PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Honors Geometry

Curriculum Writing Committee:

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Grade Level: 9

Date of Board Approval: June 2026

Course Weighting: Honors Geometry

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total Points
Tests	300	300	500	300	1400
Quizzes	100	175	80	100	455
Homework	20	20	20	20	80
Total Points	420	495	600	420	1935

Curriculum Map

Overview: This course is written to follow Honors Algebra One. Significantly more material is covered at a faster pace than in the regular sections of Geometry. In addition, a more abstract approach is followed, emphasizing proof and the solution of non-routine problems using critical reasoning. The course covers the foundations of Euclidean Geometry, triangles and relationships, proofs of congruence and similarity and applications, triangle centers, parallelism, properties of quadrilaterals, applications of proportion and similarity, right triangle relationships and trigonometry, circles, and solid geometry. This course is designed for highly motivated students of exceptional ability who have a strong interest in mathematics. Technology is integrated whenever appropriate to support and challenge the learning of the students, serving to facilitate student discovery as they conjecture, test, and synthesize ideas. Such technological instruction will be through the use of Geometer's Sketchpad, graphing calculators, etc. Attention will be given to the history and development of Euclidean Geometry where appropriate. Transformations and coordinate geometry will be woven throughout the course.

Goals:

- **Marking Period 1 (45 days) -** Students will be able to …
    - **Unit 0: Introduction to Statistics (17 days)**
        - Summarize and classify data, categorical and quantifiable, and with appropriate graphs and statistical summaries
        - Compare and describe distributions, and recognize the association between variables
        - Understand probability as long-run relative frequency and apply it in problem solving, simulation, and in justifying inference-based conclusions
        - Apply Venn Diagrams and two-way tables to calculate conditional probabilities
        - Calculate and interpret standard deviation
        - Construct statistical tests to make inferences and decisions about a population based on sample data by formally testing a hypothesis

        - Perform Chi-Square Test of Independence
    - **Unit 1: Tools for Geometry (13 days)**
        - Understand the relationship between points, lines, and planes
        - Explore ancient civilizations' approaches to geometry that contrast with the Greek approach of a formalized deductive system
        - Calculate the distance and midpoint between two points
        - Apply the segment addition postulate to solve problems involving segments, midpoints, and bisectors
        - Apply the angle addition postulate to solve problems involving angles and angle bisectors
        - Identify and solve problems involving vertical angles and linear pairs
        - Solve algebraic word problems involving ratios and verbal expressions
    - **Unit 2: Logic (11 days)**
        - Represent logical arguments using Boolean algebra symbols
        - Identify, write, and determine the truth value of compound statements, conditional statements, and related conditional statements
        - Construct truth tables to find truth values of statements and determine logically equivalent statements
        - Represent quantified statements and their negations using Venn Diagrams
        - Apply the Law of Syllogism to draw valid conclusions
    - **Unit 3: Pre-Proofs (4 days)**
        - Identify properties of equality
        - Verify if a given relation is reflexive, symmetric, and transitive to prove that it is an equivalence relation
        - Construct algebraic proofs
- **Marking Period 2 (45 days) -** Students will be able to …
    - **Unit 3: Pre-Proofs (Continued) (5 days)**
        - Identify the meaning of various definitions, postulates, and theorems
        - Prove relationships between lines and angles
    - **Unit 4: Triangle Congruence (12 days)**
        - Classify triangles by their sides and angles
        - Calculate missing measures of equilateral and isosceles triangles
        - Prove triangles congruent (SAS, SSS, ASA, AAS)
        - Use CPCTC to prove triangle properties
        - Solve algebraic applications of congruent triangles
    - **Unit 5: Triangle Inequality & Triangle Centers (19 days)**
        - Apple the Exterior Angle Theorem to find missing angle measures
        - Prove triangles congruent (HL)
        - Apply the Triangle Inequality Theorem
        - Apply the Triangle Angle-Side Theorem
        - Identify and construct centers of triangles (Steiner point, centroid, circumcenter, incenter, and orthocenter)
        - Apply the Perpendicular Bisector Theorem
        - Apply properties of centroids
        - Explore the Euler line of a triangle
        - Classify triangles by the location of their centers

- **Unit 6: Parallel Lines (9 days)**
  - Indirectly prove triangles are parallel by the relationship of their corresponding angles
  - Prove the Triangle Angle Sum Theorem
  - Prove angle relationships for parallel lines (alternate interior, alternate exterior, same-side interior, same-side exterior angles)
  - Solve algebraic applications of parallel lines

