PROFESSOR	Dr. Rebekah B. Johnson Yates, Mathematics Department

OFFICE: Library 131   EMAIL: rebekah.yates@houghton.edu

OFFICE HOURS: To be announced after student survey

If you need to make an appointment to see me outside of office hours, please send me an email suggesting several times that will work for you.

LOCATION/TIME

Mondays, Wednesdays, and Fridays 2:30–3:35 PM in Library 140.

MATERIALS AND COMMUNICATION

We will use a variety of open source and freely available materials as our texts with our main text being *Understanding Linear Algebra*, by David Austin. You can find it here for free: `http://merganser.math.gvsu.edu/david/linear.algebra/ula/ula/ula.html`.

You will need a calculator that can manipulate matrices. All assignments and other course materials beyond the textbook will be posted on our class website `https://facultysites.houghton.edu/rebekahyates/LinearAlgebra.htm`. Annoncements will be posted there and/or communicated by email, so you should check your Houghton email at least once a day during the semester. If you miss class, it is your responsibility to determine what you have missed by checking the website and asking another student in the class.

DESCRIPTION

From the catalog: "Systems of linear equations, matrices, vector spaces, linear transformations, inner product spaces, determinants, eigenvectors, and eigenvalues. Fulfills General Education Abstract and Quantitative Reasoning requirement. Liberal Arts. Prerequisite: MATH 181 (or MATH 170/171)." 4 credit hours; required for a math major.

COURSE GOALS

In this course, students will

1. Learn the basic linear algebra topics: the theory of linear equations, matrix algebra, determinants, vector spaces, linear transformations, orthogonality, eigenvalues and eigenvectors.

2. Understand some applications of linear algebra.

3. Begin to learn to write and read proofs.

DAILY WORK

Each class day (almost), you will have three parts of an assignment. These will be posted on the course webpage.

I. Reading and reflection. Due at the beginning of class.

    (a) Read and respond: actively read the assigned material, making your own notes and working through parts that seem unclear to you. Write your clear responses to the reading questions.

    (b) Ask questions: Write down your own questions from the reading, including questions about new or old concepts that are confusing to you, connections to other ideas, examples you thought of, misconceptions that were clarified, etc.

    (c) Quantify: record how much time you spent on part I.

II. Exercises: these introductory/warmup/review exercises will be either on WeBWoRK or written problems (one type per class day). You should work individually and then consult with me and other class members outside of class time. You will present some of the written type to the class.

III. Problems: assigned after we've discussed the relevant material in class; due on Wednesdays (problems assigned the previous week: Monday, Wednesday, Friday). Work on these on your own and then consult with me and your classmates as needed. After your consultations, write up your final solutions completely by yourself in your own words without comparing them with other people's solutions and include a note crediting any collaborators with each problem on which you collaborated. Note: while you are welcome to use textbooks as resources (but not to copy solutions from them), looking at solutions on the internet or using AI to solve your problems is not an acceptable method to complete a homework or exam problem. Your solutions must be clear and neat (this is an important part of communicating your results to others). You may receive extra credit by typing the assignments using LaTeX.

CLASS TIME
& ATTENDANCE

The best way to learn mathematics is to do mathematics. To this end, class time will be very interactive; you need to be prepared to discuss the material each day. Come prepared to be engaged in your learning by listening, asking and answering questions, and staying on task during group activities. You will regularly present to the class solutions to problems from exercises and group work. These presentations will account for a substantial portion of your grade as well.

Please let me know (in writing or in person) if and why you will be missing a class. Since class time involves your active participation, missing class will adversely affect your grade.

TECHNOLOGY IN
THE CLASSROOM

With the possible exception of a few instances, we will be practicing an electronic-device-free classroom in order to engage deeply with the material and each other. Please turn off your cell phones and stow them in your bag upon entering the classroom and leave them there for the duration of the class. Even better (according to research, not just me!), don't bring them into the classroom at all.

QUIZZES

Linear algebra involves many new terms; in order to use these terms properly, you must know their precise definitions. To encourage you to learn these definitions, most class days will begin with a short vocabulary quiz. Occasionally, the quizzes may ask you to give an example, state a result (theorem, proposition, lemma, corollary), or do a quick calculation instead of giving a definition.

CELEBRATIONS OF
LEARNING

There will be two in-class celebrations of learning during the semester. The dates for these are on the tentative schedule in this syllabus; any changes will be announced at least two class days in advance. The cumulative final celebration of learning will consist of an in-class portion on **Friday, May 3, 1:30 PM–3:30 PM** and a take-home portion.

GRADING

As a general guideline, Part I will be worth around 10% of your grade, WeBWoRK 7.5%, presentations 10%, Part III 20%, quizzes 10%, celebration of learning 1 10%, celebration of learning 2 10%, in-class work/participation 7.5%, and the final celebration of learning 15%. I reserve the right to change the percentage distribution as the class progresses. I also recognize that this may be the first time you have encountered mathematics at this level of abstraction, so you will have opportunities to revise Part III problems and Celebrations of Learning.

ACADEMIC
INFORMATION

Academic Honesty: Honesty is the foundation on which all intellectual endeavors rest. To use the ideas of others without acknowledging the authors of those ideas belies the nature and purpose of academic life. At Houghton, where we strive to live out Christian calling and commitment, personal integrity, including academic honesty, should be the hallmark of all our work and relationships. Students are expected to exhibit extreme care relative to personal honesty in all academic work, including in-class and out-of-class learning experiences, such as exams, quizzes, journals, papers and research projects. Please refer to the catalog for the details of this policy.

Guidance and Probation: Houghton guidelines can be found in the Houghton catalog.

ACCOMMODATIONS

If you have an academic or physical disability that requires special accommodations or modifications, it is up to you to self-report any such disability to the office of Academic Support and Accessibility Services in the Center for Student Success located on the first floor of the Chamberlain Center and reachable by phone at 585–567–9622. With appropriate documentation, you will be afforded the necessary accommodations and/or modifications. For more information about Academic Support and Accessibility Services, go to `https://www.houghton.edu/undergraduate/student-life/student-success/academic-support-and-accessibility/`. Please let me know how I can assist you as well.

TϵA TIME

Every Monday at 4 PM, the math faculty and any students who want to come will gather in the ϵ Neighborhood outside the faculty offices for hot beverages, goodies, a fun math problem, and conversation (both mathematical and non-mathematical). Please join us! Note: Tϵa Time is not intended for homework help.

TIME
COMMITMENT

In accordance with the guidelines of 2–3 hours of work for each credit hour for a course, the well-prepared student should spend approximately 8–12 hours of work per week beyond the time spent in class. If you find that you are spending significantly more time than this, please let me know so that I can help you be more efficient or adjust the workload. If you are spending less time than this, you may not be investing enough time to learn well.

A typical week will include the following:

- class (65 minutes $\times$ 3 classes = 195 minutes)

- reading (approx. 30 pages $\times$ 7 min/page [technical reading] = 210 minutes)

- working on exercises and problems (5 hours/week = 300 minutes)

- going over notes and studying for quizzes (3 classes $\times$ 15 min/class = 45 minutes)

- discussing problems and office hours (1 hour = 60 minutes)

TOTAL: 810 minutes or 13 hours 30 minutes per week (3 hours and 15 minutes of class and 10 hours and 15 minutes outside of class) $\times$ 15 weeks = 12150 minutes or 202 hours and 30 minutes for the semester.

DEPARTMENT
GOALS
& HOUGHTON
ESSENTIAL
LEARNING
OUTCOMES

Course Goals 1 and 3 support the Mathematics Department Content Knowledge goal. Course Goals 2 and 3 support the Mathematics Department Effective Thinking and Communication; Independence, Collaboration, and Persistence; and Liberal Arts goals. This course fulfills the General Education Abstract and Quantitative Reasoning core course requirement and contributes to students' progress on Houghton's Essential Learning Outcomes 2: Practice scholarship informed by a Christian view of the world with integrity and respect for all; 4: Demonstrate intellectual and practical skills including critical reasoning, effective and creative communication, and quantitative thinking through application to progressively more challenging problems and projects; and 6: Practice ethical decision-making, creative problem-solving, and teamwork for service and leadership in the home, workplace, church, and community.

Tentative Schedule

This schedule is subject to modification throughout the semester.

Week 1	Systems of Linear Equations and Matrices
Week 2	Systems of Linear Equations and Matrices
Week 3	Systems of Linear Equations and Matrices
Week 4	Euclidean Space
Week 5	Euclidean Space, Celebration of Learning 1
Week 6	Vector Spaces
Week 7	Vector Spaces
Week 8	Vector Spaces
Week 9	Inner Product Spaces
Week 10	Linear Transformations, Celebration of Learning 2
Week 11	Linear Transformations
Week 12	Linear Transformations
Week 13	Determinants
Week 14	Eigenvalues and Eigenvectors
Week 15	Eigenvalues and Eigenvectors, Applications
May 3	**Final Celebration of Learning: Friday, May 3, 1:30 PM–3:30 PM**