18.726 Algebraic geometry II, Spring 2013

Website: [http://stellar.mit.edu/S/course/18/sp13/18.726/](http://stellar.mit.edu/S/course/18/sp13/18.726/)

Instructor: Bjorn Poonen [2-244], 617-258-8164, [http://math.mit.edu/~poonen/](http://math.mit.edu/~poonen/)

Office hours: M 10:15-11:30am, Tu 1:20-2:20pm, W 10:15-11:30am, in [2-244](http://math.mit.edu/~poonen/)

Email: poonen@math (add .mit.edu if off-campus). Math is much easier to explain in person than in email, so if you have a math question, come to office hours! If you do email me, include your name.

Lectures: MWF 9-10am in [2-135](http://math.mit.edu/~poonen/)

Prerequisite: 18.725.

Books: The only required text for the course is Hartshorne, *Algebraic geometry*, Springer. In fact, there are many excellent algebraic geometry texts. Here are a few others (not required):

- Shafarevich, *Basic algebraic geometry*, Springer. (It was originally one volume, but now has been split and expanded into two volumes.) This is written at a slightly more elementary level than Hartshorne; on the other hand, it points out many connections with other branches of mathematics.
- Mumford, *The red book of varieties and schemes*, now printed by Springer (so it’s now a yellow book). This is one of the earlier textbooks on schemes, and makes an effort to show that one does not lose geometric intuition when working with schemes.
- Eisenbud and Harris, *The geometry of schemes*, Springer. This also explains the geometric intuition well.
- Vakil, *Foundations of algebraic geometry*. These are course notes by an algebraic geometer who is also a master of exposition.

Algebraic geometry is based on commutative algebra, so at some point you will likely want to consult one or more commutative algebra texts. Here are a few excellent ones:

- Eisenbud, *Commutative algebra with a view towards algebraic geometry*, Springer.

Finally, here are some encyclopedic references. I do not recommend trying to read them cover-to-cover! But they are useful if you need to look up something.

- Grothendieck (with the assistance of Dieudonné), *Éléments de géométrie algébrique (EGA)*. This is very clearly written, and is easy to read except for the fact that it is very long (about 1500 pages) and contains statements in greater generality than you usually need.
- *The stacks project*. This is even longer (3500+ pages and growing), but it is a searchable PDF file.

Plan for the course: Here is a rough list of topics for this semester: smooth and étale morphisms, differentials, cohomology, basic intersection theory, with applications to curves
and surfaces. (Approximately, this means Sections I.7 and II.8 of Hartshorne, plus as much of Chapters III-V as we can manage.)

**Homework:** Assignments are posted [online](#). Completed assignments should be submitted online before 11:59 P.M. on the Monday due date. If you are writing solutions by hand, please use the scanner in 2-236 so that they can be uploaded. Homework submitted after solutions are posted will not be accepted. At the top of each assignment should appear either the text “Sources consulted: none” or a list of all sources consulted other than the recommended texts and your own notes from lecture. This is required. (Examples of things that should be listed if used: names of people that you discussed solutions with (whether or not they are taking the class), Wikipedia, and other websites. For many of the problems, there exist solutions of varying quality online; if you look at one of these, or look at solutions written by students or professors in previous semesters, you must mention the precise source on your assignment.)

You should not expect to be able to solve every single problem on your own; instead you are encouraged to discuss questions with each other or to come to office hours. If you meet with a study group, you may find it helpful to do as many problems as you can on your own beforehand. But write-ups must be done independently. (In practice, this means that it is OK for other people to explain their solutions to you, but you must not be looking at other people’s solutions as you write your own.)

Use proofs in the book as a model for the level of detail expected. Write in complete sentences whenever reasonable.

If you have questions about the homework, it is best to ask these in office hours.

**Grading:** Based exclusively on homework. No exams.

**If a personal or medical issue is interfering with your studies:**

- Contact your medical provider if you need medical attention.
- Please do not come to class if you are potentially contagious. Instead keep up with assigned readings if you can.
- Email me.
- If it is an extended illness or serious personal problem, one that will cause you to miss handing in a homework, and you are an undergraduate, then (and only then) please discuss this with Student Support Services (S³). You may consult with S³ in 5-104 or call 617-253-4861. The deans in S³ will verify your situation, and then discuss with you how to address the missed work.

If you have some other kind of conflict, email only me (not a dean) as far in advance as possible, and I will make a decision on how to proceed.

**If you need disability accommodations:** Please speak with Kathleen Monagle, Associate Dean in Student Disability Services (SDS) in 5-104 or call 617-253-1674, ideally before the semester begins, or early in the semester. If you have a disability but do not plan to use accommodations, it is still recommended that you meet with SDS staff to familiarize yourself with the services and resources of the office. If you have already been approved for accommodations, please bring the accommodation letter to Galina Lastovkina, 617-253-4977 in Mathematics Academic Services 2-285 early in the semester.
Other important things: It is your responsibility to email me as far in advance as possible in case of an extended absence, or in case you find yourself struggling with the course for any reason. If you have emergency medical information you wish to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately: feel free to talk to me privately after class or in my office.