

MTH 3306: Algebraic Curves

Sul Ross State University

Spring 2022

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Course Description An introduction to conic sections and quadric surfaces from a geometric and algebraic point of view.

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.

Class Meetings Wednesday, 6:00 – 8:45.

Class Location Virtual meeting.

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

The class will meet online at scheduled times using web conferencing. Attendance at these meetings is mandatory and contributes toward your participation grade. You will need to have your webcam turned on, barring special circumstances. You may not attend class while performing work, driving a car, or doing other things on a regular basis. You will need to be in a place where you are able to take notes.

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.

Grading Policy

Your grades will be weighted as follows:

Participation	10%
Homework	40%
Research Paper	10%
Midterm Exam	20%
Final Exam	20%

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.

Participation

Your participation grade will be assigned depending on your class attendance and participation in class activities. Simply put, if you always come to class, seem like you're trying to pay attention and take notes, and take part in class activities, then you will get full credit. If attending remotely as necessitated by university policy under pandemic restrictions, participation includes having your webcam on.

Homework

Every week or so you will be asked to complete an assignment. Assignments will be made available on Blackboard. Homework can be submitted in a variety of formats, but each assignment must be submitted as a single file that I can view and grade on Blackboard.

One possibility would be to type up your homework using the Equation Editor on Microsoft Word and save it as a PDF. Another would be to capture high-quality images of your homework using a phone or other device and combine into a single file, e.g. by pasting each image into a word processor file. Feedback will be provided in the form of comments your Blackboard file.

All work must be shown for full credit. Try to be as tidy as possible so that I can understand your work. I'm flexible as to file format provided I can view your submission on Blackboard. Submissions consisting of multiple image files will not be graded as it's too easy for me to lose my place and miss something. If I have trouble seeing your file, I will let you know and give you a chance to resubmit.

Each problem will be worth 4 points unless otherwise noted.

ALWAYS TURN IN THE HOMEWORK, EVEN IF IT'S INCOMPLETE.

YOU WILL NOT PASS THE CLASS IF YOU DON'T SUBMIT HOMEWORK.

I'm flexible about due dates if something comes up, but unexcused late work may receive a zero.

Feedback will be provided in the form of notes on your submitted file. It is your responsibility to carefully view all feedback and contact me if you have any questions or concerns.

Research Paper

In addition to the regular homework, you will be asked to complete a research paper. Some suggested topics include:

- the role of conics in ancient Greek geometry
- conics and projective geometry

- algebraic geometry
- conics and the creation of analytic geometry
- conics and Kepler's laws of planetary motion
- conic sections in acoustics and optics
- conic sections in solar observation and sundials
- the life and works of Archimedes, Apollonius, Galileo, Kepler, Descartes, Pascal, Newton, or some other scientist or mathematician associated with conics
- quadric surfaces: properties and applications

You are welcome to suggest another topic, but it must be approved before you begin work. All topics must touch on conic sections or quadric surfaces in some way.

You should choose a topic and begin work no later than February 27. You are required to notify me of your desired topic. No more than one student at each site may work on the same topic. Permission will be granted on a first-come, first-served basis.

Your paper should make use of at least three cited references. You will be graded in part on the suitability of your references. Online sources are acceptable, but you should avoid websites and self-published materials, and books should be published by a reputable publisher. If in doubt as to whether a particular source is appropriate, or if you are having difficulty locating sources, please contact me.

All sources must be correctly cited and all quotes or paraphrases attributed to their source. Plagiarism is a serious offense and will result in a failing grade for the course.

Your paper must be at least 2500 words long. It must be prepared as a .docx file on Microsoft Word using 12-point Cambria font, double-spaced, with page numbers and 1-inch margins. Use the Equation Editor for mathematical text. The Works Cited should be provided as a separate page at the end of the document.

A complete first draft must be handed in by Tuesday, May 3.

Exams

There will be one midterm exam. Its tentative date is Wednesday, March 2. This is subject to change. You will be notified of a change at least one week in advance. 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.

The final exam is scheduled by the university for Tuesday, May 3, from 6:00 – 8:00 p.m. The final exam will be comprehensive.

Dates to Remember

February 27	deadline for topic choice
March 2	midterm exam
April 17	first draft due
May 3	final draft due
May 3	final exam

Subject Outline

Below is a tentative outline of the subjects we will cover in this course.

- I. Similarity: *basic Euclidean geometry – ratio and proportion – triangle similarity – similarity and circles – the Moving Ship problem – harmonic division – the Circle of Apollonius*
- II. Conics as Loci of Points I: *ellipses, parabolas, and hyperbolas – terminology – conic graph paper – connectedness – the interior of a conic – lines and conics*
- III. Conics as Loci of Points II: *the eccentric circle – tangent properties of conics – conic diameters – the diameters of a parabola*
- IV. The Parabola: *reflective property – sunbeams and satellite dishes – pedal construction – geometric series – quadrature*
- V. The Ellipse: *structure of central conics – conjugate diameters – the area of an ellipse – two-focus construction – graph paper – eavesdropping with ellipses – pedal construction*
- VI. The Hyperbola: *asymptotes – two-focus construction – graph paper – reflective property – confocal pairs – pedal construction*
- VII. Sections of Cones: *space geometry – sections of cones – Dandelin spheres – etymology – light and shadows*
- VIII. Solar Observation: *measuring the earth – the distance of the sun and the moon – keeping time – horizontal sundials*
- IX. Other Applications: *doubling the cube – Galileo – gravitational acceleration – projectile motion – Greek astronomy – Ptolemy and Copernicus – Kepler – the laws of planetary motion*
- X. Coordinate Geometry: *the Cartesian plane – equations in two variables – the graph of an equation – lines and circles – second-degree equations – Cartesian space – algebraic curves*
- XI. Quadric Surfaces: *quadric surfaces in Greek geometry – Cartesian space – planes and spheres – second-degree equations – catalog of quadric surfaces – ruled surfaces – applications*

Schedule

This schedule is tentative only. The section numbers refer to the outline above.

Unit I	January 12 – 19
Unit II	January 19 – 26
Unit III	January 26 – February 9
Unit IV	February 9 – 16
Unit V	February 16 – 23

Midterm Exam	March 2
<i>Spring Break</i>	<i>March 7 – 11</i>
Unit VI	March 16 – 23
Unit VII	March 23 – 30
Unit VIII	April 6 – 13
Unit IX	April 13 – 20
Unit X	April 20 – 27
Unit XI	April 27
Final Exam	May 3

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.