MATH 3301: Geometry

Sul Ross State University ~ Rio Grande College
Spring 2017

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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 Student Learning Outcomes	The student will (1) be able to demonstrate content knowledge in the foundations of mathematics, including discrete mathematics and geometry, (2) be able to research a humanistic mathematical topic and communicate their knowledge in writing, and (3) be able to research a humanistic mathematical topic and communicate their knowledge orally.
Class Time	Tuesday, 6:00 – 8:45 p.m.
Class Location	Del Rio 101; Eagle Pass D202; Uvalde B113
Texts	Benno Artmann, *Euclid – The Creation of Mathematics*, ISBN 9780387984230 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 11:30 – 2:00; T/Th 2:00 – 4:30

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. 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 the Artmann text. Your understanding will be assessed through quizzes, to be completed on Blackboard. The questions for each reading must be completed by the end of the day on which it is due. The due dates are shown below.

February 3	pp. xv – 16	March 24	pp. 97 – 120
February 10	pp. 17 – 30	March 31	pp. 151 – 159, 213 – 221
February 17	pp. 31 – 36, 47 – 50	April 7	pp. 255 – 265, 271 – 278
February 24	pp. 36 – 46, 51 – 59	April 14	pp. 283 – 298
		April 21	pp 299 – 315

Constructions

You will be asked to complete some pencil-and-paper constructions. 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 7. 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 9, 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 17 – 31
Unit II	January 31 – February 14
Unit III	February 14 – 28
Midterm Exam	March 7
Spring Break	March 16 – 20
Unit IV	March 21 – April 4
Unit V	April 4 – 18

Unit VI	April 18 – May 2
Final Exam	May 9

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.