

BOROUGH OF MANHATTAN COMMUNITY COLLEGE

City University of New York

Department of Mathematics

History of Mathematics

MAT 505

Semester

Credits 3

Class hours 3

Instructor Information

Course Description

Mathematics, like other subjects, is an intellectual product of culture, society, and creative people. This course will discuss the characteristics of the Western mathematics, Islamic, Indian, and the Chinese ones. The development of algebra in the Medieval and the Renaissance, and the formation of the differential and integral calculus will also be discussed. The general trends of mathematics in the eighteenth and nineteenth centuries, and the first half of the twentieth century will be outlined. It will also explore how culture-centered different mathematics merged into a universal modern one.

Prerequisites/Co-requisites

Students must have taken (or been exempt from) MAT 206, MAT301, MAT302.

Student Learning Outcomes

- Students will learn characteristics of Babylonian mathematics.
- Students will learn characteristics of Egyptian mathematics.
- Students will learn characteristics of Greek mathematics.
- Students will learn characteristics of Chinese mathematics.
- Students will learn characteristics of Indian mathematics.
- Students will learn characteristics of Muslim mathematics.
- Students will learn the development of algebra in the Middle Ages and the Renaissance.
- Students will have a general view of the formation of the calculus.
- Students will understand the general trends of mathematics in the 18th and 19th centuries.
- Students will be able to comprehend how traditional Chinese mathematics merges with modern Western mathematics.

Required Text & Readings

No textbook is required. Hand-outs will be provided in class. PDF files may be downloadable from Blackboard. Web links on the history of mathematics may also be on Blackboard.

Evaluation & Requirements of Students

Students are required to write FOUR 5-page short essays (double space) or ONE 15-page research paper (also double space).

Arriving late or leaving early will be treated as lateness on the attendance roster. During class time 1) all cell phones MUST be powered off or set into vibration mode; 2) headphones, walkman, CD players, PSP, and iPod, are NOT allowed in the classroom; 3) all children or non-enrolled persons are not permitted to attend class.

The final grade will be defined in the following manner:

Attendance 10%

Class Participations 20%

Essays or Paper 70%

Index of the Grade Definitions:

93 – 100 % A

90 – 92 % A-

87 – 89 % B+
83 – 86 % B
80 – 82 % B-
77 – 79 % C+
73 – 76 % C
70 – 72 % C-
67 – 69 % D+
63 – 66 % D
60 – 62 % D
Below 60 % F

Outline of Topics

Traditional Chinese Mathematics

Historiography of Chinese Mathematics in English

A brief outline of Chinese Mathematics

Ten Classics of Mathematical Texts

Read: Jean-Claude Martzloff, *A History of Chinese Mathematics* (New York: Springer, 1997), chapters 1 and 2.

Chinese numeration system

Jiuzhang Suanshu (Nine Chapters)

Chinese Remainder Theorem

Siyuan Yujian (Jade Mirror of the Four Unknowns)

Solving a numeral equations with four unknowns

Hand-out taken from *Fleeting Footsteps: Tracing the Conception of Arithmetic and Algebra in Ancient China*, by

Lam Lay Yong and Ang Tian Se (revised edition,

World Scientific, 2004), and the *Jade Mirror of the Four Unknowns*, translated by Chen Zaixin (Liaoning Education Press, 2006)

Read: A review of the book by Lam Lay Yong and Ang Tian Se at

<http://www.maa.org/reviews/FleetingFootsteps.html>.

Babylonian Mathematics

Cuneiform notation

Sexagesimal (base 60) system

Four basic operations,

Babylonian reciprocal table 4

Read: Otto Neugebauer, *The Exact Sciences in Antiquity* (Penguin paperback edition), the chapter on Babylonian mathematics

Website: The MacTutor History of Mathematics Archive: <http://www-groups.dcs.st-and.ac.uk/~history/> Ancient Babylonian Mathematics

Elementary geometry

The Pythagorean Theorem, Plimpton 322 tablet

Square roots, quadratic equations

Egyptian Mathematics

Numerals

Multiplication and division

Unit fractions

Read: Otto Neugebauer, *The Exact Sciences in Antiquity* (Penguin paperback edition), the chapter on Egyptian mathematics

Richard J. Gillings, *Mathematics in the Time of the Pharaohs*

Website: The MacTutor History of Mathematics Archive: <http://www-groups.dcs.st-and.ac.uk/~history/> Ancient Egyptian Mathematics

Geometry (calculating volume of truncated pyramid, surface area of semisphere)

Greek Mathematics

Pythagoras and his School

Discovery of Irrational Numbers

Euclid's *Elements*

Mathematical Education in Ancient Greece

Read: Otto Neugebauer, *The Exact Sciences in Antiquity* (Penguin paperback edition), the chapter on Egyptian mathematics

Euclid's *Elements* (Heath's English edition)

Website: The MacTutor History of Mathematics Archive: <http://www-groups.dcs.st-and.ac.uk/~history/> Ancient Greek Mathematics

Squaring the circle

Doubling the cube

Trisecting an angle

Proof of *Elements*, Book I, proposition 47

Archimedes and the Palimpsest

Read: Shirely B. Gray, "A Centennial Celebration of Two Great Scholars" in *Notices of the AMS* **55**, no. 7, pp. 776-783.

