Linear Algebra

The Following is the list of all kind of Linear Algebra courses that OMATHA can offer either online or home tutoring

Introduction to Linear Algebra

Review of complex numbers. The fundamental theorem of algebra. Review of vector and scalar products, projections. Introduction to vector spaces, linear independence, bases; function spaces. Solution of systems of linear equations, matrix algebra, determinants, eigenvalues and eigenvectors. Gram Schmidt, orthogonal projections. Linear transformations, kernel and image, their standard matrices. Applications (e.g. geometry, networks, differential equations).

Note: This course is Intended for undergraduate majors in Mathematics, Applied Mathematics, Chemistry, Physics, Engineering, and Data Scientists.

Elementary Linear Algebra

This course is the first of a series that is designed for beginners who want to learn how to apply basic data science concepts to real-world problems. In this course, we'll cover the fundamentals of linear algebra, including systems of linear equations, matrix operations, and vector equations. Emphasis is given to topics that will be useful in other disciplines, including vector spaces, determinants, eigenvalues, similarity, and positive definite matrices.

Honours Linear Algebra

Vector spaces, direct sums and complement of subspaces, linear maps, representation of linear maps by matrices, dual spaces, transpose mappings, multilinear mappings, determinants, inner products, orthogonal projections, the Gram-Schmidt algorithm. Eigenvalues and eigenvectors, diagonalization of symmetric matrices. The emphasis of this course is on proving all results.

Note: This course is mostly intended for those students whose major is Mathematics or those who are interested in the concept of Linear Algebra.

Introduction to Applied Linear Algebra

Review of vector spaces and matrix algebra, inner products, Gram-Schmidt, orthogonal projections. Eigenvalues and eigenvectors, diagonalization of symmetric matrices. Singular value decomposition. Applications to linear discrete dynamical systems, minimization of quadratic forms and least squares approximation, principal component analysis. Other applications chosen from: linear programming, duality and the simplex method; introduction to finite fields and coding theory.

Note: This course is intended for Applied Mathematics and Engineering students.

Applied Linear Algebra

Vector and matrix norms. Schur canonical form, QR, LU, Cholesky and singular value decomposition, generalized inverses, Jordan form, Cayley-Hamilton theorem, matrix analysis and exponentials of matrices, eigenvalue estimation and the Gershgorin Circle Theorem; quadratic forms, Rayleigh and minima principles. This course includes proofs and applications of computational methods.

Note: This course very important for mechanical, civil, electrical, and aerospace engineering students. Pure Mathematics, Applied Mathematics, Physics, and Statistics students are also welcome.

Linear Algebra I

This course covers the following topics: solving systems of linear equations; matrices and linear transformations; image and kernel of a linear transformation; matrices and coordinates relative to different bases; determinants; eigenvalues and eigenvectors; discrete and continuous dynamical systems; least-squares approximation; applications, differential equations, and function spaces.

Linear Algebra II

Linear spaces: subspaces, linear span, linear dependence, basis, dimension, change of bases. Matrices: rank, column space and row space. Linear transformations: their matrix and its dependence on the bases, composition and inverse, range and nullspace, the dimension theorem. Euclidean spaces: inner product, the Cauchy-Schwarz inequality, orthogonality, ON-basis, orthogonalisation, orthogonal projection, isometry. Quadratic forms: diagonalisation. Spectral theory: eigenvalues, eigenvectors, eigenspaces, characteristic polynomial, diagonalisability, the spectral theorem, second degree surfaces. Systems of linear ordinary differential equations.

Applied and Computational Linear Algebra for Energy Engineers

An introduction to systems of linear equations, vectors in Euclidean space, matrix algebra, linear transformations, eigenvalues and engenvectors. Geometrical applications and computing techniques will be emphasized. Students will complete a project using mathematical software.

Linear Methods I

An introduction to systems of linear equations, vectors in Euclidean space and matrix algebra. Additional topics include linear transformations, determinants, complex numbers, eigenvalues, and applications.

Linear Methods II

An introductory course in the theory of abstract vector spaces: linear independence, spanning sets, basis and dimension; linear transformations and the rank-nullity theorem; the Gram-Schmidt algorithm and orthogonal diagonalization; singular value decomposition and other applications.

Linear Methods III

Canonical forms. Inner product spaces, invariant subspaces and spectral theory. Quadratic forms.

