

Module Overview

Chapter Overview:

This chapter provides a foundational understanding of the essential mathematical concepts used in data science. It covers key areas such as linear algebra, calculus, probability, and statistics. Each section is designed to equip students with the mathematical tools necessary to analyze, interpret, and derive insights from data effectively.

Chapter Objectives:

- Comprehend the role of mathematics in data science.
- Apply linear algebra techniques for data manipulation and dimensionality reduction.
- Utilize calculus for understanding changes and trends in data.
- Employ probability theory for data analysis and prediction.
- Use statistical methods for data inference and hypothesis testing.

Chapter Outline:

1. Introduction to Data Science and Mathematics

- **The Role of Mathematics in Data Science:** Understanding why mathematics is critical in data science.
- **Mathematical Tools for Data Science:** Overview of the mathematical concepts and techniques covered in this chapter.

2. Linear Algebra

- **Vectors and Matrices:** Basic definitions, properties, and operations on vectors and matrices.
- **Matrix Decompositions:** LU decomposition, QR decomposition, Eigenvalues, and Eigenvectors, and their significance in data science.
- **Principal Component Analysis (PCA):** Dimensionality reduction technique and its applications.
- **Singular Value Decomposition (SVD):** Understanding SVD and its use in data compression and noise reduction.
- **Linear Transformations and Projections:** The concept of linear mappings and their applications in data analysis.