MATH 491 A, Spring 2017: Mathematics Seminar

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Class Meetings

Tuesdays and Thursdays: 1:10 PM - 2:40 PM in Trexler 374

Office Hours

Mondays, Wednesdays, Fridays: 9:00 AM - 10:30 AM
Tuesdays: 9:00 AM - 10:00 AM, 2:45 PM - 3:30 PM
Thursdays: 10:00 AM - 11:30 AM, 2:45 PM - 3:30 PM and by appointment (email me; take advantage of this, as because of chairperson duties, regularly scheduled office hours may occasionally be shortened or canceled)

Course Information

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.

Intended Learning Outcomes

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,

- explain mathematics and mathematical concepts both orally and in writing,

Required Materials

Optional Book: *Learning LaTeX*, by David F. Griffiths and Desmond J. Highman, Second Edition, SIAM Press, ISBN: 978-1-611974-41-6, Mathematical Association of America
Other: Other readings will be provided throughout this class.

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%
LᴬTEX Homework	10%
General Presentation	10%
Research Summary Paper	10%
Background Presentation	10%
Final Presentation	20%
Final Paper	20%

A grade scale will be determined after final grades are computed, but will be no worse than the scale given below.

		B+	87-89	C+	77-79	D+	67-69		
A	93-100	B	83-86	C	73-76	D	63-66	F	0-59
A-	90-92	B-	80-82	C-	70-72	D-	60-62		

Class Format	Details on specific elements of this class are below, but generally speaking, 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 (or for this semester, one group will be of size three), 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 60-70 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 Math Major?	The second presentation for this class will be a short presentation, again in teams of two (or for this semester, one group will be of size three), different from the first presentation, on why one should choose to major in mathematics. The target audience for this presentation is Roanoke College freshmen and it will again be graded by the instructor and audience feedback. The top two groups may be invited to give their talk again in a MATH 122 class, or more, this spring. You should target a length of 10-15 minutes.
LaTEXHomework	All written material in the class is required to be typed in the LaTEX typesetting language. Invariably, some of you are already comfortable with LaTEX and need little-to-no instruction. Others may never have used LaTEX before; for the latter group, the optional textbook is highly recommended and contains general information about getting started with LaTEX along with many, many examples (source and output) for you to see and use later in class (there will be no formal instruction in using LaTEX but the instructor is happy to meet with you for help, as always). There will be two homework assignments before Spring Break which will simply consist of retyping a document that I give you to reproduce the output. Note that Google can be an excellent resource for finding how to do certain things in LaTEX as well.
	For Windows, I use the MiKTeX system for LaTEX, which can be found online by going to https://miktex.org/ along with WinEdt for an editor and compilation environment (please install MiKTeX first, then WinEdt, so that your computer with automatically link the two). You can find WinEdt, a trial-edition, at http://www.winedt.com, but you may also find your own editor. For a Mac, I suggest using MacTeX, available at http://www.tug.org/mactex, which includes TeXworks, a front-end editor. Finally, you may also wish to start using Overleaf, which is an online editor and compiler for LaTEX which will allow you to see, live, what you are typing. Visit https://www.overleaf.com/ to check that out.
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 an individual 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 presentation is designed to take about 15 minutes and 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. Generally speaking, you will complete, individually, 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 end 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, and the report must be typed in L^ATEX).

- Starting in March, several class periods will be denoted as "Work Days" so that you will have time to work on your project in the presence of the instructor; while some days will not be formal class meetings, the instructor will be around during this time for help.

- 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 wellenough 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 meeting and must be typed in L^ATEX.

- Your final paper will be due at the time of the final presentation, which will be during the final exam time block for this class (Friday, April 28); due to the large size of the class, we will meet slightly before the start of that time (1 PM instead of 2 PM) and you should plan to talk for 20 minutes.

MCSP Conversation Series As you already know from spending a few years here, the MCSP Department offers a series of discussions that appeal to a broad range of interests related to these fields of study. These are known as the talks and lectures in the MCSP Conversation Series. You are invited to be involved with all of these meetings; however participation in **at least three** of these sessions is mandatory. After attending, submit a one page paper reflecting on the discussion. This should **not** be a regurgitation of the content, but rather a personal contemplation of the experience. These reaction papers will be submitted through Inquire; your final grade will be reduced by 2% for each paper not submitted.

Attendance & Participation	Perfect attendance is expected and is the best strategy for success in this course; if you have a valid excuse for missing class, it must be discussed with me prior to that class. If an absence is required, you are responsible for the material covered in that class. No late work will be accepted in any circumstance except in the case of an emergency discussed with me as soon as possible.
Academic Integrity	Students are expected to adhere to the Academic Integrity policies of Roanoke College. All work submitted for a grade is to be your own work! No electronic devices other than calculators can be taken out during any class (this includes cell phones; please turn them **off** before class).

Course Schedule The following schedule is approximate and subject to change. We will attempt to stay as close to this schedule as possible, but small deviations may be necessary. Any changes will be discussed in class, disseminated through email, and posted on Inquire as a revised syllabus.

Tue	Jan 17	Introduction to Mathematics Seminar
Thu	Jan 19	Preparation for Math Major Review and Why Math Major?
		Begin L^{A}TEX Homework #1
Tue	Jan 24	Tenure-Track Candidate Teaching Demonstration
Thu	Jan 26	Tenure-Track Candidate Teaching Demonstration
Tue	Jan 31	Tenure-Track Candidate Teaching Demonstration
Thu	Feb 2	Major Review: MATH 121, 122
Tue	Feb 7	Major Review: MATH 201
		L^{A}TEX Homework #1 Due
Thu	Feb 9	Major Review: MATH 331
		Begin L^{A}TEX Homework #2
Tue	Feb 14	Major Review: STAT 202
Thu	Feb 16	Major Review: Proofs (MATH 131, 361, 371, 381)
Tue	Feb 21	Discussion of Final Project
		L^{A}TEX Homework #2 Due
		List of Favorite Applications and Theoretical Results Due
Thu	Feb 23	Presentations on "Why Major in Mathematics?"
Tue	Feb 28	Discussion of First Individual Presentation
Thu	Mar 2	Work Day: First Individual Presentation
		Research Papers Report Due
	Spring Break	
Tue	Mar 14	Individual Presentation Day #1
Thu	Mar 16	Individual Presentation Day #2
Tue	Mar 21	Work Day: Background/Final Paper/Presentation
Thu	Mar 23	In-Class Work Day: Background/Final Paper/Presentation
Tue	Mar 28	Background Presentation Day #1
Thu	Mar 30	Background Presentation Day #2
Tue	Apr 4	In-Class Work Day: Final Paper/Presentation
Thu	Apr 6	Work Day: Final Paper/Presentation
		First Draft of Final Paper Due
Tue	Apr 11	No Class: Individual Meetings with Instructor
Thu	Apr 13	No Class: Individual Meetings with Instructor
Tue	Apr 18	Preparation for the Inquisition
Thu	Apr 20	Inquisition
Fri	Apr 28	Final Presentations, 1 PM - 5 PM
		Final Paper Due