NDA 1 2025

LIVE

MATHS

MATRICES & DETERMINANTS

CLASS 3

NAVJYOTI SIR

21 Nov 2024 Live Classes Schedule

8:00AM	21 NOVEMBER 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	21 NOVEMBER 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

SSB INTERVIEW LIVE CLASSES

9:30AM	MOCK PERSONAL INTERVIEWS	ANURADHA MA'AM

NDA 1 2025 LIVE CLASSES

11:30AM	GK - ECONOMICS - CLASS 4	RUBY MA'AM
1:00PM	PHYSICS - UNITS & DIMENSIONS - CLASS 1	NAVJYOTI SIR
4:30PM	ENGLISH - USAGE OF PAIRED WORDS - CLASS 1	ANURADHA MA'AM
✓ 5:30PM	MATHS - MATRICES & DETERMINANTS - CLASS 3	NAVJYOTI SIR

CDS 1 2025 LIVE CLASSES

11:30AM	GK - ECONOMICS - CLASS 3	RUBY MA'AM
1:00PM	PHYSICS - UNITS & DIMENSIONS - CLASS 1	NAVJYOTI SIR
4:30PM	ENGLISH - USAGE OF PAIRED WORDS - CLASS 1	ANURADHA MA'AM
✓ 7:00PM	MATHS - SPEED DISTANCE TIME - CLASS 3	NAVJYOTI SIR

SSBCrack EXAMS

QUESTION

PYQ – 24 - I

Let A and B be matrices of order 3×3.

If $|A| = \frac{1}{2\sqrt{2}}$ and $|B| = \frac{1}{729}$, then what is the value of $|2B(adj(3A))|$?

(a) 27

(b) $\frac{-27}{2\sqrt{2}}$

(c) $\frac{27}{2}$

(d) 1 ✓

$|2B|\,|adj(3A)|$

$2^3|B|\;3^{3(3-1)}|A|^{3-1}$

$8 \times \frac{1}{729} \times 3^6 \times \left(\frac{1}{2\sqrt{2}}\right)^2$

$= 8 \times \frac{1}{729} \times 729 \times \frac{1}{8} = 1$

$|A|$

order

$|kA| = k^n|A|$

$|adj\,A| = |A|^{n-1}$

$|adj(kA)| = (|kA|)^{n-1}$

$= (k^n|A|)^{n-1}$

$= k^{n(n-1)}|A|^{n-1}$

QUESTION

PYQ – 24 - I

. Consider the following statements in respect of two non-singular matrices A and B of the same order n :

1. $adj(AB) = (adjA)(adjB)$ ✗
2. $adj(AB) = adj(BA)$ ✗
3. $(AB)adj(AB) - |AB|I_n$ is a null matrix of order n ✓

How many of the above statements are correct ?

(a) None

(b) Only one statement ✓

(c) Only two statements

(d) All three statements

① $adj(AB) = adj(B)adj(A)$

② $AB \neq BA$

$adj(AB) \neq adj(BA)$

③ $A(adjA) = (adjA)A$

$= |A|I_n$

A can be replaced by AB.

$A\,adjA - |A|I_n = 0$ } zero matrix

INVERSE OF A MATRIX

$$A^{-1} = \frac{1}{|A|} \text{adj } A$$

→ If $|A| = 0$, A^{-1} does not exist.

(A is invertible only when it is non-singular)

PROPERTIES OF INVERSE

$$(A^{-1})^{-1} = A$$

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

$$|A^{-1}| = |A|^{-1} = \frac{1}{|A|}$$

$A \longrightarrow |A|$

$A^{-1} \longrightarrow |A|^{-1} = \frac{1}{|A|}$

reciprocal

SYSTEM OF LINEAR EQUATIONS

$$a_1 x + b_1 y + c_1 z = d_1$$

$$a_2 x + b_2 y + c_2 z = d_2$$

$$a_3 x + b_3 y + c_3 z = d_3$$

$$\begin{bmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} d_1 \\ d_2 \\ d_3 \end{bmatrix}$$

(A) (X) (B)

→ Soln. of given linear eqns, finding X.

