2 & 0 & 2 \end{bmatrix} = [3, 0, 1] \text{ then } 2p + q - r \text{ equals}$$

A. -3

B. -1

C. 4

D. 2

Answer: A



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6. If $f(x) = x^2 + 4x - 5$ 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. $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

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

Answer: D



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7. If $\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 0 & 5 & 1 \\ 0 & 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ 1 \\ -2 \end{bmatrix} = [0]$ then x is

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

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

C. 1

D. -1

Answer: B



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8. Let $A = [a \ 0 \ 0 \ 0 \ a \ 0 \ 0 \ 0 \ a]$, then A^n is equal to $[a^n \ 0 \ 0 \ 0 \ a^n \ 0 \ 0 \ 0 \ a^n]$ (b)

$[a^n \ 0 \ 0 \ 0 \ a^n \ 0 \ 0 \ 0 \ a]$ (c) $[a^n \ 0 \ 0 \ a^n \ 0 \ 0 \ 0 \ a^n]$ (d) $[n \ a \ 0 \ 0 \ n \ a \ 0 \ 0 \ n \ a]$

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

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: C



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9. Which is true about matrix multiplication?

- A. It is commutative
- B. It is associative
- C. Both of the above
- D. None of the above

Answer: B



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10. If $R(t) = \begin{bmatrix} \cos t & \sin t \\ -\sin t & \cos t \end{bmatrix}$, then $R(s)R(t)$ equals

- A. $R(s + t)$
- B. $R(s-t)$
- C. $R(s)+R(t)$
- D. None of these

Answer: A



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11. If $\begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ is square root of identity matrix of order 2 then-

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

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

Answer: D



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12. If $A = \begin{bmatrix} 1 & 0 \\ 3 & -1 \\ -5 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ -2 & 2 \\ 1 & 1 \end{bmatrix}$, then find the matrix 'X' such that $3A + X = 5B$.

A. $\begin{bmatrix} 2 & -10 \\ -19 & 13 \\ 20 & -1 \\ -10 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 13 & -19 \\ -1 & 20 \\ -10 & 12 \end{bmatrix}$

C. $\begin{bmatrix} 3 & -19 \\ -1 & 20 \end{bmatrix}$

D. None of these

Answer: A



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13. Find matrices X , if $2X - Y = \begin{bmatrix} 6 & -6 & 0 \\ -4 & 2 & 1 \end{bmatrix}$ and $X + 2Y = \begin{bmatrix} 3 & 2 & 5 \\ -2 & 1 & -7 \end{bmatrix}$.

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

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

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

D. None of these

Answer: C



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14. If $A = [1 \ 2 \ 8]$, $B = \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}$, and $C = [0 \ 2 \ 0]$ and

$D = \begin{bmatrix} 5 \\ 2 \\ 4 \end{bmatrix}$, then $AB + CD$ is equal to

A. [66]

B. [-66]

C. [32]

D. [20]

Answer: A



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15. If $\begin{bmatrix} 2 & 0 & 7 \\ 0 & 1 & 0 \\ 1 & -2 & 1 \end{bmatrix} \begin{bmatrix} -x & 14x & 7x \\ 0 & 1 & 0 \\ x & -4x & -2x \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, then find

the value of x

- A. $\frac{1}{2}$
- B. $\frac{1}{5}$
- C. No unique value of 'x'
- D. None of these

Answer: B



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16. If A is involuntary matrix and I is unit matrix of the same order
then $A(I - A)(I + A)$ is equal to

- A. 0
- B. A
- C. I
- D. 2A

Answer: A



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17. Suppose a matrix A satisfies $A^2 - 5A + 7I = 0$. If $A^8 = aA + bI$, find a-b.

