

## Math 2055 A Fundamentals of Mathematics Syllabus Fall 2023

### Course Overview:

#### **MATH 2055. Fundamentals of Mathematics.** 3 Credits

Emphasizing proofs, fundamental mathematical concepts and techniques are investigated within the context of number theory and other topics. Prerequisite: MATH 1234 or MATH 1242. Credit not given for more than one of MATH 2055 and CS 1640. Catamount Core: MA, QR.

The course is designed to give a firm foundation in sophisticated Mathematics through the idea of **proofs**. This is accomplished by introducing the standard mathematical structures and investigating them thoroughly. The transition from computational mathematics to theoretical mathematics can be a difficult one. This class should help bridge that gap.

Topics will be presented with a level of depth and rigor appropriate for students pursuing degrees in technical fields such as mathematics, statistics, engineering, or the physical sciences. Topics covered: Language of Logic and Proof, Techniques of Proof, Induction, Sets, Functions, An Introduction to Number Theory, Equivalence Relations and Partitions, Cardinality

### Learning Outcomes:

At the end of this course, you will be ready to take and do well in the more theoretical math courses such as Linear Algebra, Geometry, Abstract Algebra, and Real Analysis.

Students will be able to...

1. Write sound logical proofs on various topics with correct terminology, notation, and grammar.
2. Think like a mathematician: analyze how they arrive at conclusions, distinguishing definitions from theorems.
3. Follow different types of proofs in math and be able to identify the proof techniques being used.
4. Apply fundamental concepts of Number Theory to other areas of math such as Abstract Algebra.

### Materials:

Textbook Tamara J. Lakins, The Tools of Mathematical Reasoning, American Mathematical Society, Providence, RI, 2016. ISBN: 978-1-4704-2899-0 LCC: QA300 .L26 2016

Topics covered:

Language, Logic and Proof

Techniques of Proof

Induction

Sets

Functions

An Introduction to Number Theory

Equivalence Relations and Partitions

Cardinality

**Notetaking:** My Course Notes are available as a pdf on Blackboard in the Course Materials folder. The course is based almost entirely on these Notes. They cover 95% of what I present in class. You can use these notes instead of copying everything I write on the board so that you can listen and absorb the material better during class. The # 1 thing you can do to succeed in this class is to read the Course Notes outside of class, preferably before the class where the material is presented.

**Class time:** The class meets from 2:20pm to 3:10 pm MWF in Innovation E204. Please refrain from using cell phones during class.

**Attendance:** Attendance is required. In accordance with University Policy, I allow students to miss classes due to religious observances, varsity sporting matches or any other activities stated in the UVM attendance policy. You must email me ahead of time telling me that you will be absent. If you will be absent, plan to ask a peer about what was covered in class. In borderline final letter grade situations, your attendance and participation may help your grade.

**Instructor Information:**

Name: Dr. Dan Hathaway

Email : [Daniel.Hathaway@uvm.edu](mailto:Daniel.Hathaway@uvm.edu) \*Include Math 2055 A in the subject line

Office: Innovation Bldg, Room 311

**Office Hours:**

MWF 10:50 am to 11:50 AM in Innovation Bldg, Room 311

Please feel free to email me to set up an appointment at another time if you have class during these office hours. Students are always welcome to ask me questions before or after class or send me an email for a fast response.

**Brightspace:**

Brightspace will be used for Announcements, grades, and the final exam.

**Homework:**

**Practically all of the problems on the homework will be proofs or will have proofs as essential parts of their solutions.**

Weekly homework assignments will be posted on Wednesdays on Blackboard and due the following Wednesday in class on paper at the beginning of class. For each assignment that you type in Latex, you will receive 5 bonus points on that assignment. You will not get bonus points for any other software such as Microsoft Word. Four questions at random will be graded on each homework assignment. Each homework will count the same amount and **the two lowest grades will be dropped.**

Use the 2 dropped homework assignments wisely to cover any absences for university events, illness, family emergencies, funerals, and workload issues. You must put your name on your homework and staple it to receive full credit.

