Concordia University
Department of Mathematics and Statistics

Winter semester, 2016
Math 495: Reading course in pure and applied mathematics:
Topics in the History of Mathematics
(Limited enrollment: with permission only)

Professor: J. Harnad
Day/Time: Tutorial sessions: Thurs. 3:00 p.m.-4:00: p.m.
Class Locale: Concordia Library Building , 1400 de Maisonneuve Blvd. West
Office locale: LB 901-25

The content will be drawn from the list of topics below. Weekly readings and exercises will be assigned and submitted as essays, calculations and presentations by students.
1. Mathematics in the ancient world: Mesopotamian, Greek, Egyptian, Indian, and Chinese mathematics before the 3rd century AD. Euclid's elements, Mesopotamian and Chinese proofs of Pythagoras' theorem, the Platonic solids; astronomy, planar geometry, Ptolemy's theorem and planetary system; prime numbers, Diophantine equations, Zeno's paradox.
2. From mediaeval Persia to the Renaissance: Mathematics in the Islamic world from the 8th century; the birth of algebra (Al Kharizmi to Omar Khayyam); from the Ptolemaic system to the planetary orbits of Copernicus, Galileo, Kepler.
3. The age of enlightenment. Coordinate charts and the algebraization of geometry (Descartes); the birth of infinitesimal calculus and the laws of motion (Newton, Leibnitz); differential equations and dynamics (Newton, Euler, Lagrange); the birth of probability theory (Bernoulli)**.**
4. The age of revolution; the birth of new ideas: Dynamics and differential equations (Euler, Lagrange, Hamiton, Jacobi, Cauchy, Weierstrass); birth of modern analysis; the notion of rigor (Weierstrass); complex analysis (Abel, Jacobi, Weierstrass, Riemann), non-Euclidean geometry (Gauss, Lobachevski, Riemann, Klein)**;** group theory (Abel, Galois, Lie, Frobenius, Burnside, Schur); number theory (Gauss, Dedekind, Hadamard, de la Vallée Poussin, Riemann).
5. Mathematical stories and adventures through time:
5.1. **Mathematical jousting matches:** Tartaglia, Ferrari, Cardano. (16th cent.)
5.2. Romantic genius, illness, revolution and dueling: Abel, Galois. (19th cent.)
5.4. The feminine mystique: Sophie Kovalevskaya. (19th cent.)
5.3. From an Indian village to Cambridge: Ramanujan. (Early 20th cent.)
6. Highlights from the end of the millennium: qualitative dynamics (Poincare); Hilbert spaces and operator theory; physics as geometry (Einstein), the meeting of algebra and topology; the foundations of mathematics and logic, and the limits to knowledge (Russell, Whitehead, Gödel); the meeting of complex analysis and topology: the GAGA principle; classifications of spaces and groups; categories, schemes and abstraction. Man made thinking machines (Von Neumann; randomness as a science (Wiener, Kolmogorov); games, strategies and entropy (Shannon, Von Neumann, Nash).

Required text: A History of Mathematics, Carl B. Boyer and Uta C. Merzbach (3rd ed., Wiley)

 Evaluation: Homework assignments: 30%. Essays: 30%. Presentation: 40%