

Math 296 & F1 MWF 2 441 Altgeld Class Organization Spring 2002

Instructor:

Prof. Bruce Reznick, 243 Illini Hall, 333-4284, reznick@math.uiuc.edu. My phone has voice mail and I frequently check and reply to my email, including weekends. Office hours are by appointment. I take them seriously, and they can usually be arranged within 24 hours. You are also encouraged to ask me questions immediately before, during and after class. I'm terrible with names; don't take it personally.

There will be an unmoderated newsgroup for this course, called uiuc.class.math296. I will post all organizational announcements made in class to the newsgroup. You are encouraged to use this newsgroup to ask (and answer) course-related questions. In addition, I will post my answers to your e-mail questions, after anonymizing the source.

Webpage:

<http://www.math.uiuc.edu/~reznick/classes/math296S02.html>

I plan to make all class handouts also available from the webpage. There will be a "class diary", which will summarize what happens in each class period. Experience shows that I tend to run behind on this towards the end of the semester.

The Blurb:

Few prospects are as daunting for a serious math major as that of doing research. In fact, mathematical research is a natural extension of homework in mathematics courses, except that there is no back of the book to look for the answer. This course is designed to help students develop their skills in mathematical creativity and problem-solving. (These skills are useful in all advanced mathematics classes as well.) The only formal prerequisite is Math 247, or the ability to convince the instructor that you can write proofs correctly. However, this **is** an honors course in terms of the approach to the subject.

Some of the ways in which research differs from homework are these: the problems are harder, you may not know whether you (or anyone else) can solve them, you do not always know what you need to know in order to solve them, they are usually motivated by a larger set of questions and, ultimately, by the researcher's own curiosity. Research is often a matter of synthesizing several seemingly different ideas into a cohesive whole.

The Course:

The best way for a student to become successful in mathematical research is to take as many challenging and meaningful mathematics courses as possible, in many different areas. This course, on the other hand, concentrates on building an infrastructure for research. In the first part of the semester, we will consider problem-solving, question-asking, answer-analyzing and knowledge-finding, and you will choose a project and start working on it. Mathematical creativity is a subset of human creativity, and much is known about how to become more creative. In the second part of the semester, students will present their own research projects and listen to and critique the work of the others. These projects can be used as a basis for the Senior Paper or as a submission to the Greenwood-Trjitzinsky Prize. The instructor's own Ph.D. thesis began as an undergraduate project, but he cannot guarantee this outcome!

There will be students at varying levels of mathematical knowledge and sophistication in this class, Don't be scared off by thinking that you don't know enough mathematics – nobody ever knows enough mathematics. (Your professors are continually learning new material.) Class members may work on any approved mathematical research topic; a range of topics will also be provided for those who request it. It's OK to work in a related area (e.g. computer science, economics, physics, statistics), as long as the research itself has a serious mathematical component. Collaboration is both acceptable and strongly encouraged, and is good practice for future research and professional life.

Since this class is a seminar, you will be expected to participate actively. I will interrupt any presentation I have planned if you get excited about something mathematically and want to share it with the group. In addition, you will have significant class time to give the results of your research at the end of the semester.

This is an experimental course, and the above description represents the instructor's expectation, without accounting for student input into the organization. Changes suggested by the first two groups of students (in Fall 1999 and Spring 2001) have been incorporated: I will ask that you keep "discovery notebooks" to record your ideas through the semester, and I will try to be more explicit about the connection between the creativity techniques and the mathematics presented. I encourage you to be assertive in giving me feedback on the way things are going: my ambition is that this be the most successful course in the history of undergraduate mathematics, and I'll settle for 90% of that.

The Texts:

Two texts are required, and I may ask you to read material from them; I may also present some of this in class: "Mathematics and plausible reasoning: induction and analogy in mathematics" by George Pólya and "Proofs from the Book" by Martin Aigler and Gunter Ziegler. The first book is part of a classic series of books on problem solving by the man who coined the word "heuristics". The second is a collection of short, accessible and beautiful proofs on a range of mathematical topics. Think of it as the Louvre. These books will provide many embarkation points for your projects. Three books are recommended: "Essays on Numbers and Figures" by V. V. Prasolov, another collection of short mathematical topics, "The man who loved only numbers" by Paul Hoffman, a biography of Paul Erdős and "A mathematician's apology" by G. H. Hardy, which is a classic and thoughtful essay on mathematics. There will also be many various handouts. If you are impatient, you will soon be able to find the earlier versions at

<http://www.math.uiuc.edu/~reznick/oldclasses/math296F99.html>

<http://www.math.uiuc.edu/~reznick/oldclasses/math296S01.html>

Homework, Exam (what exam?) and Grading Policy:

I will attempt a range of assignments in the first half of the semester. I expect you to concentrate your energies on your projects for the second half of the semester. The final project will serve in lieu of a Final.

For an experimental course such as this, I have no objection to giving very high grades overall, provided they reflect your effort and commitment to the class. Let me repeat: I will take your background into account when evaluating your work, and the more you put in to this course, the more you will take away.