

# Mathematics

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The essence of orderliness, form and elegance, mathematics is a basic tool for many disciplines and careers. The mathematics curriculum is designed to provide the student with a strong mathematics background enhanced by technological tools, such as the graphing calculator and symbolic algebra software. It also is flexible enough to accommodate the diverse interests of mathematics majors, including those preparing for graduate work, those preparing to become an actuary and those seeking to teach on the elementary or secondary level. Upon completion of the Mathematics program, students will be able to:

1. Comprehend and simplify mathematical expressions.
2. Build or solve mathematical models.
3. Prove or disprove a theory with logical steps.
4. Understand and use modern technology in mathematics.
5. Pursue high-level mathematical theory.

Core Fulfilling Mathematics courses (1 course required):

CSC 110 Computer Science I (3 crs)

MAT 102 Math in Society (3 crs)

MAT 105 Introduction to Statistics I (3 crs)

MAT 108 Pre-Calculus (3 crs)

MAT 111 Calculus I (4 crs)

(A student with advanced placement may substitute a higher level MAT or CSC course to fulfill the core requirement.)

### **Requirements for Bachelor of Science Degree in Mathematics**

In fulfilling the core curriculum requirements, Mathematics majors will take MAT 111 to fulfill the mathematics core and take PHY 110 to fulfill one of the science core courses. In addition to completing the core curriculum requirements, Mathematics majors must complete the following courses:

PHY 110 Physics I	(4 crs)
MAT 111 Calculus I	(4 crs)
MAT 112 Calculus II	(4 crs)
MAT 211 Calculus III	(4 crs)
MAT 212 Differential Equations	(4 crs)
MAT 235 Discrete Math	(4 crs)
MAT 240 Linear Algebra	(4 crs)
MAT 382 Junior Seminar	(2 crs)

Upper-Level Requirements:

Three courses from MAT 351, MAT 352, MAT 411, MAT 413 (9 crs)

Upper-Level Electives:

An additional four courses from MAT 204 and MAT 300 and above (one may be taken from CSC or PHY) (12 crs)

MAT 482 Senior Seminar (2 crs)

### **Requirements for Certification in Math Education**

The student wishing to pursue certification for teaching mathematics in the intermediate and/or secondary schools should consult the director of the Professional Education Department for specific requirements. Generally, the student completes the mathematics major as described above with two upper-level electives being specified as MAT 424 and either MAT 335 or MAT 204. PSY 110 should be taken as early as possible.

### **Requirements for Mathematics Minor**

Mathematics minors must complete a minimum of 15 credit hours in mathematics beyond MAT 111.

## ***Course Descriptions:***

### **MAT 101 Algebra Review (3 crs)**

A review of topics from elementary and intermediate algebra, including first order equations, exponents and radicals, polynomials, quadratic expressions, quadratic equations, rational expressions, linear and nonlinear systems of equations, inequalities and the binomial theorem. This course is preparatory and will not satisfy the University's core curriculum requirement in mathematics.

**MAT 102 Math in Society (3 crs) (core)**

This course is designed to meet the needs of students who do not have a specific course needed for support of their major. The fundamental properties of numbers, geometry and statistics are covered through the collection of modern and useful applications of mathematics. The course contains a collection of topics of modern society: Social Choice, Management Science, Growth and Symmetry and Statistics. *Prerequisite: MAT 101 or equivalent.*

**MAT 105 Introduction to Statistics (3 crs) (core)**

Descriptive statistics including measures of central tendency and variability, graphic representation, probability, the binomial, normal and T distributions, hypothesis testing and linear regression. *Prerequisite: MAT 101 or equivalent.*

**MAT 108 Pre-Calculus (3 crs) (core)**

A thorough preparation for calculus with analytic geometry, including conic sections, and the transcendental functions: logarithmic, exponential and trigonometric functions. *Prerequisite: MAT 101 or equivalent.*

**MAT 111 Calculus I (4 crs) (core)**

A theoretical introduction to differential calculus including limits, continuity, the basic rules for derivatives and applications including optimization problems. A brief introduction to integration leading to the Fundamental Theorem of Calculus completes this course. *Prerequisite: MAT 108 or equivalent.*

**MAT 112 Calculus II (4 crs)**

Transcendental functions, applications of integrals, volumes of revolution, surface areas; techniques of integration, including powers of trigonometric functions, integration by parts and by partial fractions, improper integrals, infinite series, Taylor's expansion and indeterminate forms. *Prerequisite: MAT 111.*

**MAT 204 Scientific Statistics (3 crs)**

An introduction to scientific statistics with emphasis on experimental design methods such as random assignment, block design, factorial crossings and repeated measures. Various statistics analyses, such as analysis of variance and analysis of covariance are applied to the appropriate design. *Offered every spring semester. Prerequisite: MAT 111.*

