

# Mathematics

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*Major:* Mathematics courses – 111/112 or 121 or equivalent; 122; 220; 221; 224; 324; 327; 461 or 471 (culminating experience); two others, not including 143, 210, 212 or 217, and including at least one at the 300 level or higher.

Cognate course – CS 110.

Comprehensive evaluation, with passing grade. Total of 10 major courses, plus 1 cognate = 11.

Recommended: Phy 161, Phi 321. Candidates for secondary teaching certification in Mathematics must include Mat 339.

*Minor:* Mathematics courses – 111/112 or 121 or equivalent; 122; three others, not to include 210 or 212. Either 143 or 220 (not both) may count toward the minor. Total of 5 minor courses.

Bypass credit opportunities: Students who are placed directly into 122, Calculus II, and who receive a grade of B or above therein, will receive credit for 121, Calculus I, upon request. Bypass credit for other courses may be awarded in special cases.

**Mat 111, 112. Calculus with Review.** A two-course sequence including a review of algebra, trigonometry, and analytic geometry integrated with an introduction to the theory of differential and integral calculus. Completion of 111/112 satisfies the Abstraction and Formal Reasoning LADR.

**Mat 121. Calculus I.** An introduction to the theory of differential and integral calculus for functions of one variable. Includes the concepts of limit, continuity, derivatives, and indefinite integrals and definite integrals, culminating in the Fundamental Theorem of Calculus. Applications to related rates and optimization problems. Prerequisite: a high-school calculus course or placement via departmental placement test. Satisfies the Abstraction and Formal Reasoning LADR.

**Mat 122. Calculus II.** Differentiation and integration of logarithmic functions, exponential functions, and inverse trigonometric functions. Study of polar coordinates, conic sections, and various integration techniques. Applications to computations of volumes, surface areas, and centers of mass. Prerequisite: 121 or equivalent college course, or placement via departmental placement test. Satisfies the Abstraction and Formal Reasoning LADR.

**Mat 143. Discrete Mathematics I.** A survey of the math topics which are foundational to computer science: functions, relations, sets, basic logic, proof techniques, combinatorics, graphs and trees, discrete probability. No prerequisite. Does not count toward major. Counts toward minor but not in addition to Mat 220.

**Mat 160. Special Topics.**

**Mat 210. Mathematics: Topics for the Liberal Arts.** Non-technical introduction to selected concepts of modern mathematics (such as logic, set theory, axiomatic systems, non-Euclidean geometry, number theory, graph theory, etc.) that illustrate the nature of mathematics and its connections to other areas of knowledge. Does not count toward major or minor. Satisfies the Abstraction and Formal Reasoning LADR.

**Mat 212. Problem Solving with Elementary Mathematics.** A study of mathematical concepts that are taught in elementary school, including problem solving, sets, numbers and their properties, operations on sets and numbers, geometry, measurement, probability and statistics. Satisfies the

Abstraction and Formal Reasoning LADR. Does not count toward a major or minor in math.  
Prerequisite: EDU 221.

**Mat 217. Applied Statistics.** Use of graphs and numerical summaries to describe data from individual variables and to investigate relationships among variables. Design of statistical experiments. Survey of fundamental concepts of probability, including sampling distributions. Use of sample data to estimate, and to test hypotheses about, unknown parameters. Satisfies the Abstraction and Formal Reasoning LADR. Does not count toward major. No prerequisites.

**Mat 220. Logic, Sets and Relations.** An introduction to the foundations of mathematics, with emphasis on developing basic reasoning skills needed for constructing proofs. Required for major. Counts toward minor but not in addition to Mat 143. Satisfies the Abstraction and Formal Reasoning LADR.

**Mat 221. Calculus III.** Differentiation and integration of vector-valued functions. Study of functions of several variables, including partial derivatives and multiple integrals. Detailed study of infinite sequences and series. Prerequisite: 122 or equivalent. Satisfies the Abstraction and Formal Reasoning LADR.

**Mat 224. Linear Algebra.** Systems of linear equations and their solutions. Study of the algebraic properties and applications of vectors, matrices, and linear transformations. Prerequisite: 121.