You are encouraged to work with other classmates on your homework, but the write-up you turn in must be your own. Your objective on homework should be to write a clear, concise exposition of each solution. This means all work that is required to arrive at an answer should be included and all proofs must be written explanations in complete, grammatical sentences with correct mathematical terminology and notation. Simplify as much as possible. Academic honesty demands that you indicate clearly that you have referred to people, books, or sources of any kind. Responsible work habits and consideration for the grader dictate that late homework cannot be accepted.

**Midterm Exams:** There will be 2 midterm exams. The dates of the midterms are **Wednesday, Sept 27 and Friday, Nov 3 in our usual classroom.** You may bring one 3 inch by 5 inch note card filled front and back to the first midterm exam and two 3 inch by 5 inch note cards filled front and back to the second midterm exam. Each test is **cumulative** from the beginning of the course. No books, calculators or electronic devices. No make-up exams.

**Final Exam:** There will be a **cumulative** final exam given at the end of the semester. The final exam will be held **Thursday, Dec 14 at 1:30 PM (until 4:15) in our usual classroom.** You may bring three 3 inch by 5 inch note cards filled front and back to the final exam. No books, calculators or electronic devices. No make-up exams.

**On ALL exams and labs, you MUST show all your work, justify your answers and simplify as much as possible to get full credit. If you do not answer a True/False question on an exam, you will not get credit for it.**

### **Computation of grade:**

Homework: 35%

Midterm1: 21%

Midterm2: 22%

Final Exam: 22%

### **Point Values for Final Grades:**

A+	97–100%
A	93–96%
A-	90–92%
B+	87–89%
B	83–86%
B-	80–82%
C+	77–79%
C	73–76%
C-	70–72%
D+	67–69%
D	63–66%
D-	60–62%
F	< 60%

### **Technical support for students:**

Students should contact the Helpline (802-656-2604) for support with technical issues.

**Math 2055**

	<b>Course Schedule Detail</b>	<b>Fall 2023</b>	Note: Subject to Change
Week #	Monday	Weds	Friday
1	Start Chapter 1 Language and Logic	Continue Chapter 1 Language and Logic	Chapter 2 Proofs and 3 Basic Properties of Integers
2	No School	Start Ch 4 More Direct Proofs	Worksheet and almost finish Ch 4 More Direct Proofs
3	Finish Ch 4 More Direct Proofs and almost finish Ch 5 Indirect Proofs	Finish Ch 5 Indirect Proofs, Ch 6 Two Important Theorems, Ch 7 Proofs With Mixed Quantifiers	Worksheet and start Ch 8 Induction
4	Finish Ch 8 Induction and start 9 Strong Induction	Finish 9, start 10 Set Theory	Worksheet
5	Review for Midterm	Midterm #1	Worksheet
6	More Ch10 Set Theory	Finish Ch 10 Set Theory, start Ch 11 Operations on Sets	Worksheet
7	Finish CH 11 Operations on Sets; most of Ch 12 Arbitrary Unions and Intersections	Worksheet , Finish 12 Arbitrary Unions and Intersections Start 13 Intro to Functions	No School
8	Finish 13 Intro to Functions, almost Ch 14 Function Composition	Finish 14 Function Composition, almost finish 15 One-to-one and Onto Functions	Worksheet, finish 15 One-to-one and Onto Functions, Ch 16 The Two Kinds of Functions
9	Half of Ch 17 Invertible Functions	Finish Ch 17 Invertible Functions, start Ch 18 Functions and Sets	Worksheet, more Ch 18 Functions and Sets
10	Finish 18 Functions and Sets, Completed 19 The Division Algorithm and Well-Ordering Principle, Start 20 Greatest Common Divisors and the Euclidian Algorithm	Review for Midterm #2	Midterm #2
11	Finish 20, Start 21 Relatively Prime Integers and the Fund Theorem of Arith	Worksheet, more Ch 21	Finish Ch 21
12	Half of Chapter 22 Congruences	Go over exam, More Congruences	Worksheet; Finish Congruences, Started Ch 23
	No School	No School	No School
13	Finish Ch 23, Started Ch 25 Equivalence <b>Relations</b>	Finish Ch 25 Equivalence Relations, complete Ch 26 Partitions, start Ch27 Intro to Cardinality	Finish Ch 27; Chapter 28 Finite Sets
14	Chapter 29 Infinite Sets	Jeopardy!	Review for Final Exam

## The following are General Policies from UVM and CEMS:

### Additional Information on Attendance and Illness:

If a student will not be able to attend in-person classes for qualifying health reasons, Student Health Services (SHS) will send a notification to the appropriate student services office or designated staff member informing them of this along with the dates the student is unable to attend. The SHS notification will specify whether the request for flexibility is only around in-person class attendance or includes additional flexibility for assignments and tests because the student is too ill to participate. Students are responsible for working with their faculty to make up class content and work they miss due to a documented illness.

