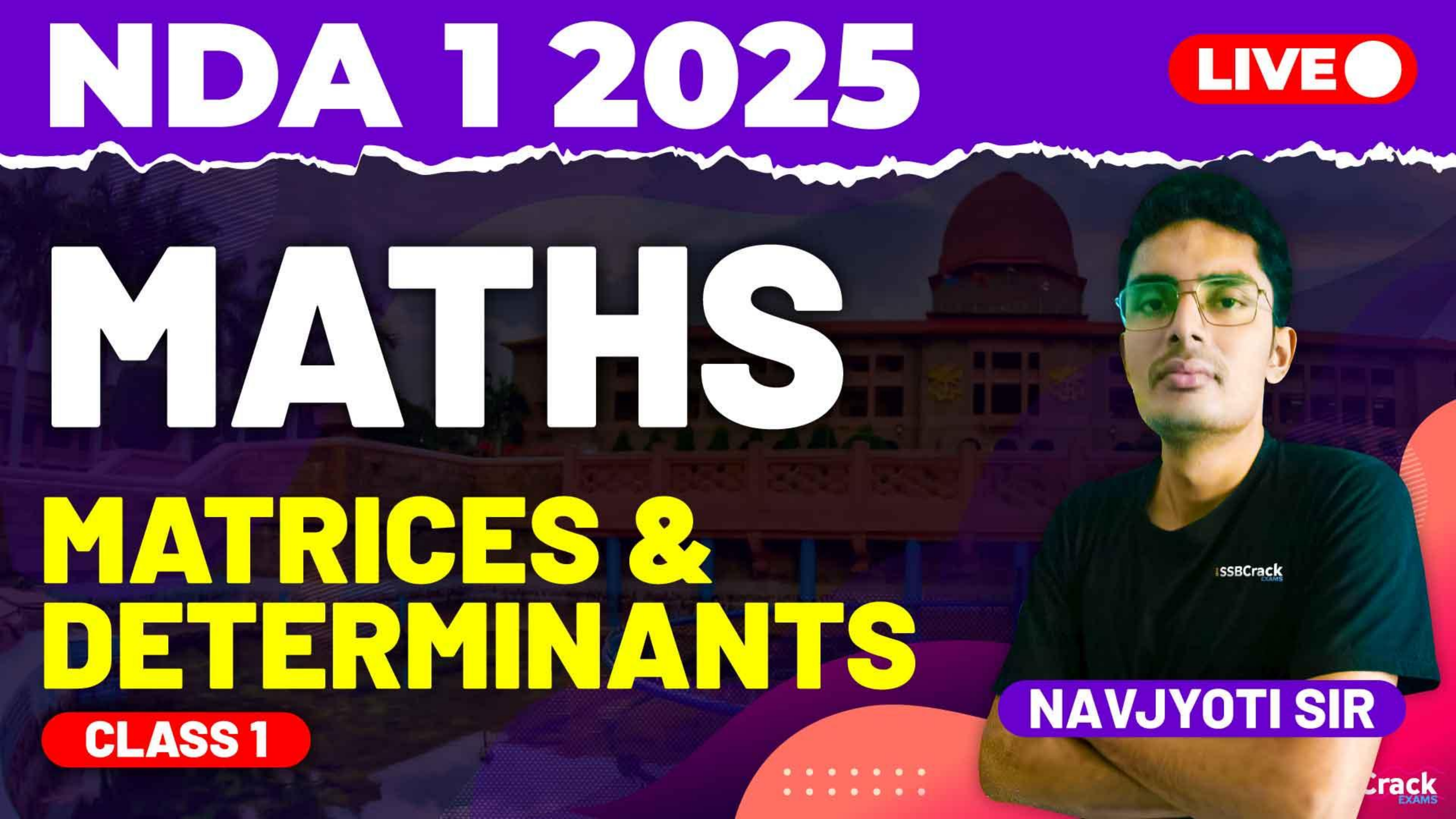

NDA 1 2025
LIVE
MATHS
MATRICES &
DETERMINANTS
CLASS 1
NAVJYOTI SIR
SSBCrack EXAMS
Crack EXAMS

19 Nov 2024 Live Classes Schedule

8:00AM	19 NOVEMBER 2024 DAILY CURRENT AFFAIRS	RUBY MA'AM
9:00AM	19 NOVEMBER 2024 DAILY DEFENCE UPDATES	DIVYANSHU SIR

NDA 1 2025 LIVE CLASSES

11:30AM	GK - ECONOMICS - CLASS 2	RUBY MA'AM
1:00PM	GS - CHEMISTRY MCQ - CLASS 10	SHIVANGI MA'AM
4:30PM	ENGLISH - PREPOSITIONS & DETERMINERS - CLASS 1	ANURADHA MA'AM
5:30PM	MATHS - MATRICES & DETERMINANTS - CLASS 1	NAVJYOTI SIR

CDS 1 2025 LIVE CLASSES

11:30AM	GK - ECONOMICS - CLASS 2	RUBY MA'AM
1:00PM	GS - CHEMISTRY MCQ - CLASS 10	SHIVANGI MA'AM
4:30PM	ENGLISH - PREPOSITIONS & DETERMINERS - CLASS 1	ANURADHA MA'AM
7:00PM	MATHS - SPEED DISTANCE TIME - CLASS 1	NAVJYOTI SIR

MATRIX

→ representing numbers in rows and columns.

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

square brackets

Rows

elements of matrix

columns

→ denoted by capital letters, of alphabet.

SSBCrack EXAMS

ORDER OF A MATRIX

→ number of rows (m) × number of columns (n) for a matrix.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \quad \begin{matrix} m = 2 \\ n = 3 \end{matrix}$$

Order of A, $O(A) = \underline{2 \times 3}$

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & a_{15} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & a_{24} & a_{25} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & & \vdots \\ a_{1m} & a_{2m} & \cdots & \cdots & \cdots & \cdots & a_{mn} \end{bmatrix}_{\underline{m \times n}}$$

