June 2004

High School Mathematics
Honors Geometry

This is an accelerated course designed for the motivated math student with an above average interest in mathematics who is willing to devote the extra time necessary to succeed in an honors course. It covers all the topics presented in Geometry but in greater depth while stressing logical deductive reasoning. Additionally, it covers topics from solid and coordinate geometry, loci, and transformations.

Learning Opportunities

Special projects (mini golf, transformations, tilings and Escher style designs, polyhedra, history of math essays and class presentations, construction project, classroom discussion portfolio projects, group work and discussion.

Standards

Fields of Knowledge: Mathematics, Science, Technology

Inquiry, Experimentation and Theory
7.4 History of Math: Students understand the history of math and technology.

Mathematical Understanding
7.7 Geometric and Measurement Concepts: Students use geometric and measurement concepts

Mathematical Problem Solving and Reasoning
Applications: Students use concrete, formal, and informal strategies to solve mathematical problems, apply the process of mathematical modeling, and extend and generalize mathematical concepts.

Content Knowledge and Skills

Semester 1:
Introduction to Geometry

Basic concepts and proofs
Congruent triangles
Lines in the plane
Parallel lines and related figures
Lines and planes in space

Semester 2:
Polygons
Similar polygons
The Pythagorean Theory
Circles
Area
Surface areas and volume
Miscellaneous topics inserted throughout the year
(three dimensional graphing and reflections, rotational, reflectional and transformational symmetry, fourth dimensional analysis with the reading of Flatland, coordinate geometry, spherical geometry, locus and compound locus, advanced construction projects, triangle inequalities)

Assessment Criteria

1. Introduction to Geometry:
Students are able to:
identify types of angles and perform measurement
understand collinearity, betweenness and assumptions
perform beginning proofs
know division rules of segments and angles
form paragraph proofs
create and apply a deductive structure
understand statements of logic, syllogisms
know the basic rules of probability

2. Basic Concepts and Proofs
Students are able to:
understand rules of perpendicularity
work with complementary and supplementary angles
draw conclusions based on given information
apply addition and subtraction properties to proof
apply multiplication and division properties to proof
apply transitive and substitution properties to proof

identify and use the properties of vertical angles
construct perpendicular lines (from a point on a line, not on a line), angle bisection, segment bisection, complementary angles, copying angles based on basic geometric concepts

3. Congruent triangles
Students are able to:
define congruent figures
learn and apply the four ways to prove triangles congruent (ASA,SSS,SAS,AAS)
extend their knowledge of triangles with corresponding parts of congruent triangles are congruent (CPCTC), and intro to circles and double proofs going beyond CPCTC
work with overlapping triangles
identify all types of triangles
identify and use the hypotenuse-leg postulate
construct triangles given parts of triangles, constructing points of concurrence (centroid, orthocenter, incenters and circumcenters)

4. Lines in the Plane
Students are able to:
create proofs involving detours and midpoints
solve missing diagram proofs
understand and apply the right angle theorem and equidistance theorems
define and work with parallel lines and slope
construct of parallel lines given a line and a point on the line.

5. Parallel lines and related figures
Students are able to :
understand and solve indirect proofs
prove that lines are parallel
identify angle sets and their relationship in angles associated with parallel lines
identify types of quadrilaterals and know their properties
prove that quadrilateral is a parallelogram
prove that figures are special quadrilaterals (rhombus, kite, rectangle, square)

6. Lines and planes in space
Students are able to:
relate lines to planes

understand perpendicularity of a line and plane
know the basic facts about parallel planes
draw three dimensionally on isometric and orthographic paper

7. Polygons
Students are able to:
understand the triangle application theorems and formulas
identify the various common regular polygons
work with tiling, Escher type drawings

8. Similar polygons
Students are able to:
continue to work with ratio, proportion and similarity as applied to Geometry
utilize methods of proving triangles similar
use congruence and proportions in similar triangles

9. The Pythagorean Theorem
Students are able to:
work with radicals and quadratic equations
understand basic facts about circles
learn and apply the altitude-on-hypotenuse theorems
learn and apply the Pythagorean Theorem
apply the distance formula
learn and apply families of right triangles and special right triangles
apply the Pythagorean Theorem and Space Figures
learn and apply the trigonometric ratios (sine, cosine, tangent)

10. Circles
Students are able to:
identify parts of a circle, including congruent chords, arcs of a circle, secants and tangents, and angles related to a circle
learn and apply the arc theorems
learn and apply the power theorems
work with circle circumference and arc length, pi
construct tangents

11. Area
Students are able to:
understand area
find the areas of parallelograms and triangles, trapezoids, kites and related figures, regular polygons, circles
find the area of sectors, segments of circles
find and work with the ratios of areas
use Hero's and Brahmagupta's formulas to find the area of a figure given just sides of the figure

12. Surface areas and volume
Students are able to:
calculate surface areas of prisms, pyramids, circular solids
calculate volumes of prisms, pyramids, cones and cylinders
calculate volume and surface area of spheres
identify and calculate the ratio of volumes
identify and construct polyhedron,
use Euler's formula

Resources

Text: *Geometry for Enjoyment and Challenge* - Rhoad, Milauskas and Whipple (McDougla, Littell)