

✉ Class 12 Mathematics – Chapter: Matrices

1. Introduction

- A matrix is a rectangular array of numbers arranged in rows and columns.
 - Used in solving systems of linear equations, transformations, and more.
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2. Types of Matrices

- Row Matrix: One row, multiple columns.
- Column Matrix: One column, multiple rows.
- Square Matrix: Same number of rows and columns.
- Zero Matrix: All elements are zero.
- Diagonal Matrix: Non-zero elements only on the main diagonal.
- Scalar Matrix: Diagonal matrix with all diagonal elements equal.
- Identity Matrix: Diagonal elements are 1, rest are 0.
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Symmetric Matrix: $A = A^T = A^T A = A A^T$.

- **Skew-Symmetric Matrix:** $A = -A^T = -A^T A = -A A^T$.

3. Matrix Operations

- **Addition:** Possible if matrices have same dimensions.
 $(A+B)_{ij} = A_{ij} + B_{ij} \quad (A+B)_{\{ij\}} = A_{\{ij\}} + B_{\{ij\}} \quad (A+B)_{ij} = A_{ij} + B_{ij}$
- **Scalar Multiplication:** Multiply each element by a scalar k .
 $(kA)_{ij} = k \times A_{ij} \quad (kA)_{\{ij\}} = k \times A_{\{ij\}} \quad (kA)_{ij} = k \times A_{ij}$
- **Matrix Multiplication:** Possible if number of columns in A equals number of rows in B .
 $(AB)_{ij} = \sum_k A_{ik} B_{kj} \quad (AB)_{\{ij\}} = \sum_k A_{\{ik\}} B_{\{kj\}} \quad (AB)_{ij} = \sum_k A_{ik} B_{kj}$
- **Transpose:** Interchanging rows and columns.
 $(A^T)_{ij} = A_{ji} \quad (A^T)_{\{ij\}} = A_{\{ji\}} \quad (A^T)_{ij} = A_{ji}$

4. Determinant of a Matrix

- Only square matrices have determinants.
- For 2×2 matrix:
 $\det \begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - bc \quad \det \begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - bc \quad \det[abcd] = ad - bc$
- For 3×3 matrix, use expansion by minors.

5. Inverse of a Matrix

- For a square matrix A , inverse A^{-1} exists if $\det A \neq 0$.

- Satisfies:

$$AA^{-1} = A^{-1}A = I$$

- For 2x2 matrix:

$$A^{-1} = \frac{1}{\det A} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

6. Applications

- Solving systems of linear equations.
- Computer graphics.
- Economics and engineering.

7. Exam Tips

- Practice matrix operations thoroughly.

- Memorize determinant formulas.
- Understand conditions for inverse matrix existence.
- Solve problems on applications in linear equations.