

# Special & Advanced Mathematics Courses for *Fall 2026*

## 264 - Differential Equations (Halmrast, Zulli)

An introductory course in ordinary differential equations including techniques of elementary linear algebra. Emphasis is on first-order equations, higher-order linear equations, and systems of equations. Topics include qualitative analysis of differential equations, analytical and numerical solutions, Laplace transforms, existence and uniqueness of solutions, and elemental models in science and engineering. **Prerequisite: MATH 263**

## 272 - Linear Algebra with Applications (Miller-Brown, Zhou)

An introduction to linear algebra and some of its many applications. Topics include systems of linear equations, matrix algebra, Euclidean spaces and linear transformations between them, the rank-nullity theorem, eigenvalues, diagonalization, orthogonality and least squares approximation. Not open to students who have credit for MATH 300.

**Corequisite: MATH 162 or permission of instructor**

## 287 - Introduction to Data Modeling (Gaugler)

This course will examine advanced methods for analyzing data. Topics will include experimental design concepts, one- and two-way ANOVA (and interaction), multiple regression and ANCOVA, analysis of categorical outcomes (including logistic regression), and power. Time permitting, additional topics may be covered. The course emphasizes the correct application and interpretation of these methods, including assessment of underlying assumptions. Applications will require use of statistical software (presumably R), which is left to the discretion of the instructor. [W] **Prerequisite: MATH 186 or 286 or 336 or PSYC 120**

## 290 - Transition to Theoretical Math (Bloom)

An introduction to the concepts and techniques that permeate advanced mathematics. Topics include set theory, propositional logic, proof techniques, relations, and functions. Special emphasis on developing students' facility for reading and writing mathematical proofs. Examples and additional topics are included from various branches of mathematics, at the discretion of the instructor. **Corequisite: MATH 263 or MATH 272 or permission of instructor**

## 301 - Case Studies in Mathematical Modeling (Lewis)

A course which engages students in the creation of mathematical models to answer questions about a variety of phenomena. Students work in small teams on a sequence of projects which require the formulation, analysis, and critical evaluation of a mathematical model and conclude with the submission of a written report by each student. [W] **Prerequisite: (MATH 272 or 300) and 263, 282**

## 323 – Geometry (Corvino)

Various geometries are considered including absolute, Euclidean, and the classical non-Euclidean geometries. General properties of axiomatic systems, models, and the role of Euclidean geometry in the development of other branches of mathematics are discussed.

**Corequisite: MATH 263 or permission of instructor; reading and writing proofs will be a significant part of the course, so MATH 290 could be useful, though it is not a prerequisite**

## 335 - Probability (Campbell)

A development of basic probability theory including the axioms, random variables, expected value, the law of large numbers, and the central limit theorem. Additional topics include distribution functions and generating functions. **Prerequisite: MATH 263**

## 336 - Mathematical Statistics (Ackerman)

A mathematical development of fundamental results and techniques in statistics. Topics include estimation, sampling distributions, hypothesis testing, correlation and regression. **Prerequisite: MATH 335**

## 345 – Complex Analysis (Abedin)

An introductory course in the calculus of complex functions including the algebra and geometry of complex numbers, elementary mappings, complex derivatives and integrals, Cauchy-Riemann equations, harmonic functions, Cauchy's Integral Theory, Taylor and Laurent series, residues. **Prerequisite: MATH 263**

## 349 – Numerical Analysis (Carr)

A course in the study of algorithms that use numerical approximation to analyze model behavior. Numerical techniques will be developed that address problems that can occur when analyzing models from a variety of fields. Topics will include interpolation and curve fitting, numerical differentiation and integration, iterative solvers for linear systems, Runge-Kutta and other numerical methods for solving ODEs, and eigenvalue algorithms. Emphasis will be placed on implementing algorithms via computer programming. **Prerequisite: Math 272 and (Math 264 or 282 or 310), or permission of instructor**

## 351 - Abstract Algebra I (Balasubramanya)

An introduction to some of the fundamental ideas and structures of abstract algebra. Homomorphisms and isomorphisms, substructures and quotient structures are discussed for algebraic objects such as fields, vector spaces, rings, and groups. Other topics may include factorization in rings, and finite group theory. [W] **Prerequisite: MATH 290**

## 358 – Topology (Berkove)

The main topics are set theory, the separation axioms, connectedness, compactness, and the continuity of functions. Classical general topological spaces are studied including regular spaces, normal spaces, first or second countable spaces, and metrizable spaces.

**Prerequisite: MATH 356 or permission of instructor**

## 382 – ST: Math Foundations of Deep Learning & Modern Extensions (Lu)

This course introduces the mathematical foundations of deep learning, emphasizing modern models. Students study the structure of neural network architectures, including multilayer perceptron, convolutional neural networks, and transformers, with a focus on loss functions, gradient-based optimization, and training algorithms. Additional topics include self-supervised learning, reinforcement learning, and generative models such as variational autoencoders and diffusion models. Theory is reinforced through problem sets, hands-on labs, and readings from seminal research papers. **Prerequisite: Math 272 and Math 335, or permission of instructor**

### **TENTATIVE Courses for SPRING 2027 :**

272 Linear Algebra with Applications

282 Techniques of Math Modeling

286 Intro to Probability and Mathematical Statistics

290 Transition to Theoretical Mathematics

300 Vector Spaces

306 Operations Research

312 Partial Differential Equations

328 Number Theory

335 Probability

336 Mathematical Statistics

347 Financial Mathematics

354 Topics in Modeling

356 Real Analysis

3XX Special Topic - Moral Machine Learning

3XX Elective in Algebra

***Recommendation:*** It is important that students who wish to major in mathematics take Mathematics 272 and 290 during the first two years to ensure the widest possible selection of electives in the third and fourth years.

<https://math.lafayette.edu/degree-requirements/> has updated information regarding Math 272, Math 290, and Math 300 relevant to the Fall 2026 registration.

Visit <http://math.lafayette.edu/> for updates on these and other courses anticipated for next academic year.