**MAT 211 Calculus III (4 crs)**

Vectors and vector valued functions, extrema of multivariate functions and the method of Lagrange multipliers, surfaces in three dimensions, line and surface integrals; multiple integration and Stokes' Theorem. *Prerequisite: MAT 112.*

**MAT 212 Ordinary Differential Equations (4 crs)**

ODEs of first order: linear, homogeneous, separable and exact, with applications; orthogonal trajectories; those of second order: reducible to first order, general and particular solutions by the methods of undetermined coefficients, variation of parameters and power series; and an introduction to numerical methods and Laplace Transforms. *Prerequisite: MAT 112.*

**MAT 235 Discrete Mathematics (4 crs)**

Sets and relations, logic and truth tables, Boolean algebra, logic gates, graph theory, combinatorics, algorithms, matrix algebra and determinants. *Prerequisites: MAT 111 or equivalent.*

**MAT 240 Linear Algebra (4 crs)**

Solution spaces for systems of linear equations, elementary row operations, vector spaces, linear independence, linear transformations, change of bases, inner products, projections, the Gram-Schmidt process, eigenvalues and eigenvectors. *Prerequisite: MAT 211 or MAT 235.*

**MAT 300 Advanced Topics in Mathematics (3 crs)**

Topics will be selected by the instructor. *Offered spring semester of even years. Permission of the instructor is required.*

**MAT 310 History of Mathematics (3 crs)**

History of the development of mathematical concepts in algebra, geometry, number theory, analytical geometry and calculus from ancient times through modern times. Theorems with historical significance will be studied as they relate to the development of modern mathematics. *Prerequisite: MAT 112 or MAT 235. Offered spring semester of even years to alternate with MAT 300.*

**MAT 331 Numerical Analysis (3 crs)**

Numerical solution of linear systems and of non-linear equations; interpolation, approximation and numerical differentiation and integration (computer methods and programming will be utilized.) *Prerequisite: MAT 112. Offered fall semester of odd years.*

**MAT 335 Applied Probability and Statistics (3 crs)**

Introduction to Probability: discrete and continuous random variables (binomial, geometric, hypergeometric, Poisson, normal, exponential, Chi-square, gamma), sampling distributions (including CLT), multivariate distributions, stochastic processes. *Prerequisite: MAT 112. Offered fall semester of even years.*

**MAT 351 Introduction to Abstract Algebra: Rings (3 crs)**

Introduction to rings, integral domains; ideals and factor rings; homomorphisms and isomorphisms; polynomial rings, unique factorization, irreducible polynomials; extension fields, algebraic extensions, finite fields; geometric constructability. *Prerequisite: MAT 240. Offered fall semester of odd years.*

**MAT 352 Introduction to Abstract Algebra: Groups (3 crs)**

Introduction to groups: finite groups and subgroups, cyclic groups, permutation groups, homomorphisms and isomorphisms, cosets and Lagrange's theorem, direct products. *Prerequisite: MAT 240. Offered fall semester of even years.*

**MAT 382 Junior Seminar (2 crs)**

An introduction to research in mathematics with emphasis on acquiring and practicing skills needed for the senior research project to be completed in MAT 482. Topics include literature searches and software use for generating and presenting mathematical research. *Required of all mathematics majors in their sophomore or junior year.*

**MAT 411 Real Analysis (3 crs)**

Least Upper Bound Property of the set of all real numbers. Uniform continuity and properties of continuous functions, differentiation, integration, sequences of functions, uniform convergence and limit theorems. *Offered spring semester of odd years.*

**MAT 413 Introduction to Complex Variables (3 crs)**

Analytic functions; power series; complex integration and Cauchy's theorem; entire functions; analytic continuation. *Prerequisite: MAT 211, 212. Offered spring semester of even years.*

**MAT 424 Geometry (3 crs)**

Euclid's Axioms, the parallel postulate, leading to non-Euclidean geometries, and an introduction to projective and affine geometries. *Offered spring semester of even years.*

**MAT 429 Combinatorics**

An introduction to sophisticated counting techniques. Permutations, combinations, binomial and multinomial coefficients; the principle of inclusion/exclusion; generating functions; Fibonacci, Stirling and Catalan numbers; recurrence relations; Burnside's Lemma and Polya's Pattern inventory. *Offered spring semester of odd years.*

**MAT 482 Senior Seminar (2 crs)**

Independent study of topics not usually covered in the MAT curriculum leading to a presentation of an elementary research or survey paper by the student under the direction of a professor. *Required for all mathematics majors in their junior or senior year. Prerequisite: MAT 382.*