An element is represented as, a_{ij}

i → row, j → column

$$A = [a_{ij}]_{m \times n}$$

SSBCrack EXAMS

TYPES OF MATRICES

ROW MATRIX : only 1 row.

$$\begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}_{1\times 4}$$

order $= 1 \times n$

COLUMN MATRIX : only 1 column.

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix}_{3\times 1}$$

Order $= m \times 1$

TYPES OF MATRICES

SQUARE MATRIX : number of rows = number of columns

$$\begin{bmatrix} 2 & 3 & 9 \\ 7 & 6 & 5 \\ 4 & 3 & -2 \end{bmatrix}_{3\times 3} \qquad \begin{bmatrix} p & q \\ r & s \end{bmatrix}_{2\times 2} \qquad \begin{bmatrix} 0 \end{bmatrix}_{1\times 1}$$

Square matrix of order 3

if $m \neq n$, matrix is called 'rectangular'

TYPES OF MATRICES

DIAGONAL MATRIX : Square matrix with non-diagonal elements = 0.

$$\begin{bmatrix} 3 & 0 & 0 \\ 0 & 9 & 0 \\ 0 & 0 & 7 \end{bmatrix} \quad \begin{bmatrix} a & 0 \\ 0 & c \end{bmatrix}$$

diagonal elements $\neq 0$.

not diagonals for matrix

SCALAR MATRIX :

Diagonal matrix with diagonal elements being same (scalar → constant)

$$\begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix} \quad \begin{bmatrix} a & 0 \\ 0 & a \end{bmatrix}$$

TYPES OF MATRICES

IDENTITY / UNIT MATRIX :

scalar matrix with constant = 1.

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}_{3\times 3} \qquad \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}_{2\times 2}$$

I_m

order of square matrix.

