

**SUNY Fredonia**  
**Department of Mathematical Sciences**  
**MATH 381 – History of Mathematics**

**Course Coordinator:** Dr. Julia Wilson [www.fredonia.edu/department/math/Wilson](http://www.fredonia.edu/department/math/Wilson)

**Catalog Description:**

**MATH 381 History of Mathematics**

**B**

Chronological study of the development of mathematics. Emphasis on the solution of selected mathematical problems associated with historical periods.

*Prerequisite: MATH 210.*

*3 hours credit*

**Rationale:**

This course is designed to give students an understanding of the evolution of mathematics through its motivating problems and historical solutions. Students will come to appreciate that mathematics is a human endeavor while honing problem solving skills on historically significant problems.

The department has the following learning goals for its graduates:

- A. The ability to organize data and information and synthesize problem solutions using appropriate mathematical tools;
- B. The ability to formulate conjectures, find counterexamples, and state and prove theorems carefully;
- C. The facility to learn mathematics outside of the classroom through self-study or group-study, including the ability to refresh knowledge encountered in previous coursework;
- D. The ability to communicate mathematics effectively both orally and in writing;
- E. The facility to use technology to aid in the above.

MATH 381 is designed to help students meet all of these goals but particularly A, B, C and the ability to use writing to communicate mathematics.

MATH 381 is a required course for majors in Mathematics/Middle Childhood Education and Mathematics/Adolescence Education. It is also an elective for other mathematics majors. Its role as a mathematics elective for general mathematics majors is justified by the fact that it is a course that focuses on solving mathematical problems, with the history providing a background for the significance of these problems. In particular, this will be of direct use to future teachers as they address the problem-solving standard of the National Council of Teachers of Mathematics (NCTM). Indeed, aspects of a number of these problems can be applied to create problem-solving opportunities for students at both the middle and high school levels. These problem-solving opportunities will

be pointed out whenever possible. Furthermore, this course will help future teachers address the connections and communication standards of the NCTM. For the former, the course's problem solving nature highlights the development of mathematical ideas to solve significant problems from other areas of mathematics and from other disciplines. It also provides an opportunity to see different areas of mathematics blend together in attempts to solve these historically significant problems. As to the communication standard, as in all mathematics courses, much emphasis is placed upon explaining mathematical ideas. Since many of the problems can be solved in different ways, students will need to be able to explain their ideas to someone who may be realizing a different solution.

This course is also consistent with the Conference Board of the Mathematical Sciences (CBMS) recommendations for middle and high school teacher preparation, which calls for a history of mathematics course to provide such teachers with an understanding of the background and historical development of many topics in the curriculum. Indeed, elementary topics such as number theory, algebra, and geometry will be approached from an advanced standpoint as the course presents the germination of ideas of talented mathematicians growing into our modern formulations. Students will have ample opportunity to see clever tricks evolve into our standard techniques.

The course's emphasis on problems also lends itself to the presentation of ideas in a thematic way. This will provide opportunities for students to see mathematical ideas evolve across various cultures rather than focusing on one particular culture. This evolution from concrete problems to abstract ideas is important not only to future teachers but also is consistent with the CUPM (the Mathematical Association of America's Committee on the Undergraduate Program in Mathematics) recommendation that all mathematics majors see the interconnections and broad themes in the subject. Specifically, the most recent curriculum recommendations from the CUPM (2004) stipulate that courses designed for mathematical sciences majors should ensure that students:

- Develop mathematical thinking and communication skills.
  - Progress from a procedural/computational understanding of mathematics to a broad understanding encompassing logical reasoning, generalization, abstraction, and formal proof;
  - Become skilled at conveying their mathematical knowledge in a variety of settings, both orally and in writing.
- Develop skill with a variety of technological tools.
  - All majors should have experiences with a variety of technological tools, such as computer algebra systems, visualization software, statistical packages, and computer programming languages.
- Provide a broad view of the mathematical sciences.
  - All majors should have significant experience working with ideas representing the breadth of the mathematical sciences. In particular, students should see a number of contrasting but complementary points of view: continuous and discrete; algebraic and geometric;

deterministic and stochastic; theoretical and applied.

Majors should understand that mathematics is an engaging field, rich in beauty, with powerful applications to other subjects, and contemporary open questions.

The CUPM makes several additional recommendations concerning programs of study to prepare future teachers. Courses for pre-service elementary and middle school teachers should help candidates develop:

- A deep understanding and mastery of the following mathematical topics through several grade levels above what they will be certified to teach: number and operations, algebra and functions, geometry and measurement, and data analysis, statistics, and probability;
- Mathematical common sense, including a broad range of examples and explanations, well-developed reasoning and communication skills, and facility in separating and reconnecting the component parts of concepts and methods;
- An understanding of and extensive experience with the uses of mathematics in a variety of areas;
- The knowledge, confidence, and motivation to pursue career-long professional mathematical growth.

