

MATH 4390: Senior Project

Sul Ross State University

Spring 2021

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Course Description Directed individual studies in a mathematical topic of interest to the student. Emphasis on written and oral communication.

Mathematics Program Outcomes (1) The student will be able to demonstrate content knowledge of basic mathematical principles. (2) The student will be proficient in logic, able to negate statements, provide counterexamples to false statements, and determine the validity of arguments. (3) The student will be able to communicate mathematical content clearly and with valid reasoning.

Marketable Skills (1) Logical and analytical skills. (2) Problem-solving using analytic and algebraic methods. (3) Use of technology in problem-solving and presentation. (4) Communication and pedagogical skills.

Mathematics Program Outcomes The graduating student will be able to demonstrate content knowledge in mathematics including arithmetic, algebra, geometry, probability, statistics, and calculus.

Class Meetings Monday and Wednesday, 2:00 – 3:15

Class Location Del Rio 107; Eagle Pass B112; Uvalde B114; Alpine WSB 101; Midland College TBA; or synchronous online as determined by university administration in response to pandemic conditions.

Required Texts There are no required texts for the course but content will be provided to students as needed. In addition, students will be responsible for finding some sources on their own.

Course Policies

Attendance Policy

Attendance is mandatory. Students are expected to attend class in person in their classroom of registration unless permission is given for extenuating circumstances. You will be held responsible for all material covered in class or in the reading assignments. If you have to miss a class, it is your responsibility to obtain all notes, assignments, and announcements from someone else in the class. Make-up exams will be given only in the event of an emergency, in which case written justification and/or documentation must be provided and approved.

Communication

The Blackboard system will be used to provide course materials, submit assignments, and post grades. You are welcome to e-mail, call, or text me at any time. My cell number is **(830) 333-0164**.

Please identify yourself in your text or voicemail. Please make sure to check the e-mail address associated with Blackboard on a regular basis.

Reading and Participation

At the beginning of the semester, each student will select a topic based on a portion of Coxeter's *Introduction to Geometry* and/or Hilbert's *Geometry and the Imagination*. Possibilities include:

- Euclidean Geometry and Beyond: a deep dive expanding on the content of a typical geometry course (expands on geometry and trigonometry).
- Isometry and Symmetry: applying the concepts of group theory to mappings on the plane and their role in rotational and frieze ornaments (expands on geometry and algebra).
- Tessellations and Regular Solids: applying the concepts of group theory to symmetry groups with two independent translations and their role in tile and wallpaper design (expands on geometry and algebra)
- The Platonic Solids: the five regular solids and their connections to the golden ratio (expands on geometry).
- Coordinates and Curves: special curves from a classical and analytic viewpoint, including the conic sections and other curves (expands on geometry and algebra).
- Topology of Surfaces: a study of properties of that are preserved under stretching, twisting, and bending (expands on geometry).
- Three- and Four-Dimensional Geometry: using concepts from two- and three-dimensional geometry to understand the fourth dimension (expands on geometry).
- Differential Geometry: combining the techniques of multivariable calculus to geometry (expands on calculus and geometry).

Texts will be provided to help you begin your study. Once we decide which part you would like to work on, this will be your focus for the semester. You should begin by reading the chapters. Plan on working through one to two sections per week. I will direct you on which exercises I would like you to focus on and submit.

Usually, when we meet as a class, students will take turns communicating what they have been working on and discussing the exercises they have attempted. Typically two students will present during each class period, but other students are expected to listen carefully and courteously, participate, ask questions, etc. This is intended to be an informal back-and-forth, like office hours, and not a lecture.

Typically, you should plan on briefly summarizing what you've read by writing some things out for everyone to see, possibly working through proofs or computations, etc., and then discussing an exercise or two. Always make sure to bring plenty of paper! If you want to present a complete or partial solution, it's better to rewrite it and explain each step than to just stick your notebook under the document camera. This helps me and everyone else understand your thought process.

The first time you present, plan on giving an overview (about twenty minutes or so) of your chosen section. You should skim through your chapters and sections carefully enough to describe what they're about without going into details. The goal is to give **yourself** a general idea of where you're headed.

When it's your day to go, it's okay if you mostly have questions about the material, got stuck on exercises, etc. This is a time to learn and to practice communication. Your fellow students may have ideas, and I will get up there to help explain things myself sometimes.

The course is self-directed and requires some maturity; my role is that of a guide, not an instructor. It's *crucial* that you adhere to the following two guidelines:

WORK THROUGH ONE OR TWO SECTIONS EVERY WEEK

READING WITHOUT WORKING EXERCISES IS POINTLESS

Your participation grade will depend on whether you seriously grapple with the material, attempt exercises and work on them until you get them right, come to class prepared to discuss your material, and take part in discussions with other students.

Research Paper

In addition to keeping up with the assigned readings, you are required to write an expository paper. The purpose of such a paper is to inform, describe, or explain. Your paper should be based on a topic encountered in your chosen section of the Coxeter textbook. However, it should not be a textbook review or summary. The focus of your paper should be your topic, not the book.

