Topics in Geometry for the Elementary and Middle School Teacher

Spring Semester 2004

Course MATHS 360 Section 1 TR 3:30 – 4:45 pm RB 117

Instructor Dr. Hanspeter Fischer

Contact Office: RB 426 E-mail: fischer@math.bsu.edu
Phone: 285 – 8680 http://www.cs.bsu.edu/~fischer/math360

Office Hours Mon 12:00 – 12:50 pm, Tue 10:00 – 10:50 am, Wed 1:00 – 1:50 pm, Thu 2:00 – 2:50 pm, Fri 12:00 – 12:50 pm, and by appointment.

Prerequisites MATHS 202 (C^- or better)

Textbooks *Symmetry, shape, and space: an introduction to mathematics through geometry*, by L.C. Kinsey and T.E. Moore; *Flatland: a romance of many dimensions*, by E.A. Abbott; *Taxicab geometry: an adventure in non-Euclidean geometry*, by E.F. Krause.

Technology For the more involved geometric constructions, we will learn how to use the software package *The Geometer's Sketchpad*, which is available on all machines of the department's computer lab. No prior knowledge of this system is assumed.

Website The above Website will feature further discussion of some of the material as well as links to outside resources. Please visit this site regularly for course announcements, homework, and up-to-date deadlines.

Course Contents We will work through most of Chapters 1 through 6 of *Symmetry, shape, and space*, with the exception of Chapter 2. We will engage in non-Euclidean experimentation through the book *Taxicab geometry*, as well as read and discuss the classic novel *Flatland*.

Homework Homework assignments will be given as we work through the material. Some problems will be assigned for practice only, while other designated problems will be collected and graded. The assignments will mostly come from the above textbooks. However, we will engage in our own projects at times, as appropriate for the understanding of the material.

Since one of the main goals of this course is to sharpen our reasoning skills, students are encouraged to rewrite their exercises before they submit them for credit, until they are fully satisfied with their argument they are making or the explanation they are giving.

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Examinations There will be one 30-minute quiz every two weeks, the last of which will be given during the final exam period on Friday, May 7, 2:15–4:15 pm. (This simply means that the final exam is not comprehensive.)

Evaluation All quizzes combined, including the "final exam", constitute 80% of your grade. Homework and projects account for the remaining 20%.

The approximate grading scale (in percent) is:
A: 90 – 100, B: 80 – 90, C: 70 – 80, D: 60 – 70, F: below 60.

A Historical Note To this day, our approach to mathematical and physical problem solving is shaped by the very way in which Euclid conceived of describing and exploring geometry in his books *The Elements* around 300 B.C. His work was the first example of rigorous treatment of mathematical reasoning from postulates to theorems.

It is no accident that this advance came through geometry, for it is the perfect playground for making conjectures, presenting heuristic evidence, and refining our intuitive ideas to exact mathematical deduction. Exploring the world of geometry, in its commonly known as well as in its rarely seen forms, is therefore an excellent tool to sharpen our problem solving skills.

Of course, geometry is important to us not only as a method, but its study has brought about a much deeper understanding of the world we live in. As a case in point, the discovery of non-Euclidean hyperbolic geometry (by Lobatchevski in 1829 and, independently, by Bolyai in 1831), initially, was not more than an academic exercise: it proved that Euclid's parallel postulate could not be deduced from the other postulates on his list. This curious new concept, however, was quickly refined by Euler and, notably, Gauss, and was later generalized to higher dimensions by Riemann. Eventually, Riemannian geometry became invaluable to modern Physics, when its ideas were applied to Einstein's theory of general relativity, as it discusses the intrinsic curvature and large scale structure of our universe; the so-called 4-dimensional space-time continuum.

Deadlines The last day to change a course is Friday, January 16.
The first course–withdrawal period ends on Thursday, February 12.
The second course–withdrawal period ends on Friday, March 26.

General Remarks

(1) Students are expected to use their textbooks to read upcoming sections ahead of time. Always be prepared and up to date!

(2) It takes time to digest and master new concepts. Expect to study for a *minimum* of two hours outside of class for each hour in class.

(3) Everybody is strongly encouraged to form study groups with classmates. However, credit on assignments should be claimed only for one's own work.

(4) If you need course adaptations or accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible.