

PROFESSOR	<b>Dr. Rebekah Yates</b> OFFICE: Library 131 EMAIL: <a href="mailto:rebekah.yates@houghton.edu">rebekah.yates@houghton.edu</a> OFFICE HOURS: to be determined and announced
LOCATION AND TIME	To be determined based on all our schedules: watch your email.
MATERIALS	Research notebook, computer
DESCRIPTION	From the catalog: "This course is intended to introduce students to the experience of mathematics research. Each student will be part of a team working with a faculty member on an open problem. This course may be repeated multiple times for credit. Prerequisite Courses: MATH 210." 1 credit
COURSE OUTCOMES	To understand how mathematical skills are used in problem solving situations. To communicate research findings orally and in writing.
DEPARTMENTAL OUTCOMES	This course addresses the following Houghton College Math Department Learning Outcomes for mathematics majors. <ul style="list-style-type: none"> <li>• Effective Thinking and Communication: Students will develop effective mathematical thinking and communication skills.</li> <li>• Persistence: Students will experience open-ended inquiry and demonstrate persistence in solving problems.</li> <li>• Independent Work: Students will develop the ability to solve a variety of mathematical problems independently.</li> <li>• Collaborative Effort: Students will develop the ability to collaborate with others in solving mathematical problems.</li> <li>• Content Knowledge: Students will demonstrate understanding of core content in calculus, linear algebra, abstract algebra, and real analysis.</li> </ul>
INSTITUTIONAL OUTCOMES	Though not explicitly assessed in this course, learning in this course addresses the following Houghton College Essential Learning Outcomes: Christian faith, critical thinking, logical & quantitative reasoning, and ethical reasoning.
COURSE REQUIREMENTS	The following must be completed for success in this course: <ul style="list-style-type: none"> <li>• Meet at least weekly with your research team.</li> <li>• Keep a research notebook as a record of your work. Each student is expected to do a minimum of three hours of work a week, including your team meeting(s).</li> <li>• Each team will give mid-semester and final presentations. All mathematics faculty are invited to these presentations, and others may be as well.</li> <li>• Each team will prepare a technical report on their work at the end of the semester.</li> </ul>
RESEARCH NOTEBOOK	Each student will keep a research notebook, consisting of two parts: a log and a journal. This research notebook may take the form of a spiral bound notebook, a loose-leaf notebook or an organized folder.  <b>Log:</b> The first few pages of the notebook will be set aside for you to log the days and times spent working on the research project. Each entry should include the date, start time and end time, the amount worked, and a brief note on what you worked on. It is also helpful if you draw a horizontal line between weeks. <i>The main purpose of the log is as a tool for you to track the time you have spent and quickly see what you have been working on, not for the instructors to check up on the your work habits.</i>

**Journal:** The journal portion of the notebook will be the student's primary workspace for the research problem. For later reference, it will be helpful to date your work and summarize what you are doing. (It can be even better to leave a note for yourself on what you want to try next.) You should plan to have your journal with you whenever you plan to work on your problem and at research meetings. If you do any work outside the journal (for example, on scratch paper or on a chalkboard), then you should transfer that work into the journal as soon as possible so as to keep all your work in one place. None of your work on the project, no matter how bad it seems to be, should be destroyed; *all* of the work should remain in the journal. Instructors will look at the journals from time to time but will not read journals in their entirety.

Mathematics research is not a linear process, and as such, the journal is not expected to be naturally well-organized. However, you should devise some way of making note of especially important results or insights so that they can be more easily located when needed.

#### PRESENTATIONS

Each team will be required to give two presentations of their work, one midway through the semester to share progress with the math faculty and another at the final meeting to which other students and faculty will be invited.

The mid-semester presentation should be about 15–20 minutes in length and is intended to highlight the process the team has followed to date and any progress on the problem. As such, it is more informal. The final presentation should be 20–30 minutes and should summarize your team's work as a formal report and include possible extensions. You are required to use slides for the final presentation, although you may also use the board to supplement your slides. Both presentations should review the statement of the problem and appropriate definitions and should allow opportunity for questions from the listeners. Every member of the team should be involved in each presentation. We will choose mutually agreeable dates for these presentations.

#### TECHNICAL REPORT

Each team will prepare a technical report of your progress and results on your problem. The report should include the motivation for the problem, a precise statement of the problem (including relevant definitions), any historical background or known results, all the results you found including examples, and possible extensions of your work. Sources must be cited. This comprehensive technical report should be typed and is due on **Tuesday, December 16 by 9 PM**. A draft is due to the faculty leader of your project a week earlier for comment.

#### EVALUATION

As long as all course requirements are met satisfactorily, you will earn at least a B. Strong participation in team meetings, individual effort as seen in the journal, polished presentations and well-written technical reports will earn you an A. We will alert you if you are not performing satisfactorily (at least B level) so that you can make changes.

#### ATTENDANCE

Please let your professor know (in writing or in person) if and why you will be missing a team meeting. If missing a meeting is unavoidable and the meeting cannot be rescheduled, you will need to provide a report of your work over the last week to the team by email or other communication established by your team to continue the team's progress.

#### ACADEMIC INTEGRITY

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. Houghton's full Academic Integrity Policy, including procedures for addressing violations, can be found in the Academic Catalog: <https://www.houghton.edu/undergraduate/majors/academics/catalog/>. Any work or writing you turn in should be your own, and you are responsible for ensuring that you do not copy anyone else's work or writing (this includes not copying things from the internet or using generative AI). See III. Problems for further information about completing assignments.

#### ACCOMMODATIONS

If you have an academic or physical disability that requires accommodations please contact the Academic Support and Accessibility Services in the Center for Student Success located on the first floor of the Chamberlain Center (585-567-9622). With appropriate documentation, you will be afforded the necessary accommodations. For more information about Academic Support and Accessibility Services go to <https://www.houghton.edu/undergraduate/student-life/student-success/>.

*Approximate* SCHEDULE

Week 1	First meeting
Next several weeks	Weekly meetings with research teams
mid-October	Mid-semester presentations
Next several weeks	Weekly meetings with research teams
Tuesday, December 16	Technical report due
Thursday (likely) of finals week	Final presentation