MATHEMATICS (MATH)

Benjamin Marlin, Associate Professor, Chair

Mathematics has been called the language of the sciences and, more broadly, the most powerful tool for the analysis of patterns across all fields of study. The main mission of the Department of Mathematics is to promote an understanding of and appreciation for this vision of mathematics. Since the power of mathematics derives from both descriptive and inferential aspects it is important to consider the possibility for its misuse while emphasizing its enormous potential for good. In practice, students are expected to participate actively in both the formulation of mathematical questions and in trying to solve them, using appropriate mathematical methods. This goal includes the understanding that students will be expected to demonstrate mastery of the basic mathematical concepts and methods relevant to the questions they are trying to solve.

Degrees Offered

The Bachelor of Science degree is offered in mathematics.

- Mathematics Major (https://catalog.guilford.edu/catalog/academic-departments-majors/mathematics/mathematics/)
- Mathematics for the Sciences Minor (https://catalog.guilford.edu/catalog/academic-departments-majors/mathematics/mathematics-sciences-minor/)

MATH 110. Mathematics for the Liberal Arts. 4.
The nature of mathematics from cultural, historical and logical viewpoints, stressing relationships between mathematics and other disciplines. Recommended for humanities, fine arts and education majors. Does not count toward the major. Includes emphasis on basic quantitative skills. Fulfills numeric/symbolic engagement requirement (2019). Offered in 3-week terms.

MATH 112. Elementary Statistics. 4.
Descriptive statistics; probability and probability distributions; sampling and sampling distributions; confidence intervals and hypothesis testing; correlation and regression analysis. Emphasis on application and interpretation. Recommended for social science and pre-professional majors; does not count toward the major. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week term of fall semesters.

MATH 114. College Algebra. 4.
Pre-calculus analysis of algebraic, exponential, and logarithmic functions. Recommended for life sciences; does not count towards major. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week terms.

MATH 115. Elementary Functions. 4.
Pre-calculus analysis of algebraic, exponential, logarithmic, trigonometric and inverse trigonometric functions. Does not count toward the major. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week terms

MATH 116. Trigonometry. 4.
Analysis and application of trigonometric functions, complex numbers, and vectors. Recommended for natural sciences; does not count towards major. Prerequisite MATH 114 College Algebra or equivalent high school course. Fulfills numeric/symbolic engagement requirement (2019).

MATH 150. Special Topics. 1-8.
May also be offered at 250, 350 and 450 levels. 150 and 250 level courses fulfill the numeric/symbolic engagement requirement.

MATH 212. Discrete Mathematics. 4.
Algorithms, recursion, induction, sequences and series, combinatorics, counting techniques, particularly as related to the mathematics of computing. Prerequisite: MATH 220 Calculus I Differential Calculus or above. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week terms.

MATH 220. Calculus I: Differential Calculus. 4.
Limits and differentiation of functions with early use of transcendental functions. Application to Taylor polynomials, optimization. Prerequisite: MATH 114 College Algebra & MATH 116 Trigonometry or equivalent high school credit. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week term of fall semesters.

MATH 222. Calculus II: Integral Calculus. 4.
Antiderivatives, definite integrals, Fundamental Theorem of Calculus, and integration techniques. Application to area, volume, solution of differential equations. Prerequisite: MATH 220 Calculus I: Differential Calculus. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week term of spring semesters.

MATH 224. Cal III: Multivariable Calculus. 4.
Sequences, series, and power series. Functions of multiple variables, partial differentiation, and multiple integrals. Application to probability and physical sciences. Prerequisite: MATH 222 Calculus II: Integral Calculus. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week term of fall semesters.

MATH 226. Calculus IV: Vector Calculus. 4.
Algebra of vectors, valued functions, vector fields. Differentiation, line and surface integrals. Greens', Stokes', and Divergence Theorems. Prerequisite: MATH 224 Calculus III Multivariate Calculus. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week term of spring semesters.

MATH 231. Foundations of Mathematics. 4.
Axiomatic development of an elementary mathematical system, stressing the logical nature and structure of mathematics. Prerequisite: MATH 220 Calculus I: Differential Calculus or above. Fulfills numeric/symbolic engagement requirement (2019). Offered in 12-week term of spring semesters.

MATH 241. Scientific Computing. 4.
Scientific Computing is a course designed jointly by Math & Physics faculty to serve students of the sciences. We will use the programming language Python and a variety of the standard libraries (especially numpy, matplotlib, vpython) to do analyses and simulations. Emphasizes the documentation and presentation of results to peers. Taught in the 3-week term of fall semester.

MATH 250. Special Topics. 1-8.
May also be offered at 150, 350 and 450 levels. 150 and 250 level courses fulfill the numeric/symbolic engagement requirement.

MATH 260. Independent Study. 1-8.
May also be offered at 360 and 460 levels.

MATH 275. Seminar in Mathematics. 1-4.
Seminars are provided to allow and encourage students and faculty members to pursue topics of mutual interest beyond the scope of regular classes. Seminars may be arranged as extensions of existing courses, as special topics courses, as undergraduate research projects or as honors projects. Students must prearrange seminars with faculty members on or before classes begin; no student may register for a seminar without prior departmental approval. Seminars carry from one to four credits and may be repeated for credit with permission of the department. Lower- and upper-level seminars in selected topics. Prerequisite: permission of the department.

