

MATHEMATICS (MATH)

MATH 000 - Experiential Learning in Math (0 Credits)

Open to qualified students by permission of the department. Supervised on-campus or off-campus experiential learning activity developed in consultation with the department.

MATH 110 - Finite Mathematics with Applications (3 Credits)

Includes topics such as sets, counting techniques, voting theory, probability, and graph theory, together with their applications. Other topics may include fair division and logic.

MATH 111 - Precalculus (3 Credits)

Emphasis on elementary functions including rational, exponential, logarithmic and trigonometric functions. Designed for students who intend to take calculus.

MATH 115A - Introduction to Mathematical Modeling (3 Credits)

Emphasis on environmental issues such as population, growth, pollution, natural disasters, epidemics, genetics, and patterns in nature. Mathematical topics include linear functions, linear regression, curve fitting, probability models, and difference equations.

MATH 120 - Quantitative Reasoning for Decision-Making (3 Credits)

Designed to give students the quantitative skills necessary in making informed decisions as an engaged citizen. Topics include ratios, percentages, growth and decay, and basic statistics in the context of sustainability, health and nutrition, financial literacy, and other aspects of society.

MATH 121 - Calculus I (4 Credits)

First course in calculus. Topics include limits, derivatives and their applications, antiderivatives, definite integrals, the fundamental theorems of calculus, the substitution rule for integrals, and transcendental functions.

MATH 122 - Calculus II (4 Credits)

Prerequisite: MATH 121. Topics include techniques and applications of integration, sequences, and series.

MATH 201 - Introduction to Discrete Mathematics (3 Credits)

Designed to prepare prospective mathematics majors for advanced study in the field by introducing them to a higher level of mathematical abstraction. Topics include sets and logic, functions and relations, methods of mathematical proof including mathematical induction, and elementary counting techniques. (Prospective mathematics majors should take this course during their freshman year.)

MATH 204 - Mathematical Concepts and Methods I (4 Credits)

Prerequisite: EDUC 351A and EDUC 388. Mathematical concepts and methods of teaching for the elementary school. Topics include number systems and their properties, problem solving, and topics in number theory. Course intended for students certifying to teach grades PreK-6. Significant field experience required.

MATH 205 - Selected Topics in Mathematics (1-3 Credits)

Prerequisite: Course dependent. Opportunity for additional study of lower-level topics in mathematics.

MATH 207 - History of Mathematics (3 Credits)

The history of mathematics begins with the early numbering systems and mathematics of the Egyptians and the Babylonians. The course then turns to the Greeks and their emphasis on logical deduction and geometry. The Arabs develop algebra in the Middle Ages, and calculus is created during the Age of Reason. The development of individual branches of mathematics then is studied (probability, number theory, non-Euclidean geometry, set theory, and topology). The course ends with the Computer Age and implications for the future.

MATH 224A - Multivariable Calculus (4 Credits)

Prerequisite: MATH 122. Topics include parametric equations, vectors, polar, cylindrical, and spherical coordinates, vector-valued functions, functions of several variables, partial derivatives, multiple integrals, and vector calculus.

MATH 253 - Introduction to Cryptography (3 Credits)

Prerequisites: MATH 201 or CPSC 284. An introduction to standard encryption schemes and the relevant mathematics, including the classical symmetric ciphers, Diffie-Hellman key exchange, and modern public key encryption systems. Also includes cryptanalysis techniques in the context of standard message attacks. Credit for only one of MATH 253 or MATH 453 may count toward degree requirements.

MATH 300 - Linear Algebra (4 Credits)

Prerequisite: MATH 122 and either MATH 201 or CPSC 284. An introduction to linear algebra and its applications. Usually includes matrix algebra, systems of equations, vector spaces, inner product spaces, linear transformations, and eigenspaces. Applications of linear algebra topics will be explored using a computational software system such as Mathematica or R.

MATH 305 - Mathematics as a Profession (1 Credits)

Prerequisite: MATH 300. An overview of the professional experience in the discipline, to include technical tools, strategies for job placement and professional growth, and the development of one's professional identity in the mathematical sciences.

MATH 312 - Differential Equations (3 Credits)

Prerequisite: MATH 122. Ordinary differential equations which may include Laplace transformations, linear differential equations, applications, approximations, and linear systems of equations.

MATH 321 - Number Theory (3 Credits)

Prerequisite: MATH 201 or CPSC 284. An elementary, theoretical study of the properties of the integers.

MATH 325 - Discrete Mathematics (3 Credits)

Prerequisite: MATH 201 or CPSC 284. Includes topics such as discrete probability, graph theory, recurrence relations, topics from number theory, semigroups, formal languages and grammars, finite automata, Turing machines, and coding theory.

