

INTRODUCTION TO ALGEBRAIC GEOMETRY, MATH 60710, FALL 2012
MWF 12:50–1:40; DBRT 116

I will give an introduction to algebraic geometry. I will begin the course with the definitions of affine and projective varieties, and we will prove the Hilbert nullstellensatz, which establishes an equivalence between affine algebraic sets and finitely generated reduced algebras. We will interpret this equivalence as giving a way to study a geometric object by studying its functions. I will proceed to cover general abstract varieties, and notions such as irreducibility, dimension, morphisms, and tangent spaces. My plan is to proceed to discuss sheaves and some fundamental theorems due to Serre on cohomology of sheaves on projective varieties. Projective varieties have only constant functions, and these results of Serre are necessary to extend the idea of studying an affine variety through its functions to the projective setting. We will do a number of examples and applications during the course of the semester.

PREREQUISITES: In principle, this course should be understandable to a student who has completed the first year of graduate algebra (60210-60220), but some exposure to exact sequences may be useful. I will introduce concepts of commutative algebra as needed, but will begin with material from chapter 15 of Dummit and Foote.

There are many sources that are useful. I ordered Hartshorne for the bookstore, and it is a very good reference to own, but it is not necessary to buy it for this course. I will put some books on reserve, and provide lecture notes when useful.

“Algebraic Geometry” by Robin Hartshorne, Springer. 2010.

“Abstract Algebra” by David S. Dummit and Richard M. Foote, 2003.

“Linear Algebraic Groups” by James E. Humphreys, Springer, 1975.

“Introduction to Commutative Algebra” by Michael Francis Atiyah and I. G. MacDonald.

“Commutative Ring Theory” by H. Matsumura and Miles Reid, Cambridge.

The algebraic geometry course notes by J.S. Milne, available at
<http://www.jmilne.org/math/CourseNotes/ag.html>

“Faisceaux Algébriques Cohérents” or “FAC”, by J-P Serre, Ann. of Math. (2) 61, (1955). 197278 (it is easy to find an English translation online, ask if you need help).

HOMEWORK: I will give 4 or 5 homework assignments during the semester. I will be accommodating for students beyond the first year of graduate school who are busy preparing for oral exams or working on their thesis. There will be no exams.