MATH 290. Internship. 1-8.
May also be offered at the 390 level.

MATH 302. Differential Equations. 4.
4 credit hours. Introduction to ordinary differential equations, elementary techniques of solution, theory of existence and uniqueness. Other topics may include systems of ordinary differential equations using matrix techniques, introduction to partial differential equations, Fourier and Laplace transforms and application to solutions. Prerequisite: MATH 222 Calculus II: Integral Calculus or permission of instructor. Offered in 12-week terms.

MATH 310. Probability and Statistics. 4.
Fundamentals of the analysis and interpretation of statistical data, theory and application. Includes descriptive statistics; probability; discrete and continuous random variables, their probability, density and moment-generating function; joint, marginal and conditional probability and density functions of several random variables; sampling distributions; estimation; hypothesis testing. Prerequisite: MATH 222 Calculus II: Integral Calculus or permission of instructor. Offered in 12-week terms.

MATH 325. Linear Algebra. 4.
Introduction to systems of linear equations, matrices, linear spaces and linear transformations, including applications of these concepts to other areas of mathematics and to other fields. Prerequisite: MATH 226 Calculus IV: Vector Calculus. Offered in 12-week terms.

MATH 328. Analytics for Business and Government (ACCT 328 or ECON 328). 4.
This course is a hands-on introduction to business analytics. In this course, students will learn to convert quantitative data into information that can be used to help guide business/government decision making. This course provides students with the fundamental concepts and tools needed to understand the emerging role of business analytics in organizations. Students will apply modern data mining tools to various data sets in an analytical software environment. Emphasis is placed on concepts, applications, and interpretation of results as well as professional skills like communication, teamwork, and presentation. Prerequisite: ECON 222 or permission of instructor. Offered in 12-week terms.

MATH 330. Statistical Methods. 4.
This course is a hands-on introduction to statistical learning methods. Statistical learning refers to a set of tools for modeling and understanding complex data sets. This course covers many statistical learning methods such as estimation, linear and multiple regression, clustering and classification, ANOVA, and non-parametric analysis. In addition to programming techniques for statistical learning methods, students will work on professional skills including communication, teamwork, and presentation. The course is to be taught in the 3 week term of the spring semester. Prerequisite: MATH 112 or MATH 310.

MATH 345. Modern Geometry. 4.
Topics chosen from Euclidean, hyperbolic, elliptic, projective, affine, etc., geometry emphasizing axiomatic development and/or physical application with content dependent upon student interest and background. Especially recommended for students interested in mathematics education. Prerequisite: MATH 231 Foundations of Mathematical Proof, MATH 212 Discrete Math, or instructor permission. Offered in 12-week terms.

MATH 350. Special Topics. 1-8.

MATH 360. Independent Study. 1-8.

MATH 390. Internship. 1-8.

MATH 415. Numerical Analysis. 4.
Techniques, theory, computer programming and application of approximations of zeros of functions, solutions to systems of equations, integrals and ordinary differential equations. Suggested for majors emphasizing applied mathematics or mathematical physics. Prerequisite: MATH 325 Linear Algebra, computer literacy. Recommended: MATH 212 Discrete Math or MATH 231 Foundations of Mathematical Proof. Offered in 12-week terms.

MATH 430. Modern Algebra. 4.
Study of algebraic structures such as groups, rings and fields and their morphisms. Suggested for majors emphasizing theoretical mathematics or interested in mathematics education. Prerequisite: MATH 212 Discrete Math or MATH 231 Foundations of Mathematical Proof. Recommended: MATH 325 Linear Algebra.

MATH 435. Real Analysis. 4.
Rigorous study of real functions including topics from limits, sequences, series, differentiation and integration. Suggested for majors emphasizing theoretical mathematics or mathematical physics. Prerequisites: MATH 222 Calculus II: Integral Calculus and one of MATH 212 Discrete Math or MATH 231 Foundations of Mathematical Proof. Offered in 12-week terms.

MATH 445. Topology. 4.
Topics in point-set, geometric, general or algebraic topology with content dependent on student and instructor interest. Suggested for majors emphasizing theoretical mathematics. Prerequisite: MATH 231 Foundations of Mathematical Proof or MATH 212 Discrete Math. Offered in 12-week terms.

MATH 450. Special Topics. 1-8.

MATH 460. Independent Study. 1-8.

MATH 470. Senior Thesis. 1-8.
3-week semester.

MATH 475. Seminar in Mathematics. 1-4.
Seminars are provided to allow and encourage students and faculty members to pursue topics of mutual interest beyond the scope of regular classes. Seminars may be arranged as extensions of existing courses, as special topics courses, as undergraduate research projects or as honors projects. Students must prearrange seminars with faculty members on or before the first day of classes; no student may register for a seminar without prior departmental approval. Seminars carry 1 – 4 credits and may be repeated for credit with permission of the department. Lower- and upper-level seminars in selected topics. Prerequisite: permission of the department.

MATH 490. Departmental Honors. 1-8.
3-week semester.