

MAS7396: ADVANCED TOPICS IN ALGEBRA THE ARITHMETIC OF ELLIPTIC CURVES

Instructor: Jeremy Booher

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Instructor's Office: LIT 488

Course Time: MWF Period 7

Course Location: LIT 207

Course Webpage: on canvas (<https://elearning.ufl.edu/>)

Office Hours: will be posted on canvas, and by appointment

“It is possible to write endlessly on elliptic curves. (This is not a threat.)”

Serge Lang

1. COURSE DESCRIPTION

Elliptic curves are central to modern arithmetic geometry and relate algebra, geometry, and number theory. For example, the Birch and Swinnerton-Dyer conjecture about elliptic curves in one of the millennium prize problems, and partial progress towards the Taniyama-Shimura conjecture about elliptic curves implied Fermat's Last Theorem. We will roughly following Silverman's "Arithmetic of Elliptic Curves", focusing on the geometry and number theory of genus one curves over the complex numbers, number fields, p -adic fields, and finite fields. Main topics include the geometry of elliptic curves, zeta functions of curves over finite fields, rational points on elliptic curves, and a survey of recent developments.

The class will require some basic algebraic geometry and algebraic number theory which would be developed as needed or presented as a "user's guide" without proof. Topics in MAS 6331-6332 such as Galois theory and basic commutative algebra will be used, although a mathematically mature student should be able to quickly pick up the necessary background with some extra reading.

2. LEARNING RESOURCES

2.1. **Textbook.** Arithmetic of Elliptic Curves by Silverman. The library provides a PDF.

2.2. **Other References.** Silverman's "Advanced Topics in the Arithmetic of Elliptic Curves" is what it sounds like. Silverman and Tate wrote a book "Rational Points on Elliptic Curves" which assumes less background. Milne's book on Elliptic Curves (one version of which is available on his website) is also nice.

2.3. **Office Hours.** You are encouraged to come to office hours if you struggling: I am happy to help. You are also encouraged to come to office hours if you are doing well or are bored: I am happy to talk about math more generally and tell you interesting things. If the default times do not work for you, please contact me and we can find an alternate time.

3. EXPECTATIONS AND GRADING

This is an advanced graduate class, so you are expected to be independent learners. Class will focus on examples, so some parts of proof will be omitted. If it is important for you to learn them, you'll need to take responsibility for doing so.

Students who have gained familiarity with elliptic curves, with a focus on topics of relevant to their research focus, will receive an A. The main way this will be assessed is through a final presentation or written project. There will not be regularly-graded problem sets.

4. OTHER POLICIES

4.1. Communication. Course Announcements will be posted on Canvas. It is the student's responsibility to make sure they receive notifications for this course. For personal matters, students should e-mail the instructor via their official UF e-mail address.

4.2. Make-Up Policy for Homework/Exams. Make-up homework/exam work is allowed only when written evidence of an official University excused absence is provided (<http://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>).

The instructor must be notified as soon as possible, preferably *before* the homework due date or exam with as much advanced notice as possible. A detailed account of the situation and supporting documents are required.

4.3. Diversity, Inclusion, and Equity. To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed.

I am committed to diversity and inclusion of all students in this course. I acknowledge, respect, and value the diverse nature, background, and perspective of students and believe that it furthers academic achievements. It is my intent to present materials and activities that are respectful of diversity: race, color, creed, gender, gender identity, sexual orientation, age, religious status, national origin, ethnicity, disability, socioeconomic status, and any other distinguishing qualities.

4.4. Honesty Policy Regarding Cheating, Plagiarism, etc. UF students are bound by *The Honor Pledge* (<http://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) which states,

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

The Student Conduct Code (<http://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of the honor code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please or consult with the instructor in this class.

4.5. **Accessibility and Accommodations.** Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>.

It is important for students to share their accommodation letter with their instructor and discuss their access needs as early as possible in the semester.

4.6. **Online Course Evaluations.** Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <http://gatorevals.aa.ufl.edu/students/>.

Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <http://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <http://gatorevals.aa.ufl.edu/public-results/>.

4.7. **Change.** Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.