

# MATH 631

## Algebraic geometry I: Introduction to algebraic varieties

- MWF 11:00 am-12:00 pm
- Course webpage: [www.math.lsa.umich.edu/mmustata/631-17.html](http://www.math.lsa.umich.edu/mmustata/631-17.html)
- Office hours: Thursdays 1-2 PM and by appointment.
- This is the first part of a two-semester course giving an introduction to algebraic geometry. The first semester will be devoted to introducing algebraic varieties and discussing the basic notions and results related to this concept. I plan to cover many examples (determinantal varieties, Grassmannians, toric varieties, etc). The second semester will be devoted to cohomology in the setting of complex algebraic varieties, including de Rham cohomology and Hodge theory.
- Prerequisites: I will assume that everybody is familiar with rings, fields, and modules, at the level of Math 593. A first course in commutative algebra (covering, say, the material in Atiyah-Macdonald) would be helpful, but not absolutely required. We will go in detail over Noether normalization, Hilbert's Nullstellensatz, or dimension theory in the geometric setting. However, we will not cover in the course basic commutative algebra notions, such as associated primes and zero-divisors, integral and finite morphisms, etc. For this material, I will prepare some hand-outs that should be enough for people to learn things on their own (or review them, in case they have already seen them).
- I plan to run a one-hour weekly problem session (day and time to be decided). This will be largely devoted to discussing examples, which form an important component of a first algebraic geometry course. I will distribute the problem sheets one week in advance, so you have time to think about the problems.
- There will be weekly homework assignments.
- Grading policy: the grade will be based on homework (70%) and on a final take-home exam (30%).
- Here is a rough outline of the course:
  - 1) Affine algebraic subsets and Hilbert's Nullstellensatz
  - 2) Morphisms and rational maps
  - 3) Dimension theory
  - 4) Sheaves and ringed spaces
  - 5) General algebraic varieties
  - 6) Projective and quasiprojective varieties
  - 7) Coherent sheaves on algebraic varieties
  - 8) Separated and proper morphisms
  - 9) Complex algebraic varieties; the classical topology
  - 10) Normal and nonsingular varieties; differentials and the tangent bundle
  - 11) Divisors and line bundles.