

Chapter 1

Applications of Matrices and Determinants



“The greatest mathematicians, as Archimedes, Newton, and Gauss, always united theory and applications in equal measure.”

-Felix Klein

1.1 Introduction



Carl Friedrich Gauss
(1777-1855)

German mathematician and physicist

Matrices are very important and indispensable in handling system of linear equations which arise as mathematical models of real-world problems. Mathematicians Gauss, Jordan, Cayley, and Hamilton have developed the theory of matrices which has been used in investigating solutions of systems of linear equations.

In this chapter, we present some applications of matrices in solving system of linear equations. To be specific, we study four methods, namely (i) Matrix inversion method, (ii) Cramer's rule (iii) Gaussian elimination method, and (iv) Rank method. Before knowing these methods, we introduce the following: (i) Inverse of a non-singular square matrix, (ii) Rank of a matrix, (iii) Elementary row and column transformations, and (iv) Consistency of system of linear equations.



Learning Objectives

Upon completion of this chapter, students will be able to

- Demonstrate a few fundamental tools for solving systems of linear equations:
 - Adjoint of a square matrix
 - Inverse of a non-singular matrix
 - Elementary row and column operations
 - Row-echelon form
 - Rank of a matrix
- Use row operations to find the inverse of a non-singular matrix
- Illustrate the following techniques in solving system of linear equations by
 - Matrix inversion method
 - Cramer's rule
 - Gaussian elimination method
- Test the consistency of system of non-homogeneous linear equations
- Test for non-trivial solution of system of homogeneous linear equations