CBSE Class 12 Maths Notes Chapter 3 Matrices: CBSE Class 12 Maths Notes provide detailed notes of important topics, including Differential Equation , Vector, Determinants and Integrals ensuring that students have a solid grasp of the material.

These notes are designed to help students comprehend difficult concepts, solve problems efficiently and prepare thoroughly for their exams. By using these notes students can build a strong foundation in Mathematics, improve their analytical and problem-solving skills and enhance their performance in the CBSE Class 12 exams.

CBSE Class 12 Maths Notes Chapter 3 Matrices Overview

CBSE Class 12 Maths Notes for Chapter 3 Matrices are prepared by the subject experts of Physics Wallah. These notes provide a thorough overview of matrices, covering important topics such as matrix operations, types of matrices, determinants and inverses.

This detailed guide is designed to enhance students understanding of matrices and their applications, ensuring they are well-prepared for their exams and able to tackle related mathematical problems with confidence.

CBSE Class 12 Maths Notes Chapter 3 Matrices PDF

The PDF link for the CBSE Class 12 Maths Notes for Chapter 3 Matrices is available below. This PDF provides a detailed overview of matrices, including key concepts, definitions and problem-solving techniques.

It is designed to help students understand and master the chapter's content effectively. By accessing this PDF students can review the material at their convenience, practice with sample problems and enhance their preparation for exams.

CBSE Class 12 Maths Notes Chapter 3 Matrices PDF

CBSE Class 12 Maths Notes Chapter 3 Matrices

Matrices Introduction

Matrices are a fundamental concept in mathematics, especially in algebra. A matrix is a rectangular array of numbers arranged in rows and columns. These arrays can represent systems of linear equations, transformations, and more complex relationships in mathematics and applied fields like engineering, physics, and computer science.

In essence, matrices provide a compact and organized way to handle large sets of equations and data. They are used to perform various operations, such as addition, subtraction, and multiplication, which are crucial for solving problems involving multiple variables. Matrices are important for understanding advanced topics in calculus, differential equations, and linear algebra.

This introduction covers the basic types of matrices, including square matrices, diagonal matrices, and identity matrices, as well as important operations like finding the determinant and the inverse of a matrix. Understanding these concepts is key to solving complex mathematical problems and applying matrix theory to practical situations.

Types of Matrices

Column Matrix: A matrix which has only one column, is called a column matrix.
e.g. ⎡⎣⎢10−5⎤⎦⎥

In general, A = $[a_{ij}]_{m\times1}$ is a column matrix of order m × 1.

Row Matrix: A matrix which has only one row, is called a row matrix,
e.g. [159]

In general, A = $[a_{ij}]_{1\times n}$ is a row matrix of order 1 x n

Square Matrix: A matrix which has equal number of rows and columns, is called a square matrix
e.g. [35−12]

In general, A = $[a_{ij}]$m x m is a square matrix of order m.

Note: If A = $[a_{ij}]$ is a square matrix of order n, then elements a_{11}, a_{22}, a_{33},…, a_{nn} is said to constitute the diagonal of the matrix A.

Diagonal Matrix: A square matrix whose all the elements except the diagonal elements are zeroes, is called a diagonal matrix,
e.g. ⎡⎣⎢3000−3000−8⎤⎦⎥

In general, A = $[a_{ij}]_{m\times m}$ is a diagonal matrix, if a_{ij} = 0, when i ≠ j.

Scalar Matrix: A diagonal matrix whose all diagonal elements are same (non-zero), is called a scalar matrix,
e.g. ⎡⎣⎢200020002⎤⎦⎥

In general, A = $[a_{ij}]_{n\times n}$ is a scalar matrix, if a_{ij} = 0, when i ≠ j, a_{ij} = k (constant), when i = j.

Note: A scalar matrix is a diagonal matrix but a diagonal matrix may or may not be a scalar matrix.

Unit or Identity Matrix: A diagonal matrix in which all diagonal elements are '1' and all non-diagonal elements are zero, is called an identity matrix. It is denoted by I.
e.g. ⎡⎣⎢100010001⎤⎦⎥

In general, A = $[a_{ij}]_{n\times n}$ is an identity matrix, if a_{ij} = 1, when i = j and a_{ij} = 0, when i ≠ j.

Zero or Null Matrix: A matrix is said to be a zero or null matrix, if its all elements are zer0
e.g. [0000]

Equality of Matrices: Two matrices A and B are said to be equal, if
(i) order of A and B are same.
(ii) corresponding elements of A and B are same i.e. $a_{ij} = b_{ij}$, ∀ i and j.
e.g. [2013] and [2013] are equal matrices, but [3021] and [2031] are not equal matrices.

Operations on Matrices

Between two or more than two matrices, the following operations are defined below:
Addition and Subtraction of Matrices: Addition and subtraction of two matrices are defined in an order of both the matrices are same.

Addition of Matrix
If A = $[a_{ij}]_{m\times n}$ and B = $[y_{ij}]_{m\times n}$, then A + B = $[a_{ij} + b_{ij}]_{m\times n}$, 1 ≤ i ≤ m, 1 ≤ j ≤ n
Subtraction of Matrix
If A = $[a_{ij}]_{m\times n}$ and B = $[b_{ij}]_{m\times n}$, then A – B = $[a_{ij} – b_{ij}]_{m\times n}$, 1 ≤ i ≤ m, 1 ≤ j ≤ n

Properties of Addition of Matrices

(a) Commutative If A = $[a_{ij}]$ and B = $[b_{ij}]$ are matrices of the same order say m x n then A + B = B + A,

(b) Associative for any three matrices A = $[a_{ij}]$, B = $[b_{ij}]$, C = $[c_{ij}]$ of the same order say m x n, A + (B + C) = (A + B) + C.

(c) Existence of additive identity Let A = [aij] be amxn matrix and O be amxn zero matrix, then A + O = O + A = A. In other words, O is the additive identity for matrix addition.

(d) Existence of additive inverse Let A = $[a_{ij}]_{m\times n}$ be any matrix, then we have another matrix as -A = $[-a_{ij}]_{m\times n}$ such that A + (-A) = (-A + A) = O. So, matrix (-A) is called additive inverse of A or negative of A.

Note
(i) If A and B are not of the same order, then A + B is not defined.
(ii) Addition of matrices is an example of a binary operation on the set of matrices of the same order.

Multiplication of a matrix by scalar number

Let A = $[a_{ij}]_{m×n}$ be a matrix and k is scalar, then kA is another matrix obtained by multiplying each element of A by the scalar k, i.e. if A = $[a_{ij}]_{m×n}$, then kA = $[ka_{ij}]_{m×n}$.

Properties of Scalar Multiplication of a Matrix

Let A = $[a_{ij}]$ and B = $[b_{ij}]$be two matrices of the same order say m × n, then
(a) k(A + B) = kA + kB, where k is a scalar.
(b) (k + l)A = kA + lA, where k and l are scalars.

Multiplication of Matrices: Let A and B be two matrices. Then, their product AB is defined, if the number of columns in matrix A is equal to the number of rows in matrix B.

Properties of Multiplication of Matrices

(a) Non-commutativity Matrix multiplication is not commutative i.e. if AB and BA are both defined, then it is not necessary that AB ≠ BA.

(b) Associative law For three matrices A, B, and C, if multiplication is defined, then A (BC) = (AB) C.

(c) Multiplicative identity For every square matrix A, there exists an identity matrix of the same order such that IA = AI = A.

Note: For Amxm, there is only one multiplicative identity I_m.

(d) Distributive law For three matrices A, B, and C,
A(B + C) = AB + AC
(A + B)C = AC + BC
whenever both sides of the equality are defined.

Note: If A and B are two non-zero matrices, then their product may be a zero matrix.
e.g. Suppose A = [00−12] and B = [3050], then AB = [0000].

Class 12 Chapter 3 Matrices Important Questions With Solutions

Here are some important problems commonly seen in previous years' exams that can help you prepare effectively:

Q. 1: Which of the given values of x and y make the following pair of matrices equal

$$\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$$

(A) $x = \frac{-1}{3}, \quad y = 7$

(B) Not possible to find

(C) $y = 7, \quad x = \frac{-2}{3}$

(D) $x = \frac{-1}{3}, \quad y = \frac{-2}{3}$

Solution:

For the given equation, the correct solution is Option (B).

Explanation:

Since the given equations are equal, we can equate the corresponding elements. Thus, we get:

3x + 7 =0 = > x = -7/3

y – 2 = 5 = > y = 7

y + 1 = 8 => y = 7

2-3x = 4 => x = -2/3

Since, x and y cannot have two values, the values of x and y are impossible to find.

Hence, option (B) is the correct answer.

Q.2: If A = $\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$ and I = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find k so that $A^2 = kA - 2I$.

Solution:

Given that, $A^2 = kA - 2I$ … (1)

To find the value of k.

