MATH 631: ALGEBRAIC GEOMETRY I (FALL 2025)

Course Information

Lectures: TR 11:30am-1pm in EH 4088
Lecturer: Aaron Pixton
E-mail: pixton@umich.edu
Office Hours: Mon 2pm-3pm (EH 3842), Wed 8pm-9pm (Zoom: https://umich.zoom.us/j/4351078600), Thu 3pm-4pm (EH 3842), or by appointment

Course Website

The main course website is at http://websites.umich.edu/~pixton/631/.

Course Description

This course will introduce the basic notions and objects of modern algebraic geometry from a scheme-theoretic perspective. We will be (loosely) following Ravi Vakil's notes "Foundations of Algebraic Geometry" (available at http://math.stanford.edu/~vakil/216blog/index.html). We will cover most of Chapters 2-13 this term.

Prerequisites

The most essential things to know for this class are basic ring/module theory (prime ideals, localization, tensor product of algebras) and some topology (open covers, bases, etc). It will also be helpful to have some familiarity with basic category theory (see Chapter 1 of Vakil's notes).

Problem Sets

There will be weekly problem sets, usually posted on the course website on Thursday afternoons (beginning Aug 28). They will **not** count towards your grade in the course but you are still expected to think about them to follow along with the course material! Even though the problem sets will not count towards your grade, I am still happy to take a look at any solutions that you want to ask me about and I encourage you to write down and e-mail me anything (at pixton@umich.edu) that you aren't completely sure about. (If a grader is assigned to the class, I will set up Gradescope and ask you to submit full solutions there instead, though you are still welcome to ask me questions by e-mail or in office hours.)

You are highly encouraged to discuss the problems with your classmates - this is one of the best ways of learning things! On the other hand, I recommend against consulting an LLM (large language model, e.g. ChatGPT). This is despite the fact that current LLMs perform relatively well on these problem sets (and are the reason why the problem sets will not count towards your grade). Some of the issues with using current LLMs to learn math:

- At best, consulting an LLM is similar to looking for an explanation or proof of something in a different textbook or via Google searches or by coming to office hours - it isn't going to replace trying to figure things out yourself.
- But also LLMs still make many more errors than other sources, and these errors can be tricky to notice.
- LLMs perform even worse when asked questions like "Explain why [false statement] is true." (they will confidently prove the false statement) or "When is [statement] true?" (they will confidently give an incorrect criterion) than when asked standard problem set questions. Unfortunately such questions are more common than the problem set type when you are learning something and don't know what is true!

I give more detailed thoughts on using LLMs in math here: `http://websites.umich.edu/~pixton/llms_in_math.pdf`.

Grades

There will be a single in-class exam on **Tuesday, November 18**, mainly consisting of true/false questions (no proofs). Graduate students who do fine on the exam will automatically get an A in the class; those who do poorly on the exam will have to schedule a 30-minute oral exam with me. Undergraduate students will all have to schedule a 30-minute oral exam with me (in addition to the in-class exam). In general you shouldn't worry about your grade in the course if you are keeping up with the material and feel like you have a decent understanding of most of it. If you have any concerns about your potential grade and want me to explain my process more, come talk to me!

Office Hours

My current weekly office hours are Mon 2pm-3pm (EH 3842), Wed 8pm-9pm (Zoom: `https://umich.zoom.us/j/4351078600`), Thu 3-4pm (EH 3842). You are also always welcome to contact me to schedule an alternative meeting time.