**Mat 231. Differential Equations.** Survey of basic techniques for describing dynamical systems by means of equations involving derivatives of functions, and of methods for finding functions which satisfy these equations. Prerequisite: 122.

**Mat 260. Special Topics.**

**Mat 307. Directed Study.** .50 unit.

**Mat 311. History of Mathematics.** Survey of important discoveries in mathematics and the historical contexts in which they were made. Topics will include major mathematical developments beginning with the Ancient Greeks and tracing the development through Hindu, Arabic and European mathematics up to the modern developments of the 20<sup>th</sup> century. Prerequisite: 121 or permission.

**Mat 320. Introduction to Number Theory.** Explores properties of the integers such as divisibility and congruence, linear diophantine equations, prime numbers, the Fundamental Theorem of Arithmetic, Fermat's little theorem, Euler's Theorem, Euler's phi function, computing powers and roots in modular arithmetic, and public key cryptography. Prerequisite: Mat 143 or 220.

**Mat 321. Introduction to Real Analysis.** Development of the algebraic and topological properties of the real number system and the theoretical foundations of differential and integral calculus. Prerequisite: 221. Strongly recommended for students considering post-graduate study in mathematics.

**MAT 323. Introduction to Complex Analysis.** Study of complex numbers and functions of a complex variable. Topics include algebra and geometry of the complex plane, derivatives, integrals, power series, Laurent series, and residue theory. Prerequisite: 221 or permission. Recommended for students considering graduate study in mathematics.

**Mat 324. Algebraic Systems.** Study of concepts abstracted from algebraic properties of the classical number systems, including groups, rings, fields, order relations, and equivalence relations. Prerequisite: 122 or 220 or 224.

**Mat 327. Probability and Statistics.** Calculus-based survey, including axioms of probability, discrete and continuous random variables, standard probability functions (binomial, normal, Poisson, *etc.*), mathematical expectation, generating functions, and a brief introduction to estimation and hypothesis testing. Prerequisite: 122.

**Mat 339. Foundations of Geometry.** Survey of ancient, classical and modern views regarding the nature of space, the description of spatial structures and the organization of facts about space into deductive theories. Prerequisite: 121.

**Mat 343. Discrete Mathematics II.** Continues the discussion of discrete mathematics introduced in Mat 143. Topics include predicate logic, recurrence relations, graphs, trees, matrices, computational complexity, elementary computability and discrete probability. Prerequisite: 143 or 220.

**Mat 357. Internship.** Off-campus supervised experience in mathematics.

**Mat 359. Introduction to Topology.** Study of concepts, growing out of and underlying geometry and calculus, which have become important in physics, chemistry, logic, and computer science. Careful development of abstract notions such as topological spaces, continuity, topological equivalence, connectedness, and dimension, and related philosophical and historical matters in mathematics and liberal arts generally. Prerequisite: 121.

**Mat 360. Special Topics.** Topics may be drawn from analysis with complex variables, introduction to functional analysis, category theory, mathematical logic and model theory, recursive function theory, topology, universal algebra, or other areas.

**Mat 370. Directed Study.** Individual study of topics such as those listed under 360.

**Mat 434. Rings and Fields.** Selected topics, including rings, subrings, integral domains, fields, ideals, quotient rings, ring homomorphisms, polynomial rings, extension fields, finite fields. Prerequisite: 324. Recommended for students considering graduate study in mathematics.

**Mat 437. Topics in Probability and Statistics.** Content varies. Prerequisite: 327.

**Mat 461. Advanced Seminar.** Student-led inquiry/research in an area of mathematics such as real or complex analysis, topology, algebra, etc. Content varies. May be repeated for credit.

Prerequisite: Open to junior and senior math majors.

**Mat 465. Capstone Seminar.** Course content will reflect the topic for the annual Capstone. Open to all juniors and seniors and may be repeated once for credit. Students may enroll in only one Capstone seminar in a given term.

**Mat 471. Senior Thesis.**

**Mat 499. Comprehensive Evaluation.**