

History of Mathematics: Math 4007 - 44692

1 Contact Information

Professor:	Dr. Blake Farman
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Office:	Walker 3-34
Office Hours:	Monday: 8:00 AM - 10:00 AM 12:15 PM - 12:30 PM 1:45 PM - 4:00 PM Wednesday: 8:00 AM - 11:00 AM 12:15 PM - 12:30 PM 1:45 PM - 4:00 PM.

1.1 Preferred Method of Communication

The best way to communicate with me during the semester is through email. I monitor my email during regular business hours and try to respond within one business day.

1.1.1 Official University Email Addresses

The University provides each student with an email address, username@warhawks.ulm.edu, and all official course correspondence will **only** be conducted using official university email addresses.

2 Course Description

Selected topics on the development of mathematics as a human endeavor; numeration systems; growth of algebra, trigonometry, geometry, and the calculus; contributions from various cultures; selected biographies of mathematicians.

3 Course Topics

This course will cover the history of

- Mathematics before Euclid,
- Euclid's *Elements*,
- non-Euclidean Geometry,
- Algebraic Structure,
- Formal Axiomatics,
- The Real Number System,
- Sets,
- Logic and (Mathematical) Philosophy.

4 Course Objectives and Outcomes

This course traces the development of mathematics from the pre-Hellenic period to the twentieth century, marking the gradual transition from empiricism to material axiomatics to the modern axiomatic treatment and those who made contributions. Broadly speaking, the goal of this course is to widen students' perspective and understanding of mathematical structures by viewing their development through the lens of history. In particular, by the end of the course, students will be able to

- Understand the nature of mathematics in the pre-Hellenic period,
- Understand the importance of Euclid's *Elements* in the development of a (material) axiomatic development of geometry,
- Understand the importance of the parallel postulate in shaping mathematical thought,
- Understand the parallels between the historical development of geometry and the relatively recent development of algebraic structures,
- Describe the modern axiomatic method,
- Understand the notions of equivalence, consistency, independence, completeness, and categoricity of postulate sets,
- Understand the basic ideas behind the construction of the integers, rational numbers, real numbers, and complex numbers from the natural numbers,
- Understand the significance of the constructions above in the context of Newton's and Leibniz's calculus,
- Understand the role of set theory in unifying seemingly disparate branches of mathematics,
- Understand how logic forms the foundations of mathematics and its shortcomings.

5 Course Prerequisites

In order to be eligible to be enrolled in Math 4007 you must have a grade of C or better in MATH 3040 (or equivalent).

6 Instructional Methods

This course is offered as a face-to-face course.

- Learning will be facilitated through face-to-face meetings and the textbook.
- All written assessments are to be submitted in class.

6.1 Temporary Remote Instruction (TRI)

During the semester, class and/or campus operations might be disrupted by an occurrence such as a tornado, fire, or illness outbreak that temporarily prevents in-person instruction. Until in-person instruction is possible, the class may enter a phase of temporary remote instruction (TRI). During this phase, instruction will take place via virtual means, either synchronously or asynchronously. Your instructor will alert you when this happens via e-mail and will include a description of how the course will proceed.

6.2 Technical Requirements During TRI

During a period of temporary remote instruction, the need for the course to continue in a virtual manner means that you will be required to have appropriate equipment, software, and telecommunication access to allow you to participate. This course will require that you have the following, should we have to go into TRI:

- A stable internet connection that is capable of joining Zoom meetings and taking assessments.
- A web camera (internal or external) and a microphone that can be used for Zoom meetings.
- A device such as a scanner or a smartphone equipped with a scanning app such as Adobe Scan to upload assessments on Moodle.

7 Evaluation

For the course total, the final grade will be determined as follows:

A:	At least 90%
B:	At least 80% and less than 90%
C:	At least 70% and less than 80%
D:	At least 60% and less than 70%
F:	Less than 60%

7.1 Weights

Grades will be calculated with the following weights:

Participation:	40%
Presentations:	60%

7.2 Presentations

For each of the three major periods we cover, students must select a mathematician to study further and present. Students should include the area(s) of research in which this mathematician worked, major results contributed by this mathematician, and how these results influenced the mathematician's discipline and the mathematics community as a whole.

8 Class Policies and Procedures

At a minimum, all policies stated in the current ULM student policy manual & organizational handbook should be followed (see <http://www.ulm.edu/studentpolicy/>). Additional class policies include:

8.1 Textbook

The required text for this course is *Foundations and Fundamental Concepts of Mathematics*, Third Edition by Howard Eves, ISBN 0-486-69609-X.