See the websites: <http://archimedespalimpsest.org>

<http://www.cs.drexel.edu/~crrres/Archimedes/contents.html>.

Visiting the Archive of David Eugene Smith at Columbia University

Mathematical Methods in Hellenistic Times

Early trigonometry

Ptolemy and the *Almagest*

Diophantus and Greek algebra, Pappus and analysis

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 10.

Ancient and Medieval India

The Hindu-Arabic place-value system and arithmetic

Read: *Fleeting Footsteps: Tracing the Conception of Arithmetic and Algebra in Ancient China*, by Lam Lay Yong and Ang Tian Se, revised edition, World Scientific, 2004.

Ancient and Medieval India (continued)

Geometry

Equations and indeterminate analysis

Combinatorics, trigonometry

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 12.

The Mathematics of Islam

Decimal arithmetic

Algebra: quadratic equations, powers of the unknown,

Arithmetic triangle, cubic equations

Read: Edward S. Kennedy, "The Arabic Heritage in the Exact Science," *Al-Abhath* 23 (1970): 327-344. Reprinted in the *Studies in the Islamic Exact Sciences*, Beirut: American University of Beirut Press, 1983.

The Mathematics of Islam (continued)

Combinatorics 6

Geometry: parallel postulate, trigonometry

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 13.

Mathematics in Medieval Europe

Translations from Arabic into Latin in the 12th and 13th centuries

Summary of early mathematics in Western Europe

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 14.

Algebra in the Renaissance

The Italian abacists, algebra in France, Germany, England, and Portugal

The solution of the cubic equation

Early development of symbolic algebra: Viète and Stevin

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 15.

Geometry, Algebra, and Probability in the Seventeenth Century

The theory of equations

Analytic geometry: coordinates, equations of curves

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 17.

Geometry, Algebra, and Probability in the Seventeenth Century (continued)

Elementary probability

Number theory

Projective geometry

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 17.

The Beginnings of the Calculus

Tangents

Extrema

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 18.

The Beginnings of the Calculus (continued)

Areas and volumes

Power series

Rectification of curves

The fundamental theorem of calculus

Read: Carl B. Boyer, *A History of Mathematics*, revised 2nd edition by Uta C. Merzbach, Chapter 18.

Isaac Newton

Read: V. Frederick Rickey. Isaac Newton: Man, Myth, and Mathematics. *The College Mathematics Journal* **18**, no. 5(Nov. 1987): 362-389.

Gottfried Leibniz

Read: J. E. Hofmann, *Leibniz in Paris 1672-1676. His Growth to Mathematical Maturity*. Cambridge University Press, 1974.

Priority Disputes

Read: Alfred Rupert Hall, *Philosophers at War: The Quarrel between Newton and Leibniz*, Cambridge University Press, paperback, 2002.

Mathematics in the Eighteenth Century

Read: Dirk J. Struik, *A Concise History of Mathematics*, 4th Dover edition, chapter VII.

Mathematics in the Nineteenth Century

Read: Dirk J. Struik, *A Concise History of Mathematics*, 4th Dover edition, chapter VIII.

Mathematics in the First Half of the Twentieth Century

Merge of Chinese Mathematics into Modern Western Mathematics

Read: Dirk J. Struik, *A Concise History of Mathematics*, 4th Dover edition, chapter IX.

Jean-Claude Martzloff, *A History of Chinese Mathematics* (New York: Springer, 1997), chapter 10, section, “contact with Europe”.

Joseph W. Dauben, Internationalizing Mathematics East and West: Individuals and Institutions in the Emergence of a Modern Mathematical Community in China. In: Karen Parshall and Adrian Rice, eds., *Mathematics Unbound: The Evolution of an International Mathematical Research Community, 1800-1945*. American Mathematical Society and London Mathematical Society, 2002, pp. 253-285.

College Attendance Policy

At BMCC, the maximum number of absences is limited to one more hour than the number of hours a class meets in one week. For example, you may be enrolled in a three-hour class. In that class, you would be allowed 4 hours of absence (not 4 days). In the case of excessive absences, the instructor has the option to lower the grade or assign an F or WU grade.

Academic Adjustments for Students with Disabilities

Students with disabilities who require reasonable accommodations or academic adjustments for this course must contact the Office of Services for Students with Disabilities. BMCC is committed to providing equal access to all programs and curricula to all students.

BMCC Policy on Plagiarism and Academic Integrity Statement

Plagiarism is the presentation of someone else’s ideas, words or artistic, scientific, or technical work as one’s own creation. Using the idea or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations, require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism.

Students who are unsure how and when to provide documentation are advised to consult with their instructors. The library has guides designed to help students to appropriately identify a cited work. The full policy can be found on BMCC’s web site, www.bmcc.cuny.edu. For further information on integrity and behavior, please consult the college bulletin (also available online).