$$AX = B$$

$$X = A^{-1}B$$

SSBCrack EXAMS

CONSISTENT AND INCONSISTENT SYSTEM OF EQUATIONS

If soln. exists ⟶ consistent system of equations

" " does not exists ⟶ inconsistent " " "

SSBCrack EXAMS

SOLUTIONS

If $|A| \neq 0$, then there exists unique solution. (single values each of x, y and z)

If $|A| = 0$ and $(adj\ A)\ B \neq 0$, then there exists no solution. (inconsistent)

If $|A| = 0$ and $(adj\ A)\ B = 0$, then the system of equation has infinitely many solutions.

Let $x = k$, then

find y and z in terms of k.

HOMOGENEOUS SYSTEM OF LINEAR EQUATIONS

The same linear equations with,

$$\left.\begin{matrix} d_1 \\ d_2 \\ d_3 \end{matrix}\right\} = 0 \Rightarrow \text{Homogeneous system,}$$

HOMOGENEOUS SYSTEM OF LINEAR EQUATIONS AND SOLUTIONS

$|A| \neq 0$, then $x = y = z = 0$ ⟶ Trivial solution

If $|A| = 0$, then the system has infinite many solutions ⟶ non-trivial solution.

SSBCrack EXAMS

SPECIAL MATRICES

Orthogonal Matrix

$$A \cdot A^T = I \Rightarrow A^{-1} = A^T$$

Eg: $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Indempotent Matrix

$A^2 = A$

$$\begin{bmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \end{bmatrix}\begin{bmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \end{bmatrix} = \begin{bmatrix} 1/4 + 1/4 & 1/4 + 1/4 \\ 1/4 + 1/4 & 1/4 + 1/4 \end{bmatrix} = \begin{bmatrix} 1/2 & 1/2 \\ 1/2 & 1/2 \end{bmatrix}$$

SSBCrack EXAMS

SPECIAL MATRICES

Involutory Matrix

$A^2 = I$

$\Rightarrow A = A^{-1}$

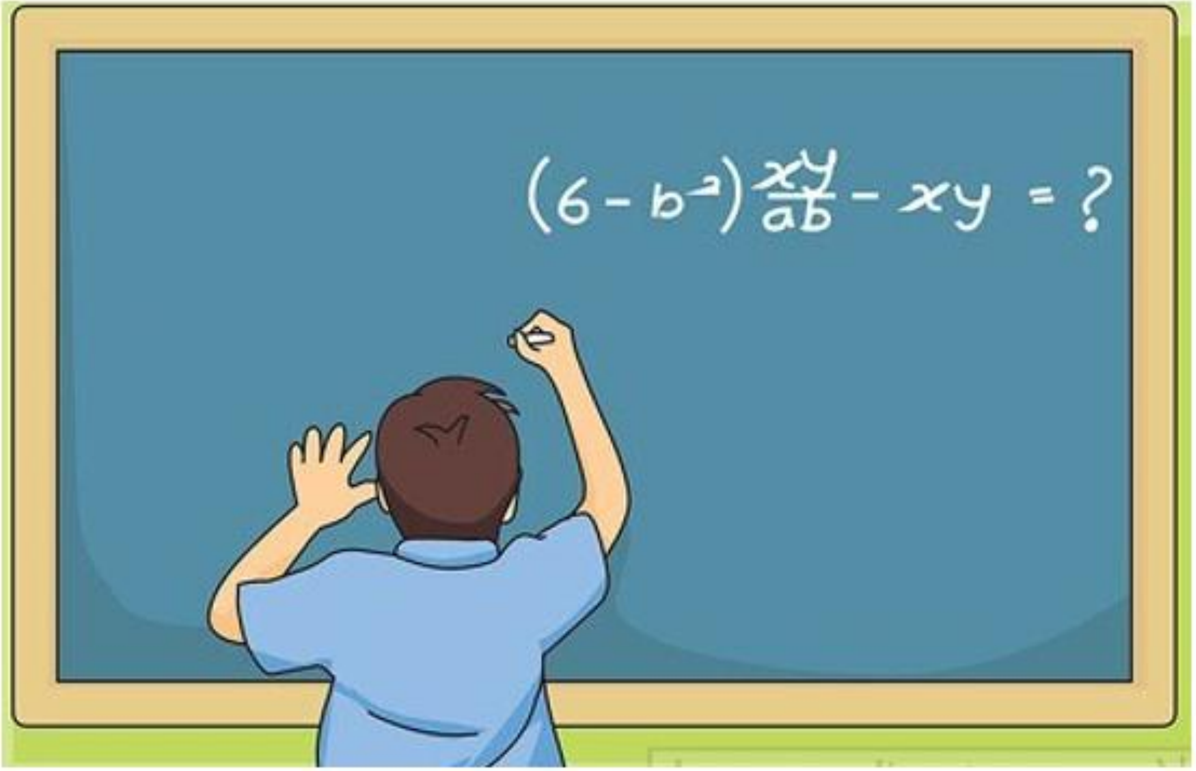
eg - $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Nilpotent Matrix

