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CHAPTER NOTES

Matrices Class 12 Notes — CBSE Maths Chapter 3

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Matrices Class 12 Notes — CBSE Maths Chapter 3

Chapter 3 — **Matrices** — covers types of matrices, operations, transpose, symmetric/skew-symmetric matrices, and elementary transformations. Carries **5-7 marks**.

Key Concepts

Types of Matrices

Type	Definition
Row Matrix	Only 1 row ($1 \times n$)
Column Matrix	Only 1 column ($m \times 1$)
Square Matrix	Number of rows = number of columns ($n \times n$)
Diagonal Matrix	All non-diagonal elements are 0
Identity Matrix (I)	Diagonal matrix with all diagonal elements = 1
Zero Matrix (O)	All elements are 0
Symmetric	$A = A^T$ ($a_{ij} = a_{ji}$)
Skew-Symmetric	$A = -A^T$ ($a_{ij} = -a_{ji}$, diagonal = 0)

Matrix Operations

Addition: $A + B$ (same order, add corresponding elements)

Scalar multiplication: kA (multiply every element by k)

Matrix multiplication: $(A)_{m \times n} \times (B)_{n \times p} = (C)_{m \times p}$

$c_{ij} = \sum a_{ik} \times b_{kj}$ (row of $A \times$ column of B)

Important: $AB \neq BA$ in general (not commutative!)

But: $(AB)C = A(BC)$ — associative ✓

$A(B+C) = AB + AC$ — distributive ✓

Transpose Properties

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

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

$$(kA)^T = kA^T$$

$$(AB)^T = B^T A^T \text{ (order reverses!)}$$

Key Result: Every square matrix can be uniquely expressed as sum of a symmetric and skew-symmetric matrix:

$$A = \frac{1}{2}(A + A^T) + \frac{1}{2}(A - A^T)$$

Solved Examples

Example 1

Q: If A is a 3×2 matrix and B is a 2×4 matrix, what is the order of AB?

Solution: $(3 \times 2)(2 \times 4) = 3 \times 4$ **matrix**. The inner dimensions (2) must match; result has outer dimensions.

Example 2

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

Solution:

$$A^T = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

$$\text{Symmetric part} = \frac{1}{2}(A + A^T) = \frac{1}{2} \begin{bmatrix} 2 & 5 \\ 5 & 8 \end{bmatrix} = \begin{bmatrix} 1 & 5/2 \\ 5/2 & 4 \end{bmatrix}$$

$$\text{Skew-symmetric part} = \frac{1}{2}(A - A^T) = \frac{1}{2} \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & -1/2 \\ 1/2 & 0 \end{bmatrix}$$

Quick Revision Points

- Matrix multiplication: order $m \times n \times n \times p = m \times p$; inner dimensions must match
- $AB \neq BA$ (not commutative); $(AB)^T = B^T A^T$
- Symmetric: $A = A^T$; Skew-symmetric: $A = -A^T$ (diagonal = 0)
- $A = \frac{1}{2}(A + A^T) + \frac{1}{2}(A - A^T)$ — decomposition into symmetric + skew-symmetric
- $AI = IA = A$ (identity matrix property)



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