TYPES OF MATRICES

ZERO MATRIX :

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}_{2\times 2}, \quad \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}_{3\times 1} = O$$

EXAMPLE

The matrix $A = \begin{bmatrix} 0 & 0 & 5 \\ 0 & 5 & 0 \\ 5 & 0 & 0 \end{bmatrix}$ is a

(A) scalar matrix (B) diagonal matrix

(C) unit matrix (D) square matrix ✓

$$\begin{bmatrix} 0 & 0 & 5 \\ 0 & 5 & 0 \\ 5 & 0 & 0 \end{bmatrix}$$

not diagonal elements

EQUALITY OF TWO MATRIX

For two matrix to be equal,

1. order of both should be same.
2. corresponding elements are equal.

$$\underbrace{\begin{bmatrix} 3 & 4 & 5 \\ 6 & 2 & 8 \end{bmatrix}}_{2\times 3} = \underbrace{\begin{bmatrix} a & b & e \\ d & e & f \end{bmatrix}}_{2\times 3} \Rightarrow \begin{array}{ll} a = 3 & d = 6 \\ b = 4 & e = 2 \\ c = 5 & f = 8 \end{array}$$

ADDITION AND SUBTRACTION OF TWO MATRIX

Let $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times 3}$ $B = \begin{bmatrix} 2 & 3 & 4 \\ 4 & 7 & 8 \end{bmatrix}_{2\times 3}$

$A+B =$, $A-B =$ defined only when A and B are of the same order

$$A+B = \begin{bmatrix} 1+2 & 2+3 & 3+4 \\ 4+4 & 5+7 & 6+8 \end{bmatrix}_{2\times 3}$$

$$A-B = \begin{bmatrix} 1-2 & 2-3 & 3-4 \\ 4-4 & 5-7 & 6-8 \end{bmatrix}_{2\times 3}$$

sum or difference is also of the same order

MULTIPLICATION OF MATRIX BY SCALAR

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times 3}$$

$$3A = 3\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} 3\times 1 & 3\times 2 & 3\times 3 \\ 3\times 4 & 3\times 5 & 3\times 6 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 6 & 9 \\ 12 & 15 & 18 \end{bmatrix}_{2\times 3}$$

MULTIPLICATION OF MATRICES

If $A = \begin{bmatrix} 1 & 4 & 2 \\ 2 & 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 2 & 2 \\ 1 & 3 \end{bmatrix}$

$$A \cdot B = \underbrace{\begin{bmatrix} 1 & 4 & 2 \\ 2 & 3 & 1 \end{bmatrix}}_{2 \times 3} \underbrace{\begin{bmatrix} 1 & 2 \\ 2 & 2 \\ 1 & 3 \end{bmatrix}}_{3 \times 2} = \begin{bmatrix} 1\times1 + 4\times2 + 2\times1 & 1\times2 + 4\times2 + 2\times3 \\ 2\times1 + 3\times2 + 1\times1 & 2\times2 + 3\times2 + 1\times3 \end{bmatrix}$$

has to be equal

no. of columns of first matrix = no. of rows of second matrix

MULTIPLICATION OF MATRICES

$$\begin{bmatrix} R_1 \\ R_2 \\ R_3 \\ \vdots \end{bmatrix} \begin{bmatrix} C_1 & C_2 & C_3 & \cdots \end{bmatrix} = \begin{bmatrix} R_1 C_1 & R_1 C_2 & R_1 C_3 & \cdots \\ R_2 C_1 & R_2 C_2 & R_2 C_3 & \cdots \\ R_3 C_1 & R_3 C_2 & R_3 C_3 & \cdots \end{bmatrix}$$

EXAMPLE

If $\begin{bmatrix} 2x & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} x \\ 8 \end{bmatrix} = O$, find the value of x.

$$\begin{bmatrix} 2x & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix} = \begin{bmatrix} 2x \times 1 + 3(-3) & 2x(2) + 3(0) \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} 2x - 9 & 4x \end{bmatrix} \begin{bmatrix} x \\ 8 \end{bmatrix} = 0$$

$$\Rightarrow \begin{bmatrix} (2x-9)(x) + 8(4x) \end{bmatrix} = \begin{bmatrix} 0 \end{bmatrix} = 2x^2 - 9x + 32x = 0$$

$$2x^2 - 9x + 32x = 0$$

$$2x^2 + 23x = 0$$

$$x(2x + 23) = 0$$

$$x = 0 \quad \bigg| \quad x = \frac{-23}{2}$$

PROPERTIES

If AB is defined, then BA need not be defined.