### Inclusion Statement:

Our intention is for CEMS to be a place where you will be treated with respect and kindness. We welcome individuals of all ages, backgrounds, beliefs, interests, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of the College are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the community. If you ever feel that you have been unfairly treated or judged by an instructor, a mentor, another student, or another member of the CEMS community, please let someone know. Your instructors and advisors in the [CEMS Office of Student Services](#) are available to discuss any concerns or you can report an incident of bias through the [Campus Bias Response Program](#).

### UVM Land Acknowledgement:

The campus of the University of Vermont sits within a place of gathering and exchange, shaped by water and stewarded by ongoing generations of Indigenous peoples, in particular the Western Abenaki.

Acknowledging the relations between water, land, and people is in harmony with the mission of the university. Acknowledging the serious and significant impacts of our histories on Indigenous peoples and their homelands is a part of the university's ongoing work of teaching, research, and engagement and an essential reminder of our past and our interconnected futures for the many of us gathered on this land.

UVM respects the Indigenous knowledge interwoven in this place and commits to uplifting the Indigenous peoples and cultures present on this land and within our community.

### Lived Name and Pronoun Information:

The UVM Directory includes fields for indicating your lived name and your pronouns. Lived names (preferred names, names in use) are names that an individual wants to be known by in the University community. Entering your pronouns is strongly encouraged to help create a more inclusive and respectful campus community. To update your information, login to the UVM Directory. A preview box will allow you to see how this information will appear in other systems used on campus such as Microsoft Teams and Brightspace.

More information about how to make changes to your lived name and pronouns is available in the [Knowledge Base](#).

To read more about official UVM policies, events, and initiatives regarding diversity, equity, and inclusion: <https://www.uvm.edu/diversity>

### Research and Citation Help:

For help selecting research topics, finding information, citing sources, and more, ask a librarian. The UVM Libraries are eager to help. You may ask questions by phone, e-mail, chat, or text, or make an appointment for an individual consultation with a librarian.

Howe Library: <https://library.uvm.edu/askhowe>

Dana Medical Library: <https://dana.uvm.edu/help/ask>

Silver Special Collections Library: <https://specialcollections.uvm.edu/help/ask>

### Career Readiness Skills:

Questions on how to incorporate coursework on your resume? Please visit the [Career Readiness Program's Resume & Cover Letter page](#).

### Course Evaluations:

All students are expected to complete a mid-term evaluation and final evaluation of each course they are enrolled in. The evaluations will be anonymous and confidential, and the information gained, including constructive criticisms, will be used to improve the course.

Students can access Blue course evaluation via Brightspace institutional homepage or by visiting <https://blue.uvm.edu/uvm>. You can also link to the UVM Knowledge Base page with [student instructions on how to access Blue course evaluations](#).

### Intellectual Property Statement/Prohibition on Sharing Academic Materials:

Students are prohibited from publicly sharing or selling academic materials that they did not author (for example: class syllabus, outlines or class presentations authored by the professor, practice questions, text from the textbook or other copyrighted class materials, etc.); and students are prohibited from sharing assessments (for example homework or a take-home examination). Violations will be handled under UVM's Intellectual Property policy and Code of Academic Integrity. Please note that 'sharing assessments' also includes course materials that students share on study sites such as Chegg and Course Hero.

### Tips for Success:

Course-specific study/preparation tips

*Here are a few resources for students on remote/online learning:*

- Checklist for success [in https://learn.uvm.edu/about/support-for-students/checklist-online-credit-courses/](https://learn.uvm.edu/about/support-for-students/checklist-online-credit-courses/)
- Academic support for online courses: <https://www.uvm.edu/academicsuccess/online-learning-student-resources-remote-instruction>
- 30-minute webinar on online learning success (Mar 2020): [https://www.youtube.com/watch?v=Xp\\_MYsqQyvE](https://www.youtube.com/watch?v=Xp_MYsqQyvE)

Helpful resources other than the professor (e.g., [Undergraduate/Graduate Writing Center](#), [Supplemental Instruction](#), [Learning Co-op tutors](#), supplemental course materials)

### Student Learning Accommodations:

In keeping with University policy, any student with a documented disability interested in utilizing ADA accommodations should contact Student Accessibility Services (SAS), the office of Disability Services on campus for students. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly recommended to discuss with their

faculty the accommodations they plan to use in each course. Faculty who receive Letters of Accommodation with Disability Related Flexible accommodations will need to fill out the Disability Related Flexibility Agreement. Any questions from faculty or students on the agreement should be directed to the SAS specialist who is indicated on the letter.

**Contact SAS:**

A170 Living/Learning Center;  
802-656-7753  
[access@uvm.edu](mailto:access@uvm.edu)  
[www.uvm.edu/access](http://www.uvm.edu/access)

**Academic Integrity:**

The policy addresses plagiarism, fabrication, collusion, and cheating.

<https://www.uvm.edu/policies/student/acadintegrity.pdf>

The Center for Student Conduct has created several modules to help students learn about UVM's Academic Integrity Policy, definitions, and process. The modules include brief readings, videos, quizzes to check knowledge, links to resources, survey on students' beliefs about cheating, discussion board topics and an honor pledge. We encourage you to check out these resources and incorporate some of them into your courses. To preview the modules, self-enroll in the Blackboard Organization (CSC 001: Academic Integrity Faculty Resources). [Click here for directions for self-enrolling](#) or reach out to Deanna Garrett-Ostermiller ([dgarett@uvm.edu](mailto:dgarett@uvm.edu)) to request a zip file and instructions for importing into your Blackboard course. Information on the Academic Integrity Process for faculty can be found in the CEMS TEACH MS Team / Resources channel or by request. Contact Courtney Giles ([cdgiles@uvm.edu](mailto:cdgiles@uvm.edu)) or Priyantha Wijesinghe ([pwijesin@uvm.edu](mailto:pwijesin@uvm.edu)).

**Code of Student Conduct:**

[UVM's Code of Student Conduct](#) outlines conduct expectations as well as students' rights and responsibilities.

**FERPA Rights Disclosure:**

The purpose of UVM's [FERPA Rights Disclosure](#) is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974.

**Final Exam Policy:**

The University [final exam policy](#) outlines expectations during final exams and explains timing and process of examination period.

**Grade Appeals:**

If you would like to contest a grade, please follow the procedures [outlined in this policy](#).

**Grading:**

[This link](#) offers information on grading and GPA calculation.

**Religious Holidays:**

Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time. The complete policy is [here](#).

### **Promoting Health & Safety:**

The University of Vermont's number one priority is to support a healthy and safe community:

[Center for Health and Wellbeing](#)

[Counseling & Psychiatry Services \(CAPS\)](#) Direct Phone Line: (802) 656-3340

**C.A.R.E.** If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380). If you would like to remain anonymous, you can report your concerns online by [visiting the C.A.R.E. Team website](#).

**Food Insecurity:** The UVM Center for Health & Wellbeing provides several on- and off-campus resources for students struggling with food insecurity: <https://www.uvm.edu/health/food-insecurity-uvm>

### **General statement regarding potential changes during the semester:**

<http://catalogue.uvm.edu/>

The University of Vermont reserves the right to make changes in the course offerings, mode of delivery, degree requirements, charges, regulations, and procedures contained herein as educational, financial, and health, safety, and welfare considerations require, or as necessary to be compliant with governmental, accreditation, or public health directives.

### **Statement on Alcohol and Cannabis in the Academic Environment:**

As a faculty member, I want you to get the most you can out of this course. You play a crucial role in your education and in your readiness to learn and fully engage with the course material. It is important to note that alcohol and cannabis have no place in an academic environment. They can seriously impair your ability to learn and retain information not only in the moment you may be using, but up to 48 hours or more afterwards. In addition, alcohol and cannabis can:

Cause issues with attention, memory and concentration

Negatively impact the quality of how information is processed and ultimately stored

Affect sleep patterns, which interferes with long-term memory formation

It is my expectation that you will do everything you can to optimize your learning and to fully participate in this course.