Honors Geometry

COURSE DESCRIPTION: Students learn to recognize and work with geometric concepts in various contexts. They build on ideas of inductive and deductive reasoning, logic, concepts, and techniques of Euclidean plane and solid geometry and develop an understanding of mathematical structure, method, and applications of Euclidean plane and solid geometry. Students use visualizations, spatial reasoning, and geometric modeling to solve problems. Topics of study include points, lines, and angles; triangles; right triangles; quadrilaterals and other polygons; circles; coordinate geometry; three-dimensional solids; geometric constructions; symmetry; the use of transformations; and non-Euclidean geometries.

This course includes all the topics in MTH203, but has more challenging assignments and includes more optional challenge activities. Each semester also includes an independent honors project.

PREREQUISITES: MTH124: Honors Algebra I, or equivalent

COURSE LENGTH: Two Semesters

REQUIRED TEXT: Geometry: A Reference Guide; a drawing compass, protractor, and ruler

MATERIALS LIST: No required materials for this course

COURSE OUTLINE:

Semester 1

Unit 1: An Introduction

- Semester Introduction
- Basic Geometric Terms and Definitions
- Measuring Length
- Measuring Angles
- Bisectors and Line Relationships
- Relationships between Triangles and Circles
- Transformations
- Using Algebra to Describe Geometry

Unit 2: Methods of Proof and Logic

- Reasoning, Arguments, and Proof
- Conditional Statements
- Compound Statements and Indirect Proof
- Definitions and Biconditionals
- Algebraic Logic
- Inductive and Deductive Reasoning

Unit 3: Polygon Basics
- Polygons and Symmetry
- Quadrilaterals and Their Properties
- Parallel Lines and Transversals
- Converses of Parallel Line Properties
- The Triangle Sum Theorem
- Angles in Polygons
- Midsegments
- Slope

Unit 4: Congruent Polygons and Special Quadrilaterals
- Congruent Polygons and Their Corresponding Parts
- Triangle Congruence: SSS, SAS, and ASA
- Isosceles Triangles and Corresponding Parts
- Triangle Congruence: AAS and HL
- Using Triangles to Understand Quadrilaterals
- Types of Quadrilaterals
- Constructions with Polygons
- The Triangle Inequality Theorem

Unit 5: Perimeter, Area, and Right Triangles
- Perimeter and Area
- Areas of Triangles and Quadrilaterals
- Circumference and Area of Circles
- The Pythagorean Theorem
- Areas of Special Triangles and Regular Polygons
- Using the Distance Formula

- Proofs and Coordinate Geometry

Unit 6: Semester Review and Test

- Semester Review
- Semester Test

Semester 2

Unit 1: Three-Dimensional Figures and Graphs

- Semester Introduction
- Solid Shapes and Three-Dimensional Drawing
- Lines, Planes, and Polyhedra
- Prisms
- Coordinates in Three Dimensions
- Equations of Lines and Planes in Space

Unit 2: Surface Area and Volume

- Surface Area and Volume
- Surface Area and Volume of Prisms
- Surface Area and Volume of Pyramids
- Surface Area and Volume of Cylinders
- Surface Area and Volume of Cones
- Surface Area and Volume of Spheres
- Three-Dimensional Symmetry

Unit 3: Similar Shapes

- Dilations and Scale Factors
- Similar Polygons
- Triangle Similarity
- Side-Splitting Theorem
- Indirect Measurement and Additional Similarity Theorems
- Area and Volume Ratios

Unit 4: Circles

- Chords and Arcs
- Tangents to Circles

- Inscribed Angles and Arcs
- Angles Formed by Secants and Tangents
- Segments of Tangents, Secants, and Chords
- Circles in the Coordinate Plane

Unit 5: Trigonometry

- Tangents
- Sines and Cosines
- Special Right Triangles
- The Laws of Sines and Cosines

Unit 6: Beyond Euclidian Geometry

- The Golden Rectangle
- Taxicab Geometry
- Graph Theory
- Topology
- Spherical Geometry
- Fractal Geometry
- Projective Geometry
- Computer Logic

Unit 7: Semester Review and Test

- Semester Review
- Semester Test