Mathematics 308—Geometry—Fall 2002

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Text: None. But notes useful for this course are available at

`http://www.math.ubc.ca/~cass/graphics/text/www/`

In addition, I will make up and hand out lecture notes from time to time. *Since there is no text, and since not everything important to this course is covered in the notes, it is important that you ask questions in class whenever you don't understand something.*

Examinations: There will be at least one mid-term examination as well as a final examination. I do not know dates yet. *Examination grades will be counted proportionally to the length of time allotted to the examinations.* You are expected to use calculators in examinations.

Assignments: Homeworks will be due roughly every 2 weeks. If handed in late, they may not be corrected. The homework assignments are extremely important. They will count about 20% of the total term grade, but—more importantly—doing them is the only way you will learn what you are supposed to. I do not object to your working together, nor to your finding the solutions to problems in books. But I ask that you tell me on the assignment that you have done so. *If I find evidence of unacknowledged collaboration or of unacknowledged use of external resources, all parties involved will lose credit.*

In addition to the usual homework assignments, of which there will probably be 4 or 5, you will have to do a special project of some kind towards the end of the term. *This is the most important part of this course*, and will count at least 20% of your grade. Details will come later.

Outline: The subject of the course is Euclidean geometry. More specifically we will range over these and related topics: Pythagoras' theorem and other stuff from Euclid, vector dot-products, linear and affine transformations in two and three dimensions, perspective, regular solids, and spherical geometry (although not necessarily in that order).

But *the special feature of this course is that I will teach you how to apply linear algebra and geometry to draw figures in both two and three dimensions by computer.* The primary programming language will be PostScript, although you might be given the option of using other programming languages for some assignments. For this purpose you will be given accounts in the Mathematics department undergraduate computer laboratory, and given an introduction to the system. You will be asked to write programs in assignments and examinations, but you will not have to memorize large chunks of any programming language, because as we go along we shall accumulate a dictionary of useful commands, and in examinations you will be allowed to refer to it. Nonetheless, you will have to become familiar with PostScript through assignments, because the 'official' dictionary will be only a brief summary.

From past experience I would say that it is not necessary that you already be familiar with programming in order to do well in this course, although it will undoubtedly save you time if you are.

The main reason I am introducing you to PostScript is that it is a well designed programming language that forces you to think carefully about aspects of geometry that might otherwise seem pointless. (One of the inventors of PostScript, and one of the two co-founders of the Adobe Systems software company, was once a graduate student in mathematics at the University of Utah.) I expect that you will actually enjoy this part of the course more than some of the more purely mathematical parts, but you must keep in mind that the two go together.

Roughly speaking, I expect you to spend an average of about 2–3 hours week with a computer, but you should also keep in mind that *drawing good pictures with a computer will often take some time calculating with just paper and pencil.*

It is not necessary that you use the Mathematics undergraduate laboratory. It will be possible for you to work at home, or indeed almost anywhere that computers are available, since there are various ways in which you can load onto your own machine, at little or no cost, a copy of the same programs you would run in the Mathematics department. There are some advantages to working in the department laboratory, however, as you will see.

Roughly speaking, there are two methods to get the software you need for your own computer.

(1) Go to the home pages of GhostScript and GSView and download the right stuff from there.

(2) In previous years, you could buy the CDROM for sale from the undergraduate Computer Science society. You were able to buy it for $5 from *Copyright* in the SUB basement. Whether or not this is true this year I do not know. At any rate, you can borrow my copy of the CD.

The standard reference for PostScript is the *PostScript language tutorial and cookbook* (usually called simply the *blue book* to distinguish it from the red and green ones) published by Addison-Wesley. It is an excellent book, and you may find it useful, but you shouldn't need it. Recently it has been available online at

    http://www-cdf.fnal.gov/offline/PostScript/BLUEBOOK.PDF

Internet access: The course home page is

    http://www.math.ubc.ca/ cass/courses/m308-02.html

Course materials will be available on line, including all handouts in either `.ps` and `.pdf` format, and an extensive local on-line help facility. One resource you will need often is David Joyce's on-line edition of Euclid at

    http://aleph0.clarku.edu/ djoyce/java/elements/Euclid.html

Joyce's text is the translation of Euclid into English made by T. L. Heath early in the nineteenth century. The site

    http://www.perseus.tufts.edu/cgi-bin/ptext?lookup=Euc.+toc

used to have not only Heath's translation of Euclid, but also his invaluable comments on interpretation and history. The text of Euclid is still there, but most of the comments seem to have been mislaid.