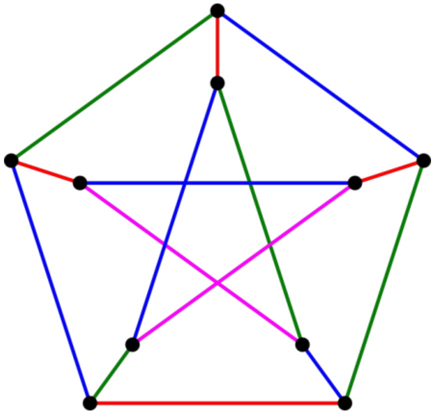
# Special & Advanced Mathematics Courses

## Spring 2017



## *Special Topics:*

**Math 378 Topics in Group Theory**
The study of finite groups probably began in earnest after the work of Galois and others revealed the deep connection between finite groups and the solutions to polynomial equations. Those equations could be "solved" if the associated group was "solvable". What do such groups look like? And what do groups that are not solvable look like? This last question led to one of the great accomplishments of 20th century mathematics, the classification of all finite simple groups. This course will explore some of the foundational ideas and techniques of finite group theory. Topics will include group actions, the Sylow theorems, solvable groups, nilpotent groups, subnormality, the Schur-Zassenhaus theorem, and an introduction to some of the ideas basic to the classification of finite simple groups. **Prerequisite: Math 351** ***Yuster***

**Math 379 Visualization, Fractals & Chaos** This course explores the visualization of mathematical objects and algorithms using computer graphics and the programming language J which will be introduced as needed. The topics include fractals, chaos, fractal dimension, iterated function systems, finite automata, fuzzy logic, image processing, complex dynamics, frieze, crystalline and hyperbolic symmetry, and chaotic attractors. Three-dimensional representations will be projected to two dimensions, ray-traced and animated. **Prerequisite: Math 272 or Math 300 (300 can be taken at the same time) or permission of the instructor.** ***Reiter***

**Math 384 Stochastic Processes**
A stochastic process is defined as any collection of random variables.
Stochastic processes are mathematical models of random phenomena that occur in time and or space. They have applications in many areas including physics, engineering, biology, mathematical finance, computer science, geology, and actuarial science to name a few. Our study will include fundamental stochastic processes and their applications, including Markov Chains, martingales, Poisson processes, and Brownian motion.
**Prerequisite: Mathematics 335 and one of Mathematics 272 or 300.** ***Fisher***

## *Anticipated Courses for Fall 2017:*

301 Case Studies in Math Modeling
325 Combinatorics
335 Probability
336 Mathematical Statistics
343 Advanced Multivariable Calculus
347 Mathematical Finance
351 Abstract Algebra
357 Real Analysis II

***Recommendation:*** ***Majors should take both Mathematics 290 and 300 by the end of the second year to permit the widest possible selection of courses in the third and fourth years.***

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

**264. Differential Equations**
An introductory course in ordinary differential equations including techniques of elementary linear algebra. Emphasis is on first-order equations, and 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: Mathematics 263.
**Dahl, Ndangali, Zulli**

**272. Linear Algebra with Applications**
An introductory course in linear algebra emphasizing applications to fields such as economics, natural sciences, computer science, statistics, and engineering. The course covers solutions of systems of equations, matrix algebra, vector spaces, linear transformations, determinants, eigenvalues, and eigenvectors. Corequisite: Mathematics 263 or permission of instructor. **Gordon, Zhou**

**282. Techniques of Mathematical Modeling**
A course that introduces students to the fundamentals of mathematical modeling through the formulation, analysis, and testing of mathematical models in a variety of areas. Modeling techniques covered include proportionality, curve fitting, elementary linear programming, and simulation.
Prerequisite: Mathematics 162 or 166. **Zhou**

**286. Intro to Probability & Math Statistics**
This course will serve as a one-semester introduction to probability and mathematical statistics, with roughly half of the semester devoted to each. After learning basics of set theory and axiomatic probability, we review random variables, probability mass/density functions, expected value (including covariance and correlation), and expected value and variance of linear combinations. Then we begin inferential statistics (confidence intervals and hypothesis tests), correlation and simple linear regression, and, time permitting, one-way analysis of variance and/or chi-squared tests. Prerequisite: Math 263. **Liebner**

**290. Transition to Theoretical Math**
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: Mathematics 263 or permission of instructor.
**Smith**

**300. Vector Spaces**
A first course in theoretical linear algebra, emphasizing the reading and writing of proofs. Topics include systems of linear equations, matrix algebra, vector spaces and linear transformations, eigenvectors and diagonalization, inner product spaces, and the Spectral Theorem. Not open to students with credit for Mathematics 272.
Prerequisite: Mathematics 290 or permission of instructor. **McMahon**

**306. Operations Research**
A study of some mathematical methods of decision making. Topics include: linear programming (maximizing linear functions subject to linear constraints), the simplex algorithm for solving linear programming problems, sensitivity analysis, networks and inventory problems and applications.
Prerequisite: Mathematics 272 or 300 or permission of instructor. **Bloom**

**312. Partial Differential Equations**
An introduction to partial differential equations and their applications. Formulation of initial and boundary value problems for these equations and methods for their solution are emphasized. Separation of variables and Fourier analysis are developed. The course includes interpretation of classical equations and their solutions in terms of applications.
Offered: Spring semester of odd-numbered years.
Prerequisite: Mathematics 263
**Corvino**

**328. Number Theory**
An introduction to the theory of the integers and techniques for their study and application. Topics include primality, modular arithmetic, arithmetic functions, quadratic residues, and diophantine equations. Prerequisite: 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. **Berkove**

**335. Probability** 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. **Gaugler, Lu**

**336. Mathematical Statistics**
A mathematical development of fundamental results and techniques in statistics. Topics include estimation, sampling distributions, hypothesis testing, correlation and regression. Offered: Spring semester.
Prerequisite: Mathematics 335. **Liebner**

**356. Introduction to Real Analysis**
A rigorous development of the calculus of functions of one real variable including the topology of the real line, limits, continuity, differentiation and integration.
Prerequisite: Mathematics 290.
**Hill**