

MA 261 - Introduction to Number Theory - Fall 2016

Instructor: Prof. Bert Guillou
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Office Hours: M 12-1PM, W 10-11AM,
& by appointment

Course Content. We will be using topics from number theory to guide our study of proof writing while learning to express abstract mathematical ideas clearly and concisely. The topics in this course include, but are not limited to, the following:

- Divisibility, Division Algorithm, Euclidean Algorithm
- Fundamental Theorem of Arithmetic, Infinitude of Primes
- Linear Congruences, Chinese Remainder Theorem
- Fermat's Little Theorem, Euler's Theorem, Wilson's Theorem
- Direct Proof, Proof by Contradiction, Mathematical Induction

Course Goals. Aside from mastering the topics listed above, I hope you will:

- Be persistent, work through perceived (and productive!) failure, and engage in strategic self-questioning
- Learn to work productively with others and ask good questions
- Learn to construct examples and non-examples to investigate and understand new definitions and theorems
- Learn to digest existing proofs and recognize incorrect or incomplete ones
- Learn to develop and communicate original proofs

Course Structure and Approach. In most of your classes, you sit through lectures and think that if the lecture is clear and easy to follow that you have learned the material. Unfortunately for most of us, myself included, we do not master the material (or sometimes even learn very much) merely by listening. We must be active in learning! In keeping with current pedagogical research, we will incorporate methods from an educational philosophy called inquiry-based learning (IBL).

IBL is a method of instruction that puts you, the material, and your interaction with that material at the center of the learning experience. My role is not to hand out knowledge (that does not work well with the sort of material we will cover) but to guide your learning process. In other words, this class is not about me, it's about you and your learning, and my job is to help you get the most out of your experience.

Thus, most of our class time will be devoted to class discussion, group work, and student-led presentations. The details of these in terms of assessment are discussed below. I know if you

are not used to these sorts of activities in a math class they may seem a bit daunting. The goal is that we, as a class, will become a team that learns together. I am part of that team with you. I will be working hard to make your experience as positive as possible.

Textbook. The text for this course is *Number Theory Through Inquiry* by Marshall, Odell, and Starbird. This text is written specifically for courses using IBL. You will notice that nearly all theorems are missing their proofs. It is our job to fill them in!

In Class. In addition to discussions both as an entire class and in smaller groups, there will be two forms of assessment.

Worksheets will be done frequently. These assignments are to be worked on in small groups. I will also post them on Canvas. If you miss one, you may complete it on your own and bring it to the next class meeting.

Presentations will be given based on problems done in the previous class meeting or given for homework. They will be graded using the following rubric:

- 5 : correct proof, well presented, questions handled well
- 4 : correct proof but difficult to follow presentation or some mistakes but fixed during presentation
- 3/2 : incorrect proof and difficult to follow; did not complete presentation

Homework. In addition to the readings and time spent preparing for presentations, there will also be weekly written homework assignments that will consist of a few proofs/exercises from the text. You are encouraged to work together on the homework but all solutions you submit must be in your own words. Your solutions should be written in full sentences and be grammatically correct. Each proof will be graded using the following rubric:

- 5 - Correct mathematical proof and very well written
- 4 - Small mathematical and/or grammatical errors; Correct but difficult to follow
- 3 - Contains good ideas, but overall an incorrect mathematical proof
- 2 - Significant mathematical errors
- 1 - Come and see me for help!

Late assignments may be submitted for partial credit, but not past the relevant exam. For example, homeworks pertaining to Exam 1 material will not be accepted after the first exam.

Exams. We will have three in-class exams in addition to a comprehensive final. **Tentative** midterm exam dates are as follows:

Exam 1 - Fri. Sept. 23 Exam 2 - Wed. Oct. 19 Exam 3 - Fri. Nov. 18

The final exam will be cumulative with a slight emphasis on material we cover after Exam 3. The date and time is as follows

Final Exam - Monday, December 12, 10:30 am

Grading. Grades will be assigned based on the following scheme

Homework - 20%

Midterm Exams - 12% each

Classwork & Participation - 20%

Final Exam - 24%

I will use the following grading distribution in assigning final grades:

A	B	C	D	E
90 - 100	80 - 89	70 - 79	60 - 69	0 - 59

Attendance. While attendance will not be officially taken, you should be regularly attending class so that you do not miss quizzes or other in-class work. Additionally, you are responsible for announcements made in class (as well as any emails sent to your UK email account or announcements on the class Canvas site).

Students with Disabilities. If you have a documented disability that requires academic accommodations, please see me as soon as possible. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center at least one week in advance of any exam. For more information regarding coordination of campus disability services available to students with disabilities see <http://www.uky.edu/StudentAffairs/DisabilityResourceCenter>.

UK Mathematics Department Professional Themes. This course will address the four themes of the conceptual framework for the UK professional education program: **research, reflection, learning, and leading**. Students will engage with fundamental ideas in mathematical research, reflecting on and analyzing core mathematical content that arises throughout mathematics at all levels. Students will develop as life-long mathematical learners who will be able to take active leadership roles in their future roles as professionals and citizens. The ultimate goal in addressing these four themes is to produce teacher leaders who work together to improve student learning among diverse populations and improve education in Kentucky and beyond.

Unbridled Learning Initiatives and the Kentucky Core Academic Standards. This course will provide students an opportunity to advance their knowledge and mastery of the “tools” associated with Kentucky education reform, focusing on the content and practice standards outlined in the the Kentucky Core Academic Standards. As students carry out projects and complete assignments that involve mathematical content underlying instructional activities for P-12 students in Kentucky schools, they will address one or more components of the Unbridled Learning initiatives.

Academic Integrity. Students are expected to adhere to university policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties up to suspension from the university may be imposed.

Plagiarism includes reproducing someone else's work, whether it be a published article, chapter of a book, online resource, a paper from a friend, etc. You are encouraged to work together on assignments and get help from me or other tutors but any submitted writeup must be completed by you in your own words. If you feel unsure about the question of plagiarism regarding your work, please consult with me before submitting the assignment.

Important Dates.

Add Deadline: Tuesday, Aug. 30
Drop Deadline: Wednesday, Sept. 14
Withdrawal Deadline: Friday, Nov 4
Thanksgiving Break: Nov. 23 - 26

Note. Changes may be made to this syllabus. I will announce any changes to the class.