SPIRIT AND EVOLUTION OF MATHEMATICS

Honors/Math 275G, Fall 2011
http://www.math.nmsu.edu/~history/

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Nature of the course: This lower division mathematics course is based entirely on the philosophy of direct study of primary historical sources in mathematics. The primary focus is on the mathematics: however, although it is not labeled as a history of mathematics course, the mathematics is set entirely in historical context, so the history is a constant companion and students will learn a lot of history in the context of learning specific mathematics. Each course offering is based on a sequence of primary sources designed for studying one or more great topics in mathematics. The course textbook *Mathematical Expeditions: Chronicles by the Explorers* provides the primary sources, along with extensive annotation, contextual historical and mathematical commentary, and mathematical exercises for students. There are five independent chapters on great themes in mathematics:

- Geometry: The Parallel Postulate
- Set Theory: Taming the Infinite
- Analysis: Calculating Areas and Volumes
- Number Theory: Fermat's Last Theorem
- Algebra: The Search for an Elusive Formula

Each offering of the course typically covers one or two of these topics.

This course is an honors option for meeting the university general education mathematics requirement.

Typical lower division students in the course come from all majors, or are undeclared. The course also serves to attract students to major in mathematics.

The course has been offered almost yearly since 1989.

About course materials: The website http://www.math.nmsu.edu/~history/ provides much more information about the course and materials, including sample sections from each chapter.

Prerequisites: A good high school mathematics background: for instance, a Mathematics ACT score of 25 or better, or meet initial placement requirements for entry into MATH 190 (Precalculus), or consent of instructor.

"Study the masters!" is the spirit of this course, in which we will study great mathematics from a breadth of times and cultures, by immersing ourselves in the very words of the masters who first discovered new ideas. We will see these ideas

develop through time into modern branches of mathematics, by studying selected sequences of primary historical sources. Themes may include the emergence of non-Euclidean geometry, the concept of the infinite, the calculus, number theory, and the quest to solve algebraic equations. At the same time we shall aim at developing an appreciation for and facility with methods of rigorous proof and mathematical thinking.

Our primary objects of study will be a collection of historical mathematical texts with annotation and commentary. The goal is to study the original proofs of the theorems in these texts, in the words of the discoverers of the mathematics, in order to understand the most authentic possible picture of the evolution of major branches of mathematics during a span of over two thousand years. It is exciting and illuminating to read original works in which great mathematical ideas were first revealed. At home and in class we will read, discuss and interpret these theorems and their proofs, with students writing their thoughts and questions about these works, and we will discuss how the various sources tie together in the development of important ideas. I expect our class discussions to be both challenging and tremendous fun. Other written assignments will consist of proving related results, and solving other mathematical problems related to the texts. Students will have the opportunity to work both individually and collaboratively with others. I encourage students to discuss their ideas with others, and then I expect students to write up their homework entirely on their own, in their own words. As we examine the development of mathematical ideas in the original texts, we will also discuss their historical context and biographies of their creators.

I will expect students to write a term paper and give a brief oral presentation on it. The choice of topic will be up to the student, with my approval, but should include a meaningful mathematical component (in particular, it should *not* be mostly biographical). So students should keep their eyes open for something along the way of interest, since this is an opportunity to delve into something particularly personally exciting. I will discuss the timetable for the development of the term paper in class, and will ask students to pick a topic by mid-semester. I will help students in refining ideas for a topic. Students should familiarize themselves with the university's policy regarding plagiarism and academic misconduct at `www.nmsu.edu/~vpsa/SCOC/misconduct.html`. I will discuss this further when students select a paper topic.

The course grade will be based on a final holistic evaluation of student work as a whole: roughly one half on regular assignments (i.e., student writings on the original sources, and related mathematical assignments); roughly one quarter on class participation; and the remaining quarter on the term paper. There will be no in-class exams. However, we will use the mandatory final exam period for class activity, probably term paper presentations; students should plan to be there.