

Math 320 History of Mathematics

Syllabus for Summer of 2004

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Course Description and Rationale

The history of mathematics is inseparable from world history, culture, and other human issues. This course is a mathematics education foundation course and is theme-based. It is synthetic in its content and approach. The student is expected to put together an evolutionary portrait of key mathematical concepts, discuss their development and implications for teaching.

Theme of Math History Lessons

Mathematics is problems: Problems unsolved, at least by you and solved problems that are studied that are used to solve new problems.

The creative product in mathematics is not a novel, symphony, or painting but rather a solved problem in the form of an explained solution, model, or theorem. Mathematician Hermann Hankel said,

In most sciences one generation tears down what another has built, and what one has established another undoes. In mathematics alone each generation adds a new story to the old structure.

Unless mathematics is taught for understanding, students will view it as rules, facts, and processes. The student must assume ownership of a concept before it can be understood. The present theory of learning, constructivism; offers that personal crises of making sense must occur and then the student can construct a usable understanding if enabled with good motivation and feedback.

All great mathematicians and mathematical masterpieces have had a common theme creativity. Just as one could not hope to understand a great novel without reading it, so one cannot really come to grips with a great mathematical solution or theorem without a careful, step-by-step study. Hopefully through such a study we can experience first-hand the ingénues and clever deductions that made the incomprehensibly clear. Most important mathematical solutions lead to theorems that changed forever the way mathematics was done and the types of problems that needed to be solved.

In the same students have certain mathematical discoveries that are crucial to their mathematical development. If these concepts are not understood but rather copied by the students in a rote sort of way, the student will not be able to understand or create their

own mathematics. In this way the history of mathematics can become a resource for developing activities that challenge and motivate students to investigate solutions to problems applicable to every mathematics student that contain priceless mathematical insights.

Assignments and Evaluation Methods

The lessons for this course will be organized around concepts with historical and mathematical emphasis. You will be given an important mathematical concept, procedure, or connection in the form of a question, please write a paper for each question with these three parts: 1) Identify the problem for the mathematicians of that time period; 2) Identify the problem for student of mathematics today; and 3) Explain how you could use a history example you just studied to teach the concept in question.

1. Commensurable – (Tension between arithmetic and geometry--(Divisibility and Irrational numbers) – Page 1 – 26. What is geometric and numeric example of a constructible, algebraic, and transcendental number?
2. History of Multiple Geometries – (Parallel Lines) – Page 27 – 60. What happens to triangles when the parallel postulate is changed?
3. History of Pi – (Length, area, and volume of circular objects) – Page 84 – 112. What length is Pi?
4. The history of Calculus – (Limits) – Page 155 – 183. How is the idea of limits essential to understanding the ideas of a derivative and integral?
5. Euler’s Refutation of Fermat’s Conjecture – (Proof by Contradiction) – Page 207 – 244. Is $2^n + 1$ prime? How would you solve and prove your solution?
6. Connecting math with Reason – (Connecting sets with logic) – How can the rationals be countable the reals be uncountable?

Text Journey Through Genius by William Dunham

Performance Learner Outcomes

Through writing assignments, exams, and a project the students will demonstrate their knowledge of process objectives that include the following:

Problem-Solving

Working on extended problems

Using diverse methods to solve problems

Using questioning and generalization in solving problems

Modeling real-world phenomena mathematically

Writing and Communication

Reading and understanding complex problems and scenarios

Summarizing and synthesizing the essential ideas of a problem or historical scenario

Describing methods used to approach a problem

Expressing solutions and syntheses in written and verbal form

Evaluating and improving the quality of written work

Reflective Papers

Each paper has three parts addressing the questions asked. These papers also cover the content of the two Exams. Each homework write-up is worth 20 points and will be graded when the exams are given.

Exams

There will be two exams. The first exam will be after the first three lessons and second exam will be during finals week. Each exam will ask a question from about a famous problem we studied from each lesson. Each of these exams counts 100 points.

Presentation/Paper

You will write a paper on mathematics in culture (100 points). Guidelines and rubric for this paper is attached.

Grading: Grades will be determined by the following percents:

93-100% = A, 90-93% = A-, 87-90% = B+, 83-87% = B, 80-83% = B- , 77-80% = C+, 73-77% = C, 70-73% = C-, 67-70% = D+, 63-67% = D, 60-63% = D-, 0-60% = F.

Schedule/Rules

The instructor has a class schedule for the quarter but it is subject to change depending on the needs of the students. If a student misses class, it is their responsibility to find out what was covered announced or assigned. In case of emergencies, it is their responsibility to contact the instructor as soon as possible. If a course deadline was missed, assessment alternatives are left up to the discretion of the instructor.

How to succeed

Take the responsibility for your own achievement of these performance objectives. Use the activities, assignments, assessments and people such as the instructor to insure that you understand the mathematical teaching concepts and can demonstrated this understanding in the form of the performance objectives.