

Mathematics 191, section 2

A Cross Cultural History of Mathematics

Prof. Robin Hartshorne and Visiting Chern Prof. David Mumford

Preliminary Syllabus

Wed Jan.20

Introduction: a) Each of our philosophies, b) timeline of cultures/dates, c) several teaser vignettes by each of us, e.g. on Pythagoras's theorem, formulas for pi

Mon Jan.25

Babylon I: background – accounting, scribal schools; sexagesimal place value numbers and their cuneiform representation; arithmetic with sexagesimals

Wed Jan.27

Babylon II: Geometric Algebra in Old Babylon: esp Pythagoras's theorem and completing the square

Mon Feb.1

Early India I: Vedic background and Sulbasutras: Pythagoras's (=Baudhayana's) theorem and geometrical algebra.

Wed Feb.3

Early India II: Other roots of mathematics in India: (a) Panini – variables and recursion through a grammar of Sanskrit and (b) Pingala – binary numbers and binomials through the study of prosody in Sanskrit verse.

Mon Feb.8

Early China I: background on China, start Nine Chapters: Arithmetic, Negative Numbers and Solving sets of linear equations by Gaussian elimination

Wed Feb.10

Early China II: Nine Chapters (cont): “Pythagoras's” Theorem and its proof via the Hypotenuse Diagram

Wed Feb.17

Euclid I: Book I, pure math: the identification of the parallel postulate, *reductio ad absurdum*, a second proof of “Pythagoras's” theorem

Mon Feb 22 (DM away)

Euclid II: Book II, 'geometric algebra' and comparisons with Babylon, India.

Wed Feb 24 (DM away)

Euclid III: Book V, the theory of proportion, real numbers, discussion of just what is a number in each culture, a third proof of Pythagoras's theorem.

Mon March 1 (RH away)

Euclid/Archimedes I: The method of exhaustion, the volume of a cone and a sphere (begins 4 lectures which are volume-of-sphere related)

Wed March 3 (RH away)

Archimedes II: The “Method” and another derivation for the volume of the sphere, Archimedes as applied mathematician and his love of numbers (Pell's equation and the cattle problem).

Mon March 8

China III: Liu Hui and Zu Geng on the volume of the sphere, “Cavalieri's” principle.

Wed March 10

India IV: Aryabhata and sines; discussion of Greek influence on Indian math; Bhaskaracharya on the volume of the sphere and numerical justifications.

Mon March 15

Islam I: Al Khwarizmi and algebra (begins a long string of algebra related lectures). Comparison of with the treatment of variables in other cultures.

Wed March 17

Islam II: Omar Khayyam and the cubic

SPRING BREAK

Mon March 29

China IV: Song dynasty algebra – work on the cubic and on systems of higher degree equations

Wed March 31

Europe I: Fibonacci introduces Islamic algebra into Europe, Oresme introduces the radical idea of graphing processes into European Math

Mon April 5

Europe II – the 15th century: Italian Renaissance polymath artists discover perspective: Brunelleschi, Alberti, Piero della Francesca

Wed April 7

Europe III – the 16th century: The crazy fight over the cubic equation: del Ferro, Cardano, Bombelli, the problem of negative and imaginary numbers

Mon April 12

Europe IV – the 16th century cont.: Algebra in Viete, trisection of the angle, Harriot struggles with imaginary numbers

Wed March 17

Europe V – the 17th century: Coordinate geometry in Descartes and Fermat, algebra in Wallis,

Mon April 19 (RH away)

India V: Calculus in the 14th century – Madhavan's power series for arctan, “Gregory's” formula for pi.

Wed April 21 (RH away)

India VI: The Kerala school continued –the integral of powers x^n , power series for sine

Mon April 26

Europe VI – the 17th century cont.: Calculus and infinitesimals as Cavalieri, Fermat, Gregory, Newton and Leibniz treated them, comparison with India and China, power series in Newton.

Wed April 28

Europe VII – the 18th century: Complex numbers tamed in Euler's hands, graphed by the surveyor Wessel and the beginning of modern mathematics.

Mon May 3, Wed May5

STUDENT REPORTS ON PAPERS