

Unit

1

MATRICES AND EIGEN VALUE PROBLEMS

◆ § 1.1. INTRODUCTION

The word 'Matrix' was used first of all by J. J. Sylvester in 1850. Then Arthur Cayley developed the principles of matrices in 1858.

◆ § 1.1. (A) MATRIX (SOME ELEMENTARY CONCEPTS)

Definition. A system of mn numbers (real or complex) arranged in a rectangular array of m rows and n columns is called a matrix of order $m \times n$. It is also called $m \times n$ matrix.

Matrices are usually denoted by capital letters A, B, C, X, Y, Z, \dots . If A is a $m \times n$ matrix, then it is represented in square brackets as follows :

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix}_{m \times n}$$

Order of a matrix. If there are m rows and n columns in a matrix, then it is called a matrix of order $m \times n$; first factor i.e., m denotes the number of rows and second factor i.e., n denotes the number of columns.

It should be noted that it is not necessary that the number of rows be equal to number of columns, in the matrix, e.g.,

$$\begin{bmatrix} 3 & 5 & 7 \\ 9 & 10 & 11 \end{bmatrix}, [7 \ 8 \ 9], \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

are matrices of order 2×3 , 1×3 , 2×1 respectively.

Elements of a matrix. $a_{11}, a_{12}, \dots, a_{mn}$ are called the elements of the matrix, a_{ij} is called the general element of the matrix and it is situated in i^{th} row and j^{th} column. First lower suffix i in a_{ij} always represents row and second lower suffix j represents column e.g.,

$$\text{In } \begin{bmatrix} 3 & -2 & 5 \\ 4 & 7 & 9 \end{bmatrix}, a_{11} = 3, a_{12} = -2, a_{23} = 9 \text{ etc.}$$

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1. Understanding the eBook Dc Agrawal Engineering Maths Cgamra
 - The Rise of Digital Reading Dc Agrawal Engineering Maths Cgamra
 - Advantages of eBooks Over Traditional Books
2. Identifying Dc Agrawal Engineering Maths Cgamra
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Dc Agrawal Engineering Maths Cgamra
 - User-Friendly Interface
4. Exploring eBook Recommendations from Dc Agrawal Engineering Maths Cgamra
 - Personalized Recommendations
 - Dc Agrawal Engineering Maths Cgamra User Reviews and Ratings
 - Dc Agrawal Engineering Maths Cgamra and Bestseller Lists
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 - Dc Agrawal Engineering Maths Cgamra eBook Subscription Services
 - Dc Agrawal Engineering Maths Cgamra Budget-Friendly Options
6. Navigating Dc Agrawal Engineering Maths Cgamra eBook Formats
 - ePub, PDF, MOBI, and More
 - Dc Agrawal Engineering Maths Cgamra Compatibility with Devices
 - Dc Agrawal Engineering Maths Cgamra Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Dc Agrawal Engineering Maths Cgamra
 - Highlighting and Note-Taking Dc Agrawal Engineering Maths Cgamra
 - Interactive Elements Dc Agrawal Engineering Maths Cgamra
 8. Staying Engaged with Dc Agrawal Engineering Maths Cgamra
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Dc Agrawal Engineering Maths Cgamra
 9. Balancing eBooks and Physical Books Dc Agrawal Engineering Maths Cgamra
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Dc Agrawal Engineering Maths Cgamra
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Dc Agrawal Engineering Maths Cgamra
 - Setting Reading Goals Dc Agrawal Engineering Maths Cgamra
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Dc Agrawal Engineering Maths Cgamra
 - Fact-Checking eBook Content of Dc Agrawal Engineering Maths Cgamra
 - Distinguishing Credible Sources
 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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