Linear Algebra, Multivariable Calculus, and Modern Applications & ACE

This course provides unified coverage of linear algebra and multivariable differential calculus, and the free course e-text connects the material to many fields. Linear algebra in large dimensions underlies the scientific, linear algebra portion includes orthogonality, linear independence, matrix algebra, and eigenvalues with applications such as least squares, linear regression, and Markov chains (relevant to population dynamics, molecular chemistry, and PageRank); the singular value decomposition (essential in image compression, topic modeling, and data-intensive work in many fields) is introduced in the final chapter of the e-text. The multivariable calculus portion includes unconstrained optimization via gradients and Hessians (used for energy minimization), constrained optimization (via Lagrange multipliers, crucial in economics), gradient descent and the multivariable Chain Rule (which underlie many machine learning algorithms, such as backpropagation), and Newton's method (an ingredient in GPS and robotics). The course emphasizes computations alongside an intuitive understanding of key ideas. The widespread use of computers makes it important for users of math to understand concepts: novel users of quantitative tools in the future will be those who understand ideas and how they fit with examples and applications. & Students attend one of the regular lectures with four hours per week.

Differential Equations with Linear Algebra, Fourier Methods, and Modern Applications & ACE

Ordinary differential equations and initial value problems, linear systems of such equations with an emphasis on second-order constant-coefficient equations, stability analysis for non-linear systems (including phase portraits and the role of eigenvalues), and numerical methods. Partial differential equations and boundary-value problems, Fourier series and initial conditions, and Fourier transform for non-periodic phenomena. Throughout the development we harness insights from linear algebra, and software widgets are used to explore course topics on a computer (no coding background is needed). The free e-text provides motivation from applications across a wide array of fields (biology, chemistry, computer science, economics, engineering, and physics) described in a manner not requiring any area-specific expertise, and it has an appendix on Laplace transforms with many worked examples as a complement to the Fourier transform in the main text. **&** Additional problem solving session guided by a course assistant.

Applied Matrix Theory

Linear algebra for applications in science and engineering. The course introduces the key mathematical ideas in matrix theory, which are used in modern methods of data analysis, scientific computing, optimization, and nearly all quantitative fields of science and engineering. While the choice of topics is motivated by their use in various disciplines, the course will emphasize the theoretical and conceptual underpinnings of this subject. Topics include orthogonality, projections, spectral theory for symmetric matrices, the singular value decomposition, the QR decomposition, least-squares methods, and algorithms for solving systems of linear equations; applications include clustering, principal component analysis and dimensionality reduction, regression.

Linear Algebra and Matrix Theory

Algebraic properties of matrices and their interpretation in geometric terms. The relationship between the algebraic and geometric points of view and matters fundamental to the study and solution of linear equations. Topics: linear equations, vector spaces, linear dependence, bases and coordinate systems; linear transformations and matrices; similarity; dual space and dual basis; eigenvectors and eigenvalues; diagonalization. Includes an introduction to proof-writing.

Numerical Linear Algebra

Numerical linear algebra, is the study of how matrix operations can be used to create computer algorithms which efficiently and accurately provide approximate answers to questions in continuous mathematics. It is a subfield of numerical analysis, and a type of linear algebra. Computers use floating-point arithmetic and cannot exactly represent irrational data, so when a computer algorithm is applied to a matrix of data, it can sometimes increase the difference between a number stored in the computer and the true number that it is an approximation of. Numerical linear algebra uses properties of vectors and matrices to develop computer algorithms that minimize the error introduced by the computer, and is also concerned with ensuring that the algorithm is as efficient as possible.

Numerical linear algebra aims to solve problems of continuous mathematics using finite precision computers, so its applications to the natural and social sciences are as vast as the applications of continuous mathematics. It is often a fundamental part of engineering and computational science problems, such as image and signal processing, telecommunication, computational finance, materials science simulations, structural biology, data mining, bioinformatics, and fluid dynamics. Matrix methods are particularly used in finite difference methods, finite element methods, and the modeling of differential equations. Noting the broad applications of numerical linear algebra, Lloyd N. Trefethen and David Bau, III argue that it is "as fundamental to the mathematical sciences as calculus and differential equations",even though it is a comparatively small field. Because many properties of matrices and vectors also apply to functions and operators, numerical linear algebra can also be viewed as a type of functional analysis which has a particular emphasis on practical algorithms.

Common problems in numerical linear algebra include obtaining matrix decompositions like the singular value decomposition, the QR factorization, the LU factorization, or the eigendecomposition, which can then be used to answer common linear algebraic problems like solving linear systems of equations, locating eigenvalues, or least squares optimisation. Numerical linear algebra's central concern with developing algorithms that do not introduce errors when applied to real data on a finite precision computer is often achieved by iterative methods rather than direct ones.