

Math 455 Course Syllabus

Principles of Geometry (3 credits)

Fall 2006

Instructor: Dr. Mark Oursland

Office: Room 107B Bouillion Hall

Office Hours: 10:00 AM to 11:00 PM Mon. - Thurs. (other times by appointment)

e-mail oursland@cwu.edu

Office Phone: 963-2100

Course Description: This course will emphasize three primary objects: (a) Study and use axiomatic systems where results are deduced by pure reason from complete and consistent geometric systems; (b) Study and use geometric models to deduce geometry solutions between mathematics systems and the real-world; (c) Express formal and intuitive arguments to abstract and real-world problems; and (d) Use the computer to model geometric concepts and real-world situations.

Course Rationale: To meet the expectations for mathematics education for secondary teachers a shift in content, instructional, and assessment practices are crucial. The Curriculum and Evaluation Standards of School Mathematics (NCTM, 1989) outlines the specific changes needed in pre-service mathematics education. "Prospective teachers must be taught in a manner similar to how they are to teach--by exploring, conjecturing, communicating, reasoning, and so forth." In addition, "all teachers need an understanding of both the historical development and current application of mathematics. Furthermore, they should be familiar with the power of technology." This course is designed to achieve the needed changes in mathematics education and prepare preservice secondary students with the necessary mathematical content to implement and model a dynamic pedagogy. Traditionally geometry has been preoccupation with proofs of traditional Euclidean Geometry. The vision of this course is to initiate a problem-solving approach to geometric learning. A balance between analytical and synthetic geometry will be maintained as topics such as axiomatic systems, Euclidean Geometry, and Non-Euclidean Geometry are studied. A laboratory-style of instruction and technology will be used frequently. Formal proof writing will be required but a greater emphasis will be given to intuitive arguments and explanations in everyday mathematical language.

Text: Euclidean and Non-Euclidean Geometries **Author:** M. Helena Noranha **Computer:** Geometer's Sketchpad

Learner Outcomes: Students will use the project papers, assignments, and exams to insure that they have demonstrated the following performance objectives.

Synthetic Geometry

- Understand the nature and purpose of axiomatic systems;
- Express a historical understanding of the development of both Euclidean and non-Euclidean geometries;
- Use an axiomatic system to logically deduce a series of dependent theorems;
- Create and validate both concrete and abstract model for axiomatic systems;
- Evaluate an axiomatic sets for consistency, independence and completeness;
- Determine whether a geometry exhibits the parallel axiom;
- Determine whether a set is convex;
- Perform and explain a Euclidean proof with a straightedge and compass and then with a computer tools;
- Compare and contrast the axioms and undefined terms of the various Euclidean and non-Euclidean geometries;
- Compare and contrast the theorems of the various Euclidean and non-Euclidean geometries as they involve the basic geometric concepts of angle measure, polygons, circles, congruency, similarity, and area.

Analytic Geometry

- Create and use models of finite geometries;
- Create and use models of the Euclidean plane and space to solve abstract and real-world problems;
- Create and use models of the non-Euclidean space to solve abstract and real-world problems;
- Interpret basic geometric terms in Euclidean and non-Euclidean models: distance, point, line, parallel, similar, area, and congruent.
- Use computer tools to create models of problems that reveal important Euclidean and non-Euclidean concepts.
- Analyze projective geometry as a general geometry explaining both Euclidean and non-Euclidean geometry;

Communication

- Express in written and oral form argument for solutions to posed problems;
- Critique the argument of others and themselves in writing and in an oral discussion;

- Write a formal argument (Proof) using the mathematical language correctly (including symbols);
- Write an intuitive argument in everyday mathematical language.
- Use computer to communicate a dynamic and interactive geometric model.

Assessment and Evaluation Guidelines: In this course the distinction between learning activities and assessment activities is blurred. I present a sequence of problems (together with motivation, discussion of contexts, and connections of the problems with other areas of mathematics and life). The students are to work on the problems individually and report their thinking back to the class and instructor. This cycle of writing, comments, and discussion continues on each assignment until both the student and I are satisfied or unless the quarter ends first. The assessment procedures are chosen to provide information about your progress in achieving the performances objectives and eventually revealing your achievement of these objectives. You are responsible through completing the following course work to demonstrate your ability to perform the above course objectives.

Daily Assignments: Daily assignments of problems to be worked on individually. The writing on these problems will be both formal and informal. Some times the feedback will come from times me. Some times the writing will assessed and given a low point score another times the cycle of writing, comments, and discussion continue before a score is given.

Topical Papers: Three class papers (50 points) will be assigned and collected. The projects will be open-ended questions on a specific topic requiring both formal and intuitive discourse demonstrating and understanding of the concepts of both synthetic and analytic geometry.

Final Paper: The final paper will be worth 100 points and will integrate the three topical papers into a summative paper covering all the course outcomes. This paper will be given a mathematical writing grade and a mathematical content grade, an explanation of these two assessment areas is given below. It will be due at the final examination time.

Mathematical Writing

Narrative:	Places more emphasis on impressions as opposed to relating objective analysis of specific examples; covers brief or general lists of topics; some terms are misrepresented or placed in an inappropriate context
Summary:	Directs some on one's own thinking ; sites some specific examples, makes fairly general statements concerning mathematical concept or procedure; discussion of mathematics is generally clear and precise.
Dialogue:	Directs reflection at analyzing ones own mathematical processes; always uses specific examples in discussing mathematical concepts or procedures; demonstrates great precision in communication of mathematics.

Mathematical Proficiency

Apprentice:	Indicates a general understanding of the mathematical concept or procedure; usually selects appropriate strategies; uses mathematics and mathematical representations accurately some of the time; more evidence is needed to show proficient performance.
Proficient:	Indicates an understanding of the mathematical concept or procedure most of the time; most of the time selects appropriate strategies; uses mathematics and mathematical representations accurately most of the time; more evidence is needed to show distinguished performance.
Distinguished:	Indicates a comprehensive understanding of the mathematical concept or procedure; uses multiple strategies appropriately; uses mathematics and mathematical representations accurately; evidence of distinguished performance.

Examinations: Four examinations will be worth 50 point and will be given at the end of the quarter.

Grading: Grades will be determined by the following percents:
 93-100% = A, 90-93% = A-, 87-90% = B+, 83-87% = B, 80-83% = B- , 77-80% = C+, 73-77% = C, 70-73% = C-, 67-70% = D+, 63-67% = D, 60-63%, 0-60% = F.

How to succeed: Take the responsibility for your own achievement of these performance objectives. Use the activities, assignments, assessments and people such as the instructor to insure that you understand the mathematical concepts and can demonstrated this understanding in the form of the performance objectives.

Students who have special needs or disabilities that may affect their ability to access information and or material presented in this course are encouraged to contact the office of student assistance on campus 963-2171.