

**Math E-320:  
Teaching Mathematics with a Historical Perspective**  
Oliver Knill, Harvard Extension School, Spring 2011

**Key information:**

- **URL:** <http://www.math.harvard.edu/~knill/teaching/mathe320.2011/index.html>
- **Class:** Monday, 5:30-7:30 PM, SC 113
- **First Class:** Monday, Jan. 24, 2011
- **Instructor:** Oliver Knill, 434 Science Center, knill@math.harvard.edu
- **Office hours:** By appointment.
- **Text:** Mathematics and Its History, by John Stillwell, Springer.



**Abstract:**

The difficulty of both learning and teaching math is evident in its history. The struggle of early research mathematicians who developed and formalized a topic parallels the struggle of students and teachers in the modern classroom. Students learning about the concept of limits and series undergo a similar process as the pioneers of a subject did when they developed the subject. This struggle goes on today, as new flavors of calculus are developed and studied. Each week, this course considers a different mathematical subject and pinpoints a moment when something interesting happened. This moment is condensed into a specific and concrete mathematical problem.

**Prerequisites:**

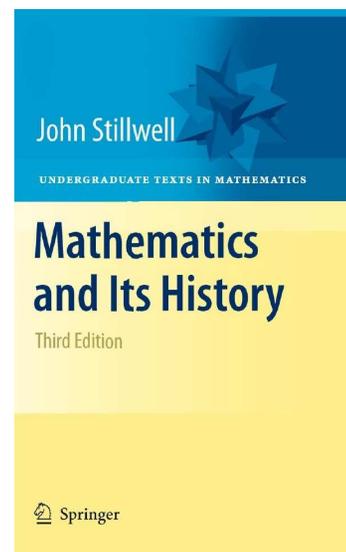
While we try to keep the presentation on a level accessible to a more general public, a good pre-calculus background is an advantage. Even interesting mathematics can be presented on a high school level. For interested participants, we can make more resources available.

**Methodology:**

We use the "case method" methodology and cover in every lecture a different part of mathematics. The range of mathematical topics will therefore be rather broad. After a general overview of Mathematics in the first lecture, We will work each week with a specific branch of mathematics and see its development in a historical context. The **case method** is diametrically opposed to an **encyclopedic approach**. The advantage of the method is that one can get more involved if a concrete example is used. A specific story is more engaging and each "case" can serve as a crystallization point for an entire subject. In a time when knowledge explodes fast and a plethora of possibilities are offered online, teaching requires both to be broad as well as care for details. The dilemma of combining these two can be achieved with a "short story approach". It is well established and was used especially at the Harvard business school, where "discussions focused on real-world situations" was considered a good way to prepare students. In our case, the "real world situations" are "historical highlights". Participants can adapt such models for their own teaching. Besides the material, the pedagogy will play an important role. While all of the lectures could be adapted to lectures for to high school students, we will discuss also pedagogy and think about it.

**Text:**

To get an other perspective beside the lectures, we will do some reading in "Mathematics and Its History, by John Stillwell, Springer" We will not follow or cover the book but select some stories.



**Day to Day Syllabus:**

Here is the plan

Lecture	Topic	Presentation
January 24, 2011	Mathematics	What is mathematics?
January 31, 2011	Arithmetics	The development of numbers
February 7, 2011	Geometry	Important geometric ideas
February 14, 2011	Number theory	Equations with integer solutions
February 21, 2011	Presidents day	No class
February 28, 2011	Algebra	Symmetries and games
March 7, 2011	Calculus	On Summation and Differences
March 14 , 2011	Set theory	Different type of infinities
March 28, 2011	Probability	Chance and Processes
April 4, 2011	Topology	Polyhedra and invariants
April 11, 2011	Analysis	Objects with fractal dimension
April 18, 2011	Cryptology	Codes and Cyphers
April 25, 2011	Dynamics	Chaos and Predictability
Mai 2 , 2011	Computer science	Artificial intelligence

**Special dates:**

Feb 21:	Presidents day
May 9-13:	Exam period
Mar 13-Mar 20:	Spring break