

Chapter

7

Matrices and
Determinants

“Mathematics is the music of reason”

- Sylvester

7.1 Introduction

The beginnings of matrices and determinants go back to the second century BC although traces can be seen back to the fourth century BC. However, it was not until near the end of the seventeenth century that the ideas reappeared and development really got underway. It is not surprising that the beginnings of matrices and determinants should arise through the study of systems of linear equations. The Babylonians studied problems which lead to simultaneous linear equations and some of these are preserved in clay tablets which survive till now.

The evolution of the theory of ‘**matrices**’ is the result of attempts to obtain compact and simple methods for solving systems of linear equations. It also began with the study of transformations of geometric objects. In 1850, it was **James Joseph Sylvester** an English Mathematician and lawyer, coined the word ‘**Matrix**’ (originally from Latin: *Mā* ter means Mother – Collin’s Dictionary). Matrices are now one of the most powerful tools in mathematics.

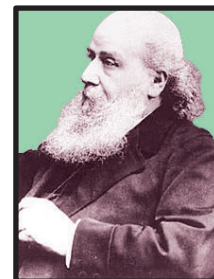


Generally, a matrix is nothing but a rectangular array of objects. These matrices can be visualised in day-to-day applications where we use matrices to represent a military parade or a school assembly or vegetation.

The term ‘**determinant**’ was first coined by **Carl F Gauss** in *Disquisitiones arithmeticae* (1801) while studying quadratic forms. But the concept is not the same as that of modern day determinant. In the same work Gauss laid out the coefficients of his quadratic forms in rectangular arrays where he described matrix multiplication.



It was Cauchy (in 1812) who used *determinant* in its modern sense and studied it in



Sylvester
(1814 - 1897)

detail. He reproved the earlier results and gave new results of his own on minors and adjoints. It was **Arthur Cayley** whose major contribution was in developing the algebra of matrices and also published the theory of determinants in 1841. In that paper he used two vertical lines on either side of the array to denote the determinant, a notation which has now become standard. In 1858, he published