8.2 Statement on COVID-19 Protocols (all classes)

Since the beginning of the COVID-19 pandemic, ULM has followed the guidance of the CDC and the ULS System regarding what measures to put in place at various stages of the outbreak. This situation is unchanged in the coming semester, as the CDC guidance on the need for social distancing, mask wearing, and vaccinations will be followed as the outbreak continues to evolve. Therefore, please continue to monitor university e-mails and websites (<https://www.ulm.edu/coronavirus/>) for any new updates on the pandemic.

8.3 Attendance Policy

Students are expected to adhere to the Class Attendance Policy outlined in the ULM Student Policy Manual.

- Class attendance is regarded as an obligation and a privilege, and all students are expected to attend all required classes in which they are enrolled regularly and punctually. Failure to do so may jeopardize a student's scholastic standing and may lead to suspension from the University. **Students are responsible for the effect absences have on all forms of evaluating course performance.**
- In accordance with University policy, the instructor will take roll regularly. It is the student's responsibility to ensure that his/her attendance is recorded. To be marked present for a given class period, students must stay until the class is completed.
- Each student is responsible for all class material and assignments whether or not the student is present. If a student misses class, then he/she is expected to check Moodle and ULM email for announcements and to work on the assignments listed on Moodle.
- A student accumulating absences of 25% of the class meetings regardless of the reasons (excused or unexcused) will be reported to the Dean of Arts, Education, & Sciences which could result in academic withdrawal from the course or a course grade of F. This may be avoided if the course is dropped; however, it is the responsibility of the student to drop the course. Class removal carries with it the penalties of being assigned a grade of W or F, whichever is appropriate, and no credit for the course. Academic withdrawal may negatively impact a student's full-time status.
- If a student comes to class late, it is his/her responsibility to let the instructor know after class to be counted present and to receive the appropriate attendance credit.
- University Excuses: Any University-related activity requiring an absence from class will count as an absence when determining if a student has met the minimum attendance requirement.

8.4 Make-up Policy

In the event of a missed exam due to absence, the Final Exam can be used to replace the missing exam.

8.5 Academic Integrity

Faculty and students must observe the ULM published policy on Academic Dishonesty (see the ULM Student Policy Manual – <http://www.ulm.edu/studentpolicy/>).

Any student caught turning in work that is not their own will be reported to the School of Sciences. If the student is found to be responsible for such a violation, then a formal report will be made to the Office of Student Services and the student will receive **a grade of F for the course.**

8.6 Course Evaluation Policy

At a minimum, students are expected to complete the online course evaluation.

9 Student Services

You can find information about the following available ULM student services at the websites listed below.

- Student Success Center (<http://www.ulm.edu/cass/>).
- Counseling Center (<http://www.ulm.edu/counselingcenter/>).
- Special Needs (<http://www.ulm.edu/counselingcenter/special.htm>).
- Library (<http://www.ulm.edu/library/referencedesk.html>)
- Computing Center Help Desk (<http://www.ulm.edu/computingcenter/helpdesk>)

Additional information can be found on The Student Services web site (<http://www.ulm.edu/studentaffairs/>).

9.1 Disability Accommodations

The University of Louisiana at Monroe strives to serve students with special needs through compliance with Sections 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act. These laws mandate that postsecondary institutions provide equal access to programs and services for students with disabilities without creating changes to the essential elements of the curriculum. While students with special needs are expected to meet our institution's academic standards, they are given the opportunity to fulfill learner outcomes in alternative ways. Examples of accommodations may include, but are not limited to, testing accommodations (oral testing, extended time for exams), interpreters, relocation of inaccessible classrooms, permission to audiotape lectures, note-taking assistance, and course substitutions.

Current policies on serving students with disabilities can be obtained from the ULM website: <http://ulm.edu/counselingcenter/>. If you need accommodation because of a known or suspected disability, you should contact the director for disabled student services at:

- Voice phone: (318) 342 - 5220
- Fax: (318) 342 - 5228
- Walk In: ULM Counseling Center, 1140 University Avenue (this building and room are handicapped accessible).

If you have special needs of which I need to be made aware, you should contact me within the first two days of class.

