

## Math 491: Math Seminar

2024

*The Magic of Math*, Art Benjamin

Dr. Roland Minton, Trexler 270-C, 375-2358

office hours by appointment at [calendly.com/minton](https://calendly.com/minton)

**Course Objectives:** This is a capstone course, in which we summarize and identify the skills and mathematical knowledge you have obtained at Roanoke College. You should 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. Given a problem of practical interest with mathematical content, you can identify the mathematical options available, and will be able to explain the mathematics used in non-technical terms. You have learned valuable skills in your major; you are able to articulate your technical and computational skills, your ability to think creatively and independently, your ability to identify the important components of a problem, and the precision with which you progress to logically valid conclusions.

**Intended Learning Outcomes:** At the end of the course, successful students will be able to

- articulate the interplay between applied mathematics and theoretical mathematics.
- state important results from the required classes in the mathematics major.
- form connections among the required classes in the mathematics major.
- explain mathematics and mathematical concepts both orally and in writing.

**Attendance Policy:** Perfect attendance is the best strategy. The concept of a seminar is for the leadership to be shared. We will all present material and participate in the discussion of that material. Attendance and participation affect the final grade.

**Academic Integrity:** The college policy is fully supported. The papers turned in should be your own work, without collaboration outside of your group or unauthorized use of AI technology. Papers should be properly documented.

**Presentations:** You will do five formal presentations, plus one video.

The first will be to review a required course from the math major. This will be done with a partner and should last 12-15 minutes. Give the important concepts of the course, state the top three or four results, and indicate how the course relates to other courses.

The second is a follow-up, where you should present your favorite problem or idea from the course. This will require you to get into far more detail than in the first talk. Thoroughly cover the result and state what you like about it. This should also last 12-15 minutes.

The third report is a short video (about 3–5 minutes) on why one should choose to major in mathematics. This is an individual assignment. The target audience for this presentation is Roanoke College freshmen or prospective students and it will be graded by the instructor and audience feedback. The top submissions will be sent to PR for use on the department website.

The fourth assignment is also individual. In a well-written paper, describe your three favorite math magic tricks from the first five chapters of *The Magic of Math* and your three favorite tricks from the remaining chapters. Individually, present and explain your favorite trick (5 minutes).

For the main project, you will work with a partner (different from the first presentation). The assignment is described more below. You will first present your ideas and preliminary results in a 15-minute talk. After receiving feedback, at the end of the semester you will present your final project in a 20-25 minute talk. Your final results will be turned in as a 10-15 page paper due during exam week.

**Project:** The 2015 CUPM (Committee for Undergraduate Programs in Mathematics) of the MAA Project (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. One 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, again in groups of two, 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. Then, research and explore the opposite side of the same topic. The result will be a paper and presentation on both sides of the topic that you have chosen. To help you reach that point, several checkpoints are present in the class to keep you focused. On February 13, you will submit a short list with your favorite applications and theoretical results in mathematics, and why you have enjoyed those items. The reviews of the major and why you chose to major in math should help in crafting this list. Then, find research papers in mathematics journals regarding these items and type a short report on the papers that you find (at least one journal article per person is required). This will be due before Spring Break. During March 19-21 you will give a Preliminary 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 March and April, there will be days where, instead of class, you will have an individual meeting with me to discuss progress on your project. Your final paper will be due on Friday, April 26. Note that Senior grades are due on Wednesday May 1, noon, so that is an absolute last day. The presentation itself will happen either Tuesday or Thursday of the last week of regularly scheduled classes. You should plan to talk for 20-25 minutes, including allowing time for questions.

**Co-curricular:** You are to attend three talks in the MCSP Conversation Series of talks and turn in reports. The report should consist of two parts: (1) a brief summary of the talk, and (2) some thoughts, questions, or extended comments on some aspect of the talk that was of special interest to you. You may copy reports due to other classes.

**Inquisition:** The focus of this class is to review your work in mathematics and start to put into perspective the different skills you have developed. This puts you into a great position to help us improve mathematics at Roanoke College. Individually, you will meet with some of the math faculty for an oral examination that we lovingly named the Inquisition. Sincere participation is required, but you are not otherwise graded on this experience.

**Grading:**

Major review presentations:	15%
Why Math video:	10%
Magic presentation, paper	15%
Preliminary project work	15%
Final project presentation	15%
Project paper	20%
Participation	10%

Participation in the Inquisition is required; failure to do so will result in an F. Poor effort in the Inquisition may result in a one- or two-letter grade reduction.

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

### **Anticipated Schedule:**

- 1/16: Introduction, math major
- 1/18: Work on major presentations
- 1/23: **Major course presentations part 1**
- 1/25: **Major course presentations part 2**
- 1/30: Discussion of math courses
- 2/1: Why Math workday
- 2/6: **Why Math videos due**
- 2/8: Project introduction
- 2/13: **Project ideas submitted**
- 2/15: **Math Magic presentations, paper**
- 2/20: Discussion of math magic
- 2/22: Project ideas finalized
- 2/27: wild card
- 2/29: **Math journal report due**

### **Spring Break**

- 3/12: Discussion of graduate school
- 3/14: Project meetings
- 3/19: **Preliminary Project presentations**
- 3/21: **Preliminary Project presentations**
- 3/26: Discussion of projects
- 3/28: Inquisition prep
- 4/2: **Inquisition**
- 4/4: **Inquisition**
- 4/9: Project meetings
- 4/11: Project meetings
- 4/16: **Project presentations**
- 4/18: **Project presentations**
  
- 4/26: **Project paper due**