MATH 3306: Conic Sections and Quadric Surfaces
Sul Ross State University ~ Rio Grande College
Fall 2016

Professor: Michael Ortiz, Ph.D.   **Office:** Uvalde Campus A101
E-mail: mortiz4@sulross.edu   **Telephone:** (830) 279-3048

Course Description	MTH 3306 (Topics in Mathematics) is intended as an introduction to conic sections and quadric surfaces.
Course Objectives	Students will be introduced to conic sections as they appear in ancient Greek geometry; explore the connections between conic sections and algebra established by analytic geometry; and learn about the applications of conic sections in astronomy, celestial mechanics, artillery, acoustics, optics, and other fields.
Mathematics Program Outcomes	The graduating student will be able to demonstrate content knowledge in mathematics including arithmetic, algebra, geometry, probability, statistics, and calculus.
Class Time	Monday and Wednesday, 4:30 – 5:45 p.m.
Class Location	Del Rio 107; Eagle Pass B112; Uvalde B114c
Required Texts	J. W. Downs, *Practical Conic Sections*, ISBN 9780486428765
	You will also need a compass, a straightedge, a ruler, and a protractor. Later in the semester you may have to acquire some other inexpensive supplies.
Office Hours	M/W, 12:00 – 2:00; T/Th, 10:30– 12:30

Course Policies

Attendance Policy

Attendance is mandatory. 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

I will post course documents, reminders, announcements, and assignments on the Blackboard system. I may also occasionally send announcements via e-mail. You should make sure you

know how to access and use these tools. E-mail is the best way to contact me.

You are welcome to stop by my office if you wish to speak about the content or your progress in the course. I AM HERE TO HELP YOU. Ask questions in class, call me, e-mail me, or come to my office. If you don't communicate with me, then I can't help you.

Grading Policy

Your grades will be weighted as follows:

Assignments	25%
Research Paper	10%
Midterm Exam	25%
Final Exam	40%

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.

Homework

Homework will be assigned for each section that we cover. Worksheets will be made available for download and printing on Blackboard. Your homework will be prepared on paper and submitted via your site secretary. Each problem will be worth 2 points unless otherwise noted. ALWAYS TURN IN THE HOMEWORK. LATE WORK WILL NOT BE ACCEPTED.

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
- 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 September 28. 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. Several restrictions apply:
- No online sources whatsoever may be used.

- No encyclopedias may be used.
- At most one textbook may be used.
- No magazine or journal articles may be used without approval.
- Each source must be an actual physical book obtained from the SWTJC library, the SRSU library, or Interlibrary Loan, unless approved by the instructor.

If in doubt as to whether a particular source is appropriate, or if you are having difficulty locating sources, please contact me.

All work must be done independently. Please make use of the Writing Center if you need writing assistance. I am also happy to provide feedback at any point in the semester.

All sources must be correctly cited and all quotes or paraphrases attributed to their source. Plaigiarism 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 Monday, November 14. The final version must be handed in by Friday, December 1.

Exams

There will be one midterm exam. Its tentative date is Wednesday, October 12. 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 for Monday, December 5, from 3:00 – 5:45 p.m. The final exam will be comprehensive.

Dates to Remember

September 28	deadline for topic choice
October 12	midterm exam
November 14	first draft due
December 1	final draft due
December 5	final exam

Subject Outline

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*

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 unit numbers refer to the above outline.

Unit I	August 22 – 24
Unit II	August 24 – 31
Labor Day Holiday	*September 5*
Unit III	September 7 – 21
Unit IV	September 21 – 28
Unit V	September 28 – October 10
Midterm Exam	**October 12**
Unit VI	October 17 – 24
Unit VII	October 24 – 31
Unit VIII	October 31 – November 7
Unit IX	November 7 – 14
Unit X	November 14 – 21
Thanksgiving Holiday	*November 23 – 25*
Unit XI	November 28 – 30
Final Exam	**December 5**

Americans With Disabilities Act

Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Kathy Biddick, Student Services Administrative Secretary.