

Instructor: Dr. Chris Lee clee@roanoke.edu Trexler 270D

Office Hours: Have a question? Please stop by my office to chat. Regular office hours are:

Tue: 2:50-4:00pm and Wed: 1:10-2:40pm.

I welcome you to contact me to make an appointment outside of these hours.

Intended Learning Outcomes: This course is designed to have students summarize and extend the mathematical knowledge obtained at Roanoke College. Given a problem of interest with mathematical content, students will identify the mathematical options available, and be able to explain the mathematics used in non-technical terms. Students should also be able to articulate what modern mathematics is, how it relates to classical mathematics, what roles theoretical and applied mathematics play, and how technology is utilized.

By the end of this course, successful students will be able to understand and appreciate the interplay between applied mathematics and theoretical mathematics, state important results from the required classes in the mathematics major, form connections between the required classes in the mathematics major, and explain mathematics and mathematical concepts both orally and in writing, state important results from the required classes in the mathematics major, form connections between the required classes in the mathematics major, explain mathematics and mathematical concepts both orally and in writing.

Attendance: Come to class and be prepared to actively participate - this is the best way for you to engage in the learning material and it makes our class meeting so much more fun! You should attend every class, but extenuating circumstances can arise that can make this difficult. If you cannot attend a class, please let me know. If circumstances cause you to miss more than 3 classes during the semester, you may be overextended and should consider dropping the class.

Late & Missed Work: Unfortunately, illnesses, death in the family, or other traumatic events are part of life. Such events are unwelcome and because I understand how difficult these times are, if you contact me within 24 hours of the event and provide documentation, I will be happy to extend deadlines and/or provide make-up work.

Academic Integrity: Students are expected to follow the integrity policy detailed in the handbook *Academic Integrity at Roanoke College*. Additionally, if you are ever uncertain as to how the College's policy pertains to any assignment or exam in this course, please ask me for clarification. The bottom line is that all work that a student submits for a grade must be **solely** the work of that student unless the instructor has given explicit permission for students to work together.

Expected Hours of Work: To be successful in this course it is anticipated that you will put in at least 12 hours of work inside and outside of class each week.

Grading Components

Course Grades: The following table lists the weights for the various forms of assessment for this class.

| | |
|---------------------------------|-----|
| Math Major Content Presentation | 10% |
| Why Math Major? Presentation | 10% |
| General Presentation | 10% |
| Research Summary Paper | 10% |
| Background Presentation | 10% |
| Final Presentation | 25% |
| Final Paper | 25% |

A grade scale will be determined after final averages are computed but will be no lower than the scale given below.

| | | | | | | | | | | | |
|---|----|----|----|----|----|----|----|----|----|----|----|
| 0 | 60 | 63 | 67 | 70 | 73 | 77 | 80 | 83 | 87 | 90 | 93 |
| F | D- | D | D+ | C- | C | C+ | B- | B | B+ | A- | A |

Class Format: Details on specific elements of this class are below, the focus on this class will be exploring the mathematics major and learning to link applied mathematics and theoretical mathematics. Since this is a seminar, the course will feel quite different from those you have taken in the mathematics major so far. The first part of this course will involve a trip through the mathematics major as you will present to each other the main ideas and thoughts from each of the classes involved in the mathematics major and Roanoke College while the remainder will focus on developing your oral and written communication in mathematics.

Components of the Course

Major Review: The first part of this class will involve giving a presentation to the class regarding one piece of our review of the mathematics major at Roanoke College; in teams of two, you will review your chosen topic and present to the class the main concepts and ideas from that topic. Note that you should focus on the “big ideas” from the topics and the relationship of your topic to other courses in the major. For example, when talking about Linear Algebra, it is less important to spend time on *how* to row-reduce matrices rather than *why* you would row-reduce matrices and what that can tell you about a system of equations. This presentation will be graded partly by audience feedback and partly by the instructor and possible guests. You should target a length of about 30-40 minutes.

Note that this is excellent preparation for the Inquisition which is an oral review of the mathematics major, done individually, in front of the mathematics faculty in April. The primary goal of the Inquisition is for the faculty to assess the mathematics program as a whole; participation in the Inquisition is required and failure to participate will result in a course grade of F.

Why Major in Math? The second presentation for this class will be a short video (about 3–5 minutes) on why one should choose to major in mathematics. You may talk to each other to get ideas, but you will create these individually. The target audience for this presentation is Roanoke College freshmen or prospective students and it will again be graded by the instructor and audience feedback. The top two will be sent to PR for use on the department website.