In addition to the skills to be developed in K-8 teachers, the CUPM recommends that mathematical sciences majors preparing to teach secondary mathematics:

- Learn to make appropriate connections between the advanced mathematics they are learning and the secondary mathematics they will be teaching;
- Fulfill their requirements for a mathematics major by including topics from abstract algebra, analysis, geometry, probability and statistics (with an emphasis on data analysis), discrete mathematics, and number theory;
- Experience many forms of mathematical modeling and a variety of technological tools, including graphing calculators and geometry software;
- Learn about the history of mathematics and its applications, including recent work.

MATH 381 is consistent with all of these goals. Most importantly, however, by providing coherence to the development of mathematical ideas, MATH 381 can be a valuable course to any mathematics major.

**Textbook:** *A History of Mathematics, Brief Edition*, by Victor J. Katz, Pearson Addison Wesley, 2003.

**Objectives:** This course is designed to enable students to:

- Transfer intuitions in mathematics from thought to paper;

- Solve problems of historical significance and appreciate their role in the development of mathematics;
- See the interaction between various branches of mathematics and the historical relationship between mathematics and other disciplines;
- Develop an overall perspective of their mathematical experiences in both grade school and in their college math classes;
- Communicate mathematical ideas in a precise, effective manner;
- Recognize that history is not an exact science and that even in mathematics, interpretations are open to debate;
- Gain insight into the ideas of renowned mathematicians;
- See that certain mathematical ideas transcend cultures and that other ideas are culture-bound;
- See that even elementary mathematical ideas were not always elementary and appreciate the effort that went into their evolution;
- Use technology where appropriate and be cognizant of the issue of reliability of both textbook and web accounts of historical topics;
- Work cooperatively and learn to teach each other and teach themselves.

**Instructional Methods and Activities:** Lecture/Discussion

Refer to individual instructor syllabus for additional details.

**Evaluation and Grade Assignment:** Typically will involve homework and quizzes/exams.

Refer to individual instructor syllabus for additional details.

**Grading Scale:**

Refer to individual instructor syllabus.

**Bibliography:**

1. W.S. Anglin, *Mathematics, a Concise History and Philosophy*, Springer, 1996.
2. Carl B. Boyer (revised by Uta C. Merzbach), *A History of Mathematics*, Wiley, 1989.
3. Phillip J. Davis, Reuben Hersh, and Elena Anne Marchisotto, *The Mathematical Experience*, study edition, Birkhauser, 1995.
4. William Dunham, *Journey Through Genius: The Great Theorems of Mathematics*, Wiley, 1990.
5. William Dunham, *The Mathematical Universe: An Alphabetical Journey through the Great Proofs, Problems, and Personalities*, Wiley, 1994

6. Howard Eves, *An Introduction to the History of Mathematics*, 6th edition, Saunders, 1992.
7. Howard Eves, *Great Moments in Mathematics (before 1650)*, Mathematical Association of America, 1980.
8. Howard Eves, *Great Moments in Mathematics (after 1650)*, Mathematical Association of America, 1983.
9. John Fauvel and Jeremy Gray, ed., *The History of Mathematics: A Reader*, MacMillan Education, 1987.
10. Victor J. Katz, *A History of Mathematics: An Introduction*, 2nd edition, Addison Wesley, 1998.
11. Morris Kline, *Mathematical Thought from Ancient to Modern Times*, Oxford University Press, 1972.
12. Frank J. Swetz, editor, *From Five Fingers to Infinity: A Journey Through the History of Mathematics*, Open Court, 1994.
13. Ivor Grattan-Guinness, *The Norton History of the Mathematical Sciences*, Norton, 1998.
14. <http://www-gap.dcs.st-and.ac.uk/~history/> (Mactutor History of Mathematics Archive)

**Topics:** The topics covered in the course vary from year to year but the following gives an indication of the possibilities:

Arithmetic and number theory:

- Representation of numbers and number bases
- Algorithms for computation
- Mechanical aids for computation
- Classification of numbers – prime, figurate, pythagorean triples, etc.

Geometry:

- Earth measure
- Axioms and postulates
- Quadrature problems
- Geometric algebra
- Analytic geometry

Algebra:

- Development of symbolism
- Ratio and proportion

- Solution of equations
- Series and continued fractions
- Determinants
- Logarithms

Trigonometry:

- Chords
- Relation to astronomy - spherical trigonometry
- Evolution to periodic functions

Calculus:

- Greek influence
- Calculus before calculus
- Newton and Leibniz
- Utilization of calculus in the eighteenth century
- Evolution toward analysis

**Policies:**

Refer to individual instructor syllabus.