A. 5299

B. 6554

C. 11234

D. None of these

Answer: D



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18. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, I is the unit matrix of order 2 and a, b are arbitrary constants, then $(aI + bA)^2$ is equal to

- A. $a^2I + abA$
- B. $a^2I + 2abA$
- C. $a^2I + b^2A$
- D. None of these

Answer: B



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19. If A is a square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to
(a) A (b) $I - A$ (c) I (d) $3A$

- A. A

B. I-A

C. I

D. 3A

Answer: C



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

A. AB and BA are square matrix.

B. AB and BA are of order 8×8 and 3×13 , respectively

C. $AB = BA$

D. None of these

Answer: A



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21. If $X = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 5 & 2 \\ -2 & 1 \end{bmatrix}$ and $A = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ If $AB = C$, then what is A^2 equal to ?

A. $\begin{bmatrix} 6 & -10 \\ 4 & 26 \end{bmatrix}$

B. $\begin{bmatrix} -10 & 5 \\ 4 & 24 \end{bmatrix}$

C. $\begin{bmatrix} -5 & -6 \\ -4 & -20 \end{bmatrix}$

D. $\begin{bmatrix} -5 & -7 \\ -5 & 20 \end{bmatrix}$

Answer: A



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

- A. a null matrix
- B. an identity matrix
- C. $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$
- D. None of these

Answer: A



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23. If matrix $A = ([a_{ij}])_{2 \times 2}$, where $a_{ij} = \begin{cases} 1, & \text{if } i \neq j \\ 0, & \text{if } i + j \end{cases}$, then A^2 is equal to I (b) A (c) O (d) I

A. I

B. A

C. O

D. None of these

Answer: A



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Exercise 1 Concept Builder Topic 3

1. If $A = \begin{bmatrix} 6 & 8 & 5 \\ 4 & 2 & 3 \\ 9 & 7 & 1 \end{bmatrix}$ is the sum of a symmetric matrix B and skew-symmetric matrix C, then B is

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

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

Answer: A



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2. If A and B are square matrices of the same order and if $A = A^T$, $B = B^T$ then $(ABA)^T =$

- A. BAB
- B. ABA
- C. ABAB
- D. AB^T

Answer: B



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3. Which of the following is/are correct ?

- A. $B'AB$ is symmetric if A is symmetric
- B. $B'AB$ is skew-symmetric if A is symmetric
- C. $B'AB$ is symmetric if A is skew-symmetric
- D. None of these

Answer: A



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4. If $A = \begin{bmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{bmatrix}$, then AA^T is

- A. Zero matrix

B. I_2

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

D. None of these

Answer: B



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

A. Diagonal

B. Null

C. Triangular

D. None of these

Answer: B



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6. Which of 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 the above

Answer: C



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7. The element a_{ij} of square matrix is given by

$a_{ij} = (i + j)(i - j)$ then matrix A must be

- A. Skew-symmetric matrix

B. Triangular matrix

C. Symmetric matrix

D. Null matrix

Answer: A



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8. 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. 5

B. -1

C. 2

D. -2

Answer: A



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9. Consider the matrix $A = \begin{bmatrix} 4 & 1 \\ 1 & 5 \end{bmatrix}$ on applying elementary row operations $R_2 \rightarrow R_3 - n_1$, it becomes $\begin{bmatrix} 4 & 3 \\ -11 & -4 \end{bmatrix}$, then the value of $n=$

A. 2

B. 3

C. 4

D. 5

Answer: B



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10. if A and B are matrices of same order, then $(AB' - BA')$ is a
1) null matrix 3)symmetric matrix 2) skew -symmetric matrix 4)unit
matrix

A. skew symmetric matrix

B. null matrix

C. symmetric matrix

D. unit matrix

Answer: A



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11. 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

D. A+I

Answer: A



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12. For any square matrix A , AA^T is a

A. skew-symmetric matrix

B. symmetric matrix

C. diagonal matrix

D. None of these

Answer: B

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13. Which one of the following is wrong?
- A. The elements on the main diagonal of a symmetric matrix are all zero
 - B. The elements on the main diagonal of a skew-symmetric matrix are all zero
 - C. For any square matrix A , $\frac{1}{2}(A + A')$ is symmetric
 - D. For any square matrix A , $\frac{1}{2}(A - A')$ is skew-symmetric

Answer: A

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14. If A is a 3×3 matrix and B is a matrix such that $A^T B$ and BA^T are both defined, then order of B is

A. 3×4

B. 3×2

C. 4×4

D. 4×3

Answer: B



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15. h1. If C is skew-symmetric matrix of order n and X is $n \times 1$ column matrix, then $X'CX$ is a

A. scalar matrix

B. unit matrix

C. null matrix

D. None of these

Answer: C



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

A. -1

B. 1

C. 0

D. None of these

Answer: C



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17. Orthogonal matrix

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

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

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

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

Answer: B



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18. $A = \begin{bmatrix} 2 & -1 \\ -7 & 4 \end{bmatrix}$ & $B = \begin{bmatrix} 4 & 1 \\ 7 & 2 \end{bmatrix}$ then $B^T A^T$ is :

A. $AA^T = I$

B. $BB^T = I$

C. $AB \neq BA$

D. $(AB)^T = I$

Answer: D



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19. If $A = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix}$, then $A^T + A = I_2$, if

A. $\theta = n\pi, n \in Z$

B. $\theta = (2n+1)\frac{\pi}{2}, n \in Z$

C. $\theta = 2n\pi + \frac{\pi}{3}, n \in Z$

D. None of these

Answer: C

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20. Using elementary row transformations, find the inverse of the

$$\text{matrix } A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ -2 & -4 & -5 \end{pmatrix}$$

- A. $\begin{bmatrix} 3 & -3 & 3 \\ -4 & 1 & -1 \\ 2 & 0 & 1 \end{bmatrix}$
- B. $\begin{bmatrix} 3 & -3 & 3 \\ -4 & 2 & -1 \\ 2 & 0 & 1 \end{bmatrix}$
- C. $\begin{bmatrix} 3 & -2 & -1 \\ -4 & 1 & -1 \\ 2 & 0 & 1 \end{bmatrix}$
- D. $\begin{bmatrix} 3 & -2 & 1 \\ -4 & 2 & -1 \\ 2 & 0 & 1 \end{bmatrix}$

Answer: C

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21. Consider the matrices

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

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

A. $(AB)^T C$

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

C. $C^T AB$

D. $A^T ABB^T C$

Answer: B



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22. If $A = \begin{bmatrix} 2 & 1 \\ 0 & x \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} \frac{1}{2} & \frac{1}{6} \\ 0 & \frac{1}{x} \end{bmatrix}$, then the value of x is equal to

A. -3

B. 3

C. -2

D. 6

Answer: A



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23. If P is a two-rowed matrix satisfying $P' = P^{-1}$, then P can be

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: B



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Exercise 2 Concept Applicator

1. If matrix $A = \begin{bmatrix} -5 & -8 & 0 \\ 3 & 5 & 0 \\ 1 & 2 & -1 \end{bmatrix}$ then find

$$tr(A) + tr(A^2) + te(A^3) + \dots + tr(A^{100})$$

A. 100

B. 50

C. 200

D. None of these

Answer: C



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

A. $I + 2^n Z$

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

C. $I - (2^n - 1)Z$

D. None of these

Answer: B



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3. If B , C are n rowed square matrices and if $A = B + C$,
 $BC = CB$, $C^2 = O$, then show that for every $n \in N$,
 $A^{n+1} = B^n(B + (n + 1)C)$.

A. 1

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

C. 2

D. None of these

Answer: A



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

A. B is idempotent

B. $AB = O$

C. $BA = O$

D. None of these

Answer: D



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5. Let A , B and C be $n \times n$ matrices. Which one of the following is a correct statement?

A. If $AB = AC$, then $B = C$

B. If $A^3 + 2A^2 + 3A + 5I = 0$, then A is invertible.

C. If $A^2 = 0$, then $A=0$

D. None of these

Answer: B



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6. If $A = \frac{1}{\pi} \left[\sin^{-1}(\pi x) \tan^{-1}\left(\frac{x}{\pi}\right) \sin^{-1}\left(\frac{x}{\pi}\right) \cot^{-1}(\pi x) \right]$ and $B = \frac{1}{\pi} \left[-\cot^{-1}(\pi x) \tan^{-1}\left(\frac{x}{\pi}\right) \sin^{-1}\left(\frac{x}{\pi}\right) - \tan^{-1}(\pi x) \right]$, then $A - B$ is equal to I (b) 0 (c) $2I$ (d) $\frac{1}{2}I$

A. I

B. 0

C. $2I$

D. $\frac{1}{2}I$

Answer: D



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7. Let A and B be 3×3 matrices of real numbers, where A is symmetric, B is skew-symmetric, , and $(A + B)(A - B) = (A - B)(A + B)$. If $(AB)^t = (-1)^k AB$, where $(AB)^t$ is the transpose of the matrix AB , then find the possible values of k .

- A. any integer
- B. odd integer
- C. even integer
- D. cannot say anything

Answer: B



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8. If $P = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{bmatrix}$ and $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ and $Q = PAP^T$ and $x = P^T Q^{2005} P$ then x is equal to

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

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: A



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9. If $\begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is orthogonal matrix, then the value of $|abc|$

is equal to (where $|\cdot|$ represents modulus function)

- A. $a = \pm \frac{1}{\sqrt{2}}, b = \pm \frac{1}{\sqrt{6}}, c = \pm \frac{1}{\sqrt{3}}$
- B. $a = \pm \frac{1}{\sqrt{2}}, b = \pm \frac{1}{\sqrt{3}}, c = \pm \frac{1}{\sqrt{6}}$
- C. $a = \pm \frac{1}{\sqrt{6}}, b = \pm \frac{1}{\sqrt{2}}, c = \pm \frac{1}{\sqrt{3}}$
- D. $a = \pm \frac{1}{\sqrt{3}}, b = \pm \frac{1}{\sqrt{2}}, c = \pm \frac{1}{\sqrt{6}}$

Answer: A



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10. If A is a square matrix of order m, then the matrix B of same order is called the inverse of the matrix A, if

A. $AB = A$

B. $BA = A$

C. $AB = BA = I$

D. $AB = -BA$

Answer: C



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11. If $A_1, A_2, \dots, A_{2n-1}$ are n skew-symmetric matrices of same order, then $B = \sum_{r=1}^n (2r-1)(A^{2r-1})^{2r-1}$ will be symmetric
skew-symmetric neither symmetric nor skew-symmetric data not
adequate

A. symmetric

B. skew-symmetric

C. neither symmetric nor skew-symmetric

D. data is adequate

Answer: B



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12. For $k = \frac{1}{\sqrt{50}}$, the value of a, b, c such that $PP' = I$, where

$$P = \begin{bmatrix} 2/3 & 3k & a \\ -1/3 & -4k & b \\ 2/3 & -5k & c \end{bmatrix} \text{ is}$$

A. $\pm \frac{13}{5\sqrt{2}}, \pm \frac{16}{5\sqrt{2}}, \pm \frac{1}{3\sqrt{2}}$

B. $\pm \frac{3}{5\sqrt{2}}, \pm \frac{2}{5\sqrt{2}}, \pm \frac{1}{3\sqrt{2}}$

C. $\pm \frac{21}{5\sqrt{2}}, \pm \frac{19}{5\sqrt{2}}, \pm \frac{1}{3\sqrt{2}}$

D. None of these

Answer: A



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13. If $A^k = 0$ (A is nilpotent with index k),

$$(I - A)^p = I + A + A^2 + \dots + A^{k-1}, \text{ thus } p \text{ is}$$

A. -1

B. -2

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

D. None of these

Answer: A



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

A. O

B. $A^2 + B^2$

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

D. A+B

Answer: B



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15. If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & a \\ 4 & b \end{bmatrix}$ and $(A + B)^2 = A^2 + B^2$.

Then a and b are respectively

- A. 2
- B. 3
- C. 4
- D. 5

Answer: D



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16. If A is a square matrix such that $AA^T = I = A^TA$, then A is

A. $\frac{A - I}{2}$

B. $\frac{A + I}{2}$

C. $2(A-I)$

D. $2A+I$

Answer: A



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17. If A and B are symmetric matrices of the same order and

$X = AB + BA$ and $Y = AB - BA$, then $(XY)^T$ is equal to XY

b. YX c. $-YX$ d. none of these

A. XY

B. YX

C. $-YX$

D. None of these

Answer: C



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18. $\begin{bmatrix} 2x + y & 4x \\ 5x - 7 & 4x \end{bmatrix} = \begin{bmatrix} 7 & 7y - 13 \\ y & x + 6 \end{bmatrix}$ then the value of x, y is

A. $x = 3, y = 1$

B. $x = 2, y = 3$

C. $x = 2, y = 4$

D. $x = 3, y = 3$

Answer: B



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19. Given that $\begin{bmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{bmatrix} \begin{bmatrix} k & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ then $k =$

A. 6

B. 1

C. 8

D. 9

Answer: B



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20. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$, then the value of α for which $A^2 = B$, is

A. 1

B. -1

C. 4

D. no real values

Answer: D



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21. $\begin{bmatrix} i & 0 & 0 \\ 0 & i & 0 \\ 0 & 0 & i \end{bmatrix}$ then $A^{4n+1} = \dots n \in N$

A. I

B. $-A$

C. $-I$

D. A

Answer: C



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22. The matrix $A = \begin{bmatrix} 0 & -5 & 8 \\ 5 & 0 & 12 \\ -8 & -12 & 0 \end{bmatrix}$ is a (a) diagonal matrix (b) symmetric matrix (c) skew-symmetric matrix (d) scalar matrix

A. diagonal matrix

B. symmetric matrix

C. skew-symmetric matrix

D. scalar matrix

Answer: C



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23. If $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 9 & a \\ b & c \end{bmatrix}$ and $A^2 = B$, then the value of $a + b + c$ is

A. 1 or -1

B. 5 or -1

C. 5 or 1

D. no real values

Answer: B



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24. Find the value of k so that $A^2 = 8A + kI$ where $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$.

A. $k = 7$

B. $k = -7$

C. $k = 0$

D. None of these

Answer: B



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25. A square matrix P satisfies $P^2 = I - P$ where I is identity matrix. If $P^n = 5I - 8P$, then n is

A. 4

B. 5

C. 6

D. 7

Answer: C

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26. If $A_\alpha = \begin{bmatrix} \cos \alpha & -\sin \alpha \\ \sin \alpha & \cos \alpha \end{bmatrix}$, then

A. $A_\alpha \cdot A_{(-\alpha)} = I$

B. $A_\alpha \cdot A_{(-\alpha)} = O$

C. $A_\alpha \cdot A_\beta = A_{\alpha\beta}$

D. $A_\alpha \cdot A_\beta = A_{\alpha+\beta}$

Answer: A

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

A. $A^2 = A$

B. $A^2 = I$

C. $AB = I$

D. $BA=I$

Answer: A



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28. If $B = \begin{bmatrix} 3 & 4 \\ 4 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 3 & -4 \\ -2 & 3 \end{bmatrix}$ and $X=BC$, find X^n

A. 0

B. I

C. $2I$

D. None of these

Answer: B



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29. If $A = \begin{bmatrix} 1 & 0 \\ 1/2 & 1 \end{bmatrix}$, A^{400} is equal to

- A. $\begin{pmatrix} 1 & 0 \\ 50 & 1 \end{pmatrix}$
- B. $\begin{pmatrix} 1 & 0 \\ (1/2)^{100} & 1 \end{pmatrix}$
- C. $\begin{pmatrix} 1 & 0 \\ 25 & 1 \end{pmatrix}$
- D. None of these

Answer: D



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30. Let $A = \begin{bmatrix} 0 & \alpha \\ 0 & 0 \end{bmatrix}$ and $(A + I)^{50} - 50A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, find

$$abc+abd+bcd+acd$$

A. 0

B. -1

C. 1

D. None of these

Answer: A



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