If A, B are, respectively $m \times n$, $k \times l$ matrices, then both AB and BA are defined if and only if $n = k$ and $l = m$.

If AB and BA are both defined, it is not necessary that AB = BA.

PROPERTIES

If the product of two matrices is a zero matrix, it is not necessary that one of the matrices is a zero matrix.

For three matrices A, B and C of the same order, if $A = B$, then $AC = BC$, but converse is not true.

$A. A = A^2$, $A. A. A = A^3$, so on

$A^2 \cdot A = A^3$

EXAMPLE

If A and B are square matrices of the same order, then (A + B) (A – B) is equal to

(A) $A^2 - B^2$ (B) $A^2 - BA - AB - B^2$

(C) $A^2 - B^2 + BA - AB$ ✓ (D) $A^2 - BA + B^2 + AB$

$$(A+B)(A-B) = A\cdot A - A\cdot B + B\cdot A - B\cdot B$$

$$= A^2 - \underbrace{AB + BA}_{} - B^2$$

cannot be cancelled

as $AB \neq BA$

TRANSPOSE OF A MATRIX

$$A = \begin{bmatrix} 2 & 3 & 5 \\ 7 & 8 & 3 \\ -2 & 4 & -4 \end{bmatrix}$$

shifting rows $\longrightarrow$ columns

or,

columns $\longrightarrow$ rows.

$$A' \text{ or } A^T = \begin{bmatrix} 2 & 7 & -2 \\ 3 & 8 & 4 \\ 5 & 3 & -4 \end{bmatrix}$$

(Transpose of A)

only defined for square matrix.

PROPERTIES

$(A^T)^T = A,$

$(kA)^T = kA^T$ (where k is any constant)

PROPERTIES

$$(A + B)^T = A^T + B^T$$

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

SYMMETRIC MATRIX

* $A^T = A$

$$A = \begin{bmatrix} 4 & 5 & 6 \\ 5 & 3 & 2 \\ 6 & 2 & 4 \end{bmatrix} \Rightarrow A^T = \begin{bmatrix} 4 & 5 & 6 \\ 5 & 3 & 2 \\ 6 & 2 & 4 \end{bmatrix}$$

* for any matrix A,

  $A + A^T$ will always be a symmetric matrix.

SSBCrack EXAMS

SKEW - SYMMETRIC MATRIX

* $A^T = -A$
* diagonal elements are 0.

$$A = \begin{bmatrix} 0 & 3 & 4 \\ -3 & 0 & 6 \\ -4 & -6 & 0 \end{bmatrix} \xrightarrow{\text{Transpose}} \begin{bmatrix} 0 & -3 & -4 \\ 3 & 0 & -6 \\ 4 & 6 & 0 \end{bmatrix} = \underline{-A}$$

(negative of all elements in A)

Any square matrix A can be expressed as the sum of a symmetric matrix and a skew symmetric matrix, that is

$$A = \frac{(A + A^T)}{2} + \frac{(A - A^T)}{2}$$

INVERTIBLE MATRIX

If A is a square matrix of order m x m, and if there exists another square matrix B of the same order m x m, such that $AB = BA = I_m$, then, A is said to be invertible matrix and B is called the inverse matrix of A and it is denoted by A^{-1}

