Foundations of Mathematics: MATH 2040 - 65041

1 Contact Information

Professor:	Dr. Blake Farman
Phone Number:	(318) 342 - 1851
Email Address:	farman@ulm.edu
Website:	https://ulm.edu/~farman
Office:	Walker 3-34
Office Hours:	Monday/Wednesday: 8:00 AM - 11:00 AM 12:15 PM - 12:30 PM 1:45 PM - 3:30 PM

1.1 Preferred Method of Communication

The best way to communicate with me during the semester is through email. I monitor my email Monday - Friday from 9:00 AM until 5:00 PM. I normally try to respond within one business day.

1.2 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

Introduction to logic and proofs, set theory, functions and structures relating to algebra and analysis.

3 Course Objectives and Outcomes

The primary goal of this course is to gain familiarity with the axiomatic structure of formal mathematics. Students will learn to read and write mathematical proofs, with a particular emphasis on communicating mathematical ideas clearly and concisely.

4 Course Topics

- Mathematics and Logic
- Set Theory
- Induction
- The Real Numbers
- Relations and Partitions
- Functions
- Cardinality

5 Course Prerequisites

You must have one of the following prerequisites to be eligible to be enrolled in Math 2040: A grade of C or better in MATH 1031.

6 Instructional Methods

This course is offered as a face-to-face course and will utilize a pedagogical technique called Inquiry-Based Learning (IBL). Unlike many of your other courses, this will **not be a lecture based course.** The bulk of class time will center around you, the students, developing the material for yourselves rather than me presenting it to you.

I will act primarily as the facilitator, providing guidance and mentorship throughout the learning process. My role will be to encourage classroom discussion, answer clarifying questions that may arise, and to guide you along the path to becoming an independent student of mathematics. As students, you will be expected to assume the role of mathematicians, meaning you will be tasked with solving problems that will require you to probe new concepts through experimentation and conjecture.

This process will force you to construct much of this new material on your own, which can be frustrating. Throughout the semester, it is **EXPECTED** that you **will get stuck**, you **will be confused**, and you **will experience failure**. This is often referred to as *productive struggle* and is a **completely normal** part of the learning process that will lead to **understanding** at a deeper level than can be achieved through observing lectures.

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 will 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:

Exams:	40%
Homework:	20%
Presentations:	20%
Final Exam:	20%

7.2 Exams

There will be two in-class exams and a cumulative final exam. The exams are tentatively scheduled as follows:

Exam 1:	March 1, 2023.
Exam 2:	April 19, 2023.
Final Exam:	Thursday, December 2, 2021, 3:00 PM - 4:50 PM.

7.3 Homework

7.3.1 Daily Assignments

Problems will be assigned during each course meeting and will be collected at the end of the next class meeting. The homework sets are arguably the most important component for learning the material in this course, so you are expected to complete as much of the homework as you are capable of accomplishing on your own **before class begins**. Time will be devoted in class to student presentations and discussion of selected homework problems, during which time you may revise your work **in a different color than you used before class.**

7.3.2 Formal Writeup

An important aspect of mathematics is to communicate mathematical ideas coherently and succinctly. As such, one of the goals of this course is to improve your proof writing skills and to familiarize you with the LaTeX typesetting program used by mathematicians. To achieve this goal, you will be expected to typeset a subset of the homework problems assigned each week. You must provide complete solutions that are written in complete sentences with appropriate use of symbols, with the goal of regularly producing solutions that could appear in a textbook.

7.3.3 Homework Scoring

Problems will be scored based on the following rubric.

3 Points:	The given solution is correct with no content related errors. Appropriate justification is provided in a clear, easy to follow manner.
2 Points:	The given solution demonstrates an understanding of the material, but contains content related errors or lacks justification.
1 Point:	The given solution is difficult to follow or uses inappropriate techniques.
0 Points:	The given solution was blank or illegible.

7.4 Participation

Each class will involve student presentation of assigned homework problems. The goal of each presentation is to ensure that each member of the class thoroughly understands the solution to the given problem. This means it is your duty as the presenter to clearly explain your thought process while you work through the solution and answer questions from other students to the best of your ability.

