ChapterNotes

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CHAPTER NOTES

Matrices Class 12 Notes — CBSE Maths Chapter 3

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

$c_{ij} = \Sigma\, a_{ik} \times b_{kj}$ (row of A × 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

$(A^T)^T = A$

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

$(kA)^T = kA^T$

$(AB)^T = B^TA^T$ (order reverses!)

Key Result: Every square matrix can be uniquely expressed as sum of a symmetric and skew-symmetric matrix: $A = ½(A + A^T) + ½(A – A^T)$

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: (3×2)(2×4) = **3×4 matrix**. The inner dimensions (2) must match; result has outer dimensions.

Example 2

Q: Express the matrix A = [1 2; 3 4] as sum of symmetric and skew-symmetric matrices.

Solution:
A^T = [1 3; 2 4]
Symmetric part = $½(A + A^T)$ = ½[2 5; 5 8] = [1 5/2; 5/2 4]
Skew-symmetric part = $½(A – A^T)$ = ½[0 –1; 1 0] = [0 –1/2; 1/2 0]

Quick Revision Points

- Matrix multiplication: order m×n × n×p = m×p; inner dimensions must match
- AB ≠ BA (not commutative); $(AB)^T = B^TA^T$
- Symmetric: $A = A^T$; Skew-symmetric: $A = –A^T$ (diagonal = 0)
- $A = ½(A+A^T) + ½(A–A^T)$ — decomposition into symmetric + skew-symmetric
- AI = IA = A (identity matrix property)

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