INVERTIBLE MATRIX

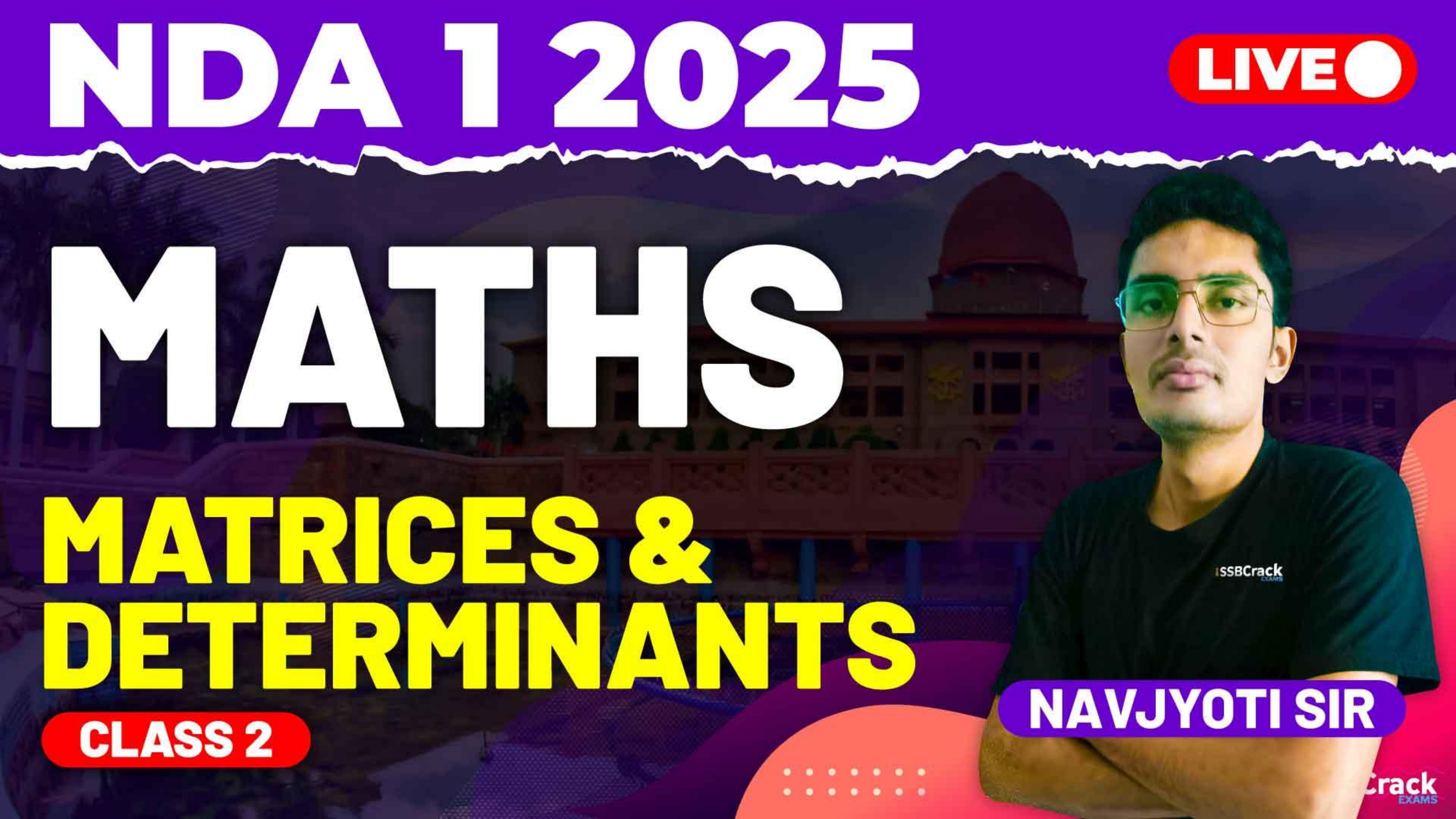
A rectangular matrix does not possess its inverse, since for the products BA and AB to be defined and to be equal, it is necessary that matrices A and B should be square matrices of the same order.

If B is the inverse of A, then A is also the inverse of B.

INVERTIBLE MATRIX

→ The inverse is unique for a given matrix.

→ $(AB)^{-1} = B^{-1}A^{-1}$


NDA 1 2025
LIVE
MATHS
MATRICES &
DETERMINANTS
CLASS 2
SSBCrack EXAMS
NAVJYOTI SIR
Crack EXAMS