MATH 491 A: Mathematics Senior Capstone
Spring 2026

Instructor: Dr. Michael Weselcouch
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Student Hours: MWF 9:15 - 11:15 or by appointment
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Course Description. 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 Policy. 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.

Structure and Grading. A grade scale will be determined after final grades are computed, but will be no worse than the scale given below. Attendance and class participation will be considered when determining marginal grades.

Grading Scale

		93-100	A	90-92.99	A-
87-89.99	B+	83-86.99	B	80-82.99	B-
77-79.99	C+	73-76.99	C	70-72.99	C-
67-69.99	D+	63-66.99	D	60-62.99	D-

The final course grade is determined in the following way:

Math Major Content Presentation	10%	Background Presentation	10%
Why Math Major? Presentation	15%	Final Presentation	25%
General Presentation	15%	Final Paper	25%

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.

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 short (about 10–15 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.

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; the presentation itself will happen the last week of regularly scheduled classes. You should plan to talk for 15-20 minutes, including questions.

MCSP Conversations. The MCSP department offers a series of talks designed to appeal to a broad audience. Members of this class are encouraged to attend many of these meetings, however attending at least one session is mandatory. The schedule for the talks is posted on Inquire. Within one week of attendance you must submit a response to the talk. This will count towards your Homework grade.

Expected Work Policy. This course expects you to spend at least 12 hours of work each week inside and outside of class.

Electronic Devices. You can use only your calculator during class unless stated otherwise. (This means no cell phones - please set them on silent and leave them in your bag.)

Inquire Policy. Students are required to be knowledgeable of all postings on Inquire. It is each student's responsibility to consistently monitor Inquire for course information. This means every day! Any assignment that requires an Inquire upload will not be accepted in any other form. Also, to receive credit for uploads, the file must be readable on the instructor's college computer. It is the student's responsibility to make successful submissions. It is the student's responsibility to resolve technology problems through the college's IT department.

Academic Integrity. I expect all of you to follow the Academic Integrity policies of Roanoke College. All work submitted for a grade must be your own (for instance, you cannot use internet resources aside from my own YouTube videos or other videos linked on Inquire and, if you do work and study with others, the final write-up must be done by yourself). If you ever have questions about how these policies apply to our class please contact me. Any violations of our AI policies will automatically be turned over to the Academic Integrity Council.

Artificial Intelligence. There are situations when the use of generative AI may be appropriate and educational. If you believe that your use of generative AI is appropriate for a given assignment, please contact me (via email, or in person at least 3 days before the due date) to explain your rationale for its use. No use is permitted without prior permission.

Subject Tutoring. Subject Tutoring, located on the lower level of Fintel Library (Room 5), is open 4 pm – 9 pm, Sunday – Thursday. We are a Level II Internationally Certified Training Center through the College Reading and Learning Association (CRLA). Subject Tutors are friendly, highly-trained Roanoke College students who offer free, one-on-one tutorials in a variety of general education and major courses such as: Business, Economics, Mathematics, INQ 240, Modern Languages, Lab Sciences, INQ 250, and Social Sciences (see all available subjects at www.roanoke.edu/tutoring). Tutoring sessions are available in 30 or 60-minute appointments. Schedule an appointment at www.roanoke.edu/tutoring, or contact us at (540)375-2590 or subject_tutoring@roanoke.edu. We hope to see you soon!

AES. Accessible Education Services (AES) is located in the Goode-Pasfield Center for Learning and Teaching in Fintel Library. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. To schedule an appointment, call (540)375-2247 or e-mail aes@roanoke.edu. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact the AES at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

Course Schedule

		Major Review	Why Major in Math?	General Presentation	Final Project
Mon	Jan 12	Introduction			
Wed	Jan 14	Work day - in class			
Wed	Jan 21	Work day - in class			
Mon	Jan 26	Presentations: -121/122 -MATH 131			
Wed	Jan 28	Presentations -MATH 201			
Mon	Feb 2	Presentations: -Bridge Courses			
Wed	Feb 4	Presentations: -Applied -Theoretical	Discussion		
Mon	Feb 9			Discussion	Discussion
Wed	Feb 11		Presentations		
Mon	Feb 16		Presentations		
Wed	Feb 18			Work day - in class	
Mon	Feb 23			Presentations	Rosters & Topics Due
Wed	Feb 25			Presentations	
Mon	Mar 9				Individual Meetings
Wed	Mar 11				Individual Meetings
Mon	Mar 16				Work day - in class
Wed	Mar 18				Background Presentations
Mon	Mar 23				Background Presentations
Wed	Mar 25				Inquisition Prep
Mon	Mar 30				Work day - in class
Wed	Apr 1				No class meeting First Draft of Final Paper Due
Mon	Apr 6				**Inquisition**
Wed	Apr 8				**Inquisition**
Mon	Apr 13				Presentations
Wed	Apr 15				Presentations
Mon	Apr 20				No class meeting