

University of Arkansas – Fort Smith
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General Syllabus

MATH 23473 Informal Geometry

Credit Hours: 3

Lecture Hours: 3

Laboratory Hours: 0

Prerequisite: MATH 11003 College Algebra or higher MATH or required placement

score Effective Catalog: 2018~2019

I. Course Information

A. Catalog Description

Designed for middle level teachers. Students study pedagogical methods used by current practitioners. Content includes traditional Euclidean geometry, transformational geometry, coordinate geometry, congruence, area, volume, and surface area.

B. Additional Description - None

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Draw significant connections between knowledge of geometric mathematical domains and age appropriate pedagogical methodologies that lead to significant student knowledge of grades 4-8 mathematics.
2. Create age appropriate mathematical learning plans that engage all students using the common core content standards and the standards of mathematical practice.
3. Use appropriate technology when developing age appropriate lessons and activities to be presented in class.
4. Use proper geometric notation.
5. Identify and describe properties of lines (including parallel, perpendicular, intersecting, parallel lines cut by a transversal), segments, and angles.
6. Perform basic constructions.
7. Determine when triangles are congruent.
8. Determine when triangles are similar and use proportional reasoning to find missing sides of similar triangles, including application problems.

9. Understand properties of quadrilaterals (rectangle, rhombus, trapezoid, etc.) and other polygons, including triangles.
10. Understand systems of measurement (metric, customary).
11. Identify parts of a circle and their relationships.
12. Identify and draw the basic transformations from a given picture.
13. Compute the area and perimeter (or circumference) of polygons and circles.
14. Compute the surface area and volume of polyhedra, cones, and spheres.
15. Compute the sides of a triangle using the Pythagorean Theorem. Apply the Pythagorean Theorem in various contexts.
16. Understand the connection between the coordinate system, geometry, and algebra.
17. Interpret geometric relationships in the xy-plane (transformations, distance) and know how to analyze and represent functions that model given information.

B. University Learning Outcomes

Informal Geometry enhances student abilities in the following areas:

Analytical Skills

Quantitative Reasoning: Students will recognize geometry as a tool for dealing with space relations. Students will analyze properties and orientations of two- and three-dimensional shapes, leading students to summarize relationships among various shapes such as categories of quadrilaterals and properties of prisms. Students will analyze given information to formulate proofs about properties of shapes, angle relationships, and congruence and similarity of triangles. Students will assign and use numbers, read and analyze data, create models, draw inferences, and support conclusions based on sound mathematical reasoning. Students will interpret and/or draw inferences regarding quantitative relations through spatial concepts such as linear measure, area, volume, and among a variety of shapes in varying dimensions. Students will compare and contrast the various types of measurements to decide on appropriate computations needed.

Communication Skills (written and oral)

Students will communicate proficiently by small group and individual presentations of problem-solving strategies as well as written reflections of various aspects of geometric shapes, measurements, and transformation of shapes.

Ethical Decision Making

Students will model ethical decision-making processes while working with other students and during assessments. Student will practice the expectations concerning plagiarism by completing their own work.

Global & Cultural Perspectives

Students will reflect upon cultural differences and their implications for interacting with people from cultures other than their own. Students will experience when analyzing how shapes such as trapezoids and isosceles triangles have been given new definitions in the United States based on Asian and European influence.

Students will reflect upon how mathematics is a coherent language to be understood worldwide.

III. Major Course Topics

- A. Pedagogy for grades 4-8
 - 1. Use of manipulatives for conceptual understanding
 - 2. Standards of Mathematical Practice
- B. Basic Notation and Terms in Geometry
 - 1. Importance of vocabulary
 - 2. Importance of symbol usage
 - 3. Foundational terms such as point, line, plane, and angle
- C. Constructions
 - 1. Copy angles, segments, and triangles
 - 2. Bisect segments, angles
 - 3. Parallel and perpendicular lines to a given line through a given point
 - 4. Centers of triangles
- D. Properties of shapes
 - 1. Polygon properties and their names through 12 sides
 - a. Regular, convex, concave
 - 2. Types of triangles based on sides and angles
 - a. Isosceles triangles have AT LEAST two congruent sides
 - 3. Types of quadrilaterals
 - a. Hierarchy for quadrilaterals & how it has changed recently
 - b. Trapezoid has AT LEAST 1 pair of parallel sides
- E. Congruence
 - 1. Definition using corresponding parts of 2 polygons
 - 2. Triangle congruence theorems: SAS, SSS, ASA, SAA, HL, HA, LL
- F. Similarity
 - 1. Basic definition
 - 2. Relation to congruence
 - 3. Triangle similarity theorems: SSS, SAS, AA
- G. Circles and Spheres
 - 1. Name parts of circles
 - 2. Calculate circumference and area of circles
 - 3. Calculate surface area and volume of spheres
 - 4. Calculate arc length and sector area of circles
- H. Transformational Geometry
 - 1. Draw, describe, and contrast translations, rotations, reflections, and dilations
 - 2. Use technology and manipulatives to construct transformations
- I. Systems of measurement
 - 1. Dimensional analysis for 1-, 2-, and 3-dimensional shapes within customary and metric systems
- J. Area and perimeter
 - 1. Derive and use formulas for area for various polygons, including triangles and types of quadrilaterals

2. Circles
3. Composite shapes
- K. Surface area and volume
 1. Derive and use formulas for surface area for prisms, pyramids, cones, cylinders, spheres, and composite shapes
 2. Derive and use formulas for volume for prisms, pyramids, cones, cylinders, spheres, and composite shapes
- L. The Pythagorean Theorem and its applications
 1. Derive and use the formula to find missing sides of right triangles
 2. Applications: distance formula, equation of a circle
- M. Coordinate Geometry, including line of best fit
 1. Distance formula
 2. Scatterplots and finding line of best fit