Math 818: Algebra and Geometry

Intructor: Dr. Katrina Honigs, khonigs@sfu.ca, Office SC K 10506

Course info will be listed at www.sfu.ca/~khonigs/818/

Lecture Time and Location: 2:30-4:20 pm WF, AQ 5051

Office hours:

Grading: Assignments 60%, Final Exam 40%

Final Exam: In-class
SFU will schedule sometime in the final exam interval Dec. 5 - Dec. 17.

Textbooks: Course notes by Andreas Gathmann (linked online).
There may be readings from other texts. These will also be available electronically.

Coursework:

- **Assigned readings**: I will list reading assignments next to the lectures they are associated with on the course website.
- **Homework Assignments**: Problem sets will be due in class on Fridays.
  - I will mark some (probably 4-ish) of the questions in each problem set.

    I am trying a new grading scale:

    alpha: The argument is correct and explained well. Anything missing is cosmetic.

    beta: Something is missing. Perhaps part of the proof is missing or the write-up is hard to follow. In a graduate course, this can look like a write-up that's very long where it's not clear what point is being made.

    gamma: Something larger is missing. The proof is further away from being correct or the write-up is obscuring my ability to judge the proof. The solution should be resubmitted.
  - Work can be resubmitted one week after the initial due date (and no later). Your best grade on each question is what will be counted.
  - Work that is submitted for the first time after the due date but before the resubmission deadline will count for only half as many points.
  - LaTeX-ed assignments are ok. So are hand-written ones as long as I can read them.
  - A writing guideline: Proofs in this class shouldn't tell me anything is "clear", "obvious", "easy", or similar. If you find yourself wanting to use phrases like this, think about what you're trying to tell the reader when you use them.
  - Your total assignment grade will be a weighted based on the number of alphas, betas, and gammas you receive.
  - For grad students, a grade of B or lower (MSc) or B+ or lower (PhD) in a course will result in a meeting with your advisor. (This has to do with how SFU handles grades for qualifying for a graduate fellowhsip, graduating, etc). A grade of alpha on a writing assignment is an A.

Accessibility: Students with disabilities who believe they may need class or exam accommodations should contact the SFU Centre for Accessible Learning (CAL).
If you wish to request religious accommodation, contact me by the end of the first week of classes.

Questions: I love questions, especially in lecture. They help make courses better. I often don't have much time to respond to math questions via email in much detail, but I hope there will be many opportunities to ask me in person.

Working together: I encourage you to work together on problem sets, studying, etc. However, everyone should write up their work separately.

Respectfulness: Courses need everyone's cooperation to be as successful as possible. It's important to treat each other with kindness and respect. I expect you to arrive in the course on time and we will start lecture promptly after breaks. If there's a common scheduling issue where you'll have trouble arriving on time (e.g. for grading), let me know and we can do something like starting a few minutes late.

What will we do in this course?

Algebraic geometry is the study of polynomials, but this is a misleadingly simple description. It is a large and old field of math that has undergone many changes in terminology and the frameworks people use to think about it. Mathematicians working in algebraic geometry vary widely in terms of what they study and the methods they use.

Algebraic geometry courses also vary a great deal in the background they assume, the material they cover, and their goals. They might be aimed at working up to a specific theorem, introducing a specific subfield or approach, or simply introducing a bunch of terminology. So books and notes labelled as an introduction to algebraic geometry can vary hugely and may vary greatly from what we do here.

In this course, we will begin by studying affine varieties and polynomial rings. Then we'll move on to projective varieties and some other topics. One of our major course goals is to see the Riemann–Roch theorem for curves and applications.

Background reading and getting started (This was posted on the course website earlier)

This is a graduate level introduction to algebraic geometry, both for students who will specialize in a field that uses algebraic geometry as well as students specializing in other fields who are broadening their studies with algebra.

There is no prerequisite course, but it is assumed that students are, minimally, familiar with rings, ideals, quotient rings and the isomorphism theorems as well as prime and maximal ideals. I recommend doing the first reading listed and working on the first problem set, "Homework 0" in advance of the start of the course. Students with a lighter background in algebra will find this to be useful preparation.

The first reading listed, Ch. 0-2 of Gathmann's Commutative Algebra notes, covers material on ideals and affine varieties. Some of the material on ideals may be unfamiliar to students who are sufficiently prepared for the course, but should be accessible with study. The proof of Zorn's lemma in this reading will not be used, but that result will be applied. Affine varieties (which I do not assume students have seen before) will be covered in lecture, but digesting their correspondence with algebra takes time, and students generally find it beneficial to begin this process early with reading in advance.