

AN INTRODUCTION TO SCHEMES (PMAT 685.08 W04)

Monday	Tuesday	Wednesday	Thursday	Friday
Meeting: 09:30-10:50 MS 522		Meeting: 09:30-10:50 MS 522		

Instructor and web-site.

- Instructor: Clifton Cunningham
- Office: Mathematical Sciences Building, Room 528
- Telephone: voice 220-6888; fax 282-5150
- E-mail: cunning@math.ucalgary.ca
- Course Web-site: <http://www.math.ucalgary.ca/~cunning/685/>
[under construction]

Syllabus. This course provides an introduction to modern algebraic geometry, which is built on the notion of *scheme* and central to the study of problems from number theory by algebraic-geometric techniques. We begin by studying the spectrum $\text{Spec}(A)$ of a commutative ring A with unity, which is, quite simply, the set of prime ideals in A . We show how that this set is naturally equipped with a topology, called the *Zariski topology*. We then study sheaves on topological spaces and equip $\text{Spec}(A)$ with a sheaf called the *structure sheaf* for A . Armed with these concepts, we define affine schemes and show that the category of affine schemes is dual to the category of commutative rings with unity. The course includes the notion of *glueing* and various examples of a special class of schemes called *algebraic varieties* including projective varieties and algebraic groups. The course includes examples of schemes which are *not* algebraic varieties.

Textbook. *The Geometry of Schemes*, by David Eisenbud and Joe Harris, hereafter referred to as ‘EH’. Available at the campus bookstore and from the library.

Pre-requisites. PMAT 511 or PMAT 613 or permission.

Evaluation. Your final grade is determined by the following three equally weighted components:

- one take-home test;
- one in-class seminar on a mutually agreeable topic;
- one final paper based on your seminar.

Date: Monday, 5 January 2004.

In-class seminar and final paper. During the first two months of the academic term each of you should be on the look out for an aspect of scheme theory which catches your interest. Based on this we will develop the outline of a seminar together, to be presented during the last few weeks of term. Your final paper will expand on the seminar.

TENTATIVE SCHEDULE OF TOPICS AND PRESENTATIONS

WEEK OF	TOPIC	COMMENTS
12 January	the functor $\text{Spec}(\)$	EH 1.A.i
19 January	localisation and the Zariski topology	EH 1.A.ii
26 January	sheaves and ringed spaces	EH 1.A.iii and EH 1.B.ii
02 February	schemes and subschemes	EH 1.A.iv and EH 1.B.i
09 February	glueing	EH 1.B.ii
16 February		Reading Week
23 February	products of schemes	EH 1.C.i
01 March	S-schemes	EH 1.C.ii
08 March	the functor of points	EH 1.C.iii
15 March	projective varieties	test posted 13-03-2004
22 March	algebraic groups	test due 25-03-2004
29 March	presentations	Jean-Martin A.& Peter P.
05 April	presentations	Tracy W.& Jordan W.
12 April	presentations	Marton N.& Paul S.
19 April	presentations	Elizabeth R.
		final paper due 25-04-2004

DEPARTMENT OF MATHEMATICS & STATISTICS, UNIVERSITY OF CALGARY, 2500 UNIVERSITY DRIVE N.W., CALGARY ALBERTA, CANADA T2N 1N4

E-mail address: cunning@math.ucalgary.ca