

Math 389: Advanced Analysis

First Lecture

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http://www.williams.edu/Mathematics/sjmiller/public_html/317

Bronfman B34
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Introduction and Objectives

Introduction / Objectives

Objectives

- Obviously learn advanced analysis.
- Emphasize techniques / asking the right questions.
- Find out if grad school (in math) is what you want.
- Help you get into grad school (or a job, ...).
- Writing textbook, broader impact activities (MathSciNet, refereeing, math riddles).

Types of Problems

- Benford's Law.
- The Circle Method: Goldbach, Twin Primes, Sophie Germain Primes,
- *L*-Functions and Random Matrix Theory.
- Poissonian Behavior.
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Course Mechanics

Grading / Administrative

- Homework: 20%, Midterm 20%, Final / Research Project 20%, Class Presentation: 20%, Broader Impact Projects: 20%
- Pre-reqs: real analysis (complex analysis, probability, programming a plus).

Office hours / feedback

- TBD and when I'm in my office (schedule online).
- Feedback ephsmath@gmail.com, password first 8 Fibonacci numbers (011235813).

Other

- Webpage: numerous handouts, additional comments each day (mix of review and optional advanced material).
- Opportunity to help write a book.
- **PREPARE FOR CLASS!** Must do readings before each class.

Erdős Numbers and Generalizations

My Erdős number is 2, Erdős-Bacon number is unclear,
but.....

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Other: Advice from Jeff Miller

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Happy to do practice interviews, adjust deadlines....

Useful links

LaTeX and Mathematica Tutorials and Templates

http://web.williams.edu/Mathematics/sjmiller/public_html/math/handouts/latex.htm

Has templates for using LaTeX for papers, talks, posters, and a Mathematica tutorial.

Also videos on each.

GRE

GRE links:

<http://www.ets.org/gre/subject/about/content/mathematics>

http://www.ets.org/s/gre/pdf/practice_book_math.pdf

◇ CALCULUS: 50%: Material learned in the usual sequence of elementary calculus courses – differential and integral calculus of one and of several variables: includes calculus-based applications and connections with coordinate geometry, trigonometry, differential equations and other branches of mathematics.

◇ ALGEBRA: 25%: Elementary algebra: basic algebraic techniques and manipulations acquired in high school and used throughout mathematics Linear algebra: matrix algebra, systems of linear equations, vector spaces, linear transformations, characteristic polynomials and eigenvalues and eigenvectors Abstract algebra and number theory: elementary topics from group theory, theory of rings and modules, field theory and number theory.

◇ ADDITIONAL TOPICS: 25%: Introductory real analysis: sequences and series of numbers and functions, continuity, differentiability and integrability, and elementary topology of \mathbb{R} and \mathbb{R}^n , Discrete mathematics: logic, set theory, combinatorics, graph theory and algorithms. Other topics: general topology, geometry, complex variables, probability and statistics, and numerical analysis.