

Mathematics 3010: Syllabus

History of Mathematics

Text: Classics of Mathematics, Ronald Calinger, ed.; handouts

Instructor: Jim Carlson

Office hours: Thursdays, 1PM, JWB 301, and by appointment (see me after class, or call Annetta Cochran at 581-8307)

E-mail: carlson@math.utath.edu

Telephone: 581-7429 or 581-7870

Grading: two examinations (midterm (15%) and final (20%)), problem sets (25%), two papers (20% each).

Assignments: There will be weekly problem and reading assignments.

Due dates: The first paper is due on the date of the midterm exam (Tuesday, February 27). The second paper is due on the last day of class (April 26).

Notebook: Class notes ...

Papers: These should be between ten and fifteen pages long and must include a bibliography. The bibliography must include at least three sources which you find in the library, and which you use in your research for the paper. For the first paper I suggest that you write on the life, work, and influence of a particular mathematician. To get started on this project, look through the bibliographical sketches in Calinger. (For example, on page 131 you will find a biography of Archimedes). Note that the introductory essays in Calinger contain suggested further readings. (For example, on pages 105–108, there is an extended bibliography of Hellenistic mathematics). Please discuss with me early on the topic of your paper. You may choose a topic other than biography if you have a well-formulated project which interests you. Papers will be graded on content, clarity of exposition, and quality of English prose. Papers (and problem assignments generally) must be clearly legible.

Course outline and aims

The outline follows the major headings of Calinger's book and spans a 3500 year period, from about 1750 BC to 1750 AD. Each of the corresponding introductory essays in Calinger's book should be read in its entirety. A theme of the course is that historical study must include work with primary materials, or, failing that, copies and translations. Therefore we will study selected readings in each part of Calinger, e.g., Archimedes' *Sand Reckoner*, and his *On Measurement of a Circle*. Notes and materials will be distributed to supplement the main text, e.g., reproduced drawings of Babylonian clay tablets which we will decode and understand.

The aim of the course is to gain an understanding of how mathematical ideas have developed over time, how social, cultural, and historical factors influenced the development of mathematics, and, conversely, how mathematics contributed to society and human culture, leading eventually to a scientific view of nature. This view, fully achieved with the work of Newton as the result of

a three-millennium-long historical process, began early. We cite (and will study) the quantitative work of the Babylonian scribes and astronomers, the work of the philosopher-mathematicians Pythagoras and Democritus, and the words of ancient sages:

... thou hast arranged all things by measure and numbers and weight.
— *Wisdom of Solomon 11:20*

I. Mathematics in Egypt and Mesopotamia

Number systems, arithmetic, and geometry; nature of problems considered and methods developed; major achievements; recovery and influence of the tradition. Mathematical science: astronomy.

Weeks of January 8, 15, 22

II, III. Greek and Hellenistic Mathematics

Distinct character of Greek mathematics (geometry, logic, proof, axiomatic structure). Nature of problems considered, methods developed. Relation to philosophy (Plato, Aristotle). Proofs by contradiction, theory of incommensurables, method of exhaustion. Work of individual mathematicians: Hippocrates of Chios, Pythagoras, Eudoxus, Euclid, Archimedes, Apollonius, Ptolemy. The three classic problems (trisection of the angle, duplication of the cube, squaring the circle). Mathematical science: astronomy and some physics.

Weeks of Jan 29, Feb 5, 12, 19

IV. Hindu and Arabic contributions

Invention of negative numbers and zero, development of algebra, roots of equations, refinement of mathematical astronomy. Islamic art and geometry.

Weeks of Feb 26 (midterm exam Feb 27) and March 5 (one day).

IVb. Chinese and Mayan mathematics

Largely independent development of positional notation (Mayas); Chinese achievements in arithmetic, algebra, and geometry, examination of *the Nine Chapters on the Mathematical Art (Jiuzhang suanshu)*.

Week of March 5 (one day)

V. Europe in the Medieval, Renaissance, and Reformation periods

Leonardo of Pisa, Oresme, Cardano, Viète; Development of algebra, reconsideration of the infinite; Copernicus and the heliocentric theory.

Weeks of March 20, 27

VI. The Scientific Revolution at its Zenith (1620–1720)

Descartes, Fermat, Kepler, Galileo, Leibnitz, Newton; rise of the scientific view of the world, development of a new mathematical astronomy, development of calculus as the language of physics.

Weeks of April 3, April 10, 17, 24