- **Marking Period 3 (45 days) -** Students will be able to …
  - **Unit 6.5 Polygons (7 days)**
    - Discover symmetries of regular polygons via rotations and reflections
    - Apply composition of transformations to a figure
    - Derive formulas for the number of diagonals, sum of interior angles, sum of exterior angles, each interior angle (if equiangular), and each exterior (if equiangular)
    - Solve algebraic applications of regular polygons
  - **Unit 7 Quadrilaterals (11 days)**
    - Prove properties of a parallelogram
    - Prove a quadrilateral is a parallelogram
    - Prove properties of rectangles, rhombi, and squares
    - Prove properties of trapezoids, isosceles trapezoids, and kites
    - Solve algebraic applications of quadrilaterals
    - Solve midsegments of triangles and medians of trapezoids
  - **Unit 8 Area (8 days)**
    - Derive formulas for area of triangles and quadrilaterals
    - Use Heron's formula to find the area of a triangle based on its side lengths
    - Solve algebraic applications of area
  - **Unit 9 Similarity (12 days)**
    - Review properties of ratios and proportions
    - Calculate the geometric mean between two numbers
    - Prove triangles are similar (AA, SAS, SSS)
    - Solve algebraic applications involving similar triangles
    - Calculate and apply the ratios of similar areas and perimeters
    - Model real-world problems with proportions
    - Explore the Fibonacci sequence and the Golden Ratio
  - **Unit 10 Right Triangle Trigonometry (7 days)**
    - Calculate missing measures using proportions of similar right triangles
    - Identify Pythagorean triples
    - Identify and calculate missing measures of special right triangles
    - Apply right triangle trigonometry to find missing angle measurements and side lengths

- **Marking Period 4 (45 days) -** Students will be able to …
  - **Unit 10 Right Triangle Trigonometry (Continued) (5 days)**
    - Apply right triangle trigonometry and relationships to find missing measures

        - Solve real-world problems using right triangle trigonometry involving applications with angle of elevation or angle of depression
    - **Unit 11 Circles (15 days)**
        - Identify the parts of a circle
        - Derive angle relationships within circles
        - Derive segment relationships within circles
        - Calculate missing measures of angles in circles formed by radii, chords, secants, and tangents
        - Calculate missing lengths of segments in circles formed by chords, secants, and tangents
        - Derive relationships between tangents, chords, diameters, and secants
    - **Unit 12 Area of Regular Polygons and Circles (7 days)**
        - Derive formulas for regular polygons using trigonometry
        - Derive formulas for circles as the number of sides in a regular polygon approach infinity
        - Derive arc length and area of sectors
        - Solve algebraic applications with circumference and area formulas
    - **Unit 13 Solids (18 days)**
        - Identify geometric solids and their characteristics (vertices, edges, faces, and classifications)
        - Calculate volume and surface area of prisms, pyramids, cones, and spheres
        - Calculate ratio of similitude, surface area, volume in similar figures
        - Complete Final Review and Final

Big Ideas:

- Big Idea # 1: Data can be described and summarized using both graphical and statistical summaries. Probability theory gives us the tools to analyze random behavior. Inference, the process of making a general conclusion from a finite data subset, can be done by measuring statistics and comparing them to known patterns of behavior using probability.
- Big Idea # 2: Valid conclusions can be made using Inductive reasoning (using data and probability) or deductive reasoning, the former sometimes providing good evidence while the latter can provide certainty.
- Big Idea # 3: Patterns exhibit relationships that can be extended, described, and generalized. Geometric relationships can be described, analyzed, and classified based on spatial reasoning and/or visualization.

Textbook and Supplemental Resources:

- **Primary Textbook Name:** Glencoe Geometry, 2018
    - **Textbook ISBN:** 978-0-07-903994-1
    - **Textbook Publisher/Year of Publication:** McGraw Hill 2018
- **Supplemental Resources:**
    - Geometer's Sketchpad
    - Teacher-prepared packets
    - IXL
    - Mathbits Worksheets
    - Kuta Geometry Worksheets
    - Jacobs Geometry Textbook

- TI-84 Graphing Calculators
- Desmos Calculator
- Stapplet
- Common Online Data Analysis Platform
- SAT problems from College Board practice exams
- Geogebra

Curriculum Plan

Unit 0: Introduction to Statistics (17 Days)

- **College Board Advanced Placement Statistics Skills:**
  - 2.A Describe data presented numerically or graphically
  - 2.B Construct numerical or graphical representations of distributions
  - 2.C Calculate summary statistics, relative positions of points within a distribution, correlation, and predicted response
  - 3.A Determine relative frequencies, proportions, or probabilities using simulation or calculations
  - 4.B Interpret statistical calculations and findings to assign meaning and assess a claim

Objectives:

- Identify and distinguish between categorical and quantifiable data, and construct appropriate displays to summarize the data. (DOK – Level 1, 2, 3)
- Estimate probabilities using simulation and construct models to evaluate/analyze probabilities. (DOK – Level 2, 3, 4)
- Construct a null and alternative hypothesis Chi-Square statistic from observed categorical data, such as the scores on a multiple-choice test, subject only to blind-guessing, or the distribution of candy colors compared with name-brand statements of distribution. Compare the result with simulated data to make and justify a conclusion. (DOK – Level 2, 3, 4)
- Construct Venn diagrams and two-way tables to calculate a conditional probability. (DOK – Level 2, 3, 4)

Core Activities and Corresponding Instructional Methods:

