# Matrix Theory Encyclopedia Article

## Matrix Theory

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# Contents

Matrix Theory Encyclopedia Article.....1

Contents.....2

Matrix Theory.....3

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The use of determinants to solve systems of simultaneous equations was probably known to the great Japanese mathematician Seki Kowa as early as the mid-seventeenth century. Some historians think that Chinese mathematicians were using these techniques centuries earlier. Neither of these developments in Asia had any influence on Western mathematics, however, where determinants were not introduced until about 1693. The German mathematician Gottfried Leibniz is usually given credit for this invention. Some of the most important work in Europe on determinants was done by the Swiss mathematician Gabriel Cramer (1704-1752). Cramer's method for solving simultaneous linear equations with determinants is still taught to beginning algebra students as Cramer's Rule. The Scottish mathematician Colin Maclaurin (1698-1746) apparently worked out a similar rule, which was published in his book *Treatise of Algebra* in 1748.

The use of determinants was greatly generalized by the British mathematician Arthur Cayley, who developed the algebra of matrices. Cayley created a system by which a rectangular array of numbers--a matrix--can be treated independently from any set of equations from which it was originally derived. He also developed many of the basic theorems that form the basis of modern matrix theory. The term matrix was actually suggested by Cayley's colleague and close personal friend, James Joseph Sylvester (1814-1897). Sylvester also made a number of contributions to the early development of matrix theory.

Matrix theory has become a powerful tool in mathematics, where it can be used to solve many types of systems of equations. It has also found application in a diverse range of fields, including physics, chemistry, engineering, economics, statistics, and psychology. For a period of time, the most important application of matrix theory appeared to be in the area of matrix mechanics, a mathematical system for dealing with problems in quantum mechanics. Matrix mechanics was originally formulated by a group of physicists in the 1920s, most prominently by Werner Heisenberg, Max Born, and their colleagues. This application of matrix theory owed much to the earlier work of the German mathematician Carl Gustav Jacob Jacobi (1804-1851). In 1841, Jacobi had written a pair of papers showing how matrix theory can be used to solve inverse functions and multiple integrals. It was this work on which Heisenberg built his early formulations of matrix mechanics.