Melissa Mogensen
History of Mathematics

History of Linear Algebra Timeline

1900 BC- Babylon   The beginnings of matrices and determinants arise through the study of systems of linear equations, which was first introduced by the Babylonians. The Babylonians studied problems that led to simultaneous linear equations.

200 BC- China   The Chinese actually came a lot closer to actual matrices we use today by using a method that resembles Gaussian Elimination. This technique was used before they had equations or variables.

1545 AD- Cardan   Cardon, in *Ars Magna*, gives a rule for solving a system of two linear equations called *regula de modo,* which is essentially Cramer's rule, but he (Cardan) doesn't make the final step, so he doesn't reach the definition of a determinant.

1683 AD- Seki   In Japan, Seki wrote *Method of solving the dissimulated problems,* which contains matrix methods written in tablets, the exact way the Chinese recorded them. Seki also introduced determinants and gave general methods for calculating them based on examples. He was able to find up to 5X5 matrices and applied them to solving equations but not systems of equations.

1683 AD- Leibnitz   In Europe, Leibnitz explained a system of equations
$10+11x+12y=0$
$20+21x+22y=0$ had a solution because
$30+31x+32y=0$
$10.21.32 + 11.22.30 + 12.20.31 = 10.22.31 + 11.20.32 + 12.21.30$
which is exactly the condition that the coefficient matrix has determinant 0. The periods resemble multiplication and *the two characters describe first the equation and the second resembles the letter*.

1750 AD- Cramer   Cramer presented a determinant-based formula for solving systems of linear equations, better known as Cramer's Rule for nxn systems of equations.

1773 AD- Lagrange   The first implicit use of matrices occurred in Langrange's work on bilinear forms for the optimization of a real valued function of 2 or more variables. He desired to characterize the maxima and minima of multivariable functions.

1800 AD- Gauss   The term 'determinant' was first introduced by Gauss. He used the term because the determinant determines the properties of the quadratic form, which is not the same concept of determinant used today. He describes matrix multiplication and the inverse of matrix, in the particular context of the arrays of coefficients of quadratic forms. Gauss also developed Gaussian Elimination while studying the orbit of the asteriod Pallas by obtaining a system of six linear equations and six unknowns. It (Gaussian Elimination) was later used to solve least squares problems in celestial computations and in computations to measure the earth and its surface.

1812 AD- Cauchy   In a paper, Cauchy used 'determinant' in its modern sense and proved multiplication theorem for determinants for the first time.

1826 AD   Cauchy found the eigenvalues and gave results on diagonalisation of a matrix in the context of converting a form to the sum of squares. He also introduced the idea of similar matrices and showed that if two matrices are similar, they have the same characteristic equation and proved that every real symmetric matrix is diagonalisable.

1834 AD- Sturm   Jacques Sturm gave a generalization of the eigenvalue problem in the context of solving systems of ordinary differential equations.

1844 AD- Grassmann   Grassmann proposed the first vector algebra that involved a noncommutative vector product (vxw need not equal wxv). He also introduced the product of a column matrix and a row matrix, which resulted in what is now called a simple or a rank-one matrix.

1850 AD- Sylvester   J.J. Sylvester was the first the introduce the term 'matrix', which he described as *"an oblong arrangement of terms"*. He also defined the nullity of a square matrix.

1855 AD- Cayley   Arthur Cayley nurtured matrix algebra. He studied compositions of linear transformations and was led to a matrix defining addition, multiplication, scalar multiplication, and inverses.

1870 AD- Jordan   The Jordan canonical form appeared in *Treatise on substitutions and algebraic equations*. It appears in the context of a canonical form for linear substitutions over the finite field of order prime.

1878 AD- Frobenius   Frobenius proved important results on canonical matrices as representatives of equivalence classes of matrices. He also contains the definition of the rank of a matrix, which he used in his work on canonical forms and the definition of orthogonal matrices.

1888 AD- Peano   Peano gave the modern definition of a vector space.

1890 AD- Weierstrass Weierstrass used an axiomatic definition of a determinant.

1925 AD- Heisenburg Heisenburg reinvents matrix algebra for quantum mechanics.

1942 AD- Gibbs   Gibbs represented general matrices as sums of simple matrices.

1947 AD- vonNeuman They introduced condition numbers in analyzing round-off errors.
    &Goldstine

1948 AD- vonNeuman They developed stored-program computers.
   & Turing

1948 AD- Turing   Turing introduced the LU decomposition of a matrix

1958 AD- Wilkinson Developed QR factorization.