Mathematics 308 — Geometry

Projects

The project is the most important component of this course. In doing your project, you can put together all the things you have learned, and you can work according to your own schedule. You also have a chance to display some originality.

The basic idea of a project is for you to **explain something mathematical that involves pictures in an essential way**. Normally, explaining a mathematical idea means telling **what** it says, and then **why** it is true. **Pictures must be used to convey logic**. Text will usually be necessary to make connections, but in an ideal project most of the reasoning will be conveyed by the pictures. Text at any rate should be clear and succinct. A good project will tell a story, as complete and self-contained as possible.

Your project will be graded according to

- mathematical content (how much mathematics is involved? how relevant to the course material?)
- clarity (arguments will ideally be transparent, and context explained; graphics must be easy to read, aimed at mathematics; well designed to convey ideas rather than distract)
- correctness (no serious mathematical errors)
- difficulty (how much work involved, and how much technical knowledge?)
- interest (as interesting as possible, given the topic)
- originality (how many of the ideas and how much of the execution are yours?)
- skill (are ideas presented graphically where possible? text well written?)

These count equally. I say again that a good project can consist of either pictures alone, or a combination of pictures and text. The pictures will normally be in PostScript; you must obtain my agreement for anything else. If you put the text in .html, it should be in a form readable by any Internet browser. I will not accept .html put together by a web editing program; you must make up your .html by hand. If you do make up text in .html, it will be a good idea to put some pictures right on the page, so the pictures can be read right along with the text. These will normally be either .jpg or .gif files. If you use these, then they must hide links to your original PostScript pictures which can be accessed by clicking on them.

Only mathematical content will normally be count towards the grade. If you are writing about Pythagoras' Theorem, I don't want to be told what Pythagoras ate for breakfast. Historical material should be included only if it pertains to the mathematics directly—explains who first discovered what, or why he didn't discover this or that.

All projects will be eventually posted on the course Web site.

Perhaps the most difficult part of your project will be to decide what it will be about. There are unlimited possibilities, but my basic criterion for the worth of a project is its mathematical aspect. It should be mathematical in **content** and in **technique**. That is to say, its subject should be mathematics, although in almost any form, and there should be some mathematics used in making it.

One way to get an idea of what to work on is to browse through books on mathematics, physics, astronomy, or even art to find interesting pictures you can copy or improve. Good projects in the past have illustrated propositions from Euclid and Archimedes, Kepler's Laws, regular polyhedra, interesting mathematical surfaces, the track of a sun dial's shadow, three-dimensional motion along a twisted path, the motion of falling or thrown objects, conic sections, perspective views in art, and complicated views of familiar objects in motion.

One natural way to choose a topic is to browse through early geometry texts, say from Euclid, Archimedes, Descartes, etc. or even non-Western sources. You may collaborate with someone else, but a project from two people should be roughly twice as good as one from a single person.

You can also get ideas by browsing on the Internet. I have no objection to your redoing pictures you find there, as long as you don't copy stuff without doing your own work. **All images in your project must be produced by you.** This is to avoid copyright violation, among other things. Again, there should be mathematics involved.

A more delicate matter is that in any event you must tell me your sources. *All text must be in your own words, except possible for short quotations.* I will not count at all any project that fails to observe this rule.

If you are submitting this project for credit in some other course, you must explain that.

Before you launch yourself irreversibly on a project, you must tell me what you are going to do, and I have to agree with your plan. In effect, you will negotiate with me about what you are going to submit, so as to avoid misunderstanding later on. Think of your initial proposal as a kind of contract.

I will be happy to help you out on specific items as you work along, but I will usually offer only informal advice on parts of your project; I will not actually grade projects, even in my own mind, until they are handed in. You cannot produce a project incrementally, by having me tell you how to improve successive versions. *Suggestions by me do not constitute approval of things I haven't commented on.*