

MED 4015

History of Mathematics

Syllabus

Fall 2009

Instructor: Sam Smith

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Office Hours: Tue 10:00-11:30, 1:00-2:30, Thur 10:30-11:30, or by appointment.

Text: Victor Katz, *A History of Mathematics: An Introduction*, Harper Collins

Course Description: This course will be a seminar on the history of mathematics. We will proceed chronologically from the first recorded number systems to the modern era. Highlights will include: Euclidean geometry and number theory, the discovery of the calculus, the problem of foundations for analysis, the impossibility theorems for classical constructions and polynomial equations, 20th century set theory, logic and category theory. The history of mathematics is a history of cultures, ideas and individual genius but it is also a history of problems and their resolutions. We will trace several fundamental problems through hundreds, sometimes thousands of years of developments.

This is a course with several dimensions. As a course in history, we will learn about the challenges inherent in uncovering the truth of priority for basic discoveries. As a course in mathematics, we will make a detailed study of many challenging classical problems. Finally, this is a course in education. Consequently, we will focus on the pedagogical aspects of a historical approach to mathematics. Each student will be responsible for researching, preparing and presenting one course unit, complete with learning goals and a problem set, covering a particular historical period of mathematical development.

Course Structure: Your responsibilities for this course are: a midterm exam, a final exam, ten problem sets and the preparation of one course unit. The problem sets will be due basically every week at the beginning of each class. The due dates and topics for the course units will be assigned on the first day. See below for a discussion of this requirement. See the attached calendar for the topic due dates and the dates of the midterm and final.

Grades: I will determine final course grades by curving your total scores, out of a possible 600 points, computed as follows: The midterm will be worth 100 points and the final exam 200 points. The homework will be worth a total of 150 points. The course unit components will also be worth 150 points total.

Learning Goals: By the end of this course the successful student will be able to

- solve problems in classical geometry, number theory, algebra and probability
- prove theorems within and about axiomatic systems
- prove theorems in calculus and basic analysis
- discuss the basic chronological period of mathematical development
- prepare an undergraduate-level lecture on a classical topic in mathematics
- devise learning goals for a course unit
- create a problem set, a grading rubric and lead a problem session

The Course Units: Each student will be responsible for completing the basic tasks involved in teaching a mathematics course albeit condensed to one unit. These tasks include researching a topic, identifying learning goals, preparing a lecture and a problem assignment, and assisting and assessing learning. On the calendar below I have sketched out the (probable) timeline for the course. Each student should pick a week during the semester based on interest in the topic. I will discuss the topics in the first lecture. Your responsibilities will begin in the weeks before your lecture. You will read the text and, if necessary, further research your chosen topic. You will devise learning goals for your unit and create a problem set for the class. You will meet with me at least once before your day to discuss your plans for the talk. On the day of your lecture, you will teach the class for an hour or so and give your assignment. You will also lead problem sessions on your homework assignment both the day of your lecture and, depending on the difficulty, the following week. Ultimately, you will hand in a written report for your course unit. This will include (1) a summary description of the topic covered (2) a list of learning goals for the unit (3) the problem set and (4) the solutions and (5) an assessment of yours and the group's learning. I will grade the course unit assignment by the following rubric: the lecture will be worth 75 points, the course report will be worth 50 points and the problem set and problem sessions will be worth 25 points.

The Problem Sets: You will hand in homework problems essentially every week. These will usually be problems assigned by the student lecturer. At the beginning of each class, we will have a problem session led by the previous lecturer. You will be encouraged by me and the class leader to present your solutions to problems. I will give extra credit to presenters of challenging problems.

The Exams: The exams will test the skills developed in the lectures and problem sets. The final exam is cumulative.

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Calendar

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Monday

Aug 31 Introduction: The Basic Themes
Sept 7 Labor Day -- No Class
Sept 14 Ancient Mathematics: Number Systems
Sept 21 The Early Greek Period: Axiomatics, Geometry, Number Theory
Sept 28 The Late Greek Period: Area and Volume
Oct 5 The Medieval to Early Modern Era: Algebra and Probability
Oct 12 Midterm Exam
Oct 19 Fall Break -- No Class
Oct 26 The Discovery of the Calculus
Nov 2 The Eighteenth Century: Analysis
Nov 9 The Eighteenth Century: Probability, Geometry and Algebra
Nov 16 The Nineteenth Century: Analysis, Algebra and Geometry
Nov 23 The Twentieth Century: Set Theory and Logic
Nov 30 The Twentieth Century: Topology and Combinatorics
Dec 7 Conclusion
Dec 14 Cumulative Final Exam