

MATH 3301: Geometry

Sul Ross State University ~ Rio Grande College
Spring 2015

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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 Castroville 120; Del Rio 107; Eagle Pass B112; Uvalde B114c

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

Benno Artmann, *Euclid – The Creation of Mathematics*, ISBN 9780387984230 **[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 will have to acquire some other inexpensive supplies.

Office Hours M/W, 11:00 a.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	40%
Midterm Exam	25%
Final Exam	35%

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.

Readings

Each week you will have an assigned reading from one of the required texts. Your understanding will be assessed through short-answer questions, to be completed on Blackboard. The questions for each reading must be completed by the end of Friday on the week for which it is assigned;

the due dates are shown above. Each question will be worth two points. The readings are as follows:

January 29	Artmann, pp. xv – 16	SPRING BREAK WEEK
February 5	Artmann, pp. 17 – 30	March 26 Artmann, pp. 283 – 298
February 12	Artmann, pp. 31 – 36, 47 – 50	April 2 Artmann, pp 299 – 315
February 19	Artmann, pp. 36 – 46, 51 – 59	April 9 Holden, 1 – 19
February 26	Artmann, pp. 97 – 120	April 16 Holden, 20 – 39
March 5	Artmann, pp. 151 – 159, 213 – 221	April 23 Holden, 40 – 59
March 12	Artmann, pp. 255 – 265, 271 – 278	April 30 Holden, 152 – 174

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 21). The constructions should be made using only a straightedge and compass, unless instructed otherwise; you may also be asked to make measurements using a ruler or protractor.

Exams

There will be one midterm exam. Its tentative date is Tuesday, March 10. 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 12, from 6:00 – 8:45 p.m. The final exam will be comprehensive.

Subject Outline

I. Points, Lines, and Planes

1. Incidence Geometry: *axiomatic systems – incidence axioms – models for incidence 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 20 – February 3
Unit II	February 3 – February 17
Unit III	February 17 – March 3
Midterm Exam	March 10
Spring Break	March 16 – 20
Unit IV	March 24 – April 7
Unit V	April 7 – 21
Unit VI	April 21 – May 5
Final Exam	May 12

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.