The topic you focus on needn't encompass all the material you work through during the semester. In fact, it should be fairly narrow, so that your paper has a clear focus. But it should also be broad enough that you are able to write an entire paper on that topic alone.

Begin your paper by researching your topic. Your paper should make use of at least three cited references. One of these may be the Coxeter textbook. Some restrictions apply; please see the attached guidelines for more information.

Oral Presentation

You will also be required to deliver an hour-long oral presentation based on your research paper. This can be thought of as a popular exposition. You can use the document camera or prepare a PowerPoint presentation. Your presentation should also make use of visual aids such as images, models, prepared diagrams, or demonstrations. We will tentatively schedule your presentations to take place in class during the last weeks of class, although we can be somewhat flexible in this regard. You can expect a modestly sized audience of math students and professors, and should be prepared to field questions from the audience after your presentation.

Timeline

Here is a tentative timeline for due dates. Subject to change.

Date	Assignment	Description
January 14	Section Selection	Choose section of textbook to focus on. Notify me on the discussion board.
February 4	Topic Approval	Select a topic from your chosen section to focus on for your paper and oral presentation. Notify me via e-mail.
March 4	Source Narrative	Write a short but complete account of how you

		chose and acquired your sources. You should have a working list of sources well before this date; the sources should be in your hands by this date. Your narrative should include your final list of sources. Submit on the discussion board.
March 4	Thesis Statement	See the expository paper guidelines for information on how to write a thesis statement. Submit your statement on the discussion board. Expect it to be modified somewhat.
March 25	Outline	See the expository paper guidelines for information on how to write an outline for an expository paper. Be as detailed as you can. Submit on the discussion board.
April 8	First Rough Draft	Submit a rough draft of your paper on the discussion board.
April 22	Second Rough Draft	Submit a second rough draft of your paper incorporating responses to feedback on your first draft.
May 4	Final Draft	Submit the final draft of your paper on Blackboard. Your final draft should incorporate responses to feedback on your rough drafts.
TBA	Oral Presentation	Deliver your oral presentation before an audience of undergraduate students and mathematics faculty.

Rubrics

Grading rubrics will be provided for your convenience. These will be used to score your written paper and oral presentation.

Grading Policy

Your grades will be weighted as follows:

Participation	40%
Research Paper	30%
Oral Presentation	30%

Participation will be scored out of 40 points, distributed as follows:

Independent Study	10
Daily Participation	10
Source Narrative	5
Thesis Statement	5
Outline	5

Introduction	5
Total	40

The research paper and oral presentation will each be scored out of 20 points. The grading rubrics will be provided for your convenience.

A student who averages at least 90% will receive an A; at least 80% will receive at least a B; at least 70% will receive at least a C; at least 60% will receive at least a D.

QEP Mapped Course

Course Design: Communication Infused

To be successful in college and beyond, many sources (e.g., Morrealle & Pearson, 2008) indicate that communication competencies are essential. Sul Ross recognizes that the current generation of undergraduate university students should receive training to navigate a global world as competent communicators in various contexts and channels of communication.

Through our Quality Enhancement Plan (QEP) called *Compass*, Sul Ross aims to equip you to navigate excellence in the 21st century by developing your communication skills across multiple courses. This mathematics course is designed to enhance your communication skills. Therefore, this course has the following QEP Student Learning Outcome:

QEP Student Learning Outcome

The student will create works that exhibit skill in prepared and purposeful communication (written, oral, or visual).

University Statements

Distance Education Statement: *Students enrolled in distance education courses have equal access to the university's academic support services, such as library resources, online databases, and instructional technology support. For more information about accessing these resources, visit the SRSU website. Students should correspond using Sul Ross email accounts and submit online assignments through Blackboard, which requires secure login. Students enrolled in distance education courses at Sul Ross are expected to adhere to all policies pertaining to academic honesty and appropriate student conduct, as described in the student handbook. Students in web-based courses must maintain appropriate equipment and software, according to the needs and requirements of the course, as outlined on the SRSU website. Directions for filing a student complaint are located in the student handbook.*

SRSU Disabilities Services: *Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. It is the student's responsibility to initiate a request each semester for each class. RGC students seeking accessibility services should contact Paulette Harris, Executive Assistant to the Vice President and Dean, at 830-279-3023 or email pharris@sulross.edu. Ms. Harris's office is at 2623 Garner Field Road, Uvalde, TX 78801*

(this is the mailing address, too).

University Libraries: *The Sul Ross Library offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, library.sulross.edu. SRSU RGC students may request InterLibrary Loans (ILLs) and book check outs from the Sul Ross Library to be picked up at the SWTJC library that is most convenient. Access requires your LoboID and password. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).*

The Southwest Texas Junior College (SWTJC) Library is also available on each campus for your physical use of the space or checking out books. Del Rio, Eagle Pass, and Uvalde students may use online resources available through SWTJC website, library.swtjc.edu. These libraries serve as pickup locations for your ILL or Document Delivery or book requests; to do so, choose the appropriate pick-up location when requesting materials from the Alpine campus.