

MATH 3301: Geometry

Sul Ross State University ~ Rio Grande College
Spring 2016

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Course Description MTH 3301 is intended as an introduction to classical Euclidean geometry.

Course Objectives Students will be introduced to axiomatic systems and their components; learn and practice the basic methods of mathematical proof; use these tools to prove the classical theorems of Euclidean geometry involving points, lines, planes, magnitudes, angles, polygons, and circles; relate geometric concepts to compass-and-straightedge constructions; explore the construction and properties of polyhedra; and be introduced to the study of geometry as a humanistic discipline.

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 Tuesday, 6:00 – 8:45 p.m.

Class Location Del Rio 107; Eagle Pass B112; Uvalde B114c

Texts Shlomo Libeskind, *Euclidean and Transformational Geometry: A Deductive Inquiry*, First Edition, ISBN 9780763743666 **[optional]**

Edwin A. Abbott, *Flatland: A Romance of Many Dimensions*, ISBN 9780486272634 **[required]**

Alan Holden, *Shapes, Space, and Symmetry*, ISBN 9780486268514 **[required]**

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 p.m. – 2:00 p.m.; T/Th, 10:30 a.m. – 12:30 p.m.

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. You will also submit homework on Blackboard. 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*	30%
Book Report	10%
Midterm Exam	25%
Final Exam	35%

** proofs, constructions, quizzes*

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.

There are three types of assignments: *proofs*, *readings*, and *constructions*. All assignments are weighted equally unless otherwise noted.

Proofs

Geometrical proofs will be prepared as Microsoft Word documents (.docx) and submitted on Blackboard. A sample assignment will be provided for your convenience. Approximately one to two proofs will be handed in each week; the due date will always be a Friday.

Please note that you will need to use a recent version of Word in order to make use of the Equation Editor. If your access is limited to the campus computer labs, then it is recommended that you write your proof on paper elsewhere and come to the lab just to type it out.

Proofs will be graded for correctness and returned via Blackboard, with explanatory notes in the margin. Please read the notes carefully so that you can improve your work. Scores will be out of 10 points; a proof that is complete and shows some effort will usually receive at least 5 points, even if it is completely wrong. ALWAYS ATTEMPT AND TURN IN THE PROOFS. LATE WORK WILL NOT BE ACCEPTED.

Constructions

You will periodically be asked to complete a pencil-and-paper construction. These will be turned in together as a folder at the end of the semester (April 19). The constructions should be made

using only a straightedge and compass on blank white paper, unless instructed otherwise; you may also be asked to make measurements using a ruler or protractor. The constructions will be counted with proofs under Assignments.

Reading Quizzes

In the course of the semester you will read pp. 1 – 59, 152 – 174 of Holden's *Shapes, Space, and Symmetry*. Your understanding will be assessed through multiple-choice quizzes on Blackboard. The quiz due dates are as follows, but you are encouraged to complete the readings and quizzes as soon as is convenient.

March 25 Holden, 1 – 19
April 1 Holden, 20 – 39
April 8 Holden, 40 – 59
April 15 Holden, 152 – 174

Quizzes must be completed independently. Questions may vary from student to student.

Book Report

In the course of the semester you will read Abbott's *Flatland: A Romance of Many Dimensions* and prepare a book report. Your book report should be at least 2000 words long. The due date is Tuesday, March 1. More details about how to prepare your book report will be provided on Blackboard. You are encouraged to begin as soon as possible and to use the campus Writing Center or Smarthinking to obtain feedback on your writing.

Exams

There will be one midterm exam. Its tentative date is Tuesday, March 8. 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 Tuesday, May 10, from 6:00 – 8:45 p.m. The final exam will be comprehensive.

Dates to Remember

March 1 book report due
March 8 midterm exam
March 25 – April 15 quizzes due
April 19 constructions due
May 10 final exam

Subject Outline

I. Points, Lines, and Planes

1. Basic Axioms: *axiomatic systems – axioms – models for geometry*
2. Distance: *measurement – the Ruler Postulate – betweenness – line segments*
3. Plane Separation: *half planes – Pasch's Axiom – the interior of an angle – betweenness of rays*
4. Angle Measurement: *the Protractor Postulate – angle types – vertical angles*

II. Triangles

1. Congruency Conditions: *the SAS condition – isosceles triangles and perpendicular bisectors – the circumcenter – kites and rhombii – other congruency conditions*
2. Triangle Inequalities: *the Exterior Angle Theorem – the Triangle Inequality*
3. Triangles and Circles: *the continuity of circles – existence and uniqueness of perpendiculars*
4. Basic Euclidean Constructions
5. Right Triangles: *the HL condition – the HAA condition – the incenter*
6. Optimization Problems: *Heron's Problem – Fagnano's Problem*

III. Parallel Lines

1. The Parallel Postulate: *basic terminology – Saccheri quadrilaterals – Playfair's Axiom – consequences*
2. Non-Euclidean Geometry
3. Parallel Lines and Polygons: *the interior angles of polygons – consequences for parallelograms*
4. The Centers of a Triangle: *the orthocenter – the Midsegment Theorem – the centroid – the Euler line*
5. Parallel Projection

IV. Circles

1. Intersections: *basic definitions – tangents and secants*
2. Central and Inscribed Angles: *congruence of inscribed angles – cyclic triangles – the Nine Point Circle Theorem – cyclic quadrilaterals*
3. Inscribed Circles: *incenters and excenters – circumscribed quadrilaterals – regular polygons*

V. Similarity

1. Similarity Conditions: *the Side-Splitting Theorem – the AA~ condition – chords and secants – Morley's Theorem – the SSS~ and SAS~ conditions – harmonic means*

2. The Pythagorean Theorem: *geometric means – the Pythagorean Theorem – Ptolemy's Theorem – trigonometry*
3. The Golden Ratio: *the ratio ϕ – golden rectangles – the Fibonacci spiral – regular pentagons – golden triangles – Odom's construction*
4. Cyclotomy: *the regular hexagon – the regular octagon – the pentadecagon – the heptadecagon – constructability*

VI. Area

1. Basic Formulas: *axioms – basic area formulas*
2. Applications of Area: *the Pythagorean Theorem – Heron's Theorem*
3. The Circumference and Area of Circles

Schedule

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

Unit I	January 19 – February 2
Unit II	February 2 – February 16
Unit III	February 16 – March 1
Midterm Exam	March 8
Spring Break	March 14 – 18
Unit IV	March 22 – April 5
Unit V	April 5 – 19
Unit VI	April 19 – May 3
Final Exam	May 10

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.