MATH 330 - Foundations of Advanced Mathematics (3 Credits)

Prerequisites: MATH 122 and either MATH 201 or CPSC 284. Introduction to mathematical reasoning and rigor. Includes topics such as basic logic, set theory, mathematical induction, relations, functions, sequences, cardinality, elementary number theory, and axiomatic construction of the real numbers. Emphasis placed on reading mathematics, understanding mathematical concepts, and writing proofs.

MATH 351A - Numerical Analysis I (3 Credits)

Prerequisite: MATH 300 or MATH 312. MATH 351 introduces the theory and applications of the basic computational techniques of numerical approximation. Topics include an introduction to computer programming and algorithms, root finding, interpolation, polynomial approximation, numerical differentiation and integration, and numerical linear algebra. Only in sequence.

MATH 352A - Numerical Analysis II (3 Credits)

Prerequisite: MATH 351A. Expands on the basic approximation techniques to include scientific computing. Topics include methods of simulation, initial value problems and boundary value problems for ordinary/partial differential equations, applications in science and engineering. Only in sequence.

MATH 361 - Topics in Mathematics (3 Credits)

Prerequisite: course dependent. Opportunity for additional study of mathematical topics.

MATH 372A - Modern Geometry (3 Credits)

Prerequisite: MATH 300. Axiomatic development of various geometries including modern Euclidean and non-Euclidean geometry, finite geometries, hyperbolic geometry, and elliptic geometry. Topics could also include convexity, transformational geometry, projective geometry, and constructability.

MATH 411 - Chaotic Dynamical Systems (3 Credits)

Prerequisite: MATH 122. Chaotic dynamical systems including iteration, graphical analysis, periodic points, bifurcations, the transition to chaos, fractals, Julia sets and the Mandelbrot set.

MATH 412 - Complex Variables (3 Credits)

Prerequisite: MATH 300. Analytic functions, Cauchy-Riemann conditions, integration, power series, calculus of residues, conformal mappings, and applications.

MATH 421 - Applied Partial Differential Equations (3 Credits)

Prerequisites: MATH 224A and MATH 312. This course introduces three main types of partial differential equations (PDEs): parabolic, elliptic, and hyperbolic as well as mathematical and computational tools for solving PDEs. It balances mathematical rigor, computational techniques, and real-world applications. Topics include heat equation, method of separation of variables, Laplace's equation, Fourier series, wave equation, finite difference/element methods, and highdimensional PDEs.

MATH 431 - Abstract Algebra (3 Credits)

Prerequisite: MATH 300. Mathematical systems including groups, rings, fields, and vector spaces. Only in sequence.

MATH 432 - Abstract Algebra (3 Credits)

Prerequisite: MATH 431. Mathematical systems including groups, rings, fields, and vector spaces. Only in sequence.

MATH 441A - Topology (3 Credits)

Prerequisite: MATH 300 and MATH 330. Includes topics from point-set topology such as continuity, connectedness, compactness, and product and quotient constructions.

MATH 453 - Mathematical Cryptography (3 Credits)

Prerequisite: MATH 300. A rigorous development of modern encryption techniques from the group theory perspective, including private and public-key systems, key exchange protocols, and digital signature schemes. Includes cryptanalysis by both classical message attacks and collisions. Credit for only one of MATH 253 or MATH 453 may count toward degree requirements.

MATH 461 - Topics in Mathematics (3 Credits)

Prerequisite: Course dependent. Topics such as optimization, Fourier series, ring theory, cryptology, algebraic number theory, coding theory, and modeling. May be taken up to three times for credit.

MATH 471 - Real Analysis (3 Credits)

Prerequisite: MATH 300. A rigorous, real analysis approach to the theory of calculus. Only in sequence.

MATH 472 - Real Analysis (3 Credits)

Prerequisite: MATH 471. A rigorous, real analysis approach to the theory of calculus. Only in sequence.

MATH 481 - Theory of Interest (3 Credits)

Prerequisite: MATH 122. This course introduces the mathematical concepts underlying the theory of interest. Topics include measurement of interest (including accumulated and present value factors), annuities, yield rates, amortization schedules and sinking funds, bonds and related securities, derivative instruments, and hedging and investment strategies.

MATH 491B - Directed Study (1-3 Credits)

Individual study beyond the scope of normal course offerings, done under the direction of a faculty member. May lead to graduation with Honors in Mathematics.

MATH 492A - Directed Study (1-3 Credits)

Individual study beyond the scope of normal course offerings, done under the direction of a faculty member. May lead to graduation with Honors in Mathematics.

MATH 499 - Internship (1-12 Credits)

Supervised off-campus experience, developed in consultation with the department. Does not count in the major program.