- Give an opening day pop quiz on how well students know each other. Students will play a game of 2 truths and 1 lie. Data will be collected on how many lies a student guessed correctly. This test will be used to perform a significance test to show if the students actually know each other.
- Students will collect variables of interest from the class. Students will identify the variables as categorical and quantitative. Students will use the Common Online Data Analysis Platform to discover which graphs are appropriate for each type of variable.
- Students will perform various simulations with cards, dice, and coins to experience probability as long-term relative frequency. Simulations can include “The Office Secret Santa”, "Landing on orange in Monopoly", and a family of 3 children all being boys.
- Students line up from shortest to tallest to create a human boxplot. Class will discuss the rules for finding the median and the quartiles. The teacher will be added to the data set to discuss differences in an odd or even data set.
- Students will create and describe histograms from a large set of data. (Ex: Presidents age at Inauguration)

- Students will perform a Chi-Square Test of Independence to determine if there is significant evidence of an association between two categorical variables.
- Students will analyze graphs that have been found in the news media that are incorrect and comment on the bias and ways the graphs were made misleading.
- Students use SAT problems found from College Board practice tests to answer higher-level questions regarding probability and statistics.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations and questioning techniques
  - Homework problems created by the teacher
  - 2 common assessment quizzes
- **Summative:**
  - Unit 0: Common Assessment on Statistics
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - Use statistical platforms, such as stapplet.com or Common Online Data Analysis Platform, to visualize statistics
- **Extensions:**
  - Assign additional SAT problems
  - Past AP Statistics multiple-choice problems

Unit 1: Tools for Geometry (13 Days)

- **Standards:**
  - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
  - CC.2.3.HS.A.5 Create justifications based on transformations to establish similarity of plane figures
  - CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures
  - CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically

Objectives:

- Identify and use the postulates of Euclidean Geometry. (DOK – Level 1)
- Recognize the difference between postulates and theorems of Euclidean geometry. (DOK – Level 1)
- Compare the distance formula and the Pythagorean theorem and apply it to find the distance between points. (DOK – Level 2, 3)
- Calculate the midpoint between two points on a number line or on a coordinate plane. (DOK – Level 1)

- Calculate the endpoint given a midpoint and the other endpoint on a number line or on a coordinate plane. (DOK – Level 1)
- Apply the betweenness of points and rays to solve problems related to segments and angles. (DOK – Level 2)
- Calculate missing measures using the segment addition postulate given midpoints and bisectors. (DOK – Level 2)
- Calculate missing measures using the angle addition postulate given angle bisectors. (DOK – Level 2)
- Discover the relationships between angles of intersecting lines. (DOK – Level 3, 4)
- Compare problems involving supplementary and complementary angles. (DOK – Level 2, 3)

Core Activities and Corresponding Instructional Methods:

- Engage with a scholarly article focused on Euclid, exploring the evolution of geometric thought in early civilizations. The article will detail how various cultures approached geometry, culminating in the Greek contributions led by Euclid, who established a formal framework through the introduction of theorems and postulates. Students will answer analytical questions that encourage critical thinking about the significance of these developments in the history of mathematics.
- Share examples of postulates in real life (Possible Examples: School day ends at 2:38, rules to sports, and a video clip from "Dodgeball" about the rules of dodgeball).
- Use Geometer's Sketchpad to identify properties of points, lines, and planes and discover theorems on terms such as complementary, supplementary, vertical angles, and linear pairs.
- Use Geometer's Sketchpad to show the idea of betweenness of points or segment addition postulate. That only A, B, and C are collinear does AB + BC = AC.
- Derive the distance formula from the Pythagorean Theorem.
- Complete practice problems with midpoints of segments, and find the midpoint or endpoint of a segment.
- Complete practice verbal algebraic questions with geometric vocabulary where students can write and solve their own equations.
- Complete practice problems with bisected angles.
- Solve SAT problems involving lines and angles from College Board practice tests.
- Complete warm-up problems from SAT problems, reviewing key Algebra 1 topics including equations of a line, systems of equations, and factoring.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz

- **Summative:**
    - Unit 1: Common Assessment on Tools for Geometry
- **Correctives:**
    - Provide guided practice with teacher feedback
    - Conduct small-group reteaching opportunities
    - Extra practice in the Math Lab
    - IXL Skills
        - Additive Property of Length
        - Midpoints
        - Midpoint Formula: find the midpoint
        - Midpoint Formula: find the endpoint
        - Distance Formula
        - Angle Diagrams: Solve for the variable
    - Kuta Software Worksheets
    - Khan Academy
- **Extensions:**
    - Past AMC competition geometry questions
    - Further research into how an earlier civilization used geometry

Unit 2: Logic (11 Days)

- **Standards:**
    - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
    - CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures

Objectives:

- Represent logical arguments using Boolean algebra symbols. (DOK – Level 2)
- Evaluate the equivalence of logical statements using truth tables. (DOK – Level 2)
- Model conditional statements symbolically and identify converse, inverse, contrapositive. (DOK – Level 2)
- Assess logical statements using Venn Diagrams. (DOK – Level 3)
- Analyze/prove syllogisms using symbolic logic. (DOK – Level 4)
- Identify and apply properties of equality. (DOK – Level 1)

Core Activities and Corresponding Instructional Methods:

- Introduce the logic unit using Zack Mirz's America's Got Talent magic routine.
- Perform various logic problems to learn higher order thinking/reasoning skills. (Examples: truth tellers and liars / Man with the red hats / Wason Test)
- Prove De Morgan's law using truth tables to show that if the truth tables give the same results they are logically equivalent.
- Introduce syllogisms using the Direct TV commercial.
- Introduce quantifiers and their negations using Venn Diagrams.

