

Course Outline for MATH 3511, Euclidean Geometry

MATH 3511 Euclidean Geometry (3 units)

Prerequisite: MATH 248 or [MATH 2031](#) with a grade of C- or better, or consent of instructor.

Foundations of Euclidean geometry, including constructions, congruence theorems, similarity, polygonal regions, circles, measurement and properties of angles. Includes history of the parallel postulate and principles of neutral geometry. 3 lectures. Formerly MATH 442.

Course Learning Objectives	
1	Prove results in Euclidean geometry using an appropriate axiomatic system.
2	Prove foundational theorems in Euclidean geometry, explain their significance, and compare with historical proofs of these results.
3	Prove corollaries to results in Euclidean geometry.
4	Explain the relationship between axiom, definition, undefined term, theorem, corollary, lemma, and construction, and the role of each in developing Euclidean geometry.
5	Perform basic compass/straightedge constructions, both on paper and with dynamic geometry software.
6	Explain the significance of neutral geometry and how it relates to Euclidean geometry.
7	Describe the role and importance of the parallel postulate in the historical development of Euclidean geometry.

Expanded Course Content

Textbooks, materials, and/or other resources
Clark, David. Euclidean Geometry, an Inquiry Oriented Approach, MSRI Mathematical Circles Library, AMS.

Week	Readings	Topics of Discussion
1	Clark, Chapter 1	Introduction to axiomatic systems; definitions and undefined terms; language of congruence
2	Clark, Chapter 1	Constructions with straight edge and compass; isometries
3	Clark, Chapter 2	Early proofs – turning constructions (e.g. “I can find the midpoint of this segment”) into theorems (e.g. “Every segment has a midpoint”)
4	Clark, Chapter 2	Triangle congruence (SAS, AAS, ASA, SSS); differences in using (for example) SSS as a theorem vs. an axiom; weak alternate interior angle theorem; trisquares

Week	Readings	Topics of Discussion
5	Clark, Chapters 2 and 3	Tangents; constructing a square, and the role of parallelism in our constructions; defining polygonal regions and proofs about quadrilaterals
6	Supplemental Reading Clark, Chapter 3	The parallel postulate; a basis for neutral geometry
7	Clark, Chapter 3	Area measure; an axiom and properties for area measure; areas of triangles and basic quadrilaterals
8	Clark, Chapter 4	Angle measure; a stronger axiom for angle measure; exploring units for angle measure, exploring the difference between defining a unit angle vs. defining angle non-congruence (as an axiom); triangle angle sum theorem; strong exterior angle theorem
9	Clark, Chapter 4	Pythagorean theorem; proofs of the Pythagorean theorem, converse of the Pythagorean theorem, and applications
10	Clark, Chapter 4	Properties of angles; special triangles and special right triangles
11	Clark, Chapter 5	Similarity and dilation; defining dilation and scale factor; properties of an image under a dilation
12	Clark, Chapter 5	Similarity; similar triangles and AA similarity
13	Clark, Chapter 6	Trigonometric ratios; defining trigonometric ratios and exploring their relationship to previously proven theorems
14	Clark, Chapter 7	Trigonometric ratios; defining trigonometric ratios and exploring their relationship to previously proven theorems
15	Supplemental Reading	Problems for discussion - squaring the circle, trisecting angles, etc.

Method of Assessment

The possible methods of assessment are written individual examinations, quizzes, in-class worksheets or presentations, projects, and homework. One or more midterms and a cumulative final exam are required.

Instructional Mode

The instructional mode for this class is face-to-face. This designation means that the essential academic standards of the course require in-class student engagement, and thus remote instruction is not appropriate.