While it is not necessarily expected that you, the presenter, will always have a full solution, it is expected that you will have made a good faith attempt at solving the problem in advance. If you lack a full solution to a problem you are presenting, then you should have an explanation of the techniques you have attempted to use and why those techniques have not resulted in a solution. It will be your responsibility to present this information to your peers and to facilitate a discussion that leads to progress on the problem.

7.4.1 Presentation Scoring

Presentations will be scored based on the following rubric

3 Points: The presentation was at the appropriate level for the class.

- Explanation is provided for each part of the solution presented in a clear, easy to follow manner.
- Any audience questions/concerns were addressed in a respectful manner to the best of the presenter's ability.
- In the event that parts of the problem were not solved by the presenter, fruitful class discussion resulted from the presentation and progress was made on the problem.

2 Points: The presentation was not at the appropriate level for the class. Some or all of the above criteria were not met.

1 Point: The presenter was unprepared and/or did not make a good faith effort at a solution before class, but attempted to facilitate a discussion about the problem.

0 Points: The presenter was absent.

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

An Introduction to Proof via Inquiry-Based Learning by Dana C. Ernst, ISBN 978-1-4704-6333-5.

You may obtain a free PDF copy of this book here. If you prefer a print copy, you may order one from the American Mathematical Society here.

8.2 Cooperation

Students will have the opportunity to collaborate during regular class meetings. **However, outside of class meetings and office hours, students are asked not to collaborate with any other person and not to consult any materials other than the assigned textbook – this includes using the internet, other textbooks, notes from other classes, etc.**

It is vitally important that you have time to engage with and digest the material on your own, with no assistance. Whenever you get stuck, you should prepare for the next class meeting by writing down specific questions to ask your classmates that will help you move forward. This process will help you learn how to evaluate your own understanding, to become an independent learner, and to more effectively collaborate with other mathematicians.

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 - 3:30 PM

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

Week 1

Day	Date	Material Covered
Wed	1/11	A Taste of Number Theory

Week 2

Day	Date	Material Covered
Mon	1/16	*No Class (MLK Day)*
Wed	1/18	Introduction to Logic

Week 3

Day	Date	Material Covered
Mon	1/23	Techniques for Proving Conditional Propositions
Wed	1/25	Quantification

Week 4

Day	Date	Material Covered
Mon	1/30	Sets
Wed	2/1	Russell's Paradox and Power Sets

Week 5

Day	Date	Material Covered
Mon	2/6	Indexing Setes
Wed	2/8	Cartesian Products of Sets

Week 6

Day	Date	Material Covered
Mon	2/13	Induction
Wed	2/15	Complete Induction and Well-Ordering

Week 7

Day	Date	Material Covered
Mon	2/20	*No Classes (Mardi Gras Break)*
Wed	2/22	Axioms of the Real Numbers

Week 8

Day	Date	Material Covered
Mon	2/27	Standard Topology of the Real Line
Wed	3/1	Exam 1

Week 9

Day	Date	Material Covered
Mon	3/6	Famous Theorems
Wed	3/9	Relations

Week 10

Day	Date	Material Covered
Mon	3/13	Equivalence Relations and Partitions
Wed	3/15	Modular Arithmetic

Week 11

Day	Date	Material Covered
Mon	3/20	Introduction to Functions
Wed	3/22	Injective and Surjective Functions

Week 12

Day	Date	Material Covered
Mon	3/27	Compositions and Inverse Functions
Wed	3/29	Images and Preimages of Functions

Week 13

Day	Date	Material Covered
Mon	4/3	Continuous Real Functions
Wed	4/5	Introduction to Cardinality

Week 14

Day	Date	Material Covered
Mon	4/10	*No Classes (Spring Break)*
Wed	4/12	*No Classes (Spring Break)*

Week 15

Day	Date	Material Covered
Mon	4/17	Finite Sets
Wed	4/19	Exam 2

Week 16

Day	Date	Material Covered
Mon	4/24	Infinite Sets
Wed	4/26	Countable Sets

Week 17

Day	Date	Material Covered
Mon	5/1	Uncountable Sets
Wed	5/3	*No Classes (Student Study Day)*

Finals Week

Date	Assessment	Material Covered
Tue, May 9, 2023, 8:00 AM - 9:50 AM	Final Exam	Cumulative