University of Arkansas – Fort Smith
5210 Grand Avenue
P. O. Box 3649
Fort Smith, AR 72913–3649
479–788–7000

General Syllabus

MATH 3403 College Geometry

Credit Hours: 3 Lecture Hours: 3 Laboratory Hours: 0

Effective Catalog: 2020-2021

Prerequisite: MATH 2443 Discrete Mathematics I

I. Course Information

A. Catalog Description

Classification and properties of geometric figures, Euclidean plan geometry as an axiomatic system, geometric proof, constructions, symmetry, geometric transformations, analytic geometry, measurement, three dimensional Euclidean geometry, finite geometries, problem solving, elementary non-Euclidean geometries.

B. Additional Description

This course introduces the student to geometry viewed as an axiomatic system. Emphasis will be placed on developing the ability to write proofs via the study of Euclidean and non-Euclidean geometries. Students will study the properties of Euclidean geometry and will apply these to solve applications. Constructions will be introduced as an aid to understanding geometric concepts, properties, and proofs. Transformational geometry will be studied as well as symmetry groups of regular figures. Geometric computer software will be used. This course serves as the major provider of the mathematical skills necessary to teach high school geometry.

II. Student Learning Outcomes

A. Subject Matter

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

1. Describe the major components of an axiomatic system.
2. State the postulates, definitions, and major theorems of Euclidean geometry.
3. Classify basic two and three-dimensional figures and state their characteristics.
4. Compute perimeters, areas, and volumes.
5. Construct using a compass and straightedge and using computer software:
   a. Congruent Polygons
   b. Angle and Segment Bisectors

c. Parallel and Perpendicular Lines
d. Polygons with specified properties

6. Transform plane figures using paper folding, compass and straightedge, a coordinate grid, and computer software.
7. Describe the groups of transformations (e.g. symmetries of a regular polygon) via cycle notation and as matrix groups.
8. Prove:
   a. Basic results in Euclidean and Non-Euclidean Geometries
   b. Properties of angles
   c. Properties of intersecting and parallel lines.
   d. Congruence of polygons
   e. Similarity of polygons
   f. Properties of Circles
9. Utilize geometry to solve applications.

B. University Learning Outcomes

This course enhances student abilities in the following areas:

Analytical Skills

Critical Thinking Skills: Students will analyze geometric constructs. Students will draw conclusions and make valid arguments from given information. Students will utilize geometry as a tool for describing their environment. Students will understand the foundations of geometry. They will develop a deep understanding of how and why the properties of Euclidean Geometry work, in part by also studying multiple non-Euclidean Geometries. They will demonstrate knowledge of the relationships among geometry, algebra, and their environment. Students will also be able to apply the concepts of geometry to the solution of problems. Students will develop their ability to discover conjectures and prove propositions.

Communication Skills (written and oral)

Students will communicate mathematical concepts and justifications. They will learn the importance of precise statements of definitions, postulates, and propositions. Student will write mathematically accurate and clear proofs of theorems. Students will utilize dynamic geometry computer software to investigate and demonstrate geometric properties and to communicate mathematical concepts.

Global and Cultural Perspectives

Students will recognize the importance of geometric discoveries and techniques from a variety of different global cultures.

III. Major Course Topics

A. Non-Euclidean Geometry
   1. Finite Geometries as an introduction to an axiomatic system
   2. Taxicab Geometry
   3. Hyperbolic Geometry

4. Spherical Geometry

B. Euclidean Geometry
   1. Angles and Lines
   2. Polygons, Congruence, and Similarity
   3. Measurement, Areas, and Volumes
   4. Circles
   5. Constructions
   6. Solid Geometry
   7. Transformational Geometry
   8. Symmetry
   9. Analytic Geometry