9.2 Mental Wellness

If you are having any emotional, behavioral, or social problems, and would like to talk with a caring, concerned professional please call one of the following numbers:

- The ULM Counseling Center (318) 342 - 5220
- The Marriage and Family Therapy Clinic (318) 342 - 9797
- The Community Counseling Center (318) 342 - 1263.

9.3 Title IX

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds, including federal loans and grants. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct, sexual violence, sexual harassment and retaliation. If you encounter unlawful sexual harassment or gender-based discrimination, please contact Student Services at (318) 342 - 5230 or to file a complaint, visit www.ulm.edu/titleix.

Remember that all services are offered free to students, and all are strictly confidential.

9.4 Emergency Procedures

The emergency number for the ULM Police Department is (318) 342 - 5350 and should be used for emergency calls. If the campus police are contacted about an emergency for a student, they will go to the student's class to inform the student.

9.5 Discipline / Course Specific Policies

Any policies given here may be altered by the professor if deemed necessary. If this occurs, ample notice will be given.

9.6 FERPA

Do not email or call your professor regarding your course grades. The Family Education Rights and Privacy Act (FERPA) prohibits your professor from discussing your grade in any manner except in person. Please do not have family members, friends, or anyone else contact your professor about your grade as FERPA prohibits your professor from sharing that information with them.

10 Tentative Course Schedule

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1:45 PM - 4:00 PM.

Note: The instructor reserves the right to adjust the schedule as needed.

Week 1: August 18

Organizational Meeting

Week 2 - August 23, 25

- 1.1 The Empirical Nature of pre-Hellenic Mathematics
- 1.2 Induction Versus Deduction
- 1.3 Early Greek Mathematics and the Induction of Deductive Procedures

Week 3 August 30, September 1

- 1.4 Material Axiomatics
- 1.5 The Origin of the Axiomatic Method
- 2.1 The Importance and Formal Nature of Euclid's *Elements*

Week 4: September 6, 8

- 2.2 Aristotle and Proclus on the Axiomatic Method
- 2.3 Euclid's Definitions, Axioms, and Postulates
- 2.4 Some Logical Shortcomings of Euclid's *Elements*

Week 5: September 13, 15

- 2.5 The End of the Greek Period and the Transition to Modern Times
- 3.1 Euclid's Fifth Postulate
- 3.2 Saccheri and the *Reductio ad Absurdum* Method

Week 6: September 20, 22

- 3.3 The Work of Lambert and Legendre
- 3.4 The Discovery of Non-Euclidean Geometry
- 3.5 The Consistence and the Significance of Non-Euclidean Geometry

Week 7: September 27, 29

- 4.1 The Work of Pasch, Peano, and Pieri
- 4.2 Hilbert's *Grundlagen der Geometrie*
- 4.3 Poincaré's Model and the Consistency of Lobachevskian Geometry

Week 8: October 4, 6

- 4.4 Analytic Geometry
- 4.5 Projective Geometry and the Principle of Duality
- 5.1 Emergence of Algebraic Structure

Week 9: October 11, 13

- 5.2 The Liberation of Algebra
- 5.3 Groups
- 5.4 The significance of Groups in Algebra and Geometry

Week 10: October 18, 20

- 5.5 Relations
- 6.1 Statement of the Modern Axiomatic Method
- 6.2 A Simple Example of a Branch of Pure Mathematics

Week 11: October 27

- 6.3 Properties of Postulate Sets – Equivalence and Consistency
- 6.4 Properties of Postulate Sets – Independence, Completeness, and Categoricalness
- 6.5 Miscellaneous Comments

Week 12: November 1, 3

- 7.1 Significance of the Real Number Systems for the Foundations of Analysis
- 7.2 The Postulational Approach to the Real Number System
- 7.3 The Natural Numbers and the Principle of Mathematical Induction

Week 13: November 8, 10

- 7.4 The Integers and the Rational Numbers
- 7.5 The Real Numbers and the Complex Numbers
- 8.1 Sets and Their Basic Relations and Operations

Week 14: November 15, 17

- 8.2 Boolean Algebra
- 8.3 Sets and the Foundations of Mathematics
- 8.4 Infinite Sets and Transfinite Numbers

Week 15 : November 22

- 8.5 Sets and the Fundamental Concepts of Mathematics
- 9.1 Symbolic Logic
- 9.2 The Calculus of Propositions

Week 16 : November 29

- 9.3 Other Logics
- 9.4 Crises in the Foundations of Mathematics
- 9.5 Philosophies of Mathematics

Finals Week: TBA