Math 250 Course Syllabus

Intuitive Geometry for Elementary Teachers (4 credits)

Spring 2009

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Course Description: This course is designed to prepare preservice elementary and middle school teacher to revitalize their thinking and understanding of the basic geometric and spatial concepts that are necessary for the teaching of geometry (K-8). Students will learn by using a variety of geometric tools and properties to model and solve geometric problems. Conceptual understanding will be communicated through multiple representations and making connections. Real-world examples and informal logical arguments rather than formal proofs will be emphasized.

Course Rationale: Geometry offers a means of describing, analyzing, and understanding the world and seeing beauty in its structures. Geometric ideas can be useful both in other areas of mathematics and in applied settings. Properties of geometric objects, trigonometric relationships, and other geometric theorems give students additional resources to solve mathematical problems. Geometry has always been a rich arena in which students can discover patterns and formulate conjectures. The use of dynamic geometry software enables students to examine many cases, thus extending their ability to formulate and explore conjectures. Judging, constructing, and communicating mathematically appropriate arguments, however, remain central to the study of geometry. Students should see the power of deductive proof in establishing the validity of general results from given conditions. The focus should be on producing logical arguments and presenting them effectively with careful explanation of the reasoning. A particular challenge for middle school teachers is to integrate technology in their teaching as a way of encouraging students to explore ideas and develop conjectures while continuing to help them understand the need for proofs or counterexamples of conjectures (NCTM Standards, 2000).

Text: A problem solving Approach to Mathematics for Elementary School Teachers
Author: Billstein, Libeskind, Lott
Optional: Student editions of Geometer's Sketchpad are available for $39.95
Materials Needed: Calculator, compass, protractor, ruler, scissors, and colored pencils.

Learner Outcomes: Students will use the daily quizzes, project write-ups, papers, portfolio, tests, and a comprehensive final exam to demonstrated the following performance objectives. Each quiz and test question are designed to reveal the student's ability to meet one or more of the following professional mathematics teaching standards. Students can use this sequence of assessments to monitor their own ability in meeting the course standards.

1.0 Mathematical Problem Solving: ***Middle level (ML) teacher candidates know, understand, and apply the process of problem solving in each mathematical content area. As a result, candidates:***
1.1 Apply and adapt a variety of appropriate strategies to solve problems.
1.2 Solve problems that arise in mathematics and those involving mathematics in other contexts.
1.3 Build new mathematical knowledge through problem solving.
1.4 Monitor and reflect on the process of problem solving and evaluate reasonableness of solution.
2.0 Reasoning & Proof: ***ML teacher candidates reason, construct, and evaluate mathematical arguments; also, interpret and compare information from a variety of sources. As a result, candidates:***
2.1 Recognize reasoning and proof as fundamental aspects of mathematics.

2.2 Make and investigate mathematical conjectures.
2.3 Develop and evaluate mathematical arguments and proofs.
2.4 Select and use various types of reasoning (e.g., inductive, deductive, proportional, spatial) and methods of proof.
3.0 Mathematical Communication: ***ML teacher candidates communicate their mathematical thinking orally and in writing, using appropriate mathematical language and notation to clearly and effectively express or present ideas and information in each mathematical content area. As a result, candidates:***
3.1 Systematically gather mathematical information for a given purpose and clearly communicate their findings to peers, faculty, and others.
3.2 Use the language of mathematics to express ideas precisely.
3.3 Use communication as a means of clarifying and organizing one's own mathematical thinking.
3.4 Analyze and evaluate the mathematical thinking and strategies of others.
4.0 Mathematical Connections: ***ML teacher candidates recognize, use, and make connections between and among mathematical ideas and in contexts outside mathematics to build mathematical understanding. As a result, candidates:***
4.1 Recognize and use connections among mathematical ideas.
4.2 Recognize and apply mathematical ideas to other subject areas and to real-world situations.
4.3 Demonstrate how mathematical ideas interconnect and build on one another to produce a coherent whole.
5.0 Mathematical Representation: ***ML teacher candidates use varied representations (pictorial, verbal, numerical, graphical, symbolic) of mathematical ideas to support and deepen mathematical understanding in each mathematical content area. As a result, candidates:***
5.1 Use multiple representations to model and interpret physical, social, and mathematical phenomena.
5.2 Create and use representations to organize, record, and communicate mathematical ideas.
5.3 Select, apply, and translate among mathematical representations to solve problems.
8.0 Geometry: ***ML teacher candidates use spatial visualization and geometric modeling to explore and analyze geometric figures, structures, their properties, and ways of representing mathematical relationships (numbers, tables, graphs, models, words, and symbols). As a result, candidates:***
8.1 Demonstrate knowledge of core concepts and principles of Euclidean and non-Euclidean geometries in two and three dimensions from both formal and informal perspectives.
8.2 Exhibit knowledge of the role of axiomatic systems and proofs in geometry.
8.3 Analyze characteristics and relationships of geometric objects and figures.
8.4 Build and manipulate representations of two- and three- dimensional objects using concrete models, drawings, and dynamic geometry software, and perceive an object from different perspectives.
8.5 Specify locations and describe spatial relationships using coordinate geometry, vectors, and other representational systems.
8.6 Apply transformations and use symmetry, similarity, and congruence in mathematical situations.
8.7 Demonstrate knowledge of the historical development of Euclidean and non-Euclidean geometries, including contributions from many cultures.
10.0 Measurement: ***ML teacher candidates apply and use measurement concepts and tools and ways of representing mathematical relationships (numbers, tables, graphs, models, words, and symbols). As a result, candidates:***
10.1 Recognize the common representations and uses of measurement and choose tools and units for measuring length, surface area, volume, mass, weight, angle, elapsed time, rate, and temperature.
10.2 Identify the attributes to be measured and apply appropriate techniques, tools, and formulas to determine measurements and their application in a variety of contexts.
10.3 Use estimation as a way of understanding measurement units and processes.
10.4 Demonstrate knowledge of the historical development of measurement including contributions from many cultures.
10.5 Demonstrate understanding of units of measure and apply unit conversions within the U.S. and metric measurement systems

Students will show their ability to use the following pedagogy with respects to geometry

Students will understand and be able to

a. recognize and use the van Heile levels to explain concepts and/or skills.
b. use manipulative such as pattern blocks, geoboards, etc. to explain geometric concepts and skills.
c. use constructions to explain geometric concepts and spatial skills.
d. use Geometer's sketchpad to explain geometric concepts and spatial skills.
e. use computer manipulative to explain geometric concepts and spatial skills.
f. explain the difference between a drawing and a construction.

Assessment and Evaluation Guidelines

Grades will be determined by performance on quizzes, projects, papers, portfolio, and tests. A comprehensive final will be given last day of class.

Assignments: Assignment and class activities will be given daily. These assignments and activities will be assessed at the end of the course in a portfolio. Each assignment and activity is directly tied to the knowledge and skill needed for class discussions, quizzes, projects, and tests. Solutions to the homework will be available.

Quizzes: Take home quizzes will be given (20 points each) often to assess your ability to meet the course learner outcomes. The problems will be based on the assignments and class activities. These quizzes can be used to understand what type of questions will be on the three tests and ultimately the comprehensive final.

Test: Three tests will be given (100 points) based on the topics from the daily quizzes and projects. Retests will be given after a self-assessment has taken place to allow students to earn back half of the points they missed on specific problems. The exact day of these tests will be given at least 1 week in advance. The final exam will be comprehensive (200 points).

Projects and Papers: Project write-ups and mathematical papers will be used to assess each of the major standard sections for middle school mathematics teachers. The first draft of these projects and papers are worth 10 point. The final assessment of the projects and papers will be in the portfolio.

Portfolio: The portfolio will include all quizzes, tests, self-assessments of tests, projects write-ups, papers, textbook assignments, and classroom activities. The portfolio with worth 100 points and will be assessed on the final day of class.

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.

Schedule/Rules: The instructor has a class schedule for the quarter but it is subject to change depending on the needs of the students. Toward the end of the course a record of all activities will be given to each student for the purpose of organizing their portfolio. Class participation is essential for learning the course objectives. If a student misses class, it is their responsibility to get notices and assignments. In case of emergencies, it is the students' responsibility to contact the instructor as soon as possible. If a course deadline was missed assessment alternatives are left up to the discretion of the instructor.

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

ADA: Students with special needs or disabilities who desire academic accommodation are encouraged to submit a copy of the 'Confirmation of Eligibility for Academic Adjustments' from the Disability Support Services office as soon as possible so a plan can be developed that best serves the learning needs of the student. Students without this form should contact the Disability Support Services office in Bouillon 205 at 963-2171 or dssrecept@cwu.edu as soon as possible.