$p \in N$

$A^p = 0$
(Zero matrix)

PRACTISE TIME !



Q) Consider the following statements:

1. If det A= 0, then det (adj A) = 0 ✓
2. If A is non- singular, then $\det(A^{-1}) = (\det A)^{-1}$ ✓

(a) 1 only (b) 2 only

(c) Both 1 and 2 ✓ (d) Neither 1 nor 2

(1)

$|adj\, A| = |A|^{n-1}$

$= 0^{n-1} = 0$

Q) Consider the following statements:

1. If $\det A = 0$, then $\det(\operatorname{adj} A) = 0$
2. If A is non- singular, then $\det(A^{-1}) = (\det A)^{-1}$

(a) 1 only (b) 2 only

(c) Both 1 and 2 (d) Neither 1 nor 2

Ans: (c)

Q) If $l + m + n = 0$, then the system of equations

$$-2x + y + z = l$$
$$x - 2y + z = m$$
$$x + y - 2z = n$$

has

(a) a trivial solution (b) no solution

(c) a unique solution (d) infinitely many solutions

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

$$|A| = -2(4-1) - 1(-2-1) + 1(1+2)$$
$$= -6 + 3 + 3$$
$$= 0$$

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

$$B = \begin{bmatrix} l \\ m \\ n \end{bmatrix}$$

$|A| = 0$

$(\text{adj}A)B = 0$

→ infinitely many solutions

$$\text{adj}A = \begin{bmatrix} 3 & 3 & 3 \\ 3 & 3 & 3 \\ 3 & 3 & 3 \end{bmatrix}$$

$$(\text{adj}A)B = \begin{bmatrix} 3 & 3 & 3 \\ 3 & 3 & 3 \\ 3 & 3 & 3 \end{bmatrix}\begin{bmatrix} l \\ m \\ n \end{bmatrix} = \begin{bmatrix} 3(l+m+n) \\ 3(l+m+n) \\ 3(l+m+n) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

→ zero matrix

Q) If $l + m + n = 0$, then the system of equations

$$-2x + y + z = l$$
$$x - 2y + z = m$$
$$x + y - 2z = n$$

has

(a) a trivial solution (b) no solution

(c) a unique solution (d) infinitely many solutions

Ans: (d)

Q) Consider the following statements in respect of symmetric matrices A and B

1. AB is symmetric.
2. $A^2 + B^2$ is symmetric.

Which of the above statement(s) is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Q) Consider the following statements in respect of symmetric matrices A and B

1. AB is symmetric.
2. $A^2 + B^2$ is symmetric.

Which of the above statement(s) is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: (b)

Q) If $A = \begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, where ω is cube root of unity, then what is A^{100} equal to?

(a) A

(b) $-A$

(c) Null matrix

(d) Identity matrix

Q) If $A = \begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, where ω is cube root of unity, then what is A^{100} equal to?

(a) A

(b) $-A$

(c) Null matrix

(d) Identity matrix

Ans: (a)

Q) A matrix X has $(a+b)$ rows and $(a+2)$ columns; and a matrix Y has $(b+1)$ rows and $(a+3)$ columns. If both XY and YX exist, then what are the values of a, b respectively?

