

Algebraic Geometry (M24)

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This will be a basic course introducing the tools of modern algebraic geometry. The most relevant reference for the course is the book of Hartshorne and the notes of Vakil.

The course will begin with a quick review of the theory of varieties as presented in the Part II algebraic geometry course (see e.g., the book of Reid for this background) and then proceeding to sheaves and the notion of an abstract variety. We then turn to an introduction to scheme theory, explaining why we want schemes and what they will do for us. We define schemes and introduce projective schemes. From there, we will pass to coherent sheaves, and introduce a number of tools, such as sheaf cohomology, necessary for any practicing algebraic geometer, with applications to problems in projective geometry.

Pre-requisites

Basic theory on rings and modules will be assumed. It is strongly recommended that students either have had a previous course on Commutative Algebra or had a quick read of the book on Commutative Algebra by Atiyah and MacDonal, and/or the elementary text by Reid on Algebraic Geometry.

Literature

Introductory Reading

1. M. Reid, *Undergraduate Algebraic Geometry*, Cambridge University Press (1988) (preliminary reading).
2. M. Atiyah and I. MacDonal, *Introduction to Commutative Algebra*, Addison–Wesley (1969) (basic text also for the commutative algebra we'll need).

Reading to complement course material

1. U. Görtz, T. Wedhorn, *Algebraic Geometry I*, Vieweg+Teubner, 2010.
2. R. Hartshorne, *Algebraic Geometry*, Springer (1977) (more advanced text).
3. R. Vakil, *The rising sea. Foundations of Algebraic Geometry*, available at <http://math.stanford.edu/~vakil/216blog/index.html>

Additional support

Four examples sheets will be provided and four associated examples classes will be given.