Assessments:

- **Diagnostic:**
    - Warm-up problems
    - Teacher observations and questioning techniques

- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz
- **Summative:**
  - Unit 2: Common Assessment on Logic
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills
    - Converses, inverses, and contrapositives
    - Truth Tables
  - Khan Academy
- **Extensions:**
  - Past AMC competition questions
  - Additional Logic Problems/Puzzles

Unit 3: Pre-Proofs (9 Days)

- **Standards:**
  - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures

Objectives:

- Prove relationships between lines and angles. (DOK – Level 3, 4)
- Identify the meaning of various definitions, postulates, and theorems. (DOK – Level 1)
- Apply properties of equality and geometry to answer "how do you know that" questions. (DOK – 2, 3, 4)
- Assess the validity of a statement/formula generated inductively and justify the need for a deductive approach. (DOK – Level 3)
- Compare problems involving supplementary and complementary angles. (DOK – Level 2, 3)
- Determine if a statement is an equivalence relationship. (DOK – Level 2)
- Construct algebraic proofs and justify the reason for each step. (DOK – Level 2, 3, 4)
- Set up a formal proof by writing the "Given" and "Prove" statements for a theorem. (DOK – Level 1, 2)

Core Activities and Corresponding Instructional Methods:

- Investigate fact 1, fact 2 problems to determine how they know a statement is true. This will be the foundation of proof writing.
- Review algebra questions of varying difficulty to solve algebraic proofs.
- Connect the idea of conditional statements and proof set up.

- Use a Geometer's Sketchpad to show relationships for vertical angles and linear pairs.
- Solve ratio and word problems with complementary and supplementary.
- Review system of equations with angle relationships.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz
- **Summative:**
  - Unit 3: Common Assessment on Pre-Proofs
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - Khan Academy
- **Extensions:**
  - Past AMC competition questions
  - Advanced algebra problems

Unit 4: Congruent Triangles (12 Days)

- **Standards:**
  - CC.2.3.HS.A.1 Use geometric figures and their properties to represent transformations in the plane
  - CC.2.3.HS.A.2 Apply rigid transformations to determine and explain congruence
  - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
  - CC.2.3.HS.A.4 Apply the concept of congruence to create geometric constructions
  - CC.2.3.HS.A.5 Create justifications based on transformations to establish similarity of plane figures
  - CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically

Objectives:

- Classify triangles and make observations about points that minimize distance sums to vertices and sides, hypothesizing how these points are to be found. (DOK – Level 1, 2, 3)
- Classify triangles by sides and angles via the converse of the Pythagorean Theorem. (DOK – Level 1,2)
- Synthesize methods/sets of conditions that guarantee that triangles are congruent and apply them in proving triangles congruent. (DOK – Level 3,4)

- Use CPCTC to prove additional properties of triangles. (DOK – Level 2, 3)
- Apply properties of isosceles triangles in problem solving. (DOK – Level 2)

Core Activities and Corresponding Instructional Methods:

- Use Geogebra to demonstrate four methods to always prove triangles congruent, showing that SSA and AA do not always work.
- Demonstrate the idea of CPCTC by mapping a figure to one that it is congruent to.
- Define additional segments in triangles: altitude, perpendicular bisectors, medians, and angle bisectors.
- Use two-column proofs to prove triangles are congruent.
- Prove that in an isosceles triangle, base angles are congruent.
- Solve algebra applications with triangle properties, including ratio, systems, and linear equations.
- Complete SAT problems involving triangles found from the College Board practice tests.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 2 common assessment quizzes
- **Summative:**
  - Unit 4: Common Assessment on Congruent Triangles
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills
    - Pythagorean inequality theorems
    - SSS, SAS, ASA, and AAS Theorems
    - Proving triangles congruent by SSS, SAS, ASA, and AAS
    - Congruency in isosceles and equilateral triangles
  - Kuta Software Worksheets
  - Khan Academy
- **Extensions:**
  - Past AMC competition questions
  - Additional challenging proofs

Unit 5: Triangle Inequality (19 Days)

- **Standards:**
  - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
  - CC.2.3.HS.A.4 Apply the concept of congruence to create geometric constructions

Objectives:

- Derive and apply the Exterior Angle Theorem. (DOK – Level 1, 2, 3)
- Derive Hypotenuse-Leg as a method of proving congruence in triangles. (DOK – Level 3)
- Prove right triangles congruent using the Hypotenuse-Leg Postulate, and critique the role of HL in proving triangles congruent relative to other triangle postulates. (DOK – Level 2, 4)
- Derive and apply the Perpendicular Bisector Theorem. (DOK – Level 1, 2, 3)
- Investigate the points of concurrency/triangle centers for medians, altitudes, perpendicular bisectors, and identify their properties. (DOK – Level 3, 4)
- Identify a point of concurrency from angle and segment markings. (DOK – Level 1, 2)
- Derive and apply properties of medians and centroids. (DOK – Level 1, 2, 3)
- Apply properties of triangle centers to solve problems. (DOK – Level 2)
- Apply the Triangle Inequality Theorem and Triangle Angle-Side Theorem in problem solving. (DOK – Level 2, 3, 4)

Core Activities and Corresponding Instructional Methods:

- Formally prove the Exterior Angle Theorem as a class.
- Solve algebraic applications of the Exterior Angle Theorem.
- Demonstrate that Hypotenuse-Leg only works to prove right triangles are congruent. Demonstrate using Geometer's Sketchpad or Geogebra.
- Show students the idea of the center of a triangle is vague via the Steiner Point and soap film. The teacher will use premade pieces of glass with screws attached forming various polygons. The teacher will insert the glass into a container of water and dish soap. The film from the soap will intersect at a Steiner Point, which is the shortest combined distance to the three vertices of the triangle.
- Identify the points of concurrency within triangles using Geometer's Sketchpad activity.
- Determine where to build a new high school so that it is equidistant to all three elementary schools using Geometer's Sketchpad activity.
- Explore Euler line and special relationships with centers of a triangle using Geometer's Sketchpad activity.
- Construct Voronoi Diagrams to solve problems using the Perpendicular Bisector Theorem
- Derive Triangle Inequality Theorem and Triangle Angle Side Theorem using Geometer's Sketchpad activity.
- Complete warm-ups on factoring quadratic expressions.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques

- **Formative:**
    - Teacher observations, questioning techniques
    - Group activities
    - Homework – example problems created by the teacher, from the textbook/worksheets for each section
    - 1 common assessment graded assignment
- **Summative:**
    - Unit 5: Common Assessment on Triangle Inequality
- **Correctives:**
    - Provide guided practice with teacher feedback
    - Conduct small-group reteaching opportunities
    - Extra practice in the Math Lab
    - IXL Skills
        - Exterior Angle Theorem
        - Hypotenuse-Leg Theorem
        - Identify medians, altitudes, angle bisectors, and perpendicular bisectors
        - Triangle Inequality Theorem
        - Factor quadratics with leading coefficient 1
        - Factor quadratics with other leading coefficients
    - Kuta Software Worksheets
    - Khan Academy
- **Extensions:**
    - Past AMC competition questions
    - SAT problems
    - Finding the location of triangle centers using coordinate geometry

Unit 6: Parallel Lines (9 days)

- **Standards:**
    - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
    - CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically
    - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:

- Identify the conditions necessary to prove lines are parallel and use the conditions to justify/prove statements about plane figures. (DOK – Level 1, 2, 3, 4)
- Prove through contradiction the parallelism of lines. (DOK – Level 3, 4)
- Prove angles congruent or supplementary when parallel lines are crossed by a transversal. (DOK – Level 3, 4)
- Prove that the interior angle sum of a triangle is 180 degrees and analyze the role of the parallel postulate in this proof and its consequences. (DOK – Level 3, 4)
- Solve problems related to angle measures in figures and justify solutions by applying the concepts of parallelism. (DOK – Level 2, 3, 4)
- Derive equations of a line when given parallel or perpendicular relationships. (DOK – Level 2, 3)

Core Activities and Corresponding Instructional Methods:

- Prove indirectly that corresponding angles being congruent implies lines are parallel.
- Prove that the sum of the interior angles of a triangle are 180 degrees.
- Prove how angle relationships involving alternate interior, alternate exterior, same side interior, and same side exterior angles imply parallel.
- Solve algebraic applications with parallel and perpendicular lines, including ratios, system of equations, and linear equations.
- Connect the geometric approach in parallel with the algebraic approach of writing the equations of lines given a parallel or perpendicular relationship.
- Complete SAT problems with parallel and perpendicular lines from College Board practice exams.
- Students will complete warm-up problems reviewing Unit 1 ideas and parallel/perpendicular equation of line problems.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz
- **Summative:**
  - Unit 6: Common Assessment on Parallel lines
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills
    - Transversals of parallel lines: solves for x
    - Equations of parallel and perpendicular lines
  - Kuta Software Worksheets
  - Khan Academy
- **Extensions:**
  - Past AMC competition questions
  - SAT problems
  - Advanced algebra applications of parallel and perpendicular lines

Unit 6.5: Polygons (7 Days)

- **Standards:**
    - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
    - CC.2.3.HS.A.2 Apply rigid transformations to determine and explain congruence
    - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:

- Identify the image of a figure through rotational transformation, and identify rotational symmetries in plane figures. (DOK – Level 1,2)
- Identify all of the symmetries of the equilateral triangle and find their compositions and analyze how the symmetries relate to each other in a functional sense. (DOK – Level 2,3,4)
- Derive formulas for polygons; number of diagonals, sum of interior angles, sum of exterior angles, if regular each interior angle, and if regular each exterior angle. (DOK – Level 3,)
- For a given polygon, find its number of diagonals, interior angle sum, and the measures of interior and exterior angles if equiangular. Given values of any of those quantities, identify the polygon by number of sides. (DOK – Level 1, 2)

Core Activities and Corresponding Instructional Methods:

- Show students that an equilateral triangle has 6 symmetries, 3 rotational and 3 reflections. Show that the composition of each of those symmetries creates one of the 6 symmetries. Apply this process to squares and other regular polygons.
- Discover the formulas for polygons (number of diagonals, interior, and exterior angles) through examples and deductive reasoning.
- Complete problem solving activities with polygons that challenge students to apply the formulas to solve.
- Introduce the idea of limits as the number of sides grows closer to infinity for the formulas of regular polygons.

Assessments:

- **Diagnostic:**
    - Warm-up problems
    - Teacher observations and questioning techniques
- **Formative:**
    - Teacher observations, questioning techniques
    - Group activities
    - Homework – example problems created by the teacher, from the textbook/worksheets for each section
- **Summative:**
    - Unit 6.5: Common Assessment on Polygons
- **Correctives:**
    - Provide guided practice with teacher feedback
    - Conduct small-group reteaching opportunities

    - Extra practice in the Math Lab
    - IXL Skills
        - Polygon Vocabulary
        - Interior angles of a polygon
        - Exterior angles of a polygon
        - Review: interior and exterior angles of polygons
    - Kuta Software Worksheets
    - Khan Academy
- **Extensions:**
    - Past AMC competition questions
    - SAT problems
    - Challenging proofs involving polygons

Unit 7: Quadrilaterals (11 Days)

- **Standards:**
    - CC.2.3.HS.A.1 Use geometric figures and their properties to represent transformations in the plane
    - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
    - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:

- Define quadrilateral types and represent them in a Venn Diagram to show relationships between classifications. (DOK – Level 1, 2)
- Prove relationships in a parallelogram and use them in comparing angles and side lengths. (DOK – Level 1, 2, 3, 4)
- Prove relationships in rectangles, rhombuses, and squares, and use them in comparing angles and side lengths. (DOK – Level 1, 2, 3, 4)
- Prove relationships in trapezoids and kites, and use them in comparing angles, side lengths, and midsegments. (DOK – Level 1, 2, 3, 4)
- Identify a quadrilateral based on the relationships of their diagonals. (DOK – Level 1)

Core Activities and Corresponding Instructional Methods:

- Discover the relationships of quadrilaterals via Geometer's Sketchpad.
- Draw all quadrilaterals with markings indicating all properties of the given shape.
- Use transformations to create quadrilaterals in Geometer's Sketchpad.
- Examine the relationships of triangles inside of quadrilaterals.
- Compare and contrast the properties of quadrilaterals.
- Construct proofs of the properties of quadrilaterals.
- Solve algebra applications with quadrilaterals including ratio, systems of equations, and factoring.
- Complete SAT problems with quadrilaterals from College Board practice exams.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz
- **Summative:**
  - Unit 7: Common Assessment on Quadrilaterals
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills
    - Classify quadrilaterals II
    - Properties of parallelograms
    - Proving a quadrilateral is a parallelogram
    - Properties of rhombuses
    - Properties of rectangles and squares
    - Properties of trapezoids
    - Properties of kites
    - Review: properties of quadrilaterals
  - Kuta Software Worksheets
  - Khan Academy
- **Extensions:**
  - Past AMC competition questions
  - SAT problems
  - Advanced algebra applications involving quadrilaterals

Unit 8: Area (8 Days)

- **Standards:**
  - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
  - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:

- Apply formulas in finding areas of plane figures, documenting and justifying methods of solution. (DOK – Level 1, 2, 3)
- Derive formulas for quadrilaterals. (rhombi, kites, and trapezoids) (DOK – Level 3, 4)
- Investigate the area of complex figures by partitioning a shape into familiar shapes. (DOK – Level 2, 3, 4)

- Use Heron's formula to calculate the area of a triangle based on its side lengths. (DOK - Level 2)

Core Activities and Corresponding Instructional Methods:

- Introduce area by partitioning shapes into rectangles and right triangles to calculate the sum of the square units.
- Generalize formulas for areas in polygons using deductive reasoning and coordinate planes or Geometer's Sketchpad.
- Solve area problems involving complex shapes where students need to break a complex shape into smaller known shapes.
- Derive formulas for the area of a trapezoid and rhombus.
- Use Heron's formula to find the area of triangles.
- Complete algebraic applications with area.
- Complete SAT area problems from College Board practice exams.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz
- **Summative:**
  - Unit 8: Common Assessment on Area
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills
    - Area of parallelograms and triangles
    - Area of trapezoids
    - Area of compound figures
    - Heron's Formula
    - Area between two shapes
  - Kuta Software
- **Extensions:**
  - Past AMC competition questions
  - SAT problems
  - Challenging area problems

Unit 9: Similarity (12 Days)

- **Standards**
  - CC.2.3.HS.A.5 Create justifications based on transformation to establish similarity of plane figures
  - CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures
  - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:

- Model real world problems with ratios and proportions and use them in problem solving. (DOK – Level 3, 4)
- Establish correspondence and prove figures similar. (DOK – Level 2, 3, 4)
- Apply proportion-based theorems in solving triangles. (DOK – Level 1, 2, 3)
- Compute ratios of similitude (scale factor) and area of similar figures. (DOK – Level 2, 3)

Core Activities and Corresponding Instructional Methods:

- Review properties of ratios and proportions.
- Discover the relationship between angles and sides of similar shapes.
- Calculate proportions involving geometric means.
- Discover methods to prove polygons similar via Geometer's Sketchpad.
- Applications with angle-angle similarity to use with similar triangles.
- Solve algebra applications with similarity.
- Complete the Barbie Similarity Activity to show how a real life Barbie doll would be impossible for a human being.
- Complete Golden ratio activities using goldennumber.net.
- Complete SAT similarity problems from College Board practice tests.
- Complete warm-ups featuring Unit 2 ideas and algebra review involving radicals

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz
- **Summative:**
  - Unit 9: Common Assessment on Similarity
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills

        - Factor quadratics with other leading coefficients
        - Ratios in similar figures
        - Geometric sequences
        - Similarity statements
        - Identify similar figures
        - Similarity rules for triangles
        - Similar triangles and indirect measurement
        - Perimeters of similar figures
        - Area of similar figures
    - Kuta Software
    - Khan Academy
- **Extensions:**
    - Past AMC competition questions
    - SAT problems
    - Advanced proofs with similar triangles

Unit 10: Right Triangles (12 Days)

- **Standards**
    - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
    - CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures
    - CC.2.3.HS.A.7 Apply trigonometric ratios to solve problems involving right triangles

Objectives:
- Synthesize the relationships in special right triangles. (DOK - Level 2,3)
- Apply rules of similarity within right triangles to complete a right triangle or problem solving. (DOK - Level 3,4)
- Complete a right triangle using trigonometry, Pythagorean Theorem, and Triangle Angle Sum Theorem. (DOK – Level 2, 3)
- Apply right triangle trigonometry in real world applications to find missing side lengths or angle measures. (DOK – Level 3,4)

Core Activities and Corresponding Instructional Methods:
- Investigate the rules for special right triangles. Use pythagorean theorem to derive formulas.
- Explore the similarities within a right triangle when an altitude is dropped from the right angle. Discover geometric mean relationships to complete a triangle.
- Tell the story of SOH-CAH-TOA to build trigonometric equations.
- Solve algebra applications with right triangles with a focus on rules for radicals.
- Solve trigonometry word problems with angles of elevation and angles of depression.
- Complete SAT right triangle problems from the College Board practice tests.

Assessments:

- **Diagnostic:**
  - Warm-up problems
  - Teacher observations and questioning techniques
- **Formative:**
  - Teacher observations, questioning techniques
  - Group activities
  - Homework – example problems created by the teacher, from the textbook/worksheets for each section
  - 1 common assessment quiz
- **Summative:**
  - Unit 10: Common Assessment on Right Triangles
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills
    - Simplify radical expressions
    - Similarity and altitudes in right triangles
    - Special right triangles
    - Solve a special right triangle
    - Trigonometric ratios with radicals: sin, cos, and tan
    - Trigonometric ratios: find an angle measure
    - Trigonometric ratios: find a side length
  - Kuta Software Worksheets
  - Khan Academy
- **Extensions:**
  - Past AMC competition questions
  - SAT problems
  - Find the heights of objects outside using an inclinometer and right triangle trigonometry

Unit 11: Circles (15 Days)

- **Standards**
  - CC.2.3.HS.A.3 Verify and apply geometric theorems as they relate to geometric figures
  - CC.2.3.HS.A.6 Verify and apply theorems involving similarity as they relate to plane figures
  - CC.2.3.HS.A.8 Apply geometric theorems to verify properties of circles
  - CC.2.3.HS.A.9 Extend the concept of similarity to determine arc lengths and areas of sectors of circles
  - CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically
  - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:

- Identify, name, and use relationships between radii, diameters, chords, arcs, tangent lines. (DOK – Level 1, 2)
- Synthesize, prove, and apply rules for angles in a circle and apply them in problems involving arcs and angles. (including central, inscribed, inside, and outside angles) (DOK – Level 1, 2, 3, 4)
- Formalize an equation for circles and use it to write an equation from a graph or vice-versa. (DOK – Level 1, 2, 3)
- Synthesize, prove, and apply rules for intersecting chords, secants, tangents, and two tangents from the same external point. (DOK – Level 3, 4)

Core Activities and Corresponding Instructional Methods:

- Use Geometer's Sketchpad to discover the relationships between angles and segments in circles.
- Explore the equation of a circle using Desmos graphing calculator. Discover the relationship between the center and radius and the variables h, k, and r in the equation of a circle.
- Prove relationships about angles and segments in circles.
- Solve circle puzzles involving all the different type of angles and arc relationships within circles.
- Solve algebra applications with circles including writing the equation of a circle.
- Complete SAT circle problems from College Board practice tests.

Assessments:

- **Diagnostic:**
    - Warm-up problems
    - Teacher observations and questioning techniques
- **Formative:**
    - Teacher observations, questioning techniques
    - Group activities
    - Homework – example problems created by the teacher, from the textbook/worksheets for each section
    - 1 common assessment quiz
- **Summative:**
    - Unit 11: Common Assessment on Circles
- **Correctives:**
    - Provide guided practice with teacher feedback
    - Conduct small-group reteaching opportunities
    - Extra practice in the Math Lab
    - IXL Skills
        - Parts of a circle
        - Tangent lines
        - Angles formed by chords, secants, and tangents
        - Write equations of circles in standard form from a graph
        - Segments formed by chords, secants, and tangents
    - Kuta Software Worksheets

    - Khan Academy

- **Extensions:**
    - Past AMC competition questions
    - SAT problems
    - Advanced circle puzzles and problems

Unit 12: Area of Regular Polygons and Circles (7 Days)

- **Standards**
    - CC.2.3.HS.A.5 Create justifications based on transformation to establish similarity of plane figures
    - CC.2.3.HS.A.8 Apply geometric theorems to verify properties of circles
    - CC.2.3.HS.A.9 Extend the concept of similarity to determine arc lengths and areas of sectors of circles
    - CC.2.3.HS.A.11 Apply coordinate geometry to prove simple geometric theorems algebraically
    - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:

- Analyze parts of the regular polygon and synthesize the formula for finding perimeter and area given only the radius and the number of sides. (DOK – Level 1, 2, 4)
- Apply concepts from regular polygons to create rules for the perimeter (circumference) and area of a circle. (DOK – Level 1, 2, 3, 4)
- Revise the formulas from circles to derive arc lengths and area of sectors. (DOK – Level 2, 3)

Core Activities and Corresponding Instructional Methods:

- Use Geometer's Sketchpad to show how regular polygons approach a circle as the number of sides approaches infinity.
- Derive formulas for area and perimeter of regular polygons.
- Derive formulas for arc length, area of sector, and segments of a circle.
- Solve shaded area problems involving circles and other polygons.
- Complete SAT problems involving circumference and area of circles from College Board practice tests.

Assessments:

- **Diagnostic:**
    - Warm-up problems
    - Teacher observations and questioning techniques
- **Formative:**
    - Teacher observations, questioning techniques
    - Group activities
    - Homework – example problems created by the teacher, from the textbook/worksheets for each section

- **Summative:**
  - Unit 12: Common Assessment on Area of Regular Polygons and Circles
- **Correctives:**
  - Provide guided practice with teacher feedback
  - Conduct small-group reteaching opportunities
  - Extra practice in the Math Lab
  - IXL Skills
    - Area and circumference of circles
    - Understand arc length and sector area of a circle
    - Area of sectors
  - Kuta Software Worksheets
  - Khan Academy
- **Extensions:**
  - Past AMC competition questions
  - SAT problems
  - Additional challenge problems with composite and shaded areas

Unit 13: Solids (18 Days)

- **Standards**
  - CC.2.3.HS.A.12 Explain volume formulas and use them to solve problems
  - CC.2.3.HS.A.13 Analyze relationships between two-dimensional and three-dimensional objects
  - CC.2.3.HS.A.14 Apply geometric concepts to model and solve real world problems

Objectives:
- Define and identify platonic solids, identify duality, and derive the relationship between vertices, faces, and edges of solids. (DOK – Level 1, 2, 3)
- Revise the pythagorean theorem to apply to the diagonal of a rectangular solid. (DOK – Level 2, 3)
- Identify prisms and cylinders and find their volumes and surface areas using formulas. (DOK – Level 1, 2)
- Identify pyramids and cones, derive formulas to find their volume and surface area. (DOK – Level 1, 2, 3)
- Decompose a sphere into an infinite number of pyramids and derive a formula for volume. Find volume and surface areas for spheres. (DOK – 1, 2, 4)

Core Activities and Corresponding Instructional Methods:
- Show the film, Platonic Solids, to discover the relationship between edges, sides, and vertices of solids.
- Derive formulas for volume and surface area of solids.
- Solve real world applications with solids.
- Complete SAT solid problems from College Board practice tests.
- Complete final review activities connecting multiple geometric topics in SAT style questions.

- Additional topics to discuss after final exam (if time permits):
    - Show the film, “Flatland” and/or “Flatland 2” to discuss dimensions and perspective differences between 2 and 3 dimensional space
    - Use Geometer's Sketchpad to investigate fractal geometry and determine dimensions in a figure.
    - Introduce the law of sines and cosines to solve problems with acute or obtuse triangles
    - Review algebra skills necessary for success in Honors Algebra 2 & Trigonometry.

Assessments:

- **Diagnostic:**
    - Warm-up problems
    - Teacher observations and questioning techniques
- **Formative:**
    - Teacher observations, questioning techniques
    - Group activities
    - Homework – example problems created by the teacher, from the textbook/worksheets for each section
- **Summative:**
    - Unit 13: Common Assessment on Solids
    - Cumulative Final Exam
- **Correctives:**
    - Provide guided practice with teacher feedback
    - Conduct small-group reteaching opportunities
    - Extra practice in the Math Lab
    - IXL Skills
        - Volume of prisms and cylinders
        - Volume of pyramids and cones
        - Volume of spheres
    - Khan Academy
- **Extensions:**
    - Past AMC competition questions
    - SAT problems
    - Truncated volume applications