(a) 3, 2 (b) 2, 3

(c) 2, 4 (d) 4, 3

Q) A matrix X has $(a+b)$ rows and $(a+2)$ columns; and a matrix Y has $(b+1)$ rows and $(a+3)$ columns. If both XY and YX exist, then what are the values of a, b respectively?

(a) 3, 2 (b) 2, 3

(c) 2, 4 (d) 4, 3

Ans: (b)

Q) If $f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & 4\sin 2x \\ \sin^2 x & 1+\cos^2 x & 4\sin 2x \\ \sin^2 x & \cos^2 x & 1+4\sin 2x \end{vmatrix}$

What is the maximum value of $f(x)$?

(a) 2 (b) 4

(c) 6 (d) 8

Q) If $f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & 4\sin 2x \\ \sin^2 x & 1+\cos^2 x & 4\sin 2x \\ \sin^2 x & \cos^2 x & 1+4\sin 2x \end{vmatrix}$

What is the maximum value of $f(x)$?

(a) 2
(b) 4
(c) 6
(d) 8

Ans: (c)

Q) For a square matrix A, which of the following properties hold?

1. $(A^{-1})^{-1} = A$
2. $\det(A^{-1}) = \dfrac{1}{\det A}$
3. $(\lambda A)^{-1} = \lambda A^{-1}$, where λ is a scalar

Select the correct answer using the code given below.

(a) 1 and 2 (b) 2 and 3 (c) 1 and 3 (d) 1, 2 and 3

Q) For a square matrix A, which of the following properties hold?

1. $(A^{-1})^{-1} = A$
2. $\det(A^{-1}) = \dfrac{1}{\det A}$
3. $(\lambda A)^{-1} = \lambda A^{-1}$, where λ is a scalar

Select the correct answer using the code given below.

(a) 1 and 2 (b) 2 and 3 (c) 1 and 3 (d) 1, 2 and 3

Ans: (d)

Q) The system of equations

$$2x + y - 3z = 5$$

$$3x - 2y + 2z = 5 \text{ and } 5x - 3y - z = 16$$

(a) is inconsistent
(b) is consistent, with a unique solution
(c) is consistent, with infinitely many solutions
(d) has its solution lying along X-axis in three-dimensional space

Q) The system of equations

$$2x + y - 3z = 5$$

$$3x - 2y + 2z = 5 \text{ and } 5x - 3y - z = 16$$

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(b) is consistent, with a unique solution
(c) is consistent, with infinitely many solutions
(d) has its solution lying along X-axis in three-dimensional space

Ans: (d)

Q) If $\Delta = \begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix}$

then what is

$\begin{vmatrix} 3d+5g & 4a+7g & 6g \\ 3e+5h & 4b+7h & 6h \\ 3f+5i & 4c+7i & 6i \end{vmatrix}$ equal to?

(a) Δ (b) 7Δ

(c) 72Δ (d) -72Δ

SSBCrack EXAMS

Q) If $\Delta = \begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix}$

then what is

$$\begin{vmatrix} 3d+5g & 4a+7g & 6g \\ 3e+5h & 4b+7h & 6h \\ 3f+5i & 4c+7i & 6i \end{vmatrix}$$ equal to?

(a) Δ (b) 7Δ

(c) 72Δ (d) -72Δ

Ans: (d)

Q) If $A = \begin{bmatrix} 1 & a \\ 0 & 1 \end{bmatrix}$,

where $a \in \mathbb{N}$, then what is $A^{100} - A^{50} - 2A^{25}$ equal to?

(a) $-2I$ (b) $-I$

(c) $2I$ (d) I

where I is the identity matrix.

Q) If $A = \begin{bmatrix} 1 & a \\ 0 & 1 \end{bmatrix}$,

where $a \in \mathbb{N}$, then what is $A^{100} - A^{50} - 2A^{25}$ equal to?

(a) $-2I$

(b) $-I$

(c) $2I$

(d) I

where I is the identity matrix.

Ans: (a)


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