COURSE OUTLINE

MATH 111, HISTORY OF MATH, MOON DUCHIN

This is a wish-list of topics to give you an idea of the scope and organization of the course. We will not cover all of this material.

1. Introduction

- timeline and themes
- epistemology and ontology, $2 + 2 = 4$
- polyhedra and Kepler, *Proofs and Refutations*

2. Algorithms

- algorithms versus existence/possibility
- Egyptian arithmetic
- Euclidean algorithms
- Al-Khwarizmi's quadratic formula
- Tartaglia-Cardano on the cubic
- Turing machines

3. Infinities

- Greek infinities as potentialities
- Wittgenstein: repeatability in principle vs. completed set
- historical attitudes, especially Enlightenment
- Cantor and cardinality

4. Axiomatization

- Euclid's *Elements*: postulates, common notions, deduction
- the Fifth: esp. Saccheri
- foundations, Frege, Russell, *Principia*
- Noether, Bourbaki, new math

5. Symbols and formulas

- symbols like numerals, π, $=$, Viete and algebra, ∞
- short history of zero
- Euler
- Ramanujan, Hardy

6. Numbers

- zero, π, negatives, rationals, irrationals, transcendentals, e
- continued fractions, approximability, Fibonacci numbers
- infinitesimals: calculus, Bishop Berkeley, Cauchy to the rescue
- ideals
- complex numbers

7. Space

- Descartes and analytic geometry
- the complex plane
- Poincare and the hyperbolic plane
- Klein and the Erlangen program

8. Genius

- social dimensions: professionalization, access, credit
- history of the genius ideal
- Galois, Ramanujan, Erdos, and cults of personality

9. Method and Practice

- conjecture: ζ and the Riemann hypothesis
- counterexample: Weierstrass and the birth of fractals
- episodes in quasi-empiricism

10. Purity

- Greek purity of curves and purity of methods
- the Prime Number Theorem: proofs take one and two
- nationalism, mathematical style, and Nazi theories of race

11. Provability

- axiom of choice and independence
- logic, decidability, and Godel's Theorems
- the Four Color Theorem and the role of computers