General Presentation: One of the major goals of Math Seminar is to further develop your oral presentation skills related to mathematics. The third presentation of this class will be a presentation on any topic you wish; a good starting place to find a topic will be the Martin Gardner archive of problems and solutions, which will be provided, if needed. This will be done again in groups of two or three and is designed to take about 20–30 minutes. These will be graded again by a mix of audience and instructor feedback. Note that while general presentation skills will be assessed, a major focus of the talk is clarity in the exposition of the mathematics.

Final Research Project: The 2015 CUPM (Committee for Undergraduate Programs in Mathematics) of the MAA (Mathematical Association of America) guidelines describe a national trend for what concepts and skills mathematics majors should have by the end of their undergraduate program. At Roanoke College, we feel that these guidelines are entirely appropriate and have done a great job of meeting the guidelines from the CUPM. In the 2015 edition, one cognitive recommendation is that “students should learn to link applications and theory” and while we do a good job on each of these individually, there is no class or series of classes that expressly has students link the two. One of the best times to have students link applications and theory is after students have had a lot of development in both, and that time is now.

Your major project this semester is very broadly defined. You will complete, individually or in pairs, a research project that links applied mathematics and theoretical mathematics. To start, you will reflect upon the courses you have taken and find a favorite topic from either an applied course or a theoretical course and then research and explore the opposite side of the same topic. The result will be a paper and presentation on the topic that you have chosen. To help you reach that point, several checkpoints are present in the class to keep you focused:

- Early in the semester you will submit a short list to the instructor with your favorite applications and theoretical results in mathematics, and why you have enjoyed those items.
- You will find research papers in mathematics journals regarding these items and type a short report on the papers that you find (at least two journal articles are required).
- At the end of March, you will give a Background Presentation on your project. The focus here is to make sure that you've learned the background material well-enough so that you can proceed forward. It also gives you a chance to practice your presentation skills related to your topic. Note that, at this point, the link between applications and theory should begin to take shape but may not be fully developed.
- In the middle of April, there will be a week where, instead of class, you will have an individual meeting with the instructor to discuss progress on your project; a first draft of your paper will be due shortly before this.
- Your final paper will be due at the time of the final exam time block for this class (Tue May 2); the presentation itself will happen either Tuesday or Thursday of the last week of regularly scheduled classes. Due to the large size of the class, we will meet slightly before the start for those classes (12:30 PM instead of 1:10 PM) and you should plan to talk for 15-20 minutes, including questions.

MATH 491 – Spring 2023 - Daily Schedule

| | | Major Review | Why Major in Math? | General Presentation | Final Project | |
|---------------------|--------------|--|--------------------|----------------------|---|--|
| Tue | Jan 17 | Introduction | | | | |
| Thu | Jan 19 | Work day – in class | | | | |
| Tue | Jan 24 | Work day – in class | | | | |
| Thu | Jan 26 | No class meeting | | | | |
| Tue | Jan 31 | Presentations: - MATH 121/MATH 122 - MATH 131 | | | | |
| Thu | Feb 2 | Presentation: - MATH 201 | Discussion | | | |
| Tue | Feb 7 | Presentation: - Bridge Courses | | | Discussion | |
| Thu | Feb 9 | Presentations: - Applied Courses - Theoretical Courses | | | | |
| Tue | Feb 14 | | Video viewing | | List of Favorite Applications and Theoretical Results Due | |
| Thu | Feb 16 | | Video viewing | | | |
| Tue | Feb 21 | | | Discussion | | |
| Thu | Feb 23 | | | No class meeting | Research Papers Report Due | |
| Tue | Feb 28 | | | Presentations | | |
| Thu | Mar 2 | | | Presentations | | |
| Spring Break | | | | | | |
| Tue | Mar 14 | | | | No class: Individual Meetings by Appt | |
| Thu | Mar 16 | | | | No class: Individual Meetings by Appt | |
| Tue | Mar 21 | | | | Work day – in class | |
| Thu | Mar 23 | | | | Background Presentations | |
| Tue | Mar 28 | | | | Background Presentations | |
| Thu | Mar 30 | ----- Inquisition Prep ----- | | | | |
| Tue | Apr 4 | | | | Work day - class | |
| Thu | Apr 6 | | | | No class meeting First Draft of Final Paper Due | |
| Tue | Apr 11 | ----- Inquisition ----- | | | | |
| Thu | Apr 13 | ----- Inquisition ----- | | | | |
| Tue | Apr 18 | | | | Presentations (Class Starts at 12:30) | |
| Thu | Apr 20 | | | | Presentations (Class Starts at 12:30) | |
| Tue | May 2 | | | | 11:30am, Final Papers Due | |