Now, substitute the A and I value in (1), we get

$$\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix} = k\begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix} - 2\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -2 \\ 4 & -4 \end{bmatrix} = \begin{bmatrix} 3k-2 & -2k-0 \\ 4k-0 & -2k-2 \end{bmatrix}$$

Now, equate the corresponding values in the matrices, we can find the value of k

1 = 3k – 2 => k = 1

-2 = -2k => k = 1

4 = 4k => k = 1

-4 = -2k – 2 => k = 1

It is noticed that, all the k values are equal to 1. Hence, the value of k is 1.

Q.3: Given $3\begin{bmatrix} x & y \\ z & w \end{bmatrix} = \begin{bmatrix} x & 6 \\ -1 & 2w \end{bmatrix} + \begin{bmatrix} 4 & x+y \\ z+w & 3 \end{bmatrix}$, determine the values of x, y, z and w.

Solution:

Given that,

$$3\begin{bmatrix} x & y \\ z & w \end{bmatrix} = \begin{bmatrix} x & 6 \\ -1 & 2w \end{bmatrix} + \begin{bmatrix} 4 & x+y \\ z+w & 3 \end{bmatrix}$$

$$\begin{bmatrix} 3x & 3y \\ 3z & 3w \end{bmatrix} = \begin{bmatrix} x+4 & 6+x+y \\ -1+z+w & 2w+3 \end{bmatrix}$$

To find the values of x, y, z and w, equate the corresponding elements, and we get

3x = x + 4 => **x = 2**

3z = -1 + z + w ……(1)

3y = 6 + x + y …… (2)

3w = 2w + 3 => **w = 3**

Substitute the value of w in equation (1), we get the value of z.

3z = -1 + z + 3 => 2z = 2 => **z = 1**

Similarly, substitute the value of x in equation (2), we get the value of y.

3y = 6 + 2 + y => **y = 4**.

Hence, the values are:

x=2, y=4, z=1, and w=3

Q.4:

If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$, and $A + A' = I$, then the value of α is

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$

(C) π (D) $\frac{3\pi}{2}$

Solution:

The correct answer is Option (B).

$$\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix} + \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 2\cos\alpha & 0 \\ 0 & 2\cos\alpha \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

To find the value of α, equate the corresponding terms, we get

$$2\cos\alpha = 1$$
$$\cos\alpha = \cos\frac{\pi}{3}$$
$$\alpha = \frac{\pi}{3}$$

Hence, the correct answer is option (B).

Q.5: Using elementary transformations, find the inverse of each of the matrices, if it exists

$$\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$$

Solution:

To find the inverse of the given matrix. Use the row operation for the given matrix.

Let A = $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$

We know that, A = IA

$$\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} A$$

Applying: $R_2 \to R_2 - 2R_1$

and $R_1 \leftrightarrow R_2$

$$\begin{bmatrix} 1 & 1 & 2 \\ 2 & 0 & -1 \\ 0 & 1 & 3 \end{bmatrix} = \begin{bmatrix} -2 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} A$$

Applying: $R_2 \rightarrow R_2 - 2R_1$
and $R_2 \leftrightarrow R_3$

$$\begin{bmatrix} 1 & 1 & 2 \\ 0 & 1 & 3 \\ 0 & -2 & -5 \end{bmatrix} = \begin{bmatrix} -2 & 1 & 0 \\ 5 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix} A$$

Applying: $R_1 \rightarrow R_1 - R_2$
and $R_3 \rightarrow R_3 + 2R_2$

$$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} -2 & 1 & -1 \\ 0 & 0 & 1 \\ 5 & -2 & 2 \end{bmatrix} A$$

Applying: $R_1 \rightarrow R_1 + R_3$
and $R_2 \rightarrow R_2 - 3R_3$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix} A$$

$$A^{-1} = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$$

Benefits of CBSE Class 12 Maths Notes Chapter 3 Matrices

- **Clear Understanding**: The notes provide a clear and detailed explanation of matrix concepts, including types of matrices, operations, and properties. This clarity helps students grasp the fundamental ideas and apply them effectively.
- **Step-by-Step Solutions**: The notes include step-by-step solutions to various problems, making it easier for students to follow and understand how to solve complex matrix equations and applications.
- **Comprehensive Coverage**: By covering all important topics, such as matrix addition, multiplication, determinants, and inverses the notes ensure that students have a thorough understanding of the chapter, preparing them well for exams.
- **Convenient Review**: The notes are a valuable resource for revision, allowing students to